KWAME NKRUMAH UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Research Report 2016

KWAME NKRUMAH UNIVERSITY OF
SCIENCE AND TECHNOLOGY
KUMASI

RESEARCH REPORT
2016

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VISION

To be globally recognized as the premier centre of excellence in Africa for teaching in Science and Technology for development; producing high calibre graduates with knowledge and expertise to support the industrial and socio-economic development of Ghana and Africa.

MISSION

To provide an environment for teaching, research and entrepreneurship training in Science and Technology for the industrial and socio-economic development of Ghana, Africa and other nations. KNUST also offers service to the community, is open to all the people of Ghana and is positioned to attract scholars, industrialists and entrepreneurs from Africa and the international community.

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FOREWORD

Kwame Nkrumah University of Science and Technology's (KNUST) Mission statement, among others, is to provide an environment for teaching, research and entrepreneurship training." Our aspirations are enormous and our capacity to move from ideas to action is real. Flying high on these words, the years have seen the University has over the years maintained a culture where research plays a pivotal role in the continuous ground-breaking achievements attained by the University. Some of our research outputs have had immediate and direct relevance to our urgent national development problems.

As leaders in Science and Technology education in Ghana and beyond, high level research and development has been part of our core mandate. Our research capabilities have also had to change to meet the ever-evolving trends in 21st century research and the socio-economic development of nations. Our response to some of these changes have included diverting our attention to more industry-based research. We have been constantly faced with the challenge of the demands of industry and the occasional queries on the substance of some of our graduates. We intend to bridge this gap by bringing our research findings to the doorsteps of industry thereby further strengthening our relationship.

In this respect, efforts have been made including initiatives such as tripling the initial amount voted for the KNUST Research Fund (KReF) which staff can access for research purposes. Findings from these researches would be shared with potential or actual investors with the aim of facilitating their application as well as using them to achieve outcomes that improve the quality of life and well-being of people and society in general.

The Office of Grants and Research (OGR) continues to address the needs of researchers on the campus and have an overall responsibility to coordinate research activities for the entire University. In this regard, the first ever research report detailed individual, Departmental and College research and developmental activities. The 2nd Edition is building on our long-term commitment by touching on most of the research areas that have made impact in the University and beyond.

I would like to bring the readers' minds to the fact that research is the driving force behind of our socio-economic growth as a University, Country and world at large. If so, then, we must all maintain an attitude geared towards impacting positively the lives of others through research. Without research, we cannot explore things yet unknown such as was said by the famous English scientist Michael Faraday in this quote, "Shall we educate ourselves in what is known and then casting away all we have acquired, turn to ignorance for aid to guide us among the unknown?"

Finally, I wish to express my profound appreciation to all who have in diverse ways contributed to the success of this report. We are highly gratified and cherish the ongoing relationship and contributions. I also wish, to acknowledge, most especially the support of our major funding partners: DANIDA, Bill and Melinda Gates Foundation, MasterCard Foundation, National Institute of Health (NIH), the World Bank, Rockefeller Foundation, VW Foundation, WHO, European Union, DAAD, DFID, NVFIC and those not mentioned in this report. We hope your immense support to us over the years will continue and even increase to help sustain this vital work of the University. Once again thank you all.

Professor K. Obrii-Danso
Vice Chancellor

Professor
Kwasi Obiri-Danso
Vice Chancellor

MESSAGE FROM DIRECTOR

Strengthening Research Capacity at KNUST

In this issue of the KNUST Research Report (KRR), we provide an overview of ongoing research from the Colleges that not only place KNUST on the radar of the scientific community, but also impact society. As a result of feedback from readers of the first KRR, information on the dollar value of external grants to the University during the past year is included.

Apart from the innovations and technological advances it produces, research is also a potential source of additional revenue to support academic infrastructure such as classrooms, teaching aids, laboratories, ICT, conferences, etc. Research capacity strengthening therefore has to be deliberate and systematic if such gains are to be assured. Inputs of capable human resources, facilities and finances are essential. A research culture must be created in order for faculty to see research as a core duty rather than an optional undertaking. Faculty must be self-motivated, curious, creative, inspirational, insatiable, be ready to question conventional wisdom, and be desirous of making a difference. They must be resourced and given protected time to think, reflect, innovate, and generate new knowledge.

Researchers operate more effectively and efficiently if they receive assistance from trained administrators and information experts at the various stages of proposal development, submission, and project implementation. Therefore, in order to catalyze research in the University both the central Office of Grants and Research and College based research support offices must be adequately resourced to provide the needed assistance and effective coordination of research activities.

