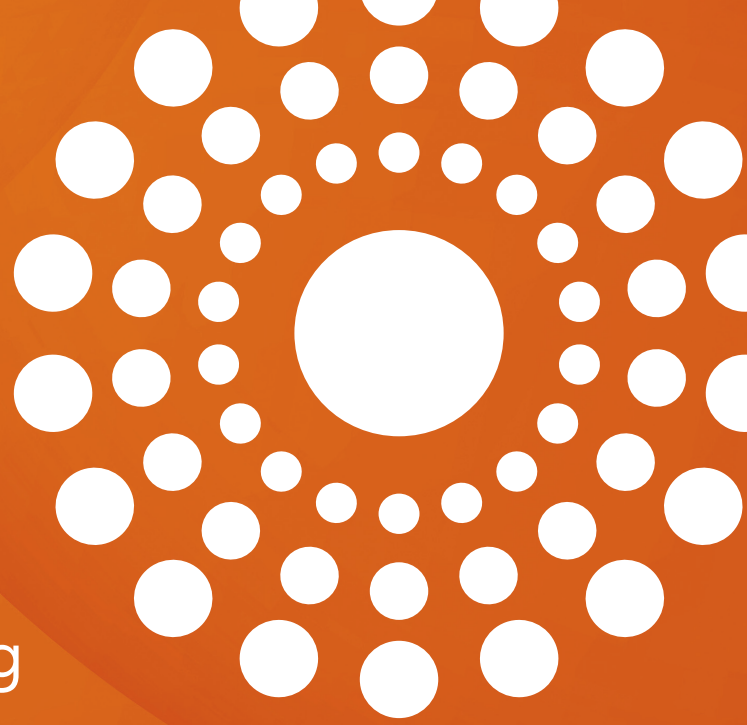


Carnegie African  
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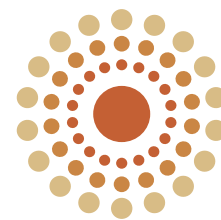


# A Vision for the Future

Mutually Beneficial Collaboration



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# New Strategies for Discovery of Drugs from African Plants

**Dr. Adeboye Adejare**

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## Drug Discovery is a Possible Area of Excellence at African Universities

Plenty of ethnomedical precedence exists for natural products, especially from plants, serving as drugs and drug leads. Common examples include Aspirin, Capsaicin, and Morphine. A U.S. Food & Drug Administration (FDA)-approved drug for the treatment of Alzheimer's disease, Rivastigmine, is a chemical derivative of Physostigmine. Physostigmine was isolated from the Calabar bean (*Physostigma venenosum*), a plant native to Nigeria. The Calabar bean was used as a source of poison in local folklore. In a classic series of experiments, a major component of the poisonous concoction was discovered to be Physostigmine. Chemical modifications of Physostigmine to increase brain bioavailability led to Rivastigmine, whereas modifications to decrease it led to Neostigmine. Neostigmine is used for urinary retention, myasthenia gravis, and Ogilvie's Syndrome. The natural product itself, Physostigmine, is used to treat glaucoma. All three compounds are used to treat various disorders but are based on a common pharmacological mechanism of action (acetylcholinesterase inhibition). Given this background, we believe that systematic exploration of plants and other natural products based on Africa's ethnomedicine can be useful in modern drug discovery. There is sufficient reason to believe that the cure for any disease — including COVID-19 — can be of African origin. The challenge is how such drug discovery can be operationalized and be beneficial to all partners. The following suggestions will be helpful in strategizing the discovery of drugs from African plants:

1. Begin a systematic effort to examine and reexamine plants for drugs and drug leads. Just because an extract or compound was discovered and found to be inactive in a particular pharmacological assay 30 years ago does not mean that reexamination may not generate interesting results. Of course, plants that have not been examined are clear targets. New technologies such as those utilized in combinatorial chemistry and high throughput screen can be used.
2. Develop better abilities to evaluate compound/extract synergies and appropriate pharmacological assays. Inconsistencies between in vitro and in vivo results led to the concept of prodrugs. Just because a preparation failed in a test or two, or even in rodents, does not mean the preparation is ineffective in humans.
3. Enhance medical research capacity, including clinical trials, in Africa. A major reason many people shy away from traditional medicine is the lack of clinical evidence, other than anecdotal incidents. COVID-19

has been supposedly "cured" by many different preparations. It is obvious that in most cases, what was cured was not COVID-19. There is no scientific diagnosis indicating that the person cured had COVID-19.

4. Grow programs with sustainable business models. Protect intellectual property. Encourage competition. Use U.S. Department of Health & Human Services National Institutes of Health-type models for grant and contract awards. Set clear short- and long-term goals, as well as criteria for terminating or extending a program.
5. Seek institutional collaborations and mentorships. There are new technologies which facilitate collaboration, such as Zoom and WhatsApp. Physical distance is becoming less of a barrier. Collaboration with those who have indigenous or local knowledge in a mutually beneficial manner needs to be carefully examined.
6. Consider diseases with global burden — including pain, cancer, diabetes, and neurodegenerative disorders; not just diseases with African burden. Efforts in this area can attract funds from anywhere in the world. For instance, pain is universal and critical need exists for non-opioid pain medications.
7. Several universities currently have ongoing efforts and lessons can be learnt from such. The University of Ibadan Faculty of Pharmacy in Nigeria has developed some teas through their Centre for Drug Discovery, Development, and Production with scientific support for the products. However, such efforts need to be taken to the next level in drug discovery. The same can be said about the Model Herbal Clinic at the University of Lagos Faculty of Pharmacy in Nigeria. I have had the privilege of serving as a Carnegie African Diaspora Fellow at both institutions, which is partly why I am familiar with those efforts.
8. Physical infrastructure and capacities are major considerations. But the biggest burden is the human will.

## Challenges

Drug discovery is a long, expensive, and risky proposition. On average, thousands of compounds need to be synthesized to obtain one that is USA FDA approved. Steps need to be taken to mitigate the risks. A substantive ethnomedicine basis for a drug discovery program greatly increases the odds of

success. Steps can be taken to optimize a lead compound, as illustrated with Physostigmine.

Incentives for faculty members to focus on these efforts are generally low. Academic salaries are typically not generous, and many countries in Africa have currencies that are depreciating — making the salaries worth even less on a global scale. It is therefore easy for such faculty members to embark on non-academic ventures for survival. Productivity on the drug discovery front then decreases, which decreases attractiveness of the efforts to global entities that might have been interested.

Funding remains a big challenge. Obtaining funding for faculty, student, and technician salaries; supplies; and travel on a sustained basis for a decade becomes a major challenge. However, such funding is necessary to increase the probability of success. Funding for purchase and maintenance of major equipment such as nuclear magnetic resonance and mass spectrometers must be sought if not locally available. Funds should be pursued at university, state, national, and international levels, as well as from both the government and the pharmaceutical industry.

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Mutually Beneficial Collaboration

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# **The Beauty, Complexity, Connectivity and Power of the CADFP Project, "Culture, History and Women's Stories: A Framework for Capacity Building in STEM Related Fields and for Fostering Entrepreneurship"**

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## ABSTRACT

The seven-year ongoing ethnomathematics thrice-funded Carnegie African Diaspora Fellowship Program (CADFP) project “Culture, history, and women’s stories: A framework for capacity building in STEM related fields and for fostering entrepreneurship” is a mutually beneficial collaboration with faculty/staff and students at four higher educational institutions: Federal University of Technology, Akure (FUTA) and National Mathematical Centre (NMC), Abuja, both in Nigeria; Borough of Manhattan Community College (BMCC), City University of New York (CUNY) in the United States; and Ecole Superieure Sainte Felicite (ESSF) in Cotonou, Benin Republic. It has extended to collaborations of Professor Nkechi Agwu, the Carnegie African Diaspora Fellow, with nine nongovernmental organizations (NGOs)/501(c)(3)s: Centre for Gbari Research and Documentation (CGRD), Chi Stem Toys Foundation, Nigerian Women in Agricultural Research for Development (NiWARD), Nigerian Women in Mathematics (NWM), and Pan-African Strategic and Policy Research Group (PANAFSTRAG), all in Nigeria; and the Drammeh Institute, Black Women for Black Girls Giving Circle, New Covenant Dominion Ministries High School, and Chi Stem Toys Inc., all in the U.S. It has resulted in several joint publications, presentations, digital media, and news features, as well as national and international awards to the collaborators. The most recent is the memorialization of Professor Nkechi Agwu as one of 64 women honored on the Association for Women in Mathematics (AWM) EvenQuads Notable Women in Math Playing Cards, released in January 2021 in commemoration of AWM’s 50th anniversary—a testimony to the global impact of this project and the power of networking and collaboration.

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## Introduction

In today’s world, collaboration and networking are key elements for the optimal success of any humanity development initiative. The Carnegie African Diaspora Fellowship Program (CADFP) is framed around international collaboration and networking between scholars in African higher educational institutions and their counterparts in the United States and Canada on mutually beneficial projects that will enhance and facilitate their research and teaching endeavors, while simultaneously facilitating the growth and development of the host and fellow institutions and promoting networking connections between program alumni and Fellows. The program encourages collaboration and networking even beyond the grant funding period. The program allows for continuity in networking and collaboration, in addition to growth of the project through funding up to three times, supplemental grants for project resources, and travel grants to conferences to give joint and individual presentations. The seven-year ongoing ethnomathematics thrice-funded CADFP project “Culture, history, and women’s stories: A framework for capacity building in STEM related fields and

for fostering entrepreneurship” exemplifies the collaboration and networking goals of the CADFP. It is a mutually beneficial collaboration with faculty/staff and students at four higher educational institutions: Federal University of Technology, Akure (FUTA) and National Mathematical Centre (NMC), Abuja, both in Nigeria; Borough of Manhattan Community College (BMCC), City University of New York (CUNY) in the U.S.; and Ecole Superieure Sainte Felicite (ESSF) in Cotonou, Benin Republic. This project was birthed through collaboration and networking within the Mathematical Association of America (MAA) Institute in the History of Mathematics and its Use in Teaching (IHMT).

This paper discusses the methodology used to facilitate the successful collaboration that extended beyond the four higher educational institutions to nine nongovernmental organizations (NGOs)/501(c)(3)s: Centre for Gbari Research and Documentation (CGRD), Chi Stem Toys Foundation, Nigerian Women in Agricultural Research for Development (NiWARD), Nigerian Women in Mathematics (NWM), and Pan-African Strategic and Policy Research Group (PANAFSTRAG), all in Nigeria; and the Drammeh Institute, Black Women

for Black Girls Giving Circle, New Covenant Dominion Ministries High School, and Chi Stem Toys Inc., all in the U.S. The collaborations on this project have resulted in several joint publications, presentations, digital media, and news features, as well as national and international awards to the collaborators. The most recent is the memorialization of Professor Nkechi Agwu by the Association for Women in Mathematics (AWM). She is one of 64 women honored on the AWM EvenQuads Notable Women in Math Playing Cards, released in January 2021 in commemoration of AWM's 50th anniversary.

This paper details the history behind and journey toward the project, how the collaborators met to develop and implement the project, and the main national and international advantages and challenges of collaboration. It highlights the problem of science, technology, engineering, and mathematics (STEM) education, particularly of female children in Nigeria and the U.S. It provides recommended solutions to these problems as modeled by this project, such as the mathematical storytelling of some members of NiWARD, NWM, and NMC; the joint PANAFSTRAG and Chi Stem Toys Foundation teacher training workshops on the use of a curriculum based on mathematical storytelling and indigenous mathematical knowledge systems for teaching and learning mathematics; and the vocational and entrepreneurial STEM workshops for women, youth, children, and disabled people in rural communities in Nigeria.

## Statement of the Problem and Proposed Solutions

We are living in a world where science and technology have become an integral part of the culture. Any country that overlooks this fact is unlikely to catch up with the rest of the world. Everyday human activities are driven by science and technology. Undoubtedly, a sound STEM education is the key to developing industries, alleviating poverty, promoting peace, conserving the environment, improving economic growth and development, and ensuring good health for all. Many students in Nigerian secondary schools encounter problems in studying mathematics. First, students have difficulties in understanding the topics taught; and second, teachers have difficulties in achieving effective teaching in our schools.

Another dimension of the problem is that in most Nigerian societies, educating female children is not a priority. Women are left behind in most professions. "Africa is the only continent where education is a male-dominated profession—an imbalance that perpetuates gender-based inequality" (Wong, 2015). In particular, the number of women in STEM related fields is low when compared with their male counterparts. This project provides a solution to the gender imbalance of women as teachers and/or STEM related professionals.

It has been observed that among the factors that influence achievement of learners of school mathematics, teachers' effectiveness as measured through the acquisition and use of good instructional skills and methodologies appears very prominent (Sobel, 1988). Studies have shown that high-quality teaching can make a significant difference in students' learning—and high-quality teaching requires a high-quality workforce. For instance, NMC organized workshops in certain schools in some states under the Mathematics Improvement Project (MIP). After NMC intervention, schools' results improved tremendously. The percentage credit pass in mathematics at Government Secondary School (GSS) Icheke-Ogene rose from 7.69% in 2010 to 55.56% in 2012, and that of Saint Peters College Idah rose from 33.02% in 2010 to 70.86% in 2012. Also, in Kaduna State, the percentage credit pass in mathematics at GSS Markarfi rose from 29.9% in 2013 to 99.2% in 2015 after NMC intervention under the MIP.

Some of the problems related to teaching and learning the core subjects in our educational system include a lack of:

- Good quality teachers
- Effective teaching methods
- Instructional materials
- Small class sizes
- Adequate teacher training
- Good working conditions for teachers
- Good teacher retraining
- Incentive for teachers
- Mathematics laboratories in our schools
- Regular workshops and seminar for teachers
- Reader-friendly textbooks in schools

Among all the stakeholders in the education process, the teacher is the most important one. No educational system can rise above its teachers, and no nation can rise above the standards of its schools. Education is the key that unlocks the door to modernization. However, the teacher holds the key to the door.

Professor Agwu offers a new and innovative way of teaching mathematics and the sciences in schools by using culture and women's stories. This approach is designed for capacity building in STEM related fields and for fostering entrepreneurship and innovation. Although teachers in many advanced countries are using this innovative pedagogical approach to teach subjects at all levels, teachers in Nigeria are not yet using this approach. The use of cultural artifacts and women's stories concretizes educational concepts, arouses and sustains the learners' interest, and fosters entrepreneurship and innovation among learners. With this innovative approach, STEM students' achievements are improved.

The problem of the teacher in terms of quantity and quality has been identified as one of the most important factors affecting student performance in mathematics. In particular, the approach to teaching mathematical sciences is an important factor that determines student achievement in mathematical sciences. The approach of using culture and women's stories has not been used in Nigeria. The NMC and Professor Agwu are collaborating on this CADFP project, "Culture, history, and women's stories: A framework for capacity building in STEM related fields and for fostering entrepreneurship," to introduce the use of culture and women's stories in STEM teaching in Nigeria. The problems confronting mathematics students resulting from the pedagogical approach of teachers and the curriculum deserve appropriate attention. This project addresses these problems.

### **The Genesis of the CADFP and Exodus to Forging Different Types of Collaborations**

The journey toward this project began with Professor Nkechi Agwu's certification training during the summers over a seven-year period, from 1997–2003. She received training from the MAA IHMT at the Catholic University of America in Washington, D.C., as a historian of mathematics and an ethnomathematician under the mentorship of Professors Victor Katz and Frederick Rickey, renowned historians of mathematics, and Professor Ubiratan D'Ambrosio, a renowned ethnomathematician. She also received motivation and inspiration to work in the area of African indigenous mathematical knowledge systems, which is an area not covered in the mathematics literature and curriculum—and which this CADFP project addresses.

All groups of people have made significant contributions to the development of mathematics, although the contributions of Africans—other than algebra and geometry in ancient Egypt—are still highly unacknowledged in the history of mathematics (Lumpkin, 1980). "This is partly due to our oral traditions, slavery, colonialism, neo-colonialism, globalization and the fact that our indigenous mathematics, scientific and technological knowledge as a people is often shrouded in our spirituality. This notwithstanding, efforts must be made to document the mathematical contributions of Africans to enrich the curriculum in a multicultural and interdisciplinary way by providing a wide repertoire of examples of mathematical concepts illustrated from the African context" (Agwu, 2016, p. 13). This CADFP project makes an effort to document those contributions.

At MAA IHMT, Professor Agwu was reminded of the traditional strategy game called *okwe* (popularly known worldwide as *mancala*) that is commonly played in villages and cities in Ala Igbo (Igboland). It teaches aspects of farming through the sowing of seeds and capturing of seeds into a player's storehouse. Professor Agwu learned this game from

her late paternal grandmother, who was an expert player and was an eighth-generation farmer from Agbakoli Alayi. She recognized the mathematical implications of the game when she began an ethnomathematics research project as part of her MAA IHMT training. Professor Agwu chose *okwe* for her research project to study topics in game theory and other mathematical topics related to the game, with input from a group of MAA IHMT historians of mathematics. She found it interesting that despite her strong mathematical background she had never been able to win against her grandmother, who never had even a primary school education. This was the genesis of Professor Agwu's work as an ethnomathematics researcher and the exodus of this CADFP project.

During the period Professor Agwu was attending MAA IHMT and afterwards, she received several research and faculty development grants from her local institution, BMCC, as well as related individual and collaborative CUNY-wide grants, to further her ethnomathematics research study on *okwe* and to conduct other ethnomathematics research and develop related curriculum on Igbo indigenous mathematical knowledge systems. She received help from a renowned Igbo cultural anthropologist and Catholic priest, Dr. Jon Ukaegbu, who is a native of Mbaise, Imo State, Nigeria, and an expert in Igbo symbolism.

Professor Agwu's strong interest in mathematical storytelling and curriculum development for women of African heritage in STEM began in 2005 when she was chair of the Black History Committee of the American Association of University Women (AAUW), New York City branch. She became president of this branch in 2009 and developed, implemented, and engaged in initiatives related to nurturing, grooming, and mentoring school girls to consider STEM related careers. This facilitated her networking connections with PANAFSTRAG, the Drammeh Institute, and Black Women for Black Girls Giving Circle, as a member of the AAUW leadership team, promoting one of AAUW's major efforts to bridge the gap of underrepresentation of women in STEM in the U.S. In the July/August 2010 issue of *The Network Journal* (<https://tnj.com/nkechi-madonna-adeleine-agwu-phd>), Professor Agwu explains the AAUW New York City branch mission, as well as her own STEM and economic agenda for women and girls, so that all women can have a fair chance at climbing the ladder to success (Gordon, 2010). She also provides policy recommendations for governmental and nongovernmental institutions that want to facilitate pathways to break down barriers for women in STEM. This CADFP project builds upon and implements some of those recommendations.

In 2001–2010, CUNY implemented a graduation requirement for each student to take at least one writing intensive course in a subject area of their choice. All departments at BMCC, Professor Agwu's own CUNY campus,

were now required to develop and implement some writing intensive courses to help students meet this graduation requirement. Faculty members were funded to develop and implement these courses. Professor Agwu saw this as an avenue to balance the mathematics curriculum at BMCC/CUNY for race, gender, class, and ethnicity as it pertains to African heritage. She took advantage of this opportunity to develop writing intensive courses in discrete mathematics, mathematics foundations, and introductory statistics featuring African indigenous mathematical knowledge systems and African women's stories. This led to several presentations of her work at a few sessions of the United Nations (UN) Commission on the Status of Women (CSW). These presentations allowed Professor Agwu to solidify her network connections with the Drammeh Institute and PANAFSTRAG and to meet with the founders of NiWARD, Professor Stella Williams and the late Dr. Mojisola Olayinka Edema—who was Director of the Centre for Gender Issues in Science and Technology (CEGIST) at FUTA.

These connections resulted in Professor Agwu writing a proposal to come to CEGIST-FUTA as a Carnegie African Diaspora Fellow for the first iteration of the project, under the title "Culture and women's stories: A framework for capacity building in STEM related fields." The project title was later modified to the current title, with subsequent second and third iterations at the NMC. A by-product of the project implementation at FUTA was Professor Agwu's journey to become a mathematical storyteller for NiWARD; partnering with PANAFSTRAG and Chi Stem Toys Foundation to conduct annual professional development workshops for mathematics teachers in Lagos State and its environs (currently ongoing); partnering with Chi Stem Toys Foundation to conduct bi-weekly STEM related vocational education and entrepreneurship workshops for women, youth, children, and disabled people in Abuja and Bende Local Government Area (LGA) in Abia State, Nigeria (currently ongoing); partnering with the BMCC Science and Technology Entry Program (STEP) to conduct weekly workshops for high school students in New York City; and partnering with the Drammeh Institute, Chi Stem Toys Inc., and Black Women for Black Girls Giving Circle on a joint mathematical storytelling and Ndebele doll sculpturing STEM program for middle school and high school girls in New York City. A by-product of the later STEM program is a collection of YouTube videos created by the Drammeh Institute in which the girls evaluate the program and discuss their Ndebele doll creations, the related mathematical ideas, and the NiWARD member the doll represents. The successful collaboration with Chi Stem Toys Foundation in providing STEM related vocational and entrepreneurship workshops to empower community members in Bende LGA in Abia State, Nigeria, resulted in the honor of

Professor Agwu being named as Chief Ada Bende (First Daughter of Bende) by the traditional ruling council of the 50 autonomous communities in Bende LGA; in production of cultural heritage items by workshop participants; and in disbursement of small empowerment grants and equipment by Chi Stem Toys Foundation to a few participants to facilitate their entrepreneurship endeavors.

At CEGIST-FUTA, Professor Agwu gave curriculum development and teacher training workshops framed around the project goals to STEM education stakeholders. A curriculum based on the Akure Kingdom and NiWARD members was also developed. The workshops were evaluated by CEGIST-FUTA within their regular mode of program assessment. Professor Agwu connected with one of her NMC research group members at these workshops, Dr. Smart Oloda, who attended the workshops as an NMC representative. Dr. Oloda shared his experiences and the successful project outcomes with the NMC director at that time, Professor Adewale Solarin. Professor Solarin was impressed and inspired by this report. He embraced the first iteration of the project at CEGIST-FUTA with a commitment by the NMC of 200,000 Nigerian naira (₦200,000) toward resources. As a result of the success of this project at CEGIST-FUTA, CADFP sponsored Professor Agwu to share her work at the African Studies Association annual meeting in 2014; at a World Bank forum in 2015 on "Engaging the African diaspora: Partnering for long-term trade, investment, and skills for workforce development in Africa"; and through a mini-conference grant sponsoring her and Ms. Olubukunola Williams, one of her co-principal investigators for the project at CEGIST-FUTA. Professor Agwu and Ms. Williams shared their work at the annual Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) conference in 2016. RUFORUM published the paper for this presentation.

Professor Solarin, the NMC director at that time, felt that the project aligned with NMC's mission and vision and that the NMC should spearhead it for a more national outreach. He invited Professor Agwu to the NMC to replicate the project there. This was the beginning of the journey for the project to come to the NMC, Abuja, as a CADFP project under the past director, Professor Solarin. Professor Agwu then wrote a proposal for the second iteration of the project, with the NMC serving as the host institution. While the proposal was undergoing review by the CADFP and before the project officially started at the NMC, Professor Agwu began collaboration with the NMC under the auspices of its mental arithmetic program. This collaboration involved putting together the NMC Ethnomathematics Research Group and engaging team members and schoolteachers in Delta and Rivers States in evaluating and field-testing the curriculum developed at

CEGIST-FUTA during the first iteration of the CADFP on the Akure Kingdom and NiWARD members.

To ensure the project's effective development, implementation, and sustainability at the NMC, it was necessary for Professor Agwu to obtain a sabbatical leave from her home institution, BMCC, to work with the NMC Ethnomathematics Research Group for an extended period of time. While in New York City for a UNESCO meeting, Professor Solarin visited Professor Agwu's host institution, BMCC/CUNY, to share the NMC's mission and vision and the significance of the project with top-level administrators, mathematics department faculty members, and students at various CUNY campuses. This visit facilitated Professor Agwu's sabbatical leave from BMCC to engage in the project as a Carnegie African Diaspora Fellow at the NMC. However, before the second iteration of the project actually started at the NMC, the NMC directorship changed hands. Professor Stephen Onah became director of the NMC. This change in leadership came with a few initial challenges in getting Professor Onah's buy-in because the new director came from outside the NMC. However, once Professor Onah was fully briefed about the project and its initial outcomes, he recognized its value in moving the NMC's mission forward and its significance to the Nigerian mathematical community. He endorsed the project, giving it the NMC's full support. He also approved financial resources for the research group to travel to various states in Nigeria to engage in ethnomathematics research on indigenous mathematical knowledge systems and to present their work at various professional groups' conferences: the Nigerian Mathematical Society (NMS), the Mathematical Association of Nigeria (MAN), and NiWARD. He also provided in-kind support for an NWM leadership team to come to the NMC to be interviewed for the women's stories part of the project and to help review and evaluate the curriculum developed within the women's stories part of the project.

The first cultural group the NMC Ethnomathematics Research Group studied was the Gbari, located in Abuja and neighboring states. The NMC Ethnomathematics Research Group, International Model Science Academy (IMSA), CGRD, and Chi Stem Toys Foundation collaborated to share information about the indigenous mathematical knowledge systems of the Gbari people, as well as develop a related mathematics curriculum and field-test the curriculum with Gbari schoolchildren at the CGRD and IMSA. Chi Stem Toys Foundation sponsored the CGRD field-testing, and the NMC sponsored the IMSA field-testing. As a result of this collaboration, the NMC Ethnomathematics Research Group has published a few papers and presented at MAN and NMS annual meetings. In addition, Professor Agwu was honored by the CGRD with the Ladi Kwali Lifetime Achievement Award.

To date, the NMC Ethnomathematics Research Group has developed and is field-testing a mathematics curriculum based on the indigenous mathematical knowledge systems of the following cultural groups: Gbari, Iggede, Tiv, Yoruba, Fulani, Igbo, Efik, and Ibibio; and stories from the lives of women in the following groups: NiWARD, NWM, and NMC Women in the Mathematical Sciences. The developed curriculum is published by the NMC in an Ethnomathematics Resource Book series. As a consequence of the CADFP making visible the indigenous mathematical knowledge systems of the Iggede people, Professor Agwu was honored with the title Queen of Iggede Land by the traditional ruling council of the Iggede people. In addition, due to the successful outcomes and visibility of this project, Professor Agwu was given a citation by the Brooklyn Borough President at the Borough's 400 Years of Fortitude Program in 2019; was an invited keynote speaker in 2020 at the Black Heroes of Mathematics Conference by the five major British mathematical societies; received the honor of Global African Woman of Distinction in STEM in 2020 by the Drammeh Institute; was recognized by the United Nations' International Decade for People of African Descent; and has been memorialized as one of 64 Notable Women in Math on the AWM EvenQuads Playing Cards released in 2021 in commemoration of AWM's 50th anniversary. All these honors are a consequence of the successful collaborations and impact of this CADFP project.

Upon her return from sabbatical leave at the NMC for this CADFP project, Professor Agwu initiated a faculty interest group (FIG) in "Culture, Women's Stories, and Creativity in STEM" at the BMCC Center for Excellence in Teaching, Learning, and Scholarship (CETLS) to further the project's research, curriculum development, and teaching initiatives with interested faculty members at BMCC and CUNY-wide. In addition, the FIG would work toward creating a BMCC study-abroad mathematics survey course in Africa that would engage students in the mathematics curriculum developed by the FIG, the NMC Ethnomathematics Research Group, and other project collaborators. The work of the FIG led to the collaboration of Professor Agwu with the New Covenant Dominion Church High School (NCDCHS) to provide an avenue of field-testing the developed curriculum not just with BMCC students but also with high school students in New York City, since her partnership with BMCC STEP was no longer in effect when she took sabbatical leave. Nigeria is considered a Level-3 risk country by the U.S., so it could not be the host country for the FIG study-abroad mathematics course. Therefore, the FIG had to explore other countries in Africa. The Benin Republic, which neighbors Nigeria, is a low-risk country with a dominant cultural group of the Yoruba people, who are also found in the southwestern part of Nigeria. One of

the members of the FIG, Professor Thierry Agbotouedo, is a native of the Benin Republic; therefore, the FIG selected the Benin Republic to serve as the host country for the study-abroad mathematics course being developed. This led to the (ongoing) collaboration of Professors Agwu and Agbotouedo with ESSF in Cotonou, Benin Republic. Travel funds for Professor Agwu to Cotonou, Benin Republic, were provided by Chi Stem Toys Foundation. Professors Agwu and Agbotouedo have both made site visits to introduce mathematics faculty members and administrators at ESSF and other higher educational institutions in the Benin Republic to Professor Agwu's CADFP project and to the work of the FIG and Chi Stem Toys Foundation, as well as to identify faculty members who would be willing to collaborate with the FIG to develop a mathematics curriculum based on the indigenous mathematical knowledge systems of ethnic nationalities in the Benin Republic and to cooperate in teaching the study-abroad course in mathematics once it is fully developed and ready to be implemented. Unfortunately, the CADFP does not serve the Benin Republic as one of its allowable host countries, so ESSF cannot apply for Professor Agbotouedo as a Carnegie African Diaspora Fellow to facilitate development of the BMCC study-abroad mathematics course. We are in the process of exploring other grant funding options. In summer 2021, BMCC open educational resources (OER) provided funding to both Professors Agwu and Agbotouedo to facilitate the development of a mathematics curriculum for the study-abroad mathematics course that will be available on the BMCC OER web page for use by anyone.

Professor Agwu has exhausted the maximum number of times she can be funded for a CADFP project. However, her project with the NMC is still ongoing beyond the Carnegie Foundation's grant funding period because of shared funding and resources provided by Chi Stem Toys Inc. and her own personal funds, which covered her international travel between the U.S. and Nigeria. NMC funds covered local travel, accommodations, and feeding Professor Agwu and the NMC Ethnomathematics Research Group. We are exploring options for grant funding that will move the project to the next level. We hope to conduct nationwide workshops to train mathematics teachers on using the curriculum we developed, similar to what is being done by PANAFSTRAG and Chi Stem Toys Foundation in Lagos.

As of August 2021, the NMC directorship changed hands. It is the prayer of the NMC Ethnomathematics Research Group to receive the same level of support and funding or even better from the new director, Professor Promise Mebine, who is coming from outside NMC. Professor Mebine has endorsed the continuity of the project but provision of resources is shaky due to internal funding

availability so the Group is having to solicit actively for grant funding to sustain the project. In addition, COVID-19 and the current issues of conflict in Nigeria have presented challenges for Professor Agwu in traveling to Nigeria since returning to the U.S. at the end of January 2021. Professor Agwu and the NMC Ethnomathematics Research Group hope to continue with study tours to meet with cultural custodians for nationalities that have yet to be studied. The next group on our agenda is the Bini people in Edo State, whose tour was supposed to take place in April 2021 but had to be rescheduled due to COVID-19 lockdowns by the Federal Government of Nigeria (FGN).

### **Research Methodology Used for the Women's Stories Aspect of the Project**

The project uses an ethnographic research approach:

1. Analysis of the biographies of members of NiWARD, NWM, and NMC Women in the Mathematical Sciences.
2. Initial mathematical storytelling explorations for interesting patterns, characteristics, and relationships; community development activities and work with rural women relevant to indigenous mathematics and scientific knowledge.
3. Selection of a subset of members of NiWARD, NWM, and NMC Women in the Mathematical Sciences for further ethnographic study based on leadership characteristics, diversity of STEM related disciplines, and community development activities that relate to farming and traditional work of rural women.
4. Participant observation of the scholarly work and community development activities of and/or interviews with the selected subset of members of NiWARD, NWM, and NMC Women in the Mathematical Sciences, which may include relevant study tours to cultural and historical sites.
5. Development of curricular activities, Ndebele doll sculptures, and mathematical stories of the selected subset of NiWARD, NWM, and NMC Women in the Mathematical Sciences.
6. Field-testing of curricular activities and professional development on their use with educators at universities, colleges, and schools and within workshops for primary, secondary, college, and university students and educators within STEM enrichment, research, and professional development programs.
7. Dissemination of curricular activities for further assessment and refinement through conference presentations, workshops, seminars, research publications, and books.

## A Sample Activity: NiWARD Women, Ndebele Doll, and Graph Theory

This activity is published in the book *God's own: The genesis of mathematical story-telling*, authored by Professor Nkechi Agwu under her pen name Nma (Beautiful) Jacob (Agwu, 2016). The activity requires participants to read the biography and/or curriculum vitae of a NiWARD woman published on the internet and/or in the following books: *The grace of Dr. Mrs. Mojisola Olayinka Edema: A visionary and a reformer* (Agwu et al., 2016); *Celebrating Africa's 50 exemplars* (Williams, 2017, Chapter 40, pp. 208–212); and *God's own: The genesis of mathematical story-telling* (Agwu, 2016). A by-product of this activity is indirectly educating participants on techniques for writing a biography and/or curriculum vitae and engaging in mathematical storytelling.

### Questions

Read Chapters 8 and 9 of *God's own: The genesis of mathematical story-telling* (Agwu, 2016). Then watch the African Views Organization's African Cultural Exchange YouTube video on how to make an Ndebele doll at <http://www.youtube.com/watch?v=HamUbtroHcA>. Use the instructions in the required reading and/or the video to:

1. Construct an Ndebele doll to represent a NiWARD woman whose biography and/or curriculum vitae you read. Prepare to bring in your doll to present it to the class.
2. Decorate your doll to reflect two vertex-edge graphs you see in the NiWARD woman's story and identify the standard name of the two vertex-edge graphs if possible.
3. Color the two vertex-edge graphs their chromatic number, state their chromatic number, and explain why you cannot color them with a number of colors less than what you claim is the chromatic number.
4. Use counting techniques and principles to count and state the number of vertices and edges of the two vertex-edge graphs on your doll and create a table showing the graph, its name, its chromatic number, and the number of its vertices and edges.
5. Develop an accompanying PowerPoint presentation on the life of this NiWARD woman that presents the two vertex-edge graphs you represented on your doll, their chromatic number, and the number of vertices and edges in each graph. Discusses why you selected those two vertex-edge graphs over the other types that are evident in the biography of the woman, and discusses what aspects of the woman's life inspire you.

## Network of Collaborations Illustrating the Beauty, Complexity, Connectivity, and Power of the CADFP Project

Figures 1–4 illustrate the beauty, complexity, connectivity, and power of the CADFP project as it relates to the four higher educational institutions and the nine NGOs. A list of these bodies is provided below before the figures.

### Four Higher Educational Institutions

- A. Federal University of Technology, Akure (FUTA), Nigeria
- B. National Mathematical Centre (NMC), Abuja, Nigeria
- C. Borough of Manhattan Community College (BMCC), City University of New York (CUNY), U.S.
- D. Ecole Superieure Sainte Felicite (ESSF), Cotonou, Benin Republic

### Nine NGOs

1. Pan-African Strategic and Policy Research Group (PANAFSTRAG), Nigeria
2. Nigerian Women in Agricultural Research for Development (NiWARD), Nigeria
3. Chi Stem Toys Foundation, Nigeria
4. Center for Gbari Research and Documentation (CGRD), Nigeria
5. Nigerian Women in Mathematics (NWiM), Nigeria
6. Chi Stem Toys Inc., U.S.
7. The Drammeh Institute, U.S.
8. Black Women for Black Girls Giving Circle, U.S.
9. New Covenant Dominion Ministries High School, U.S.

## Challenges in Forging Effective Mutually Beneficial Collaborations

The following key factors were important for forging effective mutually beneficial collaborations for this CADFP project and/or presented challenges of creating, measuring, and evaluating the collaborations.

### 1. Visibility and networking

As an African diaspora university faculty member who had not visited Africa since 2008 (many years before the first iteration of this project in 2014), it was not easy to connect with colleagues in African institutions who would value this CADFP project and help it move forward. Many of these colleagues do not have funding for travel to international conferences, where network connections to foster collaboration can take place. The majority of