University policies and processes must be updated to provide a solid administrative/legal bedrock on which research stands. For example, well-laid out policies on conflict of interest,

institutional overhead rates, intellectual property rights, research malpractices, etc. not only provide assurance for researchers but also engender sponsor confidence in the institution and its researchers. Institutional level ethical review committees for human and animal research assure protection of the rights of research subjects. They can also be charged with the responsibility to oversee training in research ethics and the periodic re-certification of researchers in ethical conduct of research.

Mentoring is key to success in all spheres of endeavor, research being no exception. Research mentoring at KNUST should be systematic and structured in order to nurture and sustain a research culture at KNUST. Seasoned researchers must be tasked to mentor young ones. Junior faculty, graduate students and undergraduates could be matched with research mentors, including contract professors. Mentor and mentee need not necessarily be in the same discipline, but must be compatible and willing to share in an open manner. More funded postdoctoral positions should be created in the University to provide a protected period for young doctoral graduates to acquire skills in scientific writing before assuming teaching roles. The interest of undergraduates in research could be developed through internships and assistantships with ongoing research projects.

In the globalized world we find ourselves, research collaboration should be actively sought in order to provide faculty access to new knowledge, skills, facilities, and funding sources. Collaborations among researchers from different disciplines within KNUST, and from universities both in Ghana and abroad help to enrich experiences, share resources, build synergies, and provide new solutions.

By building monitoring and evaluation into the university's research strategy, measurement of performance becomes reliable. Apart from technological innovations, growth in such areas as research infrastructure, training and mentoring, scientific writing, external funds, scientific publications, community engagement, etc. serve as pointers to a successful research enterprise.

Office of Grants and Research (OGR) has been privileged to administer the KNUST Research Fund (KReF) since its inception in 2015. This fund provides seed grants and also promotes multidisciplinary research. So far, two calls have been issued, 80 applications for funding have been received, and 22 awards given. Selfless colleagues have served as independent reviewers and a Scientific Review Committee collates reviewer scores and selects awardees based on merit. The University administration remains committed to funding the KReF for the foreseeable future, and it is gratifying to learn that the Vice-Chancellor plans to triple the current level of funds. KReF has served to stimulate interest in grant proposal writing across all disciplines, and KNUST researchers are encouraged to take advantage of this funding source.

This report represents the efforts of numerous contributors. We have enjoyed immense support from our researchers who have been eager to share their stories and we owe them a depth of gratitude. Through their research, they are quietly advancing the frontiers of scientific innovation and technology in Ghana. Technical assistance came from colleagues from the Department of Publishing Studies, Department of Communication Design, Department of English, International Programmes Office, University Relations Office, University Printing Press, OGR, and several others. We wholeheartedly thank them all. The Vice-Chancellor has been very supportive of OGR and personally made suggestions for improving the quality of the Report. We thank him very much. It is our fervent hope that this edition will provide a further glimpse into research activities at our University, give hope to the Ghanaian community, attract the attention of industry and motivate young researchers across the country and beyond.

Professor Peter. Donkor
Director, Office of Grants and Research

OVERVIEW OF OFFICE OF GRANTS AND RESEARCH ACTIVITIES

The Office of Grants and Research (OGR) has continued to coordinate, facilitate and support the conduct of research at Kwame Nkrumah University of Science and Technology (KNUST) since its inception. Researchers now have access to a one-stop shop where their research-related needs are addressed especially for internally and externally sponsored research projects. The Office provides pre- and post-award support to staff spanning proposal development through setting up and managing the award, if won. In addition to providing these services, the Office is also aiding in the development of appropriate policies, processes and systems for effective grants management and conduct of research.

Collectively, our services cut across the following areas:

- Sourcing for and disseminating funding opportunities
- Developing and writing research proposals
- Proposal submission and tracking
- Training of researchers
- Building research administration and management capacity
- Maintaining institutional registration and compliance
- Developing research-related policy
- Standardizing research-related procedures and practices
- Providing grant management support
- Promoting dissemination of research output
- Administration of KNUST Research Fund
- Research collaboration with external bodies

Grants and Research Support Services

Proposal Development Support

The OGR has witnessed a remarkable increase in staff interest in grant proposal writing. This is demonstrated by enquiries and requests for support in proposal development and award management processes. Research support services provided include dissemination of funding opportunities, proposal advisory services, development and submission on behalf of applicants; and processing of grant sub-awards and provision of resources to support applications. The Office has circulated 21 editions of e-alerts on Funding Opportunity Announcements to researchers since its establishment and constantly updates the OGR website with funding opportunities. Research proposals from staff have been submitted to funding agencies including the European Union, National Institutes of Health, Wellcome Trust, DANIDA, Association of African Universities and IMMANA Fellowship.

Funder Registration

The Office continues to ensure that institutional registration with funding agencies remains active. The University has the following active registrations on funder systems.