FIGURE 1

Collaborations Resulting in First CADFP Project at FUTA

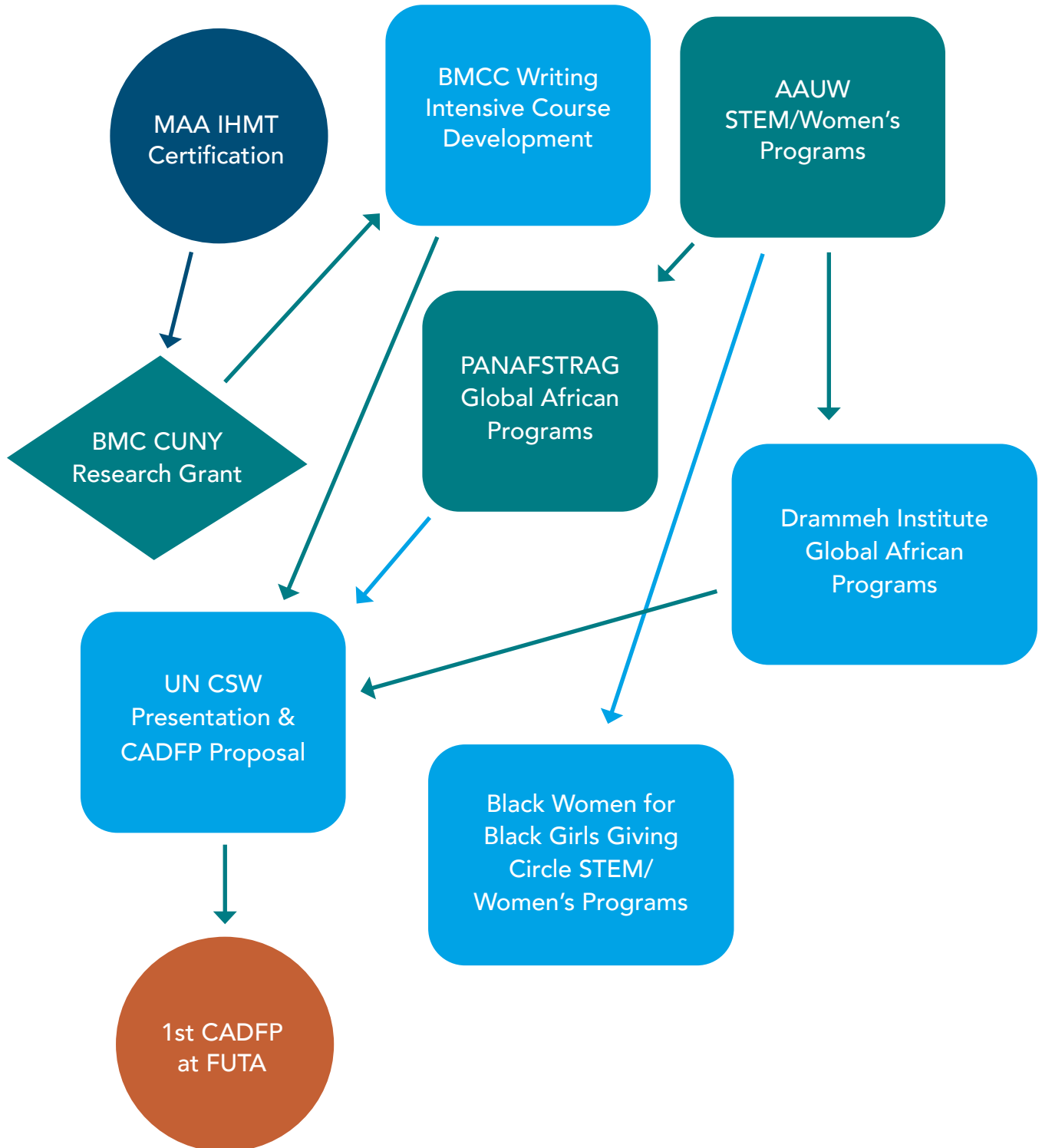




FIGURE 2

Collaborations Leading to Second CADFP Project at NMC

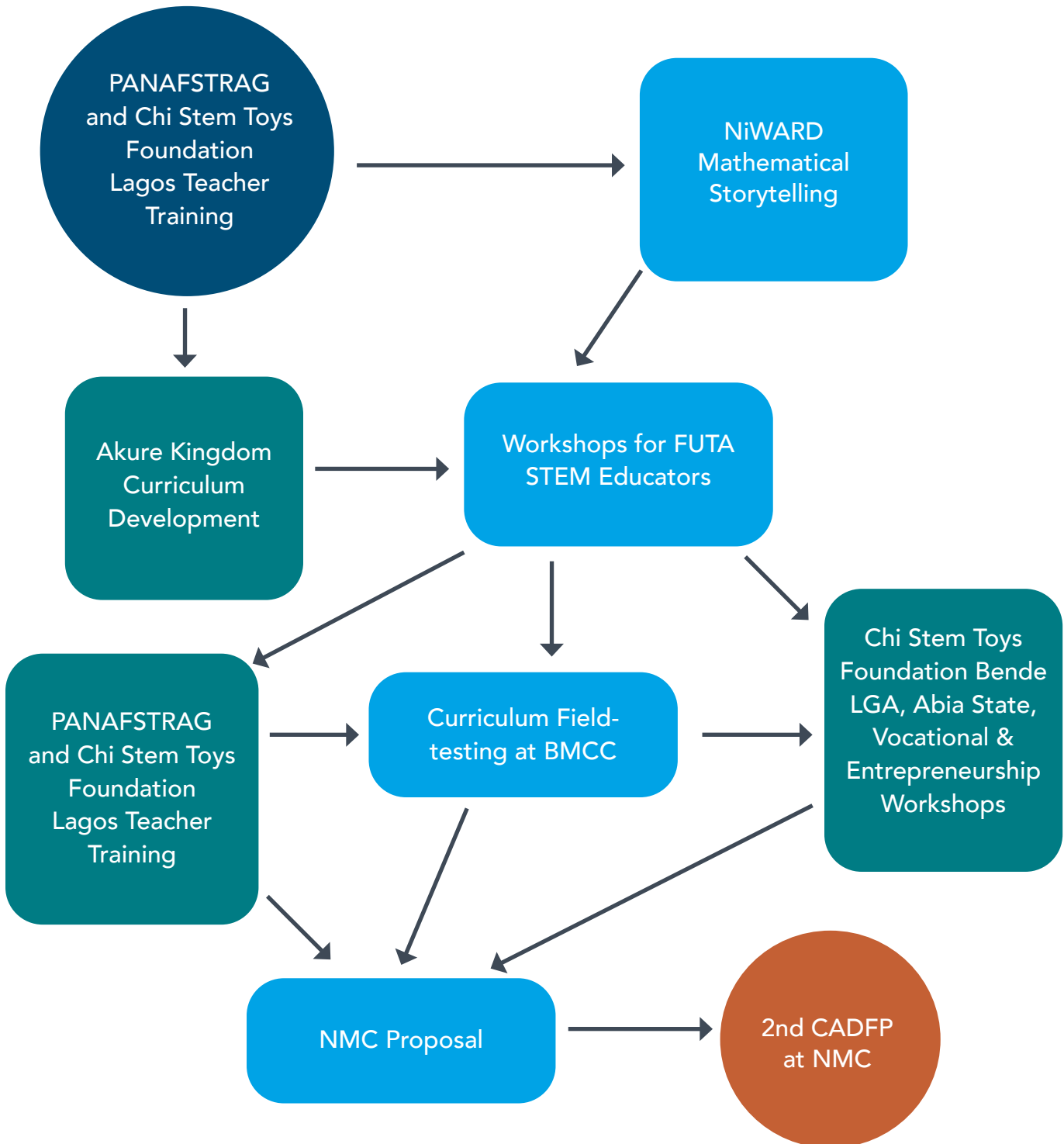


FIGURE 3

Collaborations Leading to Third CADFP Project at NMC

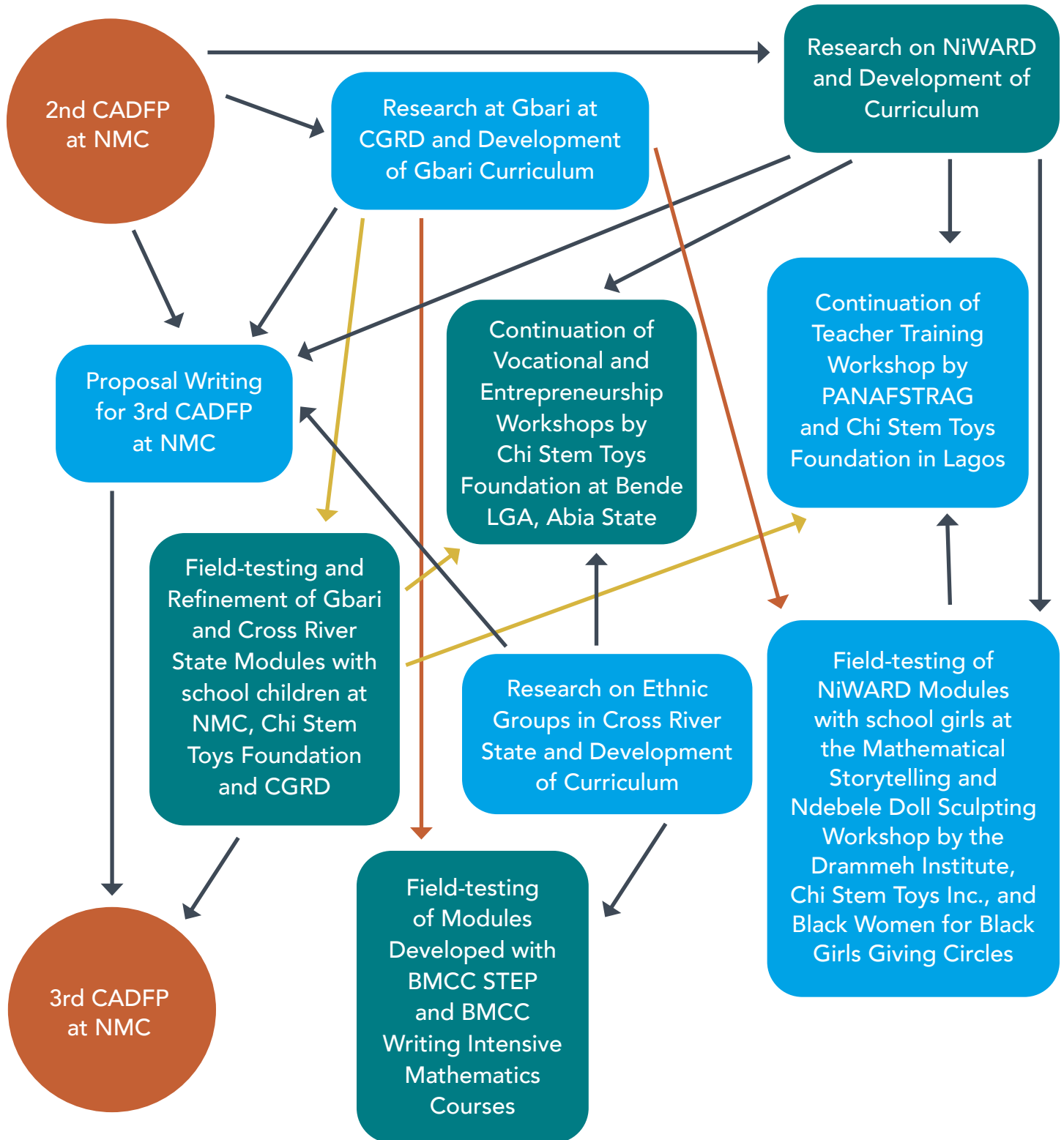
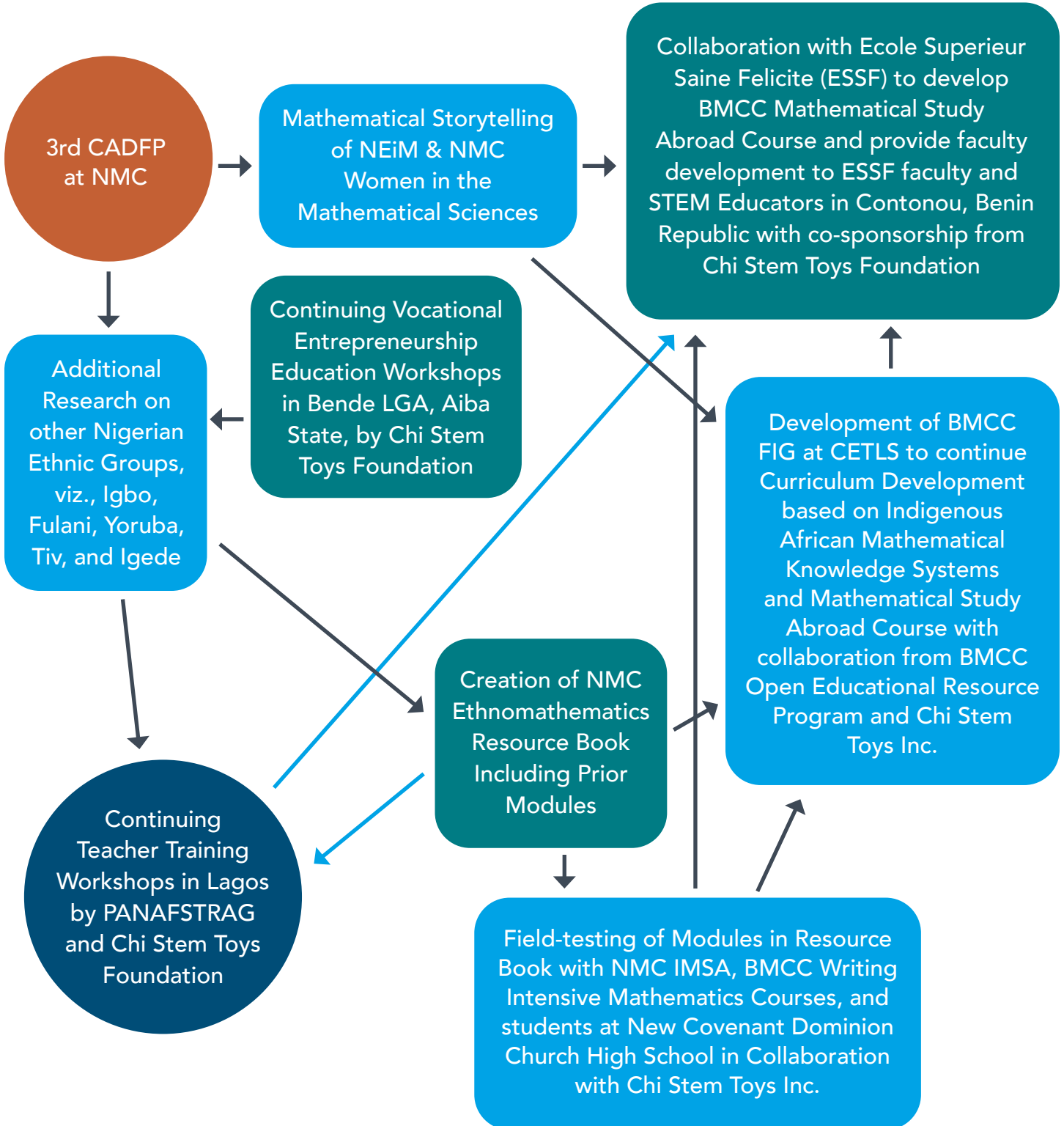


FIGURE 4

Collaborations Resulting from Third CADFP Project at NMC



these colleagues are males, who are not concerned about self-reproduction in male-dominated STEM fields. The connection to make this CADFP project possible occurred at a UN CSW. This meeting was geared toward empowering women and female children. The connection was made with two female colleagues, Professors Williams and Edema; these professors were leading a professional group—NiWARD—that was concerned with issues of women’s empowerment in STEM related fields. Professor Edema was leading a workshop about gender issues in science and technology. Without this unique connection, this CADFP project probably would not have taken off.

Part of this CADFP project’s success came from Professor Agwu tapping into her pool of networking groups with an interest in STEM education to collaborate with them on related aspects of the project, such as teacher training and faculty development, field-testing and evaluation of the developed curriculum, vocational and entrepreneurship education, and STEM enrichment for students. The project’s impact at FUTA and NMC included professional development workshops for STEM faculty and teachers on the developed curriculum and field-testing the curriculum with schoolchildren at the CGRD, NMC IMSA, BMCC STEP, and NCDCHS: students in writing intensive mathematics courses at BMCC; teacher training joint workshops by PANAFSTRAG and Chi Stem Toys Foundation in Lagos; STEM related vocational and entrepreneurship education workshops by Chi Stem Toys Foundation in Bende LGA; and the joint Mathematical Storytelling and Ndebele Doll Sculpturing Program by the Drammeh Institute, Black Women for Black Girls Giving Circle, and Chi Stem Toys Inc. Participants attending all of these workshops were surveyed for their opinions related to the impact of the workshops and use of the curriculum materials. This feedback, together with feedback from conference presentations and publications, has been used to refine the materials published by the NMC as an Ethnomathematics Resource Book on the Nigerian ethnic groups studied so far.

## 2. Funding and resources

Funding has been an extremely crucial factor for the success of this CADFP project. Many organizations have contributed funding and resources beyond that provided by the CADFP to facilitate the project’s growth and development and its extension beyond the host and home institutions. Without this support, the project would not be as acclaimed as it currently is, nor would it have the visibility it currently has. The donated funding and resources have supported workshops within and outside the host and home institution and have provided international travel funds for Professor Agwu, who has also sacrificed her own funds for international travel outside the CADFP funding period

to continue working with the NMC Ethnomathematics Research Group to facilitate the project’s sustainability. The NMC Ethnomathematics Research Group is soliciting funding to move the project to the next level, training teachers from around the nation to use the curriculum published in the NMC Ethnomathematics Resource Book. This project has received maximal funding support from the CADFP (thrice funded), supplemental grant funding, and funding for joint presentation at an international conference—which indicates successful outcomes based on the CADFP evaluation process.

A measurable success of the project is demonstrated by the fact that the NMC has continued to provide local support for Professor Agwu and the NMC Ethnomathematics Research Group to maintain the collaboration, attend national mathematics association conferences to present the group’s work, and publish the group’s work. This support indicates the impact of the project in moving the NMC’s mission forward. Another measurable success is the fact that PANAFSTRAG and Chi Stem Toys Foundation have continued the workshops to train teachers in Lagos and to provide STEM related vocational and entrepreneurship training in Bende LGA, Abia State. Lastly, FIG success is evaluated by the CETLS on an annual basis, with semester-end reports of the outcomes published on the college website. Additionally, evaluative feedback (formally, by BMCC’s Office of Institutional Effectiveness and Analytics and/or other BMCC or CUNY online training programs; informally, by the Carnegie African Diaspora Fellow) from students in BMCC writing intensive mathematics courses where the developed curriculum is being field-tested indicate that the curriculum has increased their level of interest and motivation in mathematics and is fostering cultural awareness and education on issues related to women’s empowerment in STEM. Thus, the CADFP project is meeting its goal of providing an effective model for capacity building in STEM related fields.

## 3. Commitment of leadership and leadership turnover

The change in directorship at the NMC before the second iteration of the CADFP project, with the new leadership coming from the outside, presented challenges of getting buy-in and commitment from the new director. This slowed down some of the work being done before the official start of the second iteration of the project. However, once buy-in was achieved, it came with the commitment of adequate support that ensured the project’s success, facilitating national and international visibility through conference presentation and publications. With another change in the directorship in August 2021, we pray for continuity and sustainability at the same or higher level and we are gradually getting it.

Additionally, the project's success would not have been as strong if not for the support of the home institution's (BMCC's) leadership in granting Professor Agwu a sabbatical leave for the second iteration of the project at the NMC. The extended time period allowed many more ethnic groups to be studied, with related curriculum developed and the mathematical storytelling of NiWARD, NWM, and NMC Women in the Mathematical Sciences. The home institution has faced some challenges, particularly in terms of funding for the FIG to develop the study-abroad mathematics course in the Benin Republic. Other than the recent funds made available in summer 2021 to Professors Agwu and Agbotouedo by the BMCC OER, the FIG has had to solicit for funding outside of CUNY for course development and implementation. So far, the FIG has been unsuccessful—but is hopeful for the future. We are thankful that Professors Agwu and Agbotouedo were willing to invest their personal funds with some support from Chi Stem Toys Foundation for travel to the Benin Republic. They made the necessary connections with mathematics colleagues in the Benin Republic to lay a foundation for the study-abroad course implementation at ESSF.

#### 4. Public Health and Security Challenges

The COVID-19 pandemic that has plagued the world also presented challenges for moving forward certain aspects of this CADFP project. FGN lockdowns and security issues prevented the NMC Ethnomathematics Research Group from engaging in study tours to meet with the custodians of culture for ethnic groups for which a curriculum had yet to be developed. The pandemic also affected travel of Professor Agwu to Nigeria in 2020 and 2021 to continue in-person activities with the NMC Ethnomathematics Research Group, including presentations at the NMS and MAN due to some of their annual meetings being rescheduled. The annual PANAFSTRAG and Chi Stem Toys Foundation teacher training workshop in Lagos took place in 2020 and 2021 via Zoom due to COVID-19 challenges. These security challenges have disqualified Nigeria as a host country for the study-abroad mathematics course being developed by the BMCC FIG because Nigeria is listed as a level 3 security risk country by the US.

#### Discussion of Results From Field-Testing Done at NMC IMSA and CGRD

The results of our field-testing the Gbari module both at NMC IMSA and with local Gbari children at the CGRD showed that the use of cultural materials and women's stories improves academic achievement for both male and female students in geometry. This supports the finding by Kurumeh (2004) that the use of Ethnomathematics improves the achievement and interest of students in geometry and measurement. It also lends support to Aprebo's

(2016) recommendation that the use of teaching aids in our environment for teaching mathematics and the use of African objects as examples in teaching mathematics help learners see the mathematical composition in any subject or object. And it supports Ugwuanyi (2014), who opined that the use of instructional materials in mathematics reduces to a large extent the abstract nature of many mathematical concepts. When mathematics topics are made less abstract, students' understanding and retention are improved, which leads to higher academic achievement.

The results of our field-testing the Gbari module at NMC IMSA also shows that the mean score of all male students in geometry is higher than that of female students, but there is no significant difference in the mean post-test achievement scores in geometry between male and female students taught with the use of cultural materials and women's stories. This finding supports some researchers (Atovigba et al., 2012; Ali et al., 2014), who found that male students perform better than female students in mathematics, and other researchers (Timayi et al., 2016), who found a difference in the mean and standard deviation scores of male and female students in favor of male students in geometry—but the observed difference was not statistically significant with regard to achievement and gender interaction. However, these results do not support some other researchers (Linderberg et al., 2010), who reported that gender differentials among males and females is converging; hence, they perform similarly.

#### Conclusions Related to Field-Testing at NMC IMSA

From the results of our field-testing the Gbari module at NMC IMSA, the use of cultural materials and women's stories in teaching geometry improves the academic achievement of students in general, irrespective of the student's gender. Also, although the mean post-test score of all male students in geometry is higher than that of female students, there is no significant difference in the mean post-test achievement scores in geometry between male and female students taught with the use of cultural materials and women's stories.

#### Recommendations

Based on the work so far, the NMC Ethnomathematics Research Group makes the following recommendations:

- Africa needs to use cultural, creative, and innovative methods to profile women and girls for further empowerment and sustainability of agricultural processes and other areas of STEM.
- Improve the teaching of mathematics in Africa through the use of curriculum based on our indigenous knowledge systems.

- Transform agricultural research so that the African agriculture sector can feed Africa and the rest of the world by supporting STEM that will empower women and youth in the sustainability of agriculture.
- All mathematics teachers in Nigeria should adopt the use of cultural materials and women's stories in teaching geometry in secondary schools.
- All mathematics teachers in Nigeria should undergo a capacity building workshop on the use of cultural materials and women's stories in teaching geometry in schools.
- Collaborative models that promote network connections and visibility are effective for successful outcomes in capacity building in women's empowerment in STEM related fields.

## Acknowledgements

Professor Agwu would like to thank all the institutions, organizations, and people that supported the work on this CADFP project in any way, including honoring her for her work, which led to the initiation of the CADFP project. Special thanks goes to the nine collaborating NGOs and the four collaborating higher educational institutions, in particular members of CEGIST-FUTA and the NMC Ethnomathematics Research Group who worked together for the success of this thrice-funded CADFP project, including writing the proposals to fund it. A special thanks goes to the custodians of culture for all the ethnic nationalities for which a curriculum was developed based on those nationalities. A big thank you goes to Supreme Peach Photos, a subsidiary of Chi Stem Toys Inc., for creating the figures in this paper. Lastly, The Absolute Infinite, Chukwu Okike (The Great God) cannot be forgotten for this project; the project's significant impact and successful outcomes would not have been possible without His help.

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Mutually Beneficial Collaboration

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# **A Sustainable Approach to Mutually Beneficial Collaborations Between African and North American Universities**

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## ABSTRACT

Life is about what is made out of it. The worth of a life is measurable by the significance of contributions it makes to the improvement of society, especially to the lives of others within its circle of influence. This paper presents a sustainable approach to building workable and mutually beneficial research and teaching collaboration between North American and African universities. It is based on literature and experiential knowledge that I gained working as an academic in both continents and from recent Carnegie Corporation of New York-funded collaborative research with colleagues in South Africa. It is a framework for currently evolving mutually beneficial collaboration between host institutions and the scholar, and by extension, the scholar's institution. Implementation of the framework is envisioned to enhance research and teaching capacity in host institutions. It is also expected to provide accessibility to rich/credible data and exposure for researchers and students from both the host- and scholar's institutions through established collaborative research and course-based exchange programs. Furthermore, it is expected to result in more impactful and long-lasting contributions to the improvement of lives in Africa, and better understanding of African society by North Americans who would be involved in the exchanges.

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## Introduction

International partnerships are currently receiving increasing attention among higher education institutions and in the public sector. The increasing attention is based on the belief that individuals and organizations can achieve more by working together in a collaborative setting (Dhillon, 2009). An important first step to establishing collaborative partnerships is to acknowledge its aims, actions, and benefits (Amey et al., 2007; Caniglia, 2017; Murphy et al., 2017; Nielsen et al., 2015).

There are three levels of possible mutually beneficial university partnerships, namely: individual, departmental, and institutional levels (Carfang, 2016; Cozza & Blessinger, 2016). The individual level involves scholars from two or more higher institutions agreeing to work together. The extent of their collaboration could vary from joint presentation at conferences to deeper relationships involving developing funding proposals together, research visits and co-supervision of students. This level of partnership does not usually involve many formalities. The only aspect that may officially involve the universities is when a permit is needed by the visiting scholar(s) to use university-owned equipment, residence, library, office and research facilities.