System/Registration	Funding Agency
Data Universal Numbering System (DUNS)	USA National Institutes of Health (NIH)
Grants.gov	
Sam.gov (formerly CCR)	
eRA Commons	
NSF Fastlane	National Science Foundation
eGrant System	Wellcome Trust
Joint Electronic Submission (Je-S) system	Research Councils UK
Participant Identification Code (PIC)	European Commission
Potential Applicant Data Online Registration (PADOR)	European Commission

College Research Offices

To facilitate easy access to research administration support services by staff, the OGR is collaborating with all the Colleges to establish College Research Offices (CRO). The College of Engineering has a fully-established CRO which has been

operational since 2014. Research offices for the Colleges of Agriculture and Natural Resources and Science have just been opened to provide services to faculty in their respective Colleges. The College of Health Sciences is also in the process of opening a new office as its CRO. Plans are underway to work with the remaining Colleges to establish similar offices to support research efforts. These steps are aimed at bringing research support services to the doorstep of the researchers.

Research Information System

The OGR has led in the development of a software, Research Management Information System (ReMIS) for managing the University's information on researchers' areas of expertise, proposals and research projects. The software was developed by the University Information Technology Services (UITS). The initiative is supported by the DANIDA-funded Building Stronger Universities (BSU) II project. Staff are able to access the system at **https://webapps.knust.edu.gh/remis/index.php**, using their institutional log-in details. The Office has also collaborated with the Finance Office and the UITS to develop a Grant Accounting Management System to improve the financial management of grants at the University. The two softwares are interlinked to enable an integrated support system.

Research Dissemination

As part of efforts to upscale research dissemination and the promotion of research uptake, the OGR, together with the University Relations Office (URO) provides research communication support to researchers and drives the University's research dissemination initiatives. The KNUST Research Report, website articles, periodic newsletters and stakeholder meetings are some of the activities undertaken to share the research output of staff to a wider audience. The Office has also collaborated with the University's radio station, Focus FM, to present research information on radio through a weekly programme dubbed "Nyansapɔ", which is aired on Saturdays at 2 p.m. Each edition of the programme features a researcher who presents his work and findings to the public, and interacts with listeners.

KNUST Research Fund (KReF)

The OGR is responsible for administering the KNUST Research Fund (KReF). The Office puts out a call for proposals, receives applications, identifies reviewers and oversees the review process. The Office then facilitates the work of the Scientific Review Committee, which selects awardees based on the review scores. The competitive process is objective and based on merit to ensure transparency in the award process. KReF was established in 2015 when the first round of calls for proposals was launched. Eight successful applicants received awards ranging from GH¢ 9,260 to GH¢ 21,450. Fourteen (14) awards have been made for the 2016 funding year.

Capacity Building

The Office held six (6) training workshops and seminars covering various grant and research-related topics for staff of the University. The sessions covered topics such as grant proposal writing, grant financial management and grant administration. Some of these training sessions were at the requests of departments and associations.

Group Picture of Participants at a Facilitation Worshop

The OGR also organised 3 workshops and 18 seminars for its staff and other research administrators and accounting staff in the university to build their capacity in research and grant management.

Collaboration with Other Institutions

The office continues to foster institutional collaborations both for its own operations as well as for researchers.

A five-member team from Katmandu University (KU), Nepal, led by Dr. Sagar Raj Sharma visited KNUST to facilitate the collaboration between the two institutions in research administration and other research support services. A two-member team from KNUST also visited KU to share experiences and facilitate training sessions for KU staff in grants management and e-library support for researchers. These were part of activities under the Building Stronger Universities (BSU) II Project. The project also supported reciprocal exchange visits with staff of Aalborg University to share knowledge on research administration structures and processes.

The Visiting Team with the Vice Chancellor (fourth from right) and other KU Staff

Participants in a Discussion

A seven-member team from the Schools of Engineering and Environmental and Biological Sciences of the University of Rutgers, New Jersey, USA and the University of Liberia, led by Prof. P. N. Balaguru, also paid a familiarisation visit to acquaint themselves with the research management processes at KNUST and to explore opportunities for collaboration.

The Office also played host to a three-member team from the Directorate of Research Innovation and Consultancy (DRIC) from the University of Cape Coast. The visit was to deepen relations with OGR and explore opportunities for research and research management capacity building. The OGR had earlier facilitated a workshop on Grant Applications for twenty-seven (27) participants comprising research coordinators from the various faculties and schools and staff of DRIC. The objective of the workshop was to expose faculty to research grant application processes with a special focus on the National Institutes of Health (NIH).

The OGR also facilitated a training session for staff of the Christian Service University College (CSUC) in Research and Grant Proposal Writing for Business and Social Sciences.

Participants in Group Work

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IMPACT OF KNUST RESEARCH ON SOCIETY

IMPACT OF KNUST RESEARCH ON SOCIETY

Research carried out by KNUST researchers has made enormous impact on society. The impact includes tools and methods for improving practices in industry, value addition to indigenous crops, innovations and capacity building. This section highlights some of these research projects and their impact.

Promoting Indigenous Crops through Value-Added Product Development

Value addition and product development have great potential in expanding the market space of indigenous crops, and thus serve as food and nutrition security and a source of employment for many. With the passion to **promote sustainable utilization of indigenous foods for better health, poverty alleviation and job creation,** Dr. Faustina Dufie Wireko-Manu of the Department of Food Science and her team through research conducted under the sponsorship of DANIDA and AUSAID have developed novel food products and improved many existing ones in terms of convenience especially for urban consumers. Among the many products are sweet potato-based instant pancake and doughnut mix, sweet potato complementary baby food, all with higher vitamin A content to contribute to addressing vitamin A deficiency, which is a health issue in Ghana. To increase utilisation and preservation of food culture in Ghana, the team has improved indigenous products and made them convenient for use at any point in time. Such food products include instant *eto* mix, *bankye kakuro, yakeyake* and *akyeke* have also been made convenient for use at any point in time. Innovative products such as yammy pops (extruded yam-tamarind-baobab snack), sweet potato-mango toffee, soup thickener, and a cassava-based non-alcoholic drink have also been produced. Other products with a high potential to expand small-scale processing and wealth-creation along the entire root and tuber value chain are high quality flours (HQF) from the major root and tuber crops which can be used in diverse food products. The potential for HQF from root and tubers to cut down the use of hard-earned foreign currency to import wheat is huge.

The developed products have been served at several meetings and workshops and exhibited at functions to create awareness as well as for promotional purposes. To translate efforts on product development into wealth-creation in communities where many of the indigenous crops are produced, hands-on training programmes and workshops have been organised for stakeholders, especially organised women and youth groups. Training has been held for youth in twelve (12) communities in 4 regions of Ghana, namely Northern, Ashanti, Eastern and Brong Ahafo Regions as well as the Obuasi Miners' Wives Association. One (1) PhD and three (3) Masters students from the Department of Food Science and Technology are being sponsored to build their capacity in this area. Processing equipment and drying facilities have been acquired from the two projects, with the ultimate aim of building a processing unit that would serve as a training centre for students, industry players and stakeholders across Ghana and beyond. When consumers and businesses embrace these products, it will promote the consumption of locally produced and processed foods and create entrepreneurial opportunities for Ghanaians.

Exhibition of Food Products

Some Food Products on Display

Training Programmes to Build Capacity of Community Members

Solar Refrigeration: A Solution to High Electricity Tariffs

In the midst ofthe reduced energy generation capacity and high electricity tariffs in the country, people are busily finding alternatives for their energy needs. Household refrigerators account for more than 54% of residential power consumption per year. This means that an improvement (reduction) in the power consumption of refrigerators or providing alternate means of powering them will mean a significant reduction of the burden on the national grid.

The Solar Energy Applications Laboratory (SEAL) at the Department of Mechanical Engineering has made a breakthrough by developing the techniques that allow for the conversion of a conventional AC compressor refrigerator into a solar powered refrigerator using the variable speed direct current (VSDC) compressor technology. This technique takes away the use of the inverter that is always needed to convert solar panel DC output to AC input to the appliance. This means that the new technique, due to the elimination of the inverter, reduces the overall system energy requirement and the cost of using refrigerators.