The second level is the departmental level, which, depending on the nature of the governance structure of the universities involved, requires varying complexity of paperwork. This level of collaboration may involve faculty and student exchanges

and the running of joint academic programs. Such programs at certificate, diploma, or degree levels may be a blend requiring students to spend some time at both universities. It may also involve jointly offering online courses. There would need to be an established agreement on tuition, cost, and profit sharing, in such cases.

The third level is international collaboration at the institutional level. It usually involves rigorous paperwork, and the agreement could take a substantial amount of time to achieve. It may start with the relationship between two scholars from two or more institutions and gradually evolve to the departmental and institutional levels. This level of partnership, depending on the governance structure of the participating universities, would involve communication, visitations, and signing of well spelled-out formal agreements by officials of the partnering institutions.

This paper is based on information obtained from both primary and secondary sources, as there are not many publications with records and statistics on higher education in Africa. This paper has three main sections. Resource asymmetries between North American and African universities are discussed in the first section. This is followed by a discussion of my ideas and encountering of practices used to promote mutually beneficial collaborations between home and host institutions. Metrics that can be used and are being used for measuring and evaluating effective mutually beneficial collaborations among North American and African universities are discussed in the third section, before I offer some conclusions.

## Resource asymmetries between North American and African universities

Many African governments have been making significant investments in higher education, with the aim of producing high-skilled manpower that could help in solving their local problems and propel the nations to industrial economy status. While some successes have been recorded, many African countries are still grappling with lack of adequate manpower needed to service their economies. Unlike in North America, many of the universities and other higher institutions of learning set up in some African countries are nothing more than “glorified secondary schools.” A significant number of the institutions are not adequately staffed, and many of the university laboratories are either not equipped with the needed training facilities or are operating with outdated equipment. Many of the teaching and research infrastructures are overwhelmed, as the student-to-equipment ratios are far beyond the design. Inadequate funding is among the main causes of the problems. Other causes of the problems include too frequent changes in educational policies and the politicization of education governance (Luhanga, 2010; Sayed, 2000; Taha & Bjørkelo, 2016). These have led to mass migration of many upcoming scholars to the western world, thereby depriving many of these institutions of the academics needed to train the students. The majority of those that couldn’t leave do not have access to research amenities required for graduate studies. Consequently, “half-baked” graduates are turned out from these institutions and are shouldered with the responsibility of servicing the economy, managing various organisations, and training upcoming generations (Banya, 2001; Carfang, 2016; Duffield et al., 2013; Ishengoma, 2017; Zink, 2017).

Although educational aid is being offered by many foreign governments, intergovernmental agencies, and voluntary organisations to break the cycle of incompetence, there still remain some fundamental hurdles that must be overcome in order to solve the problem of inadequate higher education in many African countries (Sayed, 2000; Taha & Bjørkelo, 2017).

## Ideas and practices encountered/used to promote mutually beneficial collaborations between home and host institutions

Governments and many of the higher institutions of learning in Africa are striving to overcome their many challenges. One of the approaches is international partnerships with universities in more developed countries and with well-equipped local institutions and industrial organisations. Many of these open-minded, forward-looking universities, with funding support from governments and non-governmental organizations, have established linkages and

international offices to foster academic collaborations. One of the approaches being used by these international offices includes inviting well-established African academics who are based abroad to come for research visits, conferences, and sabbaticals. They use such visits by these international experts as an avenue to develop linkage/partnerships with the visiting scholars and their institutions. Such visits by international experts often enrich life, study, and research opportunities for students and academics. As the interactions usually lead to long-lasting faculty and student exchanges, co-supervision of graduate student theses, curricula review, and joint research projects aimed at solving local problems. Visiting international scholars and their institutions benefit from such partnerships in terms of opportunities for faculty and students to learn about other countries’ cultures, curricula and research strengthening, and cooperation in addressing common problems (Caniglia et al., 2017; Carfang, 2016; Cozza & Blessinger, 2016; Duffield et al., 2013; Eddy, 2010; Lukman et al., 2009; Luhanga, 2010; Suarez-Balcazar et al., 2013; Wrye et al., 2019).

There are some factors that are critical to the success of international university partnerships. These factors include funding, communication, synergy, measurable outcomes, and dissemination of findings, organizational compatibility, and simplicity. Furthermore, for an international partnership to succeed, the governance approach must recognize and embrace a perspective that synergistic integration of stakeholders and communities is necessary to resolve university problems. It must also be willing to develop or adopt new methods (e.g., contracts, grants, joint initiatives) that are required to achieve its goals. The adopted governance model must emphasize a win-win situation where all partners benefit from the project (Cozza & Blessinger, 2016; Duffield et al., 2013; Eddy, 2010; Franceschet & Costantini, 2010; Hydén, 2017; Perry & Zambo, 2016; Sayed, 2000; Schmalzer & Kiendl-Wendner, 2017; Tomazic et al., 2016).

Talking about personal experience, I found all the aforementioned factors very relevant to the success of my collaboration with my hosts during my Carnegie African Diaspora Fellowship Program (CADFP). I was hosted in 2019 by two colleagues from the University of Johannesburg and University of Witwatersrand, both in Johannesburg, South Africa. Although one of them was my former undergraduate student, I didn’t really have a close relationship with either of them. However, we had brief contact prior to preparing and submitting an application for CADFP in 2018.

In our dialogue, we discussed my area of expertise which could be of benefit to them, their junior colleagues, and their students. We also considered available resources, in drafting a proposal. Our CADFP collaborative research project on the development of a life cycle assessment database brought us close together with quite a number of their graduate

students and university officials at the college level. Since the time of implementation of the CADFP in 2019, we have remained close friends and have undertaken many other activities together. These include:

1. Collaborative development of research project proposals and funding applications
2. Co-supervision of graduate students
3. Serving as external examiner for their graduate students
4. Co-authorship of book chapters, journal articles, and conference papers
5. Curriculum review
6. Undertaking research visits to each other's institutions

We are exploring more opportunities to work together on new projects, such as textbook authorship/publication and facilitating student and faculty exchanges.

Apart from scientific meetings, I found our several social activities helpful in enabling us to get to know each other better in a more relaxed environment. It also fostered an understanding of our areas of interests and limitations. Currently, our collaboration is at the individual level, and we are planning to take it to higher levels.

### **Metrics for measuring and evaluating sustainable and effective mutually beneficial collaborations**

Mutually beneficial university partnerships are necessary to foster sustained commitment to agreements and projects. Ensuring continuity of the mutual benefits for all the partners is also essential for a long-lasting collaborative relationship. However, there need to be credible metrics for evaluating the benefits, and there should be a clearly laid out plan for the evaluation of the relationship and the benefits (Murphy et al., 2017; Nielsen et al., 2015; Tomazic et al., 2016; Wrye et al., 2019).

Various metrics are used in measuring and evaluating effective mutually beneficial collaborations among scholars and their institutions. Among the commonly used metrics are the number and amount of research grants won by the team; number of collaborative projects implemented; number of exchanges that took place across the institutions, and number of graduate students supervised that successfully completed their programs within a certain period. Other metrics include the number of jointly published research papers in reputable peer-reviewed journals, and the number of patents registered. Ultimately, these metrics do not only positively affect the academic progression of the scholars involved, but they also impact the reputation and rankings of scholars and hosts, as well as of their universities (Franceschet & Costantini, 2010; Ishengoma, 2017; Reddy et al., 2016).

### **Conclusion**

A sustainable and effective mutually beneficial collaboration may or may not be difficult to form, but it definitely needs to be nurtured, flexible, and regularly reviewed to ensure continued success of the program(s). The partnership has to be synergistic in addressing local needs and beneficial to all the parties involved before all stakeholders buy in to it. Responsibilities of the collaboration also need to be stated clearly from the onset of the partnership (Suarez-Balcazar et al., 2013; Tomazic et al., 2016; Wrye et al., 2019). Furthermore, outcomes of the endeavor and lessons learned need to be disseminated at appropriate fora, whether locally, nationally, or internationally, to ensure the proliferation of excellent practices. In this way, African universities will achieve the desired progress while the collaborating North American universities will also benefit immensely from the partnership.

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Mutually Beneficial Collaboration

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# Developing an International Collaborative Family Research Project in Tanzania: Practices, Challenges, and Lessons Learned

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## ABSTRACT

Improving global health through international research collaboration is increasingly becoming a common pathway of transferring evidence-based knowledge across cultures. Developing such collaborations is both challenging and rewarding, with mutual win-win opportunities as well as practical considerations. This article describes the practices, challenges, and lessons learned while developing a family health research project partnership between Wright State University (WSU) and Muhimbili University of Health and Allied Sciences (MUHAS) through the Carnegie African Diaspora Fellowship Program (CADFP). Specifically, the article describes applying the revised 2018 Conceptual Model for Partnership and Sustainability in Global Health (PSGH) developed by Michele Upvall and Jeanne Leffer in establishing, implementing, and sustaining the WSU–MUHAS partnership. The three-level findings from this partnership include: 1) Personal level: Promotion and/or tenure awards and increased opportunities for professional development training; 2) Interpersonal level: Increased research productivity, increased partnership in scholarly activities such as manuscript and grant writing, increased trust and collegial relationships; and 3) Systems level: Increased appreciation of the CADFP at the university level. The comprehensive collaborative model is a great resource for global health networking and global health research productivity between low- and high- resource countries.

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## Introduction

Collaboration in global health research and practice between high-income countries (HICs) and low-income countries (LICs) is well documented in the literature (e.g., Atkins et al., 2016; Godoy-Ruiz et al., 2016 [especially, in addressing the Sustainable Development Goals (SDGs)]; and Rosa, 2017). Likewise, the contribution of the field of global health in global health learning across disciplines is increasingly becoming important (e.g., Kang et al., 2020; Lu et al., 2020). However, despite the increase in global health programs, empirical evidence is still lagging behind in the development of win-win collaborative models/frameworks that guide bilaterally integrated approaches between HIC and LIC partners (Upvall & Leffer, 2018). Using the Partnership and Sustainability in Global Health (PSGH) as a guide, this article describes the practices, challenges, and lessons learned when developing and implementing a collaborative family research project between Wright State University (WSU) and Muhimbili University of Health and Allied Sciences (MUHAS) through the Carnegie African Diaspora Fellowship Program (CADFP). The PSGH is instrumental in that it provides a practical guide for global health research, practice, and education initiatives. The most valuable tenet of the model is the integrated inputs from the fellow and the host in developing the partnerships and collaborations. These views were critical in establishing reciprocal relationships within the CADFP.

## The WSU–MUHAS Partnership and Sustainability in Global Health Project

### Partner Factors (CADFP Fellow):

Conceptually, the PSGH describes the fellow as a visiting scholar in a chosen country of interest. The model describes the fellow's factors that contribute to the success of a partnership in terms of cultural perspectives, personal attributes, personal expectations, power/politics differentials, professional status, and knowledge of the host country.

Within the WSU–MUHAS partnership, the fellow was a WSU nurse scientist and educator with a background in family and community/public health science. The fellow's institution, Wright State University, has a mission and vision that supports global health research and education. The vision and mission are consistent with those of professional nursing organizations such as the American Academy of Nursing that encourage nurses' involvement in global health to advance nursing science. The fellow's African-born scholar status with previous strong ties with the host was a bonus in facilitating the partnership. Legal and grants office staff at the fellow's university were supportive of and central to the funding applications as well as IRB approvals for this international research collaboration. WSU's newsroom disseminated the fellow's work through their online platform, increasing visibility of the program to the university and local community.

### **Partner Factors (CADFP Host):**

Conceptually, the PSGH describes the host institution as the setting for the visiting fellow in a chosen country of interest. The model describes the host factors contributing to the success of a partnership as: expectations of culture of the visiting fellow, expectation of visiting fellow, impact of social, political, environmental status of host settings strengths and needs, power/politics differentials and professional status.

Within the WSU–MUHAS partnership, the CADFP host was a MUHAS public health scientist and educator with a background in gender studies as well as nursing education. MUHAS has a vision and mission that supports international collaboration in global health research and education. The host faculty and researchers were actively involved in scheduling and attending introductory meetings to share personal and institutional needs for the collaborative relationship. Through the host, the fellow was able to learn about the host setting's internal and external dynamics, and its successes and challenges with previous and existing international collaborations.

The main need from the host was enhancing institutional capacity building in writing and submitting winning grants, especially National Institute of Health (NIH) grants. The host faculty voiced concern about experiencing a lack of a full commitment and follow-up by fellows on agreed-to collaborative promises. The host and fellow both acknowledged the need for developing a win-win relationship by learning more about each other during the partnership engagement process. Both the fellow and host facilitated formalizing the relationship between institutions as well as strategies to meet the needs of MUHAS research priorities. The host was able to link and support the fellow in building relationships for collaborative projects such as the global health learning study abroad program, HIV/AIDS and breast cancer awareness research projects. The host continued to participate actively in developing mutual research ideas, as well as writing and submitting joint funding applications. The official MUHAS ID issued to the CADFP fellow on arrival was significant in facilitating the sense of belonging and advertising the program to curious staff and faculty members.

### **Resources**

Conceptually, the PSGH describes the success of a global health partnership as dependent on the availability of resources (e.g., human, material, and financial) for the fellow and the host. The CADFP fellow and host both shared the need for human, material/equipment, and financial resources at the department/college and institutional levels.

#### **Human**

Research mentorship in grant writing was an urgent need for both the fellow and host as they developed the collaborative research project. A local mentor and collaborator, Dr. Josephine Wilson, played a critical role

in mentoring both the fellow and host in writing the HIV/AIDS external grant. An external mentor and collaborator, Dr. Eunice Lee, was instrumental in mentoring the fellow and host in a National Institute of Health–National Cancer Institute (NIH–NCI) application in breast cancer awareness.

#### **Material/Equipment**

Materials for data management such as a transcriber machine were a felt need by the host for the success of the program.

#### **Financial**

There was a felt concern from both sides of ongoing challenges of funding streams. It was clear that there were significant disparities in actual and perceptions of resources between the host and fellow at the personal and systems levels. At the university level, the fellow was able to secure pilot funding through professional development funds and internal seed funds to initiate the collaborative global health study abroad program and research projects on HIV/AIDS and on breast cancer awareness. Together with a team of WSU faculty, the fellow was able to travel to the host country to complete a needs assessment to determine and learn about the research and global learning needs, legal and social logistics, anticipations, people and environment. This enabled the fellow to determine how cultural perspectives and power differences of self and biases may influence/hinder expectations and professional needs in the context of a win-win collaborative relationship. These initial collaborative efforts were precursors to the ongoing CADFP funding opportunities (i.e., 2017 and 2021). The collaborative efforts completed via the 2017 CADFP program enabled the fellow, host, and a new research partner to secure a pilot seed grant from WSU School of Nursing for the Breast Cancer Family Research project. The breast cancer project thus expanded to include WSU, MUHAS, and the University of California, Los Angeles.

#### **Time**

Time was an important and essential resource for both the fellow and host in facilitating the global health collaborative project. The fellow and host conceptualized time in terms of the promotion and tenure clock, time for project development/write-up, time for implementation and analysis/evaluation, and time for grant submission. It was imperative that both parties get involved in valuing the meaning of time from a cross-cultural perspective. Time differences, delays in IRB approvals, changes in the research teams, changing political and social climates, individual priorities and work expectations, and discouragement via peer review feedback on grant submission all influenced the partnership processes.

#### **Engagement Processes**

According to the PSGH, the engagement process covers the relationship-building and developing partnership processes.

### **Relationship-building process:**

Conceptually, the PSGH describes the relationship-building process as including the main attributes of negotiating partner roles, building trust, and collaboration. Negotiating partner roles includes: needs assessment/ongoing assessment, mutual goals setting, strategies to address concerns, clear action plans, and clear communication. Building trust includes: cultural bridging organizations, two-way communication, transparency, shared mission/vision, mutual respect, and preparation for visitors. Collaboration includes: support from both partners, strong communication, and leadership

Within the WSU–MUHAS partnership, it was essential that both parties continue to assess their priorities and agree on mutual goal setting on the projects. Building a trusting relationship between the fellow and host was important as it brought to light the need for clear communication with the team. The host and fellow shared professional interests, research goals, strengths, and weaknesses and integrated these in their projects. The fellow's areas of expertise and research interest, family research, matched well with the host's interest. The host guided the direction of the research project in terms of addressing university research priorities.

Both the fellow and host played a key leadership role in the project write-ups and IRB approvals.

The host's role in project implementation to meet local needs was essential. The ongoing collaborative experience between the host and fellow gradually offered an open, safe, and trusting environment to share frustrations or concerns as they emerged. This facilitated clear action plans and ultimately successful project activities. Getting the right people and those who do the right thing was essential for relationship building. It was important to note that the most influencing factor for successful engagement was mutual respect between the fellow and host in terms of their world views.

### **Developing partnership process**

Conceptually, the PSGH describes the developing partnership as the process that includes the following attributes: cultural bridging, collaboration, capacity building, and shared leadership. Cultural bridging includes: negotiating shared language, ongoing negotiation, addressing power differences, and working within the geopolitical context. Collaboration includes: timing to meet host needs, mutual support, negotiation and timely review of the project. Capacity building includes: accompaniment, shared expertise, role modeling, and shared leadership, which includes addressing power differences, shared vision and goals, role modeling, ongoing assessment and shared expertise.

Within the WSU–MUHAS collaboration, it was vital that the fellow respect the host's goals and needs and vice versa. There was significant learning between the host

and fellow as the negotiation took place. The fellow had practical expertise from her institution that built upon the host's knowledge. The knowledge sharing was bidirectional. There were several moments of value clarification related to differences in research project approaches and priorities from the perspectives of the fellow and host and, measures to put in place a mutual beneficial cultural bridge. The fellow's language fluency in Kiswahili and prior understanding of the Tanzanian culture was a bonus in facilitating cross-cultural communication through the period of negotiations and timely reviews of project planning and implementation activities. A clear understanding of the geopolitical, social, and economic contexts was important in determining the fellow and host's perspectives and expectations in the collaborative relationship and for timely participation in the implementation of research activities.

Mutual support through trust and respect was highly needed, especially when time ran out for the fellow or host. Building capacity was essential in responding to the fellow and host's project needs. Embracing an interdisciplinary collaborative relationship reinforced the relationship by engaging potential mentors and key players. For example, key players from the MUHAS research administrative office, the Office of International External Relations, and dean and faculty at the School of Nursing were vital for the collaborative study abroad program. The IRB office staff were instrumental in the research project. The fellow practiced accompaniment to strengthen the relationship by empowering the host to take leadership roles on the projects as the principal investigator. The host and fellow shared expertise when writing the grants and role-modeled expectations to each other without judgment when things did not go as planned. They both used judgmental concerns as teachable moments for future growth. The fellow and host learned to negotiate power for the benefit of the project. The fellow mentored the host in developing and preparing research concept drafts and proposals to be submitted to NIH officers and funding opportunity announcements, respectively.

### **Sustainability**

According to the PSGH, after forging the partnership, it is vital to understand and address program factor inputs and processes that facilitate sustainability and outcomes.

The program factors include: design and implementation, organizational setting, and broader host community. The design and implementation factors include: the community/needs assessment and equal partner participation. The organizational setting factors include: resources and disparities as well as the broader host factors, namely: the geopolitical and influence of social, economic, political, and cultural factors.

### Program factor inputs and processes

Within the WSU–MUHAS partnership, ongoing learning about the host and the community where the work took place helped address the program factors related to project design and implementation. The fellow and host both participated in introductory meetings with the local hospitals/agency to plan and facilitate students’ global health learning experiences. The fellow also advocated for foreign student visas with local immigration officials. The needs assessment facilitated the identification of community strengths and key stakeholders. The students or research team engaged in an equal and mutually beneficial participatory relationship. Resources previously discussed in this article facilitated the project’s sustainability.

WSU and MUHAS administrative support to the fellow and host was critical to project implementation and future sustainability. Listening to the needs of the host and fellow and their broader communities was important to the success of

the project activities and outcomes. Growing leadership skills to champion global health learning and research was vital for sustainability. It would have been easy to give up due to the challenges involved, but the fellow’s commitment to the host and the host’s commitment to the fellow maintained a bidirectional flow of energy and stability for the collaborative work. The fellow and host had to adapt to several program changes, including the COVID-19 pandemic, in order to succeed.

### Outcomes

According to the PSGH, the outcomes include but are not limited to: improved health outcomes, continued innovations, expanded world views, host country ownership, program activities continuation, collaborative research/publications, program development/professional training, program/project completion and collegial friendships.