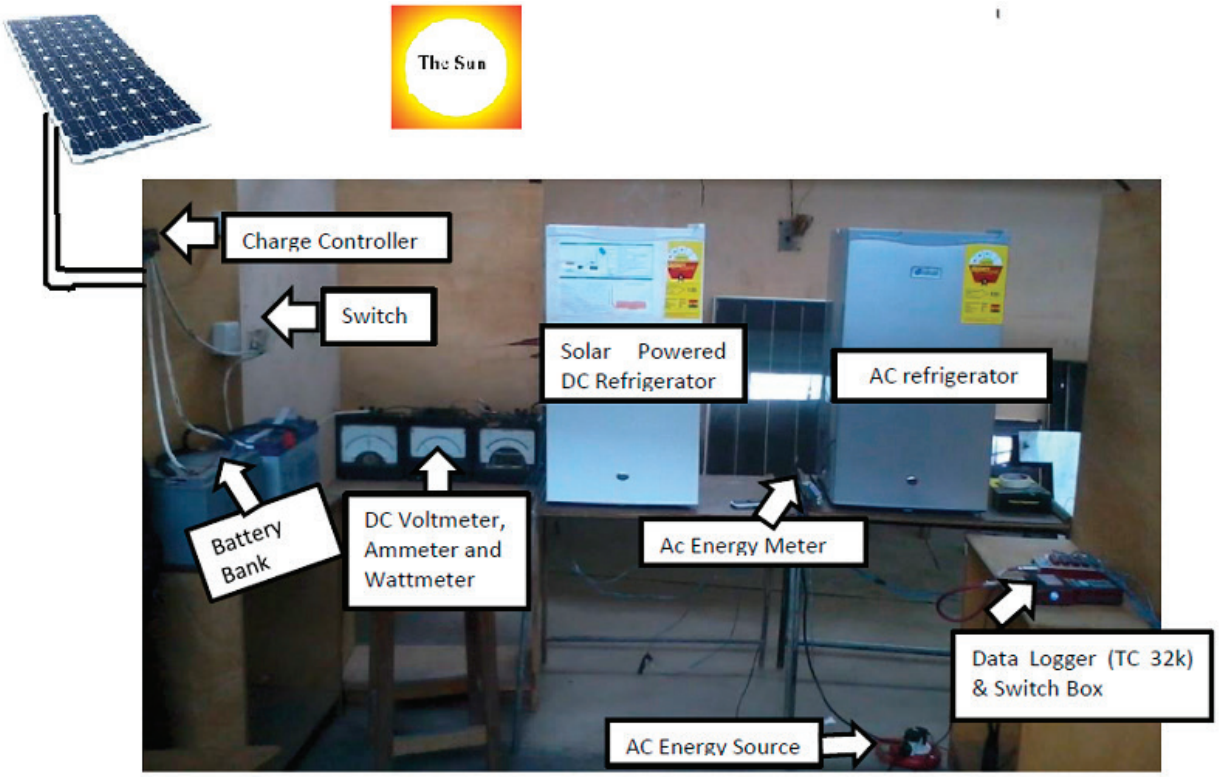
Studies conducted on a 92 L refrigerator has shown that the new VSDC compressor refrigerator compares favourably with equivalent conventional AC refrigerators. In addition, the developed solar refrigerator has the potential of reducing the overall system installation cost by 15-18 % compared to the conventional AC compressor refrigerator powered by solar energy via an inverter system.

One of the developed solar refrigerators has been tested on the market for over a year now by a shop owner at Nkoranza (an off-grid community in the Ashanti Region), and this is what he has got to say:

"With the solar fridge in this village, I can now sell cold drinks and water and I am making good business like someone living in the city. I am hoping to get a solar freezer from the developers of this system so that I can expand my business to include a cold store".

The lead project coordinators, **Dr. Richard Opoku** & **Mr. Isaac Adjei-Edwin** at SEAL are now conducting the feasibilities of extending this technique to air-conditioning systems. The successful application of this technique to air-conditioning systems will mean that office air-conditioners can be powered by solar energy during the day time without inverters. In addition, less battery storage requirements for day time air-conditioning will heavily reduce system installation cost.

The project team members have the long-term interest of promoting awareness and utilisation of Africa's abundant solar energy resources for cooling applications in African homes, offices, hospitals, schools, businesses, factories and industries. Direct application will include refrigeration of drinks, water, perishable foodstuffs, freezing of fish and meat; refrigeration of vaccines in health centres where there is no electricity, air-conditioning of offices and air-purification and controlled conditioning of special industrial processes. Studies are being conducted on production of complete systems using locally available materials in Ghana.



An experimental setup comparing converted DC solar refrigerator to conventional AC refrigerator

Low Cost Drinking Water Treatment (UPARF-LCDWT)

The Low Cost Drinking Water Treatment (LCDWT) project seeks to employ locally available materials to design, develop and fabricate filter absorbents capable of removing contaminants from drinking water. Over the last five years, researchers using a seed fund of €33 000.00 (Thirty-three thousand Euros) provided by The Netherlands Government represented by DGIS under the UPARF projects, have been developed absorbents using locally available raw materials like charcoal, bauxite ore, sand and clay. The absorbents developed include iron-oxide coated sand, alumina coated charcoal, zeolite-NaLSX and zeolite–NaA. Using the developed absorbents, point-of-use filters have been fabricated and developed that are capable of removing contaminants like dissolved iron, manganese, arsenic, fluoride, nitrates and phosphates from drinking water. Currently, field tests with some of the developed filters are under way in Northern Ghana to remove fluoride from groundwater-fed mechanised systems used to supply drinking water to some of the communities in Northern Ghana. Similar filters will be installed in selected coastal communities for another field test to remove chloride and thus deal with the occurrence of salinity that has caused a lot of boreholes to be abandoned. These innovative filters have been the fundamental mechanism in the Mwacafe

Treatment Plants that have been installed by the Community Water and Sanitation Agency in more than 500 communities nationwide. The Principal Investigator of this project is **Dr. Richard A. Buamah** of the Civil Engineering Department.