The fellow and host achieved the following outcomes from the WSU–MUHAS partnership:

TABLE 1

Program/research activities: Funded Research Projects after CADFP

YEAR	TYPE OF GRANT	DESCRIPTION OF GRANT AWARDING AGENCY/INSTITUTION, ROLE AND STATUS	AMOUNT
2020	External	The Carnegie African Diaspora Fellowship Program (CADFP) [Alumni Fellowships] March 26, 2020  <b>Project Title:</b> Co-Development of New and Strengthening Existing Academic and Clinical/Experiential Learning Policies and Procedures for MUHAS Occasional Elective Students and Collaborative Research in Family-Based Interventions for Addressing Non-Communicable Diseases.  <b>Status:</b> Completed	Paid Fellowship
2020	Internal	Wright State University, CONH Seed Grants  <b>Goal:</b> To assessment of acceptability of implementing a community health worker-led breast cancer awareness and screening program in Ileje district, Tanzania  <b>Status:</b> Ongoing	\$7,500
2016	External	Fellow, Carnegie African Diaspora Fellowship Program  <b>Goal:</b> To complete the following projects: Collaborative research in HIV/AIDS prevention and curriculum co-development in strengthening MUHAS capacity for elective programs.  <b>Status:</b> Completed	Paid Fellowship

TABLE 2

Program/research activities: Funded Research Projects Prior to CADFP

YEAR	TYPE OF GRANT	DESCRIPTION OF GRANT AWARDING AGENCY/INSTITUTION, ROLE AND STATUS	AMOUNT
2011	Internal	Wright State University Research Initiation <b>Goal:</b> To conduct a "Needs Assessment for an International Collaboration on HIV/AIDS in Tanzania." <b>Status:</b> Completed	\$9,940
2011	Internal	Wright State University Professional Development Grant <b>Goal:</b> To travel to Tanzania for a Global Health Service Learning program planning visit. <b>Role:</b> PI <b>Status:</b> Completed 41 students have completed the global health study abroad program as of 2019.	\$3,000
2010	Internal	Office of Service Learning Award <b>Goal:</b> To develop a Global Health Service Learning course <b>Status:</b> Completed	\$1,000

TABLE 3

Program/research activities: Unfunded Research Projects

YEAR	TYPE OF GRANT	DESCRIPTION OF PROPOSAL
2018	External	<b>Proposal:</b> Developing A Breast Cancer Awareness and Screening Program Among Women 40-65 years Old in Ileje, Tanzania, ONS Foundation
2018	External	<b>Proposal:</b> NIH-NCI R03 Feasibility and Acceptability of Community Health Worker-Led Couple-Based Breast Cancer Awareness (USAWA) Intervention among Women 40-60 years old and spouses in Mbeya, Tanzania.

TABLE 4

## Collaborative research/publications/presentations/reports (before and after CADFP)

YEAR	DESCRIPTION
2022	Eustace, R. W. (2022). A theory of family health: A Neuman's Systems perspective. <i>Nursing Science Quarterly</i> 35 (1), 101-110
2018	Eustace, R.W., Nyamhanga, T., & Lee, E. (2018). A discussion of social determinants of breast cancer among women in Tanzania: Advantages, gaps and future directions in family scholarship [Poster presentation]. The 2018 Annual NCFR Conference, San Diego, California, November 7-10, 2018. [International]
2018	Eustace, R.W, Nyamhanga, T. Lee, E. (2018). <i>Theorizing the social determinants of breast cancer in sub-Saharan Africa: A family nursing perspective</i> [Paper presentation]. The Nursing Theory: A 50 Year Perspective, Past and Future Service and Academic Outreach, March 21-22, 2019, Cleveland, OH. [National]
2018	Eustace, R.W., Nyamhanga, T. M., Ghuhiya, A. I., & Mushy, S. E. (2018). Family life education development, implementation, and evaluation in Tanzania. In <i>Global perspectives on family life education</i> (M. Robila & A. Taylor, Editors) (pp. 135-151). Springer, Cham.
2017	Nyamhanga, T. M. & Eustace, R. W. (2017). <i>360° review of MUHAS elective programs</i> . Muhimbili, University of Health and Allied Sciences (MUHAS).
2017	Eustace, R. W., Wilson, J. Asiedu, G., Nyamhanga, T., & Mkanta, W. (2017). Community stakeholders' perceptions of the role of family in HIV prevention in Iringa, Tanzania, <i>Journal of Community Health Nursing</i> , 34 (1), 10-20
2015	Eustace, R. W., Nyamhanga, T., et al. (2015). <i>What is the role of family in HIV/AIDS prevention? Implications for Community-based Family interventions in Tanzania</i> [Poster presentation]. The 3rd Muhimbili University of Health and Allied Sciences Scientific Conference, May 28-30, 2015, Dar Es Salaam, Tanzania. [National]
2013	Eustace, R. W., Nyamhanga, T. et al. (2013). <i>Risk factors for HIV transmission: Findings from a cross-sectional study in Iringa, Tanzania</i> [Poster presentation]. The 2013 Central Research Forum (CRF), Wright State University, Dayton, OH, October 24, 2013. [Local]
2013	Eustace, R. W., Wilson, J., Nyamhanga, T. et al. (2013). <i>Risk factors for HIV transmission: Findings from a cross-sectional study in Iringa, Tanzania</i> [Poster presentation]. The APHA 141th Annual Meeting and Exposition Boston, MA, Nov 2-6, 2013. [International]
2013	Ford, J. Eustace, R. W., Wilson J. Nyamhanga, T, et al. (2013). <i>So many people here take alcohol and AIDS is a big problem: Examining the factors influencing the HIV epidemic in Iringa, Tanzania</i> [Poster presentation]. The APHA 141st Annual Meeting and Exposition Boston, MA, Nov 2-6, 2013. [International]

TABLE 5

## Other Collaborative research/scholarly relationships

ROLE	DESCRIPTION
Manuscript Reviewer	Mwanukuzi, C. and Nyamhanga, T. (2021). "It is painful and unpleasant": Experiences of sexual violence among married adolescent girls in Shinyanga, Tanzania. <i>Reproductive Health</i> 18(1). <a href="https://doi.org/10.1186/s12978-020-01058-8">https://doi.org/10.1186/s12978-020-01058-8</a> . Dr Eustace, Reviewer
Student Advisor	Maswi, E. (Ongoing). <i>Perceived barriers to early detection of breast cancer among women at Maweni Regional Referral Hospital, Kigoma</i> . MUHAS. Dr Nyamhanga, Faculty Advisor

### Future program/project continuation/initiatives:

- Write and submit an NIH application to conduct a multi-level research study in breast cancer awareness and early screening in Tanzania.
- Develop a WSU–MUHAS collaborative application for a virtual study abroad program. Grant award WSU UCIE Seed Grants for Global Virtual Exchange Program Development.

### Program development/professional training

- SUNY COIL Study Abroad Goes Virtual Workshop, 6-24 September 2021 (Fellow - professional development)
- Certificate of Completion, 2021 National Cancer Institute Multilevel Intervention Training Institute (MLTI), (Feb 25-July 22, 2021) (Fellow)
- Certificate of Completion, 2022 National Cancer Institute Multilevel Intervention Training Institute (MLTI), (2022) (Host)

### Promotion and tenure

- Dr. Eustace: promoted to Professor
- Dr. Nyamhanga: promoted to Associate Professor

### Collegial relationships:

- Informal family dinner invitation by the host

## Conclusion

Overall, the ongoing WSU–MUHAS partnership is a successful, win-win global health program. Evidence-based theoretical frameworks such as the Partnership and Sustainability in Global Health (PSGH) are critical to the development of a successful and sustainable win-win global health partnership. A clear understanding of the mutual benefits and actual and potential barriers within the current partnership was instrumental to enhancing the quality of the relationship. The use of trust- and respect-based communication among the fellow, host and key stakeholders to address cross-cultural influences over time was vital for positive sustainability and outcomes.

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Mutually Beneficial Collaboration

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# Improving Clinical and Continuing Education Outcomes in Speech-Language Pathology: Mutual Benefits of Collaboration Across Continents

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## ABSTRACT

This paper describes collaboration in the field of speech-language pathology between researchers in South Africa and the United States. The main aim is to address resource asymmetry regarding access to professional services by confronting the paucity of validated and reliable measures for children with communication disorders in South African languages and enhancing the application of knowledge gained in interprofessional continuing education. The International Classification of Functioning, Disability and Health (ICF) (World Health Organization, 2001) was selected as the framework for the collaboration. A series of three interrelated projects within the ICF: Children and Youth Version (ICF-CY) framework is reported on: promoting the ICF through interprofessional continuing education events; translation of child communication assessment tools; and developing leadership in health care professions with a specific emphasis on speech-language pathology. The impact of the collaboration is reviewed and recommendations are made for research collaborations.

In conclusion, the collaboration significantly benefited children with communication disorders; the Carnegie African Diaspora Fellows; speech-language pathology communities, including students; and international readership.

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## Introduction

More than 200 million children under the age of 5 live in low- and middle-income countries (LMICs) and are not fulfilling their developmental potential (Morelli et al., 2017). This includes children with intellectual disability, autism spectrum disorder, cerebral palsy, and other genetic disorders. These children are at high risk for developing speech-language disorders with far-reaching consequences. Not only is interpersonal communication with caregivers, families, peers, and health care providers challenged in a significant way, but the child's growth, long-term development, learning and education, and ultimately employment and contribution to society are also negatively impacted. According to Article 19 of the Universal Declaration on Human Rights (United Nations, 1948) communication is a human right. Speech-language pathologists (SLPs) aim to prevent, assess, diagnose, and treat a plethora of speech, language, social and cognitive communication, and swallowing disorders in both children and adults (ASHA-a, n.d.). As such, SLPs play a critical role in addressing communication skills, thereby positively impacting development, learning, and skill development within a human rights paradigm.

The field of speech-language pathology was established in the 1920s in the United States (ASHA-b, n.d.), and in South Africa professional education for SLPs and audiologists began in 1937 (Pillay et al., 2020). Although the profession has a proud research, education, and clinical history in both the United States and South Africa, the latter currently faces an alarming supply-need gap (Pillay et al., 2020).

South Africa is a multicultural country with 11 official

languages. After the demise of apartheid in 1994 following the nation's first democratic elections, transformation was initiated to provide equal access to education and health care, and protection against discrimination (Abrahams et al., 2019; Ronski et al., 2018). Despite these initiatives and efforts, the disparity continues, exacerbated by the burden of disease, which creates a major context for disability associated with communication disorders (Abrahams et al., 2019; Kathard & Pillay, 2015). In addition, there is a dearth of SLPs in South Africa, which results in large, underserved populations and barriers to care, particularly in rural areas. This critical shortfall of SLPs is directly linked to inequitable service delivery. It is clear that SLPs have a professional responsibility to advocate for individuals with communication disorders.

Resource asymmetry regarding access to professional services, paucity of validated and reliable measures for children with communication disorders in South African languages, and misalignment among resources were the basis for collaboration between the authors from the United States and South Africa. The purpose of the paper is to describe collaboration within the Carnegie African Diaspora Fellowship Program (CADFP) in the field of speech-language pathology between researchers in the United States and South Africa. The main aim of this paper is to address resource asymmetry regarding access to professional services by confronting the paucity of validated and reliable measures for children with communication disorders in South African languages and enhancing the application of knowledge gained in interprofessional continuing education.

## Collaboration Framework

The World Health Organization published the International Classification of Functioning, Disability and Health (ICF) in 2001, followed by a Child and Youth Version (ICF-CY) in 2007 to provide a common language for describing human functioning and disability as well as a framework for gathering data and measuring clinical outcomes (World Health Organization, 2001, 2007). In 2012, the ICF-CY was incorporated into the ICF (WHO, 2012), and the ICF was adopted as the framework for collaboration.

The ICF is a biopsychosocial framework that allows for the holistic consideration of children with communication disorders. It allows for understanding the effects of a communication disorder on a child's ability to communicate in structured and natural contexts, and the ways that environmental and personal factors influence the child. The framework therefore attempts to move away from diagnosis to instead focus on a holistic view of health and functioning (Cunningham et al., 2017). Furthermore, it allows correct comparison between different cultures based on language, belief, environmental conditions, and beliefs, which are important considerations when planning interventions (Zakirova-Engstrand & Granlund, 2009).

The ICF framework comprises two levels: first, Functioning and Disability, which is divided into Body Function and Structures (e.g., sensory, mental, speech, or voice functions); and Activities and Participation (i.e., ability to execute tasks or actions in everyday life situations, such as mobility, communication, and self-care). The second level consists of Contextual factors, which include both Environmental factors (e.g., the physical, social, and attitudinal environment in which people live their lives) and Personal factors (e.g., age, habits, lifestyle, and social background) (Raghavendra et al., 2007; World Health Organization, 2012).

The advantages of adopting the ICF framework, which aims to establish a common language to improve communication across health care professions, are expounded in the literature. What is less frequently mentioned is that the framework also makes it easier for clinicians and parents to discuss the child not only in terms of functioning, activities, and participation but also in terms of social and physical environments. As these aspects ultimately impact health and well-being (Adolfsson et al., 2018). The ICF (World Health Organization, 2012) provides a systematic coding scheme for health information systems that can be understood across borders and languages. It also permits comparison of data across disciplines, countries, services, and time (World Health Organization, 2012). According to Moran et al. (2020), the ICF framework also bridges professional, cultural, economic, and geographical variations to provide a universal map for health care providers. Furthermore, the ICF emphasizes the strengths of an individual, focusing on the ability (instead

of disability) and how the individual's abilities can be used optimally to ensure full participation in everyday activities (Bornman, 2004). Bornman continues by explaining that the ICF focuses on an individual's participation in environments, and that both the barriers and facilitators that impact participation can be described. The ICF is thus crucial to client-centered care and incorporates child preferences and family values. The use of the ICF facilitates partnerships that ensure child and family have a voice in care received and outcomes achieved (Vallino & Louw, 2017). The ICF can be used to determine whether a particular intervention program has been effective by measuring the program's impact on the different components (Westby & Washington, 2017). For example, these components might be the impact related to (i) Body Functions and Structure (improvement in phonological awareness; improved receptive vocabulary); (ii) Activities and Participation (being included more frequently in other children's games; joining conversations with peers more often); and (iii) Environmental factors (enjoys attending preschool, where the child is comfortable with teachers and peers).

The ICF framework has been applied to children with a variety of communication disorders (e.g., speech sound disorders and/or language impairments) (McLeod & Threats, 2008; Threats, 2010), children who stutter (Yarus, 2007), children with cleft palate (Neumann & Romonath, 2012), children who use augmentative and alternative communication (AAC) (Rowland et al., 2012), and school-aged children with language impairments (Westby & Washington, 2017). As a result, clinical tools were developed based on the ICF, such as the Speech Participation and Activity Assessment of Children, the Intelligibility in Context Scale (ICS) (McLeod et al., 2012), and the Focus on the Outcomes of Communication Under Six (FOCUS©), which was later shortened to FOCUS-34© (Thomas-Stonell et al., 2010). Adopting the ICF as a basic assessment and intervention framework for children with communication disorders allows for a new therapy model that highlights speech activity, participation, and the child's environment through person-centered goals. Following their scoping review on ICF components, Cunningham et al. (2017) identified a lack of research focused on intervention outcomes for the Participation factor, specifically whether speech-language interventions affect how a child uses communication to participate in their world.

Despite clinical and research interest in the ICF and endorsement by professional associations like the American Speech-Language-Hearing Association (ASHA), Speech Pathology Australia (SPA), and South African Speech-Language-Hearing Association (SASLHA), there is still not a widespread understanding of the ICF and thus limited clinical use by SLPs in the United States (Huer & Threats, 2016) and South Africa (Bornman & Louw, 2019), in contrast to countries

such as Australia, Canada, the Netherlands, and Sweden.

By adopting the ICF-CY as a basic framework for assessment and intervention for children with communication disorders, a new therapy model that focuses on speech activity, participation, and the child's environment through person-centered goals can be adopted. There is a paucity of validated and reliable measures for children with communication disorders in all the South African languages with the exception of English. Given the advantages of working within the ICF framework as described above, the IVF was adopted for this international collaboration on multiple levels.

### **Collaboration Projects and Outcomes**

Funding from CADFP (2016 to 2022) enabled the authors to collaborate on a series of three independent yet interrelated projects within the ICF framework.

#### **Promoting the ICF**

The collaboration started with selecting the ICF (World Health Organization, 2001) and ICF-CY (World Health Organization, 2007) as a framework for our projects. In spite of the advantages of this framework, it has attracted scant attention to date in

both the United States and South Africa in comparison to, for example, Europe, Australia, and Canada. There is also limited use of the assessment measures for children with communication disorders developed within its framework in both the United States and South Africa.

A series of continuing professional education workshops for multidisciplinary audiences was conducted in South Africa on the clinical application of the ICF (World Health Organization, 2001) and ICF-CY (World Health Organization, 2007; Louw & Bornman, 2015, 2016a, 2016b). The evaluation of these continuing education (CE) events was performed in a unique and novel manner through the use of a Personal Commitment to Change (PCC) statement that was developed by the authors in lieu of more traditional satisfaction measures. A case study was then conducted on an interprofessional CE event presented to health care practitioners in 2016 in Pretoria, South Africa. Using the results of the PCC tool, a thematic analysis of the 32 participants' statements was conducted. Three main themes were identified: (1) applying new knowledge in practice (61.97%); (2) increasing content knowledge related to training (21.12%); and sharing information, skill, and resources (16.9%). To our knowledge, this is the first study to explore a reflection tool using a commitment to change statement to evaluate CE in health care professions, other than in continuing medical education. The results show that the participants engaged in deep reflection generated by the PCC statement, which contained no guiding statements yet elicited responses regarding gains

and implementation (Bornman & Louw, 2019). This project led to a national conference presentation in the United States, a publication in an international journal, and webinars aimed at graduate students.

#### **Translation of Child Communication Assessment Tools**

The aim of the second project was to address resource asymmetry of South Africa's SLP community in an innovative approach on multiple levels. This collaboration was based on issues regarding the paucity of validated and reliable measures for children with communication disorders in South African languages and the desire to enhance the application of knowledge gained in interprofessional CE to address service delivery for these children. Internationally, the challenge remains to develop culturally valid, contextually relevant and reliable speech-language pathology resources that will meet the needs of the unique populations they serve (Bornman & Louw, 2021; Pascoe & Norman, 2011; Romski et al., 2018). The ICF (World Health Organization, 2001) framework was used because it provides a standardized language (as it is perceived to have a positive impact on translation) as well as a framework for gathering data and measuring clinical outcomes (World Health Organization, 2007).

Various assessment tools for child communication developed within the ICF-CY framework (Cunningham et al., 2017) were studied, and FOCUS© (Thomas-Stonell et al., 2010) was selected to translate. This project illustrated the process involved in the cross-cultural translation and adaptation of FOCUS© and its shortened version, FOCUS-34©, while also determining the social validity and clinical applicability of the translated measure. The target language used as example was Afrikaans, one of the 11 official languages of South Africa (Bornman & Louw, 2021).

This research project employed a two-phase cross-cultural translation model. Phase 1 (comprising a seven-step blind back-translation procedure) was sequentially followed by Phase 2 (social validation and clinical applicability of the measure, using focus groups with stakeholders) (Bornman & Louw, 2021). The process resulted in a clear and appropriate translation acceptable to both parents and speech-language pathology stakeholders. Both groups questioned the meaning of certain concepts, explored cultural differences, and requested the extension of some items. A framework was proposed for cross-cultural translation and adaptation of assessment measures with suitability in the speech-language pathology discipline (Bornman & Louw, 2021). A second assessment, Speech Participation and Activity in Children (SPAA-C) (McLeod et al., 2012) was also translated into Afrikaans. The results of this collaboration led to an international publication and a national conference presentation in the United States (Louw & Bornman, 2018).

## Leadership in Health Care Professions and Speech-Language Pathology

The third project is current. SLPs work in many different contexts, such as health, education, and private practice, and often distinguish themselves as leaders irrespective of the context in which they function. However, leadership is typically not included in preprofessional training curricula (Carozza, 2019). However, recent changes in health care and education worldwide necessitate leadership skills. More recently, literature on leadership for health professionals specifically (e.g., Ledlow & Stephens, 2017) is being published. In the United States, new SLP clinical doctorate programs are including organizational leadership. However, the emphasis in the field in general is on leadership for health care systems and advancing careers, rather than on leadership for advocacy (Carozza, 2019). These new trends point to the importance of developing coursework to better prepare future SLPs and to provide continuing education to SLPs on leadership. Although leadership is an inherent quality and characteristic of the SLP profession, formal training for the development of a skill set and abilities is lacking. Health care leadership is viewed to enable SLPs to transform and improve services and care for individuals with communication disorders.

Furthermore, a deep-rooted appreciation and understanding of the role of the SLP as an advocate and enabler for children with communication disabilities and their families—and the SLP’s impact on the life outcomes of these children—is required. Leadership development for SLPs requires expertise regarding the SLP training curriculum, an appreciation for contemporary best practices, insights into current challenges facing the profession, and knowledge about advocacy (a role and responsibility for SLPs) and leadership in speech-language pathology, which includes patient needs and ethical standards.

ASHA (ASHA-a, n.d.) has identified advocacy as a role and responsibility for SLPs, as they are uniquely positioned to advocate not only at a practice level (for the importance of strengthening communication skills) but also on a policy level. This is strongly correlated to SLPs’ leadership role, which differs from traditional leadership models, as it involves patient needs and ethical standards. Despite recognition of the importance of leadership skills tailored to health care practitioners (e.g., Ledlow & Stephens, 2017) and recognition of leadership as an inherent quality and characteristic of the SLP profession, formal training for the development of a skill set and abilities is lacking.