Step Chlorination in Drinking Water (UPARF – SCID)

Using chlorination in disinfecting drinking water is a common practice used in all the water treatment headworks in Ghana. Though this practice has a lot of benefits by way of the destruction o microbes, it can also be a source or a precursor of pollutants in the treated water, especially if the dissolved organic matter content exceeds the acceptable limits. Beside this, chlorine decay is another process that could occur either in the bulk of the treated water or within the pipes that are used to distribute water in the conventional distribution network. Research on chlorine residual, chlorine decay and other chlorine induced oxidative products have been a major research focus since 2012. In this project, processes and conditions like pipe encrustations, wall and bulk chlorine deca within the treatment units and distribution networks are investigated to determine their effect on the residual chlorine that get to the taps in our homes. The processes have been modelled and used to predict locations within the distribution network that would require chlorine boosting in order to secure the wholesomeness of drinking water in our pipelines. The research has received financial support of €10, 000.00 (Ten thousand Euros) from the Netherlands Government under the DUPC programme. The research leader is **Dr. Richard Buamah.**

KNUST Introduces Twi Medical Glossary

The Pro-Vice Chancellor and other Senior Members of KNUST at the Launch

A *Twi Medical Glossary* has been developed by the College of Health Sciences in collaboration with the Akan Section of the Department of Modern Languages, to help health workers in providing care for their clients.

This was done under the Medical Education Partnership Initiative (MEPI) funded by the National Institutes of Health of the United States of America. The project initiated education for health workers on medico-legal issues confronting the health sector including legal and ethical implications in various patient care situations. In the course of executing this project, the need for a glossary of medical terms in the indigenous Ghanaian languages became evident. According to the Principal Investigator of the project, Prof. Peter Donkor, this was necessary in the sense that health workers, most especially, medical doctors and nurses needed assistance in the proper use of indigenous languages in a bid to reduce (if not to completely eliminate) language barriers that often impeded medical diagnosis. The team therefore decided to develop a *Twi Medical Glossary* for this initiative.

Prof. Peter Donkor

Before embarking on a holistic collection of data on the basis of which the glossary was to be developed, experts

in the Department of Modern Languages, particularly **Mr. Emmanuel Fordjour** and **Dr. Charles Marfo** had initial discussions with some health workers in order to gain first-hand insights into the problems they faced with the use of the Twi language in their communication with Twi-speaking patients. They found that some medical practitioners in the Komfo Anokye Teaching Hospital (KATH), where the greater part of the data was gathered, were not Akan or Twi-speaking people. Also, patients go to the hospitals not knowing how to explain their ailments to non-Twi speaking health practitioners and those who were not well-versed in the Twi language. Due to this, most practitioners resorted to interpreters to enable them understand the complaints of their patients. Some patients felt reluctant and uncomfortable to disclose their ailments in the presence of third parties

The team therefore sought to identify and capture terms, words and expressions that patients used but which practitioners found difficult to understand. These were gathered from the major medical disciplines namely Internal Medicine, Surgery, Paediatrics, Obstetrics/Gynaecology, and Dentistry. Relevant experts and users reviewed the glossary prior to publication. The book was subsequently launched by the Provost of the College of Health Sciences, Prof. Tsiri Agbenyega.

The first edition of the *Twi Medical Glossary*, which includes common words and phrases used in doctor-patient dialogues, is now available and currently being used by students (both foreign and local), clinicians and researchers.

Women's Economic Contributions Missing in National Policy Development

Workshop Participants

The Department of Economics, Kwame Nkrumah University of Science and Technology (KNUST) has disseminated findings of a research project titled ''Measuring the Distribution of Remunerated and Non-Remunerated Work among Men and Women in Ghana." The workshop which was held at the conference room of the Department of Economics on 3rd October, 2016 was aimed at counting the work of women.

Dr. Gretchen Donehower, Project Director of Counting Women's Work (CWW), stated that women's contributions were left out of the national data used for policy development.

Dr. Daniel Sakyi, a member of the research team of CWW Ghana, established that a greater proportion of women were engaged in unpaid work and this was due to the fact that traditional division of labour always assigned women to household production. Dr. Sakyi stated that the objective of the research was to estimate the amount of time men and women spent on domestic work, compare the time spent on market production for men and women and also identify the differences in the time spent by both genders.

Data was collected randomly from a list of areas where individuals aged 10 years and above were interviewed, diaries were given and their daily activities recorded.

Dr. Daniel Sakyi

Sis. Dr. Eugenia Amporfu, the leader of the research team stated that after the National Transfer Accounts (NTA) and National Time Transfer Accounts (NTTA) were combined, it

was found out that in an entire lifecycle, women dominated in household work while men dominated in paid work. Thus, women spend more time in productive work than men do. The team recommended that the education of women/girls to higher levels should be encouraged so as to enhance their chances for paid work. They also proposed a change in gender roles in our societies.

Sis. Dr. Eugenia Amporfu

Dr. Akosuah Darkwah, a sociologist and a senior lecturer at the University of Ghana supported the recommendations by the team and proposed a clear definition of work.

Mr. Joseph Donkor, a representative of the Regional Minister, was intrigued by the exposition as he was enlightened on the contributions of women in households. He urged that research of such great value should be made available to policy makers.

Counting Women's Work (CWW) is a team that looks at the work of women. It operates in nine (9) countries all over the world. The Department of Economics is fortunate to have five (5) of its researchers being part of the CWW Ghana Team. The researchers who were involved in the research were **Sr. Dr. Eugenia Amporfu, Dr. Daniel Sakyi, Dr. Prince B. Frimpong, Dr. Eric Arthur** and **Mr. Jacob Novignon**.

Ghana Peanut Value Chain Intervention: Using Applied Research and Technology Transfer to Minimize Aflatoxin Contamination and Increase Production, Quality and Marketing of Peanut in Ghana

Prof. W. O. Ellis (Department of Food Science and Technology) and **Prof. Richard Akromah** (Department of Crop and Soil Sciences) are collaborating with Prof. David Jordan USA to undertake a project on "Ghana Peanut Value Chain Intervention: Using Applied Research and Technology Transfer to Minimize Aflatoxin Contamination and Increase Production, Quality and Marketing of Peanut in Ghana".

The project seeks to identify current practices used in production, storage and processing of peanuts that contribute to aflatoxin contamination and develop, implement and evaluate strategies to reduce aflatoxin contamination for the period October 2014 to July 2017. One post-graduate student each from Food Science and Technology, Agronomy (Weed Science) and Agricultural Engineering are expected to graduate from the programme.

The project is funded by the United State Agency for International Development (USAID) Feed the Future Innovative Laboratories with an amount of US$205,000 (Two Hundred and Five Thousand US Dollars).

The team has so far conducted surveys in villages and regional and national processors to collect information on current practices associated with peanut production, drying, storage and processing. The team has also done comparative studies on levels of production in the field, drying and storage on aflatoxin contamination. This has been conducted in five villages, three near Tamale (Nyankpala (SARI-On station), Zankali and Kpalbe), two near Wa (Kpongu and Silbelle) for the 2014/2015 and the 2015/2016 planting seasons.

Pest management and production inputs comparing approaches to aflatoxin mitigation have also been conducted on-station at Savanna Agricultural Research Institute (SARI) and Crop Research institute (CRI) for 2014/2015 and 2015/2016 planting seasons. Again, variety trials of 16 ICRISAT lines and 6 promising lines have been developed in Ghana for pod yield, disease, insect and aflatoxin-resistance potential in the 2014/2015 and 2015/2016 planting seasons. The team has further developed and evaluated solar driers for groundnuts with a focus on aflatoxin mitigation and its effects on physicochemical properties of peanuts.

The overall outcome of the project will see a number of farmers adopting specific practices to minimize aflatoxin contamination, adopting new cultivars and new production practices (use of herbicide or fungicide and improved spray equipment). Again a number of farmers will adopt new drying and new seed storage methods. The project would also see a number of new cultivars recommended for release (from the multi-location trials on station) as well as developing and evaluating a solar peanut dryer and a composting system.

The project will also improve food security by reducing peanut losses caused by post-harvest aflatoxin contamination, help eliminate environmental sources of aflatoxin contamination and reduce the incidence of liver disease due to consumption of aflatoxin contaminated peanuts and peanut butter products. Value-added peanut-based products will be developed and will result in the improvement of the livelihood of small- to medium-scale processors. There will also be appropriate and affordable storage solutions for management and a reduction of aflatoxin at the farm level, as well as the implementation of Hazard Analysis Critical Control Point (HACCP) and other

good manufacturing practices and subsequent reduction in aflatoxin contamination in finished peanut products.

KNUST Researchers Delve into the Nutritional Potential of Moringa Leaves

Moringa Leaves

The leaves of ***Moringa oleifera*** have not received the needed research-based attention in Ghana despite its well-known nutritional properties. Though consumed in Asia and some sub-Saharan countries, they are largely under-exploited in Ghana. It is in this vein that a team of researchers including **Prof. Ibok Oduro, Prof. W. O. Ellis** and **Prof. Deborah Owusu** sought to study the nutritional potential of the *Moringa oleifera* leaves.

The findings have validated the fact that the value and composition of the leaves are a great source of vitamins and minerals, which can be served raw, cooked or dried, though high temperatures destroy some of the nutrients. The research findings indicate that an eight-gram (8g) serving of dried leaf powder will provide children aged one to three with 14% of their daily protein needs, 40% of calcium, 23% of iron and nearly all the vitamin A that the child needs. Also, one hundred grams (100g) of moringa leaves could provide a woman with over a third of her daily need of calcium and give her important quantities of iron, protein, copper, sulphur and B-vitamins.

The team discovered that compared to sweet potato leaves, Moringa has dietary fats, which helps to increase food palatability by absorbing 1-2% of its caloric energy. Also, the caloric value of moringa is lower than the leaves of sweet potato, amaranth, taro, pumpkin and okra, but the protein content is higher. The low caloric value therefore makes the leaves a good addition to the diet of the obese and those who want to lose weight.

In addition, Moringa leaves are a valuable source of nutrients for all age groups, and invaluable in the treatment of malnutrition in small children and anaemia in pregnant women. For nursing women, eating the leaves increases the production of breast milk. Moringa thrives in arid and semi-arid environments, and it is a nutritious food source found throughout the year and can be grown cheaply and easily. The leaves also retain lots of vitamins and minerals when dried. It can be dried and processed into powder, and used as tea, added to beverages, sprinkled on food or taken as capsules.

It is a non-toxic, easily digestible source of nutrients with many beneficial effects on health. Extensive health and safety studies conducted at the Noguchi Memorial Medical Research Centre in Ghana have also determined that moringa powder has no toxic elements, hence a safe source of nutrients.

Agroforestry Practices to Enhance Resource-Poor Livelihoods (APERL)

Most rural families, in the resource-poor regions of central and northern Ghana characterised by poverty, chronic food insecurity, and poor health and nutrition depend on subsistence agriculture. However, the increasing damage to the natural environment from farming in marginal lands and from bushfires has led to soil degradation, loss of biodiversity and reduced or contaminated water resources resulting in famine and migration. A key strategy to forestall this menace is to apply agroforestry land-use technologies. Agroforestry technologies are the most important pathways to sustainability under tropical savannah, where deforestation, land degradation and desertification are advancing at a rapid rate.

It is against this background that APERL project was initiated in 2007 to introduce interventions to enhance the livelihoods of people in three communities in Brong Ahafo Region - Ayakumaso, Dumesua/Mantukua and Fiapre in the Sunyani Municipality, in order to address the root causes and outcomes of poor natural resource management. APERL is a joint collaborative initiative between the Faculty of Forestry Resources Technology (FFRT) and the University of Guelph funded by the Canadian Ministry of Foreign Affairs, Trade and Development Canada.

APERL achieved its goal of alleviating poverty by working with local people to sustainably diversify incomes, build capacity at university level and incorporate agroforestry into government policies. Under APERL there has been an increase in awareness on empowerment of women and vulnerable social groups, coupled with a sustainable income generation farming activities among the communities involved. APERL has also assisted in training the communities to produce charcoal for commercial purposes.

The main focus of APERL activities was to increase food production and income generation. It was discovered that agroforestry practice which is the introduction of citrus, mangoes on farm lands yielded increased results. Today the project has directly benefited more than 3700 people. **Prof. William Oduro** is the project coordinator.

ACADEMIA-INDUSTRY COLLABORATION

COLLABORATION WITH INDUSTRY AND ORGANISATIONS

Academia-industry collaboration promotes problem-based research and learning and ensures that academia is fulfilling its role of providing research-based solutions and innovations to advance national development. KNUST, as the leading science and technology University in Ghana, seeks to lead efforts in developing new knowledge and technological innovations relevant for Ghanaian industry. The University is therefore increasing collaboration with industry to expand the relevance of research. This section highlights recent research collaboration between KNUST and industry.

ACARP Partners KNUST to Strengthen Teaching and Research

The Accra Compost and Recycling Plant (ACARP), an integrated waste processing and recycling company and the College of Agriculture and Natural Resources (CANR) of Kwame Nkrumah University of Science and Technology (KNUST) have established a partnership for teaching, learning and research. Though KNUST students have already been undergoing internships at ACARP since 2015, the partnership formalises arrangements between ACARP and the University, with the signing of a memorandum of understanding (MOU). The MOU was signed in June 2016, by Professor Samuel Nii Odai, on behalf of KNUST, and Dr. Richard Amponsah on behalf of ACARP.

The two institutions will collaborate in research, projects, internships, vacation training and joint supervision of post-graduate theses. Demonstration and experimental farms will be established by students of KNUST on ACARP premises. The agreement also provides for the execution of joint projects in land reclamation and waste management among other areas. Under the agreement, students from the CANR will also undertake a minimum of six (6) weeks supervised training on ACARP premises.

Dr. Kwaku Ofosu-Adarkwa, Board Chairman of ACARP, stated that the agreement marked the start of research into waste management and its application to the development of agriculture. He added that global trends had currently called for collaboration of all stakeholders to work towards the attainment