The current project has direct clinical impact and consists of two phases. Phase 1 consisted of a research-intensive, in-depth literature review of leadership in health care professions. A rapid review methodology was selected to systematically review the literature on leadership in a variety of health care professions to guide the development

of leadership training content in the discipline of speech-language pathology, especially in LMICs. Leadership is also essential to advocacy. This rapid review of leadership in health care professions will provide an evidence-based theoretical underpinning for the development of leadership program content for SLPs in LMICs.

The results of the rapid review are being finalized as a manuscript and will be reported as a rapid review study using a narrative synthesis (Dobbins, 2017; Garrity et al., 2020). The rapid review is predicted to be a useful tool to synthesize knowledge on leadership in health care professions. It will provide a strong evidence base to develop preprofessional and CE training content on leadership for advocacy, which includes leadership, “followership,” teamwork, and advocacy.

The second phase of this leadership project develops a custom-designed training module with a series of four seminars on leadership and advocacy for the SLP profession. These seminars will be freely available to SLPs from different countries across the African continent (with an emphasis on South Africa, Namibia, Kenya, and Tanzania). Graduate and doctoral students from both institutions driving this project (East Tennessee State University in the United States and the University of Pretoria in South Africa), as well as broader African families and associations on the African content, will be involved in developing the series. A measurement of success will be developed, and the results of the training series will be submitted for publication in a peer-reviewed journal.

The tectonic changes brought about by the global COVID-19 pandemic have illuminated the critical role of SLPs in supporting all individuals who are communicatively vulnerable and their families. It has brought to the fore the importance of leadership skills that encourage inquisitive, rational thinking in the speech-language pathology discipline to solve complex problems, using research evidence and knowledge of the context when making decisions and an aptitude to seek new solutions and apply new ways of working. It is envisaged that this project will provide SLPs with specialized leadership training relevant to the speech-language pathology discipline on both continents but also with a broader understanding of the environment and context in which they operate.

## Impact of the Collaboration

As the African proverb tells us, *“If you want to go fast, go alone. If you want to go far, go together.”* Research and the spirit of collaboration knows no country borders, and this project allowed the authors to expand their teaching and research partnerships. Benefits for the Centre for Augmentative and Alternative Communication at the University of Pretoria (South Africa) stem from continued close collaboration with an experienced and respected international research partner, while the East Tennessee

State University College of Clinical and Rehabilitative Health Science (United States) would meet its aims of expanding research activity and collaboration. Both institutions value research publications in high-impact peer-reviewed international journals.

The resounding success of the systematic approach to the collaboration over three projects was measured in terms of the deliverable outcomes: two new assessment measures for clinicians in South Africa were produced, professionals in two continents received CE through workshops and conference presentations, and international professionals gained access to the two publications. Students in both South Africa and the United States were educated on the ICF (World Health Organization, 2001) and ICF-CY (World Health Organization, 2007), currently accepted as the international gold standard disability framework and its clinical applications. This was done using webinars and other methods. CADFP benefited the collaborators, SLPs, communities, international readership, and most importantly children with communication disorders and their families in a significant manner.

Furthermore, the sustainability of this collaboration with its three projects is of paramount importance, which means that the projects (and/or their outcomes) should continue in the absence of CADFP support.

For example, one of the outcomes of the current project is the development of curricula on advocacy for leadership that could be used in both South Africa (and sub-Saharan Africa) and the United States. This means that a new generation of SLPs will receive this knowledge, while practicing SLPs could receive this information as part of continuing professional development. The SLPs who attend these workshops will also be encouraged—as part of the PCC statements — to actively pursue their leadership skills through sustained advocacy initiatives. Attendees will also be encouraged to develop an evidence-based portfolio of leadership, and professionals who conduct graduate SLP student training will be encouraged to include leadership portfolios as part of the outcomes expected in the final year from these students. This is a long-term vision, but given the focus on leadership and advocacy in the speech-language pathology discipline, the profession will be strengthened if this strategy is seen as “best practice.” Another strategy included on the projects that has demonstrated positive impact on sustainability is the inclusion of key stakeholders in the whole project, as that ensures buy-in. From the activities of the three projects, it is clear that the perspectives of the key role-players are considered from the beginning of the project (e.g., through online focus groups) and that their input is central in the planning of the workshops and subsequent training material. This has strengthened partnerships and developed new relations with relevant stakeholders from the onset of the collaboration. This has also ensured that once the first project ended, there was

momentum to continue, as the project has strong support to continue its further rollout and implementation.

Plans also include strengthening further institutional links — for instance, student exchange post COVID-19 — which would follow an innovative approach and not be a mere study abroad course. For example, the focus could be on service-learning placements as capstone projects, which would raise awareness of how the impact of communication disability may vary in different contexts and how that impacts advocacy (specifically related to agency and voice).

## Recommendations for Collaboration

The opportunity to develop a new collaboration through the mechanism of CADFP has been extremely valuable. Based on the authors’ highly successful experience and on literature (e.g., Nyström et al., 2018) focused on research collaboration, the following key recommendations are posited:

- Select collaboration partners with care to facilitate the process and enrich the experience
- Agree on an overarching theoretical framework or principles to be adopted for the project from the beginning
- Build trust and understanding between the collaborators and key stakeholders
- Set clear goals and timelines to ensure the project’s objectives are met
- Include goals to strengthen the collaborative partnership so that, by the completion of the project, a new partnership is forged that can lead to future collaborations and grow the research network
- Set specific milestones to evaluate project progress and measure effectiveness
- Be flexible and realize that it can be difficult to anticipate the exact roles and responsibilities of collaborators and contributors over the project’s lifetime
- Include key stakeholders in different roles and at different times throughout the collaboration
- Agree on how to assign credit to other collaborators in presentations they deliver
- Be flexible regarding variables that impact collaboration, (e.g., time zones, different academic calendars and responsibilities, use of terminology)
- For research collaborations, allow additional time for ethical clearance from all institutions and understand the requirements from the various universities
- Agree how to ensure the integrity, access, and stewardship of the research data

## Conclusion

Collaborating across continents, cultures, and languages extends the possibilities of discovery (Dusdal & Powell, 2021). New perspectives and contexts are added, projects are broadened and enriched. The three collaborative projects conducted within the ICF framework (World Health Organization, 2001, 2007, 2012) clearly demonstrated that new knowledge on creating, measuring, and evaluating material based on this framework holds mutual benefits. The overarching focus of these three projects highlighted communication advocacy, which can lead to more services for underserved populations while also raising the awareness of the types of services offered by SLPs. A greater awareness of the roles and responsibilities of SLPs will also enhance the visibility of the profession and might even result in the creation of new positions for SLPs in the health and education sectors.

Funding sources, such as CADFP, thus make a noteworthy contribution to education in higher institutions not only on the African continent but in the United States as well. Finally, the ripple effect of this collaboration also significantly touched other CADFP Fellows, children with communication disorders and their families, as well as speech-language pathology communities (including students and practicing SLPs) across the globe.

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## Disclosures

- **Financial:** Brenda Louw and Juan Bornman have received funding from CADFP for three separate projects in 2015, 2016, and 2020.
- **Nonfinancial:** Brenda Louw and Juan Bornman have no non-financial interests to disclose.

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# **Addressing North/South Resource and Power Asymmetries in Global Education: CADFP Fellow as the Activist in Ojaide's *The Activist* and Manuel in Roumain's *Gouverneurs de la Rosée***

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## Introduction

Echoing Nietzsche's view on the literary artist that the writer is not of his time, in this international education curriculum analysis, I have recourse to Tanure Ojaide's and Jacques Roumain's deployment of exegetic devices of Marxian allegory in *The Activist* and *Gouverneurs de la rosée*. My work aims to scrutinize North/South resource and power asymmetries by drawing on an aesthetic and imaginary representation of the classical education of Preceptor and Disciple transfer of knowledge. The reading of transfer of knowledge holds the critical advantage of calling for deeper analysis of the interplay of various binaries commensurate with North/South. They exhibit structures of imposition from above vs. expression and cultivation of individuality and agency; external discipline vs. free activity; acquisition of isolated skills and techniques by drill vs. acquisition of them as means of attaining ends that make vital appeal. Above all, the structures epitomize the North/South dialectic of dominance and struggle for liberation. Allegorically, the Carnegie African Diaspora Fellowship Program (CADFP) Fellow, like Ojaide's *The Activist* or Roumain's *Manuel*, is spurred into scrutinizing transfer of knowledge through North/South curriculum design in global education. It is a crucial moment when critical curriculum and critical pedagogy education compelled the Fellow as a literary artist and social critic into rethinking education and conscientization of African governments on their precariously long-standing, sociohistorical, and political realities engendered by Western education curriculum. In this framework of thought, my essay ponders North/South resource and power asymmetries in global education as any relation of two or more metaphors associating systematically with a set of similarly related real-world referents. In this vein, my analysis will demonstrate that the CADFP Fellow is *The Activist* or *Manuel* who should take critical initiation and agency in the host institutions in Africa to see the structural similarities and divergences in the represented relationships to become a transformative education and critical curriculum leader.

## Theory and Philosophy of Education: Transfer of Knowledge: North/South Curriculum and Pedagogy Asymmetries

One of the oldest and still most popular philosophies of education is the notion that education is the drawing out of our common human nature. For the Rational Humanists, education is "to lead out" on the one hand and "to rear or nurture" on the other hand. In either case, education works with what is already in the learner's nature.

Another definition of education is the "taking on," or "taking in," of the accumulated and stored-up knowledge and wisdom of the race. For the Essentialists, the learner is a

passive element in a process by which he receives, absorbs, and assimilates the various arts and sciences of civilization. No prior nature is postulated except the capacity to receive and be the receptacle for as much of the world's knowledge as possible, and, of course, in the process to develop the major skills of reading, writing, and calculating upon which all such learning depends. The North is privileged with the stored-up knowledge and wisdom of the race, whereas the South is postulated with only the capacity to be the receptacle of such knowledge.

According to a third definition, more in tune with the behavioral sciences, education is the shaping of individuals — their understandings, their attitudes, their values and aspirations — in terms of the culture in which they happen to live. The use to which the arts and sciences shall be put is always determined by a culture existing at a specific time in history and a specific place in the world's political geography. Hence, the value of this or that art or science is always a function of the social system at a given time in its history. Thus, whether a particular art or science is to be taught or learned is a negotiable matter to be determined in light of the culture's own ethic.

Professor John Dewey epitomizes the vital link between education and philosophy in the following terms: "If we are willing to conceive education as the process of forming fundamental dispositions, intellectual and emotional, toward nature and fellow men, philosophy may even be defined as the general theory of education." The first clause, "the process of forming fundamental dispositions," needs some gloss for it. I understand that Dewey is saying that human beings have dispositions ("intellectual and emotional, toward nature and fellow men"); that some of these dispositions are fundamental; that it is conceivable and possible to form them in young people by deliberate, intentional, and predetermined means; and that this activity is education (Winn, 1959a).

Dewey is clearly trying to intimate that whatever is fundamental is desirable and worth pursuing in the process of "forming." He implies that the dispositions to be formed are not only fundamental but of considerable interest to us; they are important to the task of giving a person's developing life a focus and an orientation necessary for happiness and success. In short, we want the learners to possess these dispositions. The binary referent posits the South as the receptacle of the knowledge transferred from the North.

Paraphrasing Dewey thus does not mean to suggest that he is ignoring the important role of the learner. Indeed, most of Dewey's writing in education served to explain how this role could become far more active and constructive than any previous theory had conceived. Not only was the learner a participant in the "forming" activity but also, through his own experience and the feedback effect of his reaction to

the dispositions made available to him, the learner actively shared in deciding what dispositions were most worth forming in his own character.

One of the dispositions on which Dewey put a high value was the disposition to share. The sharing of information, experiences, viewpoints and opinions, the sharing of cooperative help in the working out of learning projects — all these were considered good, and the disposition to share with one's fellows came to have an overpowering importance in Dewey's educational theory. Inevitably, "the morality of sharing" places a high premium on human intercourse and personal gregariousness. Gregariousness, then, came to assume a large auxiliary function in support of the sharing disposition. It is partly for this reason that, under Dewey's influence and that of the Progressives over the past five decades, the socialization of the learner has come into equal prominence with the intellectual development of the young learner as a strategic educational aim (Winn, 1959b).

Education may be all these things superficially, but each viewpoint makes the same mistake: believing that the learners (the South) are things to be worked over in some fashion to bring them into alignment with a prior notion of what they should be. In these conceptions of education, the learners are to be used. They are to be employed on behalf of (1) a prepared, pre certified idea of "human nature," which they are expected to fulfill; (2) an objective body of extant subject matter, which they are expected to absorb; (3) an objective concept of a culture's ways and means of living, which they are expected to assume, or (4) a set of dispositions, deemed fundamental, which are to be formed in them and for which they are expected to become the living vehicles.

In every case, the process of education is understood to have its aim and point outside the learner. The learner, by virtue of what is to be done with them and for them, is eventually seen as an object rather than a subject. Their activity of learning is aroused and promoted in the name of considerations residing outside their own self-determination and self-direction, which, in the case of global education, is the role assigned to the South.

It is about bringing the learner's own self-determination to the very center of the learning process in education that reminds the learners that they are constantly, freely, and creatively choosing. This is the kind of education we, CADFP Alumni, should pursue. It is the education of private awareness and personal involvement — education that carries the learner beyond mere intellectual discipline, beyond mere "fundamental dispositions," to the zone of value creation where selves create their own selves beyond the reach of teacher and textbook (Payne, 1996).

## Approaching North/South Curriculum and Pedagogy Asymmetries: CAMP Experience With the Sharing Disposition

I received a CADFP/UNIJOs Project grant and went to teach in the Department of Foreign Languages of the Faculty of Arts, University of Jos (Unijos), Nigeria, May 15 through August 15, 2017. The project included collaborative curriculum work, active classroom pedagogy enactment, and graduate student mentoring.

As Dr. Victor O. Aire, professor of French in charge of postgraduate programs, was retiring in May 2017, my presence was timely. I had to step in and teach three African/Caribbean literature courses.

Our comparative literature work focuses on African and the Caribbean novel explored *Gouverneurs de la rosée* by Haitian author Roumain and *Les Bouts de bois de Dieu* by the Senegalese writer and filmmaker Sembène Ousmane. At collaborative curriculum workshops on the two novels, the French-teaching faculty made remarks on the publication dates and the out-of-date thematic we tended to think the two novels presented along with other novels of the same literary production period. The syllabus design session of the workshops provided opportunities to share interdisciplinary teaching interests in curriculum, syllabus building, and pedagogy implementation.

Referring to literature and culture theorists: Roland Barthes, Jacques Derrida, Jacques Corzani, Ojaide, Wole Soyinka, and Edwards Said who say "that there is no closure to a text, that a text is polyphonic and polysemous", we opened the two novels to a new thematic and critical study. We reached a consensus on the theme of our study and collaborated equally on designing course curriculum and strategies to implement the syllabus. We encouraged students and faculty alike to explore the two texts as environmental literature in Africa and the Caribbean. This new orientation in novel study in French at Unijos also explored the theoretical work developed by Val Plumwood and other Marxist, feminist, ecofeminist, and ecocritical authors in *Ecofeminism, Women, Culture, Nature*, edited by Karen J. Warren. My personal collaborative curriculum effort was to infuse ecofeminism, Marxism, and social and liberation theory into the theoretical portion of the course to support environmental literary studies, which is our course-learning objective. Practicum and implementation of collaborative curriculum took us to Unijos, the Federal Department of Forestry, Jos Archaeological Center, and land conservation libraries to browse critical documents on environmental literature and bioecological degradation issues. Our final exam and research paper writing — Student Learning Outcomes Assessment (SLOA) — was an attempt to answer the prompt I formulated in French as follows:

## Curriculum Design and SLOA

FRANÇAIS 612

PREMIER SEMESTRE 2016–2017

Honoré Missihoun, PhD

Mai–Aout 2017

CADFP-IIE/UNIJOS Project Scholar

Examen: Sujet de Dissertation

Dans une approche de Littérature Comparée, lisez attentivement l'énonciation de Dissertation proposée ci-dessous sur deux œuvres romanesques, l'une par Jacques Roumain et l'autre par Ousmane Sembène. Basez votre travail sur les théories féministe, écoféministe et marxiste, développées par Val Plumwood.

« Elle est là, la douce, la bonne, la coulante, la chantante, la fraîche, la bénédiction, la vie. » Cette citation tirée de Gouverneurs de la rosée de Jacques Roumain, et cette conviction « J'arrose un arbre pour demain » affirmée par Maimouna au paroxysme de la grève dans Les Bouts de bois de Dieu par Ousmane Sembène, nous autorisent-elles à considérer l'eau comme un personnage principal des deux romans ?

En vous appuyant sur la plateforme théorique édifée par Val Plumwood dans son texte

« Androcentrism and Anthropocentrism, Parallels and Politics » dans Ecofeminism, Women, Culture, Nature édité par Karen Warren, rédigez un travail de comparaison entre les deux œuvres romanesques en insistant sur le personnage de l'eau dans une perspective féministe, écoféministe et marxiste. Inspirez-vous aussi du poème écrit par le linguiste Umaru Kiro Kalgo :

### Le Cadeau

Le Cadeau!

Ce mot nous rappelle la source de  
vie. On y entend Dieu qui est  
Créateur et Eau qui est moteur de la  
vie. Que ce mot est magnifique!

Il a toute la capacité d'évoquer la présence du Créateur.  
IL a tout le pouvoir de nous baigner dans cet amour de DIEU  
qui se manifeste par le cadeau de vie.

Le cadeau est la seule expression de l'amour entre le Créateur et la créature.  
La seule expression de bonne relation entre les créés.  
Le Cadeau nous lie les uns aux autres tout au long de la vie.

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I thoroughly enjoyed the opportunity to teach African literature in the context of everyday lives in which the texts were produced. Being able to feel, smell, and observe the subject of the texts in social, psychological, spiritual, and material contexts offered me a wonderful pedagogy tool as well as opportunity for discoveries and understanding. I did not have to translate every word or scene to the students. They live the experience that the texts narrate. This enabled us to take the texts to a high level of contemplation and explore their deepest meanings, as crude oil pollution is a reality that forms part of Nigeria's collective consciousness.

### Collaboration in Effective North/South Curriculum and Transformative Literary Allegories

In the framework of mutual collaboration among CADFP Alumni, I keep working with my two Unijos PhD students in Francophone African Literature whose dissertation research work I partly directed and read until one of them completed his PhD last academic year. Department chair and academic host Dr. Nora Ladi Daduut and I worked intensely in the same Alumni framework, which took her on a CADFP grant to a conference

presentation in the Department of French at the University of Western Australia in the fall of 2018. A sustained collaboration with professor Aire and the reading of my PhD students' work sparked a comparative work interest in my research endeavors on Roumain, Ousmane, and Ojaide. This culminated in writing "Action, Aims, and Purposes in Ojaide's *The Activist* and Roumain *Gouverneurs de la rosée*," a chapter for the book project of Dr. Enajite Ojaruega, professor of English at the University of Abraka, Nigeria. It is the study of the impactful and transformative action of the heroic Marxist protagonists: Bakayoko in Ousmane's *Les Bouts de bois de Dieu*, The Activist in Ojaide's *The Activist*, and Manuel in Roumain *Gouverneurs de la rosée* that inspired my abstract for this Alumni convening presentation.

"Addressing Resource and Power Asymmetries ... in Global Education in Tanure Ojaide's *The Activist* and Jacques Roumain *Gouverneurs de la rosée*" is a study of pedagogy of emancipation, critical pedagogy in minority discourses. A great deal of innovative works in the field of critical pedagogy draws on various fields of social sciences, which reflect critical pedagogy as a methodology and an approach to education that is not restricted to a single system. Paulo Freire's argument that the "open-ended" nature of education and pedagogy reflects the dynamic "human" and favors a definition of the human points toward the performative quality of representation in terms of the metaphor of "Plasticity." This, indeed, does not exclude dissenting reconstruction of human experiences through pedagogy. In the binary North/South, education, curriculum, and the transfer of knowledge and technology require dissenting reconstruction of human experiences (Freire, 2007).

Expanding on Freire, pedagogy is most effective when it derives from local experiences, which literature best translates. To understand how a crisis affects us all, we must first understand it. Only through the literary analyses of the community-engaged writers' experiences and the literature of people's own experiences can a proper pedagogy be formed for honest and effective change to be made, which is the case of the education that activism and critical pedagogy championed in *The Activist* and *Gouverneurs*. The two stories debunk the fashionable claim made even by writers that literature can do nothing to alter our social and political condition. Chinua Achebe answers: "Of course, literature can" (Achebe, 2002).

The Activist (CADFP Fellow), the protagonist of *The Activist*, and Manuel (CADFP Fellow), the protagonist of *Gouverneurs*, are returnees — they are symbols of the intellectualism, patriotism, and visions needed to effect transformation in their locales. They show that such change is feasible through changes within the dynamics of educational policy, and in the power of social engagement in intellectual activism. It is about conscientizing the people through critical education and curriculum to reform colonial and neo-colonial education by addressing the North/South asymmetric curriculum of transfer of knowledge in the context of international education (Nwagbara, 2008).

## Conclusion

The CADFP Fellow should be the epitomic example of the homo faber in global education. Everywhere tends to see in Manuel the Hebrew "Emmanuel," "God is with us." Nonetheless, that character is allegedly so divine that it does not make rainfall from heaven. He digs the ground with his hands to make water spring from it manually. His name signifies "by the hands," and by extrapolation it signifies "manual laborer," not "God with us." For Marx, Man is the "homo faber," the "creative and making man" who shows that it is labor or the social being that determines conscience (Arnold, 1979). That is as true for Ojaide's *The Activist*, the CADFP Fellow in Nigeria, as it is for Roumain's Manuel, CADFP Fellow in Haiti, for as heroes they have not come from heaven to lead the people. They belong in the broad masses of the people substantiating the practical nature of critical curriculum and critical pedagogy. Their knowledge draws on social community practice and years of work in the proletarian world. Their names and social Praxis experience may also signify a teaching/learning curriculum text, a study guide for the followers to know how a machine functions, or how to acquire a knowledge. The personas of *The Activist* and Manuel, epitome of CADFP Fellow, are "manuals" of practice and revolutionary sensibility.

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# Strategic Leveraging of Diaspora Academics: Operationalizing Brain Cycling for Innovation and Capacity Building in African Universities

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## ABSTRACT

Africa's contribution to scientific research intellectual property (IP) remains anemic. Innovation is key to growth in Africa, but Africa's innovation talent, specifically knowledge inflows by Africa's diaspora academics, remains untapped. With an enabling strategic policy, the expertise of diaspora academics can be cycled back home and, in a proper context, can contribute to stimulating the region's innovation competitiveness. Africa diaspora academics, especially in the sciences, can establish research teams in various universities to leverage bilateral knowledge exchange, especially on "frugal" innovations deployable to Africa's needs (e.g., agrifood, healthcare, and green manufacturing) while training highly qualified personnel (HQP). By embracing the silver lining of the COVID-19 pandemic—the acceleration of online learning—diaspora academics with peers in African universities can co-develop Afrocentric-responsive online curriculum learning resources, a disruptive opportunity for pedagogy revolution on the continent. This article proposes a framework of policies and operationalized solutions to barriers on transforming the "brain drain" challenge to a high-yielding diaspora "brain circulation" that results in acceleration of socioeconomic development in Africa.

## Background

According to United Nations (2020) estimates, Africa's population is 1.3 billion (~16.7% of world population) with an annual growth rate of 2.5%, the fastest in the world (Ojo, 2021). Most of the African countries remain far from meeting the base level of Maslow's hierarchy of needs for their growing population and rank poorly in their progress to realization of the 2030 United Nations Sustainable Development Goals (UN SDGs) (Adeyeye et al., 2021). Variations of the 2030 UN SDGs have been rephrased in the African Union Agenda 2063 with a commitment to achieving them (Africa Union Commission 2017). However, a structured metrical framework to track continental and member nation progress remains a missing link. Individual countries (e.g., Kenya) have developed an economic blueprint aligned to the UN SDGs, hence the Big 4 Agenda with some specific measurable goals, including food security, affordable housing, universal health coverage (UHC), and enhanced manufacturing (Kivisi, 2019; Kenya, 2018). While progress has been at a snail's pace, rapid population growth and the disproportionate impacts of global issues—such as climate change and disease pandemics, including COVID-19—have further exposed broad-based institutional vulnerabilities.

At the heart of the institutional vulnerabilities are issues, such as systemic structural biases that impede fair participation in global trade, a donor dependency mindset, poor governance allied to weak institutions, and lack of an effective policy framework (Mugo & Puplampu, 2020). As such, Africans are generally faced with "fight or flight" realities, which mirror the physiological effects of elevated hormones (e.g., cortisol and adrenaline) as a response to high stress (Mugo & Alberkant, 2020; Dhanjai et al., 2019). It can be said that, at

a biological level, African people face high levels of allostatic load—the "physiological wear and tear" due to chronic stress (McEwen, 1998). Faced with these challenges and accelerated by the modern reality of globalization and integration of world economies, modern-day human capital flight is a major problem for Africa (Sheikheldin & Mohamed, 2021). Modern-day migration, unlike historical slavery, which was achieved through physical aggression, proceeds on a subtle, consensual basis. However, both historical and current migrations rob Africa's human capital at its prime. In a world now in fierce competition for human capital, Africa has increasingly lost its innovation engine and talent, with many professionals draining to the Global North, a phenomenon christened the "brain drain" (Adesote & Osunkoya, 2018). Arguments have been made against the use of the phrase "brain drain" in favor of politically neutral terms, such as "brain circulation" or "brain exchange." (Adesote & Osunkoya, 2018; Saint-Blancat, 2018). However, especially in the case of Africa, and to some extent other weaker global economies, "asymmetric brain exchange" drains talent from Africa in a nonsymbiotic proportion, resulting in a net loss of Africa's highly qualified personnel (HQP) capacity (Saint-Blancat, 2018; Shin & Moon, 2018). The massive outflow of highly skilled African professionals to the Global North at their prime of life results in loss of human resource capacity for African development. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) science report (2021), the share of highly skilled individuals in sub-Saharan Africa is among the lowest in the world, yet the high-skilled emigration rate from these countries, especially to the United States and Europe, grew from 11% in 1995 to 16% in 2010 (likely higher today),

the highest high-skilled emigration rate of all developing regions (Mugo & Puplampu, 2020).

While all professionals are of high value to our integral society, science, technology, and innovation (STI) are the core skills essential to finding solutions to the UN SDGs. Yet it is estimated one-third of African scientists and research professionals drain out of Africa, distressing and disrupting capacity for training and development, especially in critical sectors such as healthcare, education, and engineering (Sheikheldin & Mohamed, 2021). For example, UNESCO Director General Irina Bokova reported, “In Namibia, Zimbabwe, and Tanzania, there is one qualified engineer for a population of 6,000 people—compared to one engineer per 200 people in China” (UNESCO Africa, 2013). This reality is duplicated in other African countries. As such, engineering talent to build infrastructure, such as railway lines, roads, sewer systems, and housing, is hired from other countries, especially China, at exorbitant costs often incurred as concessional loans, drowning Africa in unsustainable public debt. Dire situations also present themselves in healthcare, where the general ratio of physicians to patients is reported to be 1 to 8,000 compared to the minimum World Health Organization recommendation of 1 physician to 5,000 (Sheikheldin & Mohamed, 2021). With a healthcare system in a dysfunctional state and typically unable to cope with common tropical infections such as malaria, cholera etc., impacts from new infections such as COVID-19 compounds the human cost on the continent. Africans must urgently rethink and self-determine their own destiny through bold, action-oriented policies.

This article will provide insights on policy framework on how the enormous African diaspora brain talent could be cycled back to catalyze African innovation, especially in STI development.

### **Theoretical Framework: African Universities, the Diaspora, and Brain Drain**

Higher education institutions play the premier role in knowledge production through research and community engagement. Universities’ enterprise is at the heart of developing the human capital needed for global and national social development. Accessible quality education at all levels, including higher education, is one of the UN SDGs that directly and indirectly interweaves with all other SDGs (e.g., ending poverty, hunger, affordable health and well-being, gender and socioeconomic equalities, clean water and sanitation, sustainable cities and communities, healthy environment, and its ecosystems). Yet African universities are highly deficient in quality and quantity of professors. For example, a case study of the Ethiopian academic diaspora reported only 6.4% of the academic staff in Ethiopia’s 25 universities hold a doctoral degree, with most of them working for the University of Addis Ababa, yet over 200 Ethiopian professors work in the

United States and Canada, most with the rank of full professor (Sheikheldin & Mohamed, 2021). Further, it is estimated that about 20,000 highly qualified African researchers have been leaving the continent every year since 1990 (Sheikheldin & Mohamed, 2021). Unique to Africa, there are currently more African PhD holders outside the continent than inside it. Coupled with anemic investment in research and innovation in Africa stemming from lack of government education policy frameworks that nurtures and values an innovation mindset, it is not surprising Africa remains further from the frontier of innovation and is poorly represented as a contributor to intellectual property (IP) in science and technology. Yet, unequivocally, innovation is the key to African stability and growth in the coming decade (Mugo & Puplampu, 2020).

In recognition of the contribution of diaspora to their homeland countries, governments have narrowly focused their policies on tapping diaspora remittances, which in some African countries exceeds official development aid and private capital. For example, in 2020, Kenya’s 3 million diaspora population remitted approximately \$3 billion annually, nearly 3% of that nation’s Gross Domestic Product (GDP) (Central Bank of Kenya, 2021). In Nigeria the remittances are over \$21.7 billion (John et al., 2020). While these remittances come with some “adrenaline bursts” of (short-term) economic benefits, without a nuanced policy framework focused on targeted remittance investment on longer-term priorities aligned to the UN SDGs, the remittances could result in a negative dependency cycle that threatens Africa’s long-term socioeconomic well-being. For example, in Kenya, it is estimated about 5% of remittances is spent on funerals, and about 30% of the diaspora investment goes to real estate. Within real estate there is lack of proper land use and zoning practices, and arable land is subdivided to unproductive units for houses, thereby impacting food security, water supply, and sanitation, and as such resulting in “concrete jungles” (Kibunyi et al., 2017; Yiran et al., 2020; Onyango et al., 2021).

Beyond the narrow view of financial remittances, the largest untapped potential remains the knowledge inflows of the sub-Saharan Africa diaspora academics and professionals. This is especially the case for African scientists, whose skills are so valuable in catalyzing Africa to be a player in the emerging global knowledge economy. Yet migrant African scientists continue to robustly contribute innovations to their resident countries. Interesting and worthy an independent rigorous scrutiny is anecdotal evidence that suggests that, while Africa loses more from highly skilled professions due to initial investment in their training, diaspora academics and professionals remit less, partly due to their outlook on life and economic stability in their domiciled countries.

Visionary management insight proposes that professionals’ immigration (brain drain) could be the catalyst for brain circulation, where their broadened viewpoint from living in two worlds and innovations they are expert practitioners in can

be cycled back home in proper contextualized applications (Mugo & Puplampu, 2020). The African diaspora academic professionals could be the link for mutually beneficial collaborations between Global North and South universities, which can foster the creation of homegrown Africa innovations (Ai). Through a clear rethink in governments' higher education strategic policy and a passionate execution by stakeholders in the universities on the continent, it is possible to tap into the wealth of potential in academic diaspora brain circulation.

The proposed professional diaspora brain recirculation model for innovation competitiveness is not new. Some countries have exploited expertise mobilization to foster engagements. For example, China facilitates the inter-mobility of Chinese professors between their home country and host countries, often the United States and Canada (Tian, 2016). This ongoing mobility complemented the circulation of knowledge obtained from reverse migration, where 25% of the 1.21 million Chinese scientists went back to China following their research studies and work abroad (Tian, 2016). In this case, it is reported that, by 2017, out of the more than 5.2 million Chinese nationals who went abroad for higher education and research, nearly 3.1 million returned (Zong & Lu, 2017; Shin & Moon, 2018). This phenomenon greatly contributed to science and technology innovation takeoff in China, currently on course to overtake the United States in IP and patents generation (Mugo & Puplampu, 2020). The mobile scientists and returnees also play an instrumental role in linking China to the global knowledge network. While there is an ethical debate on the Chinese government's involvement in this strategic knowledge mobilization, now at the center of the U.S./China trade conflict, it is without debate that the bold policy initiatives by China on knowledge circulation have contributed to rise and regained pride in China's nationalism. However, the China/US fistfight on IP issues can inform other countries' policies on best practices for transboundary brain exchange that is mutually beneficial to the countries involved.

A calculated and focused strategic move by China, the brain recirculation and investment in incubators and manufacturing by private sector investments initially focused on repurposing innovations and scalable production of goods that compete on cost at a global scale, such as textiles, polymers (plastics), electronics, and other consumable products. China also focused on intensive food production innovations to feed their large population and for exports. Evolutionally, the *Homo sapiens* brain growth simultaneously happened with innovations in fire (cooking), which gave access to more digestibility of starch and other nutritious foods. When the core needs of food supply are met, this triggers energy bursts necessary for other higher technology innovations.

While the most radical strategic transformation of brain drain to brain circulation happened in Germany in 1954, Israel in the 1960s/'70s, and in contemporary times, China and other countries, such as India, Mexico, and Costa Rica, are

also making notable strides in developing incentive policies that mobilize diaspora academics to contribute technical skills to their countries, especially in medicine, biotechnology, information technology, and materials science (Ette & Witte, 2021; Shin & Moon, 2018; Sharma & Varshney, 2019; Pedroza & Palop-Garcia, 2019).

Success in other countries indicates that African countries can do the same to tap into this gold mine of untapped potential (Chand, 2019). Diaspora academics in developed countries can collaborate and establish research labs (hubs) in their motherland universities, leveraging opportunities bilaterally. The opportunities could include sharing of research infrastructure and innovation ideas; mobilizing research students between research groups spread among two or more countries; and fostering multi/bilateral research networks, thus creating a knowledge exchange and innovation ecosystem. This approach can also booster the quality and competency of training of HQP in Africa, where even though universities have grown in number, the same cannot be said of the quality of learning at both graduate and undergraduate levels (Puplampu & Mugo, 2020). The continent is in dire need for university programs in science and technology, the engine for innovation that impacts societies. African universities struggling to achieve their core mandate of research, innovation, and academic excellence could especially benefit if they adopted an open, collaborative approach where African diaspora academics find a sense of acceptance in African universities and are embraced to create research groups and innovation hubs housed in African universities. As such, if African universities open their world to the tremendous untapped potential of African diaspora academia and possibly international academia, such an approach could present far-reaching benefits in promoting economic dynamism through technology innovation and HQP training, transforming Africa to a truly knowledge economy and catalyzing Africa's human capital and social development (Mugo & Puplampu, 2020). Notably, the African diaspora is often most willing and seeks such opportunities, but the policy frameworks and territorial attitude in African universities prevents that shared, collaborative mindset from blossoming. The effort to connect African universities to diaspora academics has been realized to some extent by the establishment of the Carnegie African Diaspora Fellowship Program (CADFP). In this human capital inflow initiative, Africa remains a spectator, reflecting the donor-driven development paradigm. The lack of the required, sustained, long-term collaboration dims the optimal innovation outcomes that could otherwise ensue. Requiring a resolute determination to globally soar, African universities and especially Pan African University should exploit this brain recirculation approach to fast-track Africa's STI and social development.

With experience in forging research collaborations between Canada (resident country), India, China, Costa Rica, and Kenya, the last initially funded by CADFP, the authors share

some operationalization suggestions (vide infra) of diaspora brain exchange and recirculation involving forging mutually beneficial transborder science research ecosystems.

### Operationalization Suggestions of Diaspora Brain Exchange and Recirculation

First, with the dire state of affairs and the need to move fast, identification of scope of engagement, focusing on the lowest barriers for entry initiatives that require low-cost investment, is key for Africa economic development. African countries can learn from China regarding bolder strategic approaches to pragmatically focus on lower-investment innovation options by customizing, adopting, and adapting already known innovations and redeploying them to their needs and realities, especially where their competitive advantage lies: agriculture. As illustrated in Figure 1, there are many low-cost, local-centric ideas, such as grassroots innovations related to valorization of local low-value and waste products. Scaling up integration of low-cost smart sensor and data analytics (artificial intelligence) technologies in healthcare, manufacturing, environmental monitoring, and food production is happening in Global North and emerging countries but is minimal in Africa. The missing element is a strategic iterative and adaptive development framework and customization for application in the African

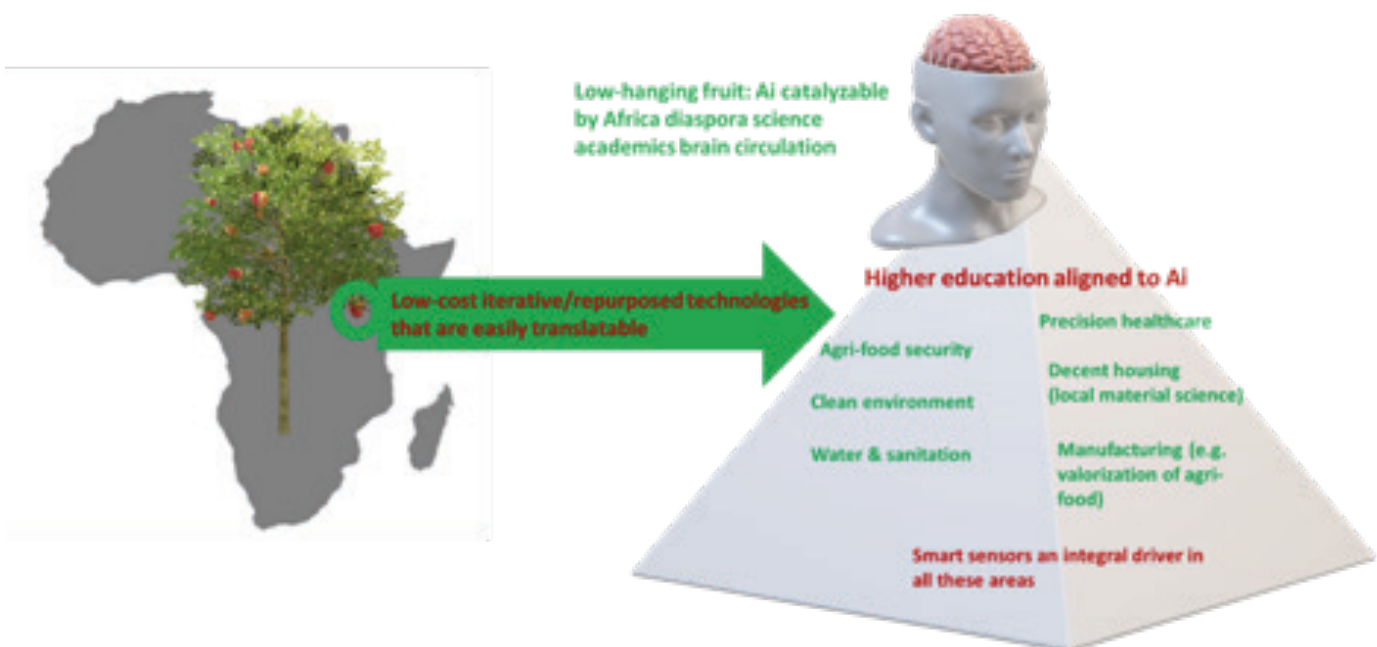
context (Mugo & Puplampu, 2020; Mugo & Alberkant, 2020). The African academic diaspora is well positioned to advance an agenda for change in a range of areas. For example, the Canada-based Mugo research group provides technology leadership in the development of smart portable and in some cases wearable sensors hyphenatable to smartphones, otherwise referred to as the Internet of Things (IoT), for real-time diagnostics monitoring of plant/soil nutrients and animal/human health (Mugo et al. 2022; Mugo & Alberkant, 2020; Dhanjai et al., 2019). These devices provide data-driven decision making to boost efficiencies in food production and monitor animal/human health and well-being.

Tapping into innovation requires the requisite mindset and focus on training the workforce that can guide the innovation culture in building technological capabilities. Strong investments in human capital, with a broad investment in basic education and higher education that nurtures creativity and policies that support innovation ecosystems, could be the missing link for economic takeoff in Africa (Puplampu & Mugo, 2020).

Due to the COVID-19 pandemic, African universities, like their counterparts elsewhere, have been delivering learning through online platforms, a clear case of disrupted innovation in the learning process. The disruption required creativity for

FIGURE 1

Illustrating the priority (“low-hanging fruit”) concept for catalyzing Ai through Africa diaspora brain cycling



science educators to use hybrid learning approaches that integrate online learning. Building on this reality, science educators in the diaspora can increasingly be called on to be integrated members of the academy in Africa, teaching undergraduate courses and mentoring graduate students with only supplementary in-person engagement. With now optimized video-chat platforms, such as Zoom, Google Classroom, Blackboard Collaborate, and many others, e-teaching across continents is possible with enhanced quality in mentor-mentee interactive engagement. This low-cost approach could significantly stimulate brain circulation and transform the training of HQP. In addition, engaging diaspora academics to collaboratively teach and be involved in graduate mentorship through e-learning would incentivize the much-needed creation of Massive Online and Open Course (MOOC) curriculum contextualized to African realities and needs. As such, this approach would accelerate the decolonization of curriculum, which is long overdue.

## Addressing Barriers to Diaspora Academics Brain Cycling

**i) Reaping full benefits for diaspora brain recirculation requires intentional government policy and investment. Priority should be on nuanced policy framework focused on achieving measurable targeted results (low-hanging fruit/competitive areas).** This is approach is how China and other emerging countries have made meteoric progress for scientific innovation through intentionally leveraging from brain exchange. African countries can create an outcome-based funding model where public universities are funded based on outcomes allied to quality publications, patenting, training on successful HQP, knowledge translation to community, and commercialization. These are quantifiable metrics. However, the reality is that such a nuanced policy framework will require many years of advocacy, and execution could become a battleground in African universities. The battle can be best addressed by enhancing university autonomy. While some scope of autonomy exists in some universities on the continent, these institutions often fail to fully activate the autonomy benefits. Individual universities could draft their strategic policy framework to tap into mutual engagements, with professional and academic diaspora as the key to scientific innovation and technology development and coordinated at the national level. It is possible to drive this initiative through the coalition of willing faculty partners (between diaspora and African resident faculty) and the creation of a collaborative research exchange. A major challenge is the near-complete lack of science infrastructure for the African collaborating research group. As such, the collaborating diaspora partner often has to provide the needed resources, which are typically inadequate, creating an unsustainable, asymmetric relationship. The approach

by CADFP to facilitate short-term mobility, while helpful for scientists in the short term, is inefficient for meaningful, long-term engagements due to this dire lack of research infrastructure. While the short-term mobility is effective in generating interest in intercollegiate cooperation through the signing of memorandums of understanding (MOUs), with gaping disparities in enabling research facilities, long-term operational viability of meaningful activation of the MOUs toward knowledge exchange is curtailed. Rethinking approaches to access various forms of funding that go toward research infrastructure would play a role in unlocking sustainable collaborations. Given that no country has an unlimited supply of resources, mutual partnerships and creative leveraging can help in operational issues.

**ii) Governance problems in African public universities often incapacitate research output, leading to lethargy and cynicism.** Science research infrastructure typically requires not only the brick-and-mortar lab but also equipment that needs maintenance and incurs operational costs. Strategic approaches by would-be collaborators and research capital investors (e.g., CADFP) should rethink investment with highest dividends. Given small success triggers a positive cascade, models such as interdependent autonomous research institutes housed within university premises can be actualized. Such a model was effective, for example, in the Japanese International Cooperation Agency (JICA) partnership with Jomo Kenyatta University of Agriculture and Technology (JKUAT) in Kenya, which has for over two decades triggered significant research capacity building (Losenge et al., 2016; Kivisi, 2019). These research institutes allied to public institutions (providing HQP training) but managed autonomously could mitigate the governance issues of public universities while playing a key role in changing the research culture. Such research centers would also aid in retaining talent on the continent, especially graduate students. In addition, such investments would minimize “brain waste,” where high-skilled individuals remain in the diaspora, yet their skills are underutilized (Zong & Lu, 2017).

**iii) Diaspora academics could play a useful role in establishing labs in such research institutes.** In addition, such research institutes could be paired with not only public universities but also Pan African University. Indeed, this could breathe new life and leadership direction into the latter. Importantly, the research institutes should be allied to focus on developing innovations and knowledge translations in core UN SDGs, such as agri-food security, sanitation, and water treatment. A good example of such research programs is the Green Revolution in India, started with the help of the U.S.-based Rockefeller Foundation, with a research focus on developing high-yielding varieties of wheat and rice. This research initiative addressed large-scale starvation in India.

Beyond India, the initiative has been replicated in Mexico and the Philippines (Sharma & Varshney, 2019). These institutes should also be equipped with high-speed wireless internet, which would especially aid in scaling up integration of digital technology and e-learning, helpful to the entire local institution. Indeed, the proposed research institutes could learn from the impressive initiative by physicist Neil Turok, the brain behind The African Institute for Mathematical Sciences (AIMS), a pan-African network of centers of excellence for postgraduate training in science, technology, engineering, and mathematics (STEM), which currently has centers in Cameroon, Ghana, Senegal, and South Africa (AIMS, 2021).

**iv) The important question is how to marshal funding for the creation of such research institutes.** A leveraging approach and starting small are key, as is very strongly aligning the initial research objectives of the institute to the most urgent societal needs (UN SDGs) that can easily be solved through “shovel-ready” iterative and repurposing innovations that can be translated for community use in short term (two to five years). Aligning institutes to such initiatives is likely to attract leveraged investment from organizations such as CADFP, Global Challenges Canada, and The Rockefeller Foundation, and a strong advocacy by African governments to also commit investment, probably through an incentive matching program, where every foreign dollar is matched by beneficiary country. African countries should be encouraged to invest at least 1% to 5% of their GDP in research and development as the only way out of dependency and poverty. In addition, an opportunity lies in finding a framework to tap onto diaspora remitting stakeholders, majority of whom are professionals with a mindset that aligns on importance of research innovation as the only long-term solution to dependency. If 1% to 5% of all remittances to each country is channeled to research and development, hopefully toward such proposed institutes, focused on short- and medium-term innovation solutions, the impact would be monumental. In the case of Kenya, a 1% allocation of the annual diaspora remittances to research institutes would mean \$30 million, a significant sum that can yield great outcomes if targeted to such investments. In addition, by recruiting competent research directors, including those from the diaspora who are experienced in scaling and leveraging research funding from diverse public and private sources, these institutes would significantly change the research and policy landscape. The proposed suggested framework and ideas are “low-hanging fruit” within the realm of short-term realization that can catalyze a quantum leap in Ai.

## Conclusion

African diaspora academic brain circulation, especially in STEM, should be a priority for development of a knowledge-based economy to fast-track an uplift in socioeconomic standing of the African continent. A strategic low-hanging-fruit approach of fostering diaspora academics to establish research labs in African universities with a research agenda of developing iterative and repurposed technologies that align to urgent societal needs, such as agri-food, water and sanitation, health solutions, and smart (green) manufacturing, could make a rapid scalable impact in these areas while producing multilayered socioeconomic benefits. Using creative funding approaches from international private donors and diaspora remittances, research centers of excellence that are autonomous yet allied to local universities could be created. Such institutes could be useful in addressing issues and rapidly influencing and enhancing the research culture in African universities.

Taking advantage of the expanded e-learning platforms accelerated by COVID-19, African universities can tap onto African diaspora academics to provide e-learning mentorships for graduate and undergraduate courses. Investments in high-speed internet connectivity in the universities is a fairly a modest way to realize such a high-value, low-cost collaborative knowledge cycling agenda that can be a catalyst for significant socioeconomic change. While a hopeful thought that African governments and public universities will rise to the occasion and fast-track these realizable possibilities, private universities in Africa, which typically have less bureaucratic inertia, could run with it. Pan African University could be especially well situated to operationalize the diaspora brain circulation possibilities to create “open innovation” research institutes as well as MOOC curricula (especially in STEM) that become a key catalyst for change for massive high-skill human capital development on the African continent. With such thinking, Africa can reclaim its place as the true cradle of human civilization.

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Mutually Beneficial Collaboration

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# Collaboration as a Key Approach in Optimizing Scientific Research Success

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## ABSTRACT

The main goal of collaboration is founded upon the need to tackle societal and fundamental challenges together. Researchers and organizations worldwide are increasingly committing themselves in mutual collaboration for multiple years to a common goal to enrich, enhance, and deepen technological capabilities and applications within their numerous fields. The existence of resource asymmetries between American and African universities and research institutions has remained a major impediment in the latter's realization of meaningful pace in scientific research progress. A practical approach toward addressing this serious setback would therefore be for fellows from American and African institutions to find convergent mutual research interests that would enable them develop joint fundable collaborative research projects. Several profound mutual benefits are expected to arise from such research collaborations for both the host and home institutions. This paper provides a quick overview that illuminates the numerous potential benefits of mutual collaboration for optimization of scientific research success.

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## Introduction

While innovation is largely attributed to be the main driver of economic growth, at the heart of it, research and development (R&D) activities are the real integral ingredients that allow scientists and researchers to develop new knowledge, techniques, and technologies. Increasing changes in technology allow people to optimize use of available resources, resulting in increased productivity. As productivity grows, so does the economy. It is thus axiomatic that innovative activity has been the single most important component of long-term economic growth. For instance, a recent study of 15 Organisation for Economic Co-operation and Development (OECD) countries, including the United States, estimates that a 1% increase in R&D spending could grow the economy by 0.61%. This is an indication that countries that invest more in R&D, commensurately, have economies that grow faster (OECD, 2004).

It is generally accepted that various scientific issues and innovative technologies can often be addressed by working together in teams of researchers from different backgrounds (Bansal et al., 2019). The merging of different fields often makes it possible to achieve research goals that are more effective and impactful. Policymakers and program managers tend to favor more international collaboration in funding considerations (He, 2009). It is also worth noting that since 1991, international collaboration has grown more than tenfold for the most advanced countries, and twentyfold for Brazil, Russia, India, and China (Adams, 2013). It is, however, rather discomfoting to observe that such trends of research

collaboration have been not only scarce but rare between African countries and other countries in the world. Also, despite some of these countries having received colossal amounts of dollars in aid, grants, and low-interest loans over the past few decades, they are still underdeveloped today. Perhaps even more painful is that their prospects are only slightly better than they were decades ago (Christensen et al., 2019). With increasing populations in many of these regions, a change of developmental strategy is urgently needed for a meaningful headway to be realized in the foreseeable future.

Collaborative research can be defined as research involving coordination between researchers, institutions, organizations, and/or communities. The cooperation has the potential to bring together distinct expertise needed for the success of a project. Collaboration can be classified as voluntary, consortium, federation, affiliation, or merger and may occur at five main levels: disciplinary, interdisciplinary, multidisciplinary, transdisciplinary, or national versus international.

A thorough consideration and understanding of research collaboration shows that its numerous advantages far outweigh disadvantages. As would be expected, however, some potential collaboration challenges may arise, including language, financial commitment, inadequate regulatory frameworks, and diverse interests among collaborators. These may nonetheless be successfully addressed by ensuring that collaborators enter into comprehensive and transparent collaborative cooperative research agreements or memoranda of understanding (MoU's) that are well designed and defined to properly guide intended collaboration projects.

An important study finding on international research collaboration by Wagner et al. (2019) showed that international collaboration and atypical knowledge recombination tend to produce higher impact research. This is yet another demonstration of the important role that international research collaboration can play, especially for developing countries, including those in Africa. So far, international research collaboration in many African countries has been addressed in a rather clunky manner; therefore, the need for redress and refocus is urgent, with a view to fine-tuning for tangibility and effectiveness.

While African researchers produce only 1% of the world's research, a recent report shows that the quality and quantity of that research is improving (World Bank, 2014). Between 2003 and 2012, African researchers more than doubled their outputs, producing papers on subjects ranging from HIV to cancer, climate change, and aging. A significant number of the peer-reviewed articles received international citations, a measure of the importance and quality of the research. As the report highlights showed improvements in science, technology, engineering, and mathematics (STEM) research outputs in Africa, it also suggests the pace and quality of research need to be stepped up further. STEM research makes up only 29% of Africa's total research output, despite the need for more research on energy, transport, light manufacturing, and extractives.

Although collaborative research projects may inevitably be associated with challenges that individual research projects might not experience, they also offer numerous potential benefits. The biggest challenge to international research is invariably the unavailability of funding, as was well exemplified in a survey by the Association of Universities and Colleges of Canada (2014) on internationalization, where 83% of universities cited the lack of research funding opportunities as the most significant barrier to international collaboration. How do we address this gigantic funding challenge when it comes to the much-needed international research collaboration between African and North American institutions? This paper attempts to highlight this topic with a view to stimulating discussion and exploring suggestions that may lead to useful implementable solutions.

## **Benefits of Research Collaboration**

Collaboration has been an integral part of research for a long time. However, the nature of collaboration appears to be evolving from conducting research within departments, disciplines, or institutions to newer areas necessitating partnerships across departments, disciplines, or institutions (e.g., academic, governments, private industry).

This type of interdisciplinary/multi-contextual collaboration has stoked the pace of research and encouraged the development of innovative and groundbreaking strategies in

investigating increasingly novel, complex, and convoluted areas.

A number of key factors and benefits may be considered to be the main drivers in the trend toward increased research collaboration, as elucidated in the following sections.

### **Division of labor to complete tasks in a timely fashion**

Research collaboration can be useful when devising a division of labor scheme to complete project tasks in a timely and efficient manner (Macrina, 2000). This is particularly important when tasks are sufficiently differentiated to require orchestrating efforts with collaborators who have diverse research interests, skills, and specialization.

For example, in the sequence of research activities, some members of the team may engage in data collection, others may specialize in data handling and preparation, and yet others may perform data analysis and reporting. The U.S. Agency for International Development recognizes the importance of strengthening the agricultural sector of developing countries to build a firm base for economic growth. The scope of this kind of endeavor is likely to be far beyond the research capabilities of a single researcher and demands a carefully orchestrated effort between multiple research groups.

Given the nature and demands of each project, certain specialized tasks will remain in the domain of select experts, while more generic tasks may be shared by others.

By dividing the workload according to collaborator skills, completion of the work may become more manageable. A tacit assumption and expectation from the practice of division of labor is that because each assigned activity targets team members with the appropriate experience and expertise, the tasks will be performed with greater efficiency.

### **Ability to share resources**

One important justification for collaboration is the enhanced ability to share and exchange resources.

Resources have generally been defined as data, databases, ideas, equipment, computers, methods, reagents, cell lines, research sites, personnel, and many other technical and human resources. Benefits from collaboration may include cost savings and the potential to facilitate scientific progress. Thus, resources found to be deficient with one member of a team or institution may be readily available from willing collaborators within or between institutions.

An example of a mutually beneficial arrangement of sharing resources would be a research team that is seeking to improve upon a particular medical or social intervention agreeing to collaborate with another research group that can provide access to a study population or database. Both parties stand to benefit from this sharing of resources.

### **Opportunity to learn about other disciplines**

Research collaboration may provide opportunities for investigators to learn how approaches from complementary

disciplines may be applied to existing problems and lead to the development of innovative solutions.

This may occur when discussions among colleagues stimulate new ideas. Collaboration between academia and private industry may also allow investigators to see real-world application of research. These types of collaboration may result in social and economic benefit to society, science, and private industry.

### **Risk management**

While most research may entail some risk or hazard, the degree of risk and its concomitant costs will depend on the nature of the research conducted.

Risk management is defined as decisions made to accept exposure or to reduce vulnerabilities by either mitigating the risks or applying cost-effective controls. Collaboration may be viewed as a strategy for the risk management of a research project.

Research activities that may knowingly or unknowingly expose investigators, participants (human or animal), or the public to some degree of danger cannot be conducted unless the risks are abated or eliminated.

Collaborative partners may differ in the experiences and expertise of risk management skills for relevant areas. An example might be found in collaborations between clinical research and basic science groups.

### **Opportunity to engage in collegiality**

Collegiality represents one of the four norms of science. Its function is to maintain a social environment promoting cooperation and trust. Researchers who treat one another as colleagues are more likely to trust one another to cooperate.

In pursuit of a common goal, researchers engaged in collegiality treat each other with respect, providing constructive criticism and assistance. Collaboration may be seen as a mechanism to promote greater collegiality between colleagues, departments, and institutions.

This can be particularly useful in opening dialogue between researchers from distinctly different disciplines where previous research efforts were in divergent and perhaps unrelated directions.

Collaboration can also be useful in establishing innovative alliances between research teams from academia, government, and private industry. These alliances can result in long-term research relationships benefiting science and society, with broad-based economic interests. Both science and society are best served by collegiality and open collaboration.

### **Opportunity to lend credibility and validity to project**

Collaboration can be beneficial when researchers invite the participation of investigators who have more experience in a desirable area of research. This experience could include a history of successful proposal submissions, insightful and

innovative approaches to problem-solving, and significant publications in the field.

Collaboration with such experienced researchers can lend credibility and increase validation to most projects and may increase the chances of a successful grant/funding submissions.

This alliance can both facilitate successful ongoing research efforts and future collaboration.

### **Technological advances facilitating communication**

Collaboration has been increasingly facilitated by advances in communication technology.

The ability to learn about the work of others has greatly been enhanced by access to online databases. Databases from numerous disciplines offer both up-to-date information and opportunities to search past publications.

Relevant information can be obtained or exchanged through phone, email, fax, shipping, teleconferencing, or virtual conferencing through institutional/individual websites. Researchers may be better able to learn about each other's work and sustain collaborative efforts as a result of available communication technology.

### **Resource Asymmetries**

The existence of vast resource asymmetries between North American and African institutions is an obvious pointer to their observed current disparity in research and technological status. Yet amidst all this, a great potential still exists to change the situation through meaningful win-win mutual international research collaborations.

Rapid economic growth in some of the emerging economies has fueled the rise of a global middle class (United Nations Conference on Trade and Development, UNCTAD, 2021). Nevertheless, there is persistent poverty and rising inequality. Wealth is highly concentrated, and there are large disparities in income-earning opportunities and in standards of education and health. These imbalances constrain economic growth and human development while heightening vulnerability to events that have a potential to destabilize societies, such as pandemics, economic crises, and climate change.

### **Suggestions for Success in International Research Collaboration**

The following suggested implementation approaches provide important pathways toward achieving potential international research collaboration success:

Establish increased mechanisms of providing availability of needed research funding sources that will enhance and increase the pace of international collaborative research efforts between North American and African institutions.

Encourage increased mutual international research collaboration avenues among researchers from African and

North American institutions. In this concerted drive, African institutions and governments, including development partners, are urged to accelerate support for research and research-based education in Africa to build the necessary human capital to further increase research collaboration efforts on solving African problems. To be effective, these efforts should also include partnerships with the private sector.

Focus needs to shift toward pursuing and accelerating relevant policies aimed at improving the quality and quantity of teaching of STEM across all levels of their systems of education to substantively incorporate research and research-based curricula in African countries. Such concerted efforts should include bilateral and multilateral university collaborations, post-graduate scholarships, and encouragement of international firms to contribute to the development of STEM capacity in Africa.

Although science can benefit from collaboration, investigators should be aware of both the positive and negative impact on the responsible conduct of research (Shamoo & Resnik, 2003). For instance, while working with a larger staff can enhance the investigation of multifaceted aspects of a research question, logistical challenges in dealing with a more complex project, as well as disagreements about the appropriateness of methodologies and analyses, can result in acrimony. Addition of a recognized name to a proposal to enhance a submission's credibility must be followed up by real participation, rather than in name only. Relying too heavily on technology to promote communication is no substitute for a shared commitment to accountability in following through on all assigned tasks in a collaborative project.

## Conclusion

International mutual research collaboration between African and North American institutions holds great promise for spurring long-term positive economic growth. The benefits envisioned in collaborative partnerships include optimizing project outputs and impact and attracting much-needed research funding.

Research collaboration will enable sharing of skills and technology as well as opening of new avenues of resource availability, including funding instruments that would be unavailable without such partnerships.

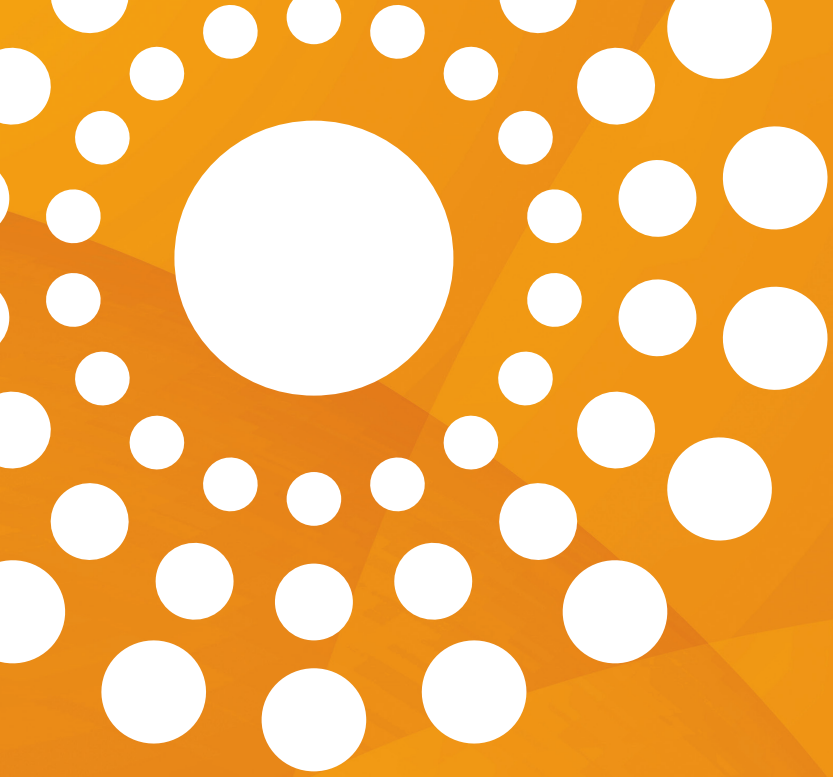
In the long term, international research collaborations are expected to go a long way toward positively mitigating the existing resource asymmetries between North American and African institutions.

The numerous advantages of research collaboration far outweigh the disadvantages. These advantages strongly suggest that focus now needs to shift toward pursuing and accelerating relevant policies aimed at fast-tracking collaboration frameworks and improving the quality and quantity of STEM education across all levels of educational systems, especially in African governments, to incorporate enhanced research and research-based curricula.

For greater success, collaborators will need to enter into comprehensive, accountable and transparent collaborative cooperative research agreements or MoUs that are well designed to properly guide projects.

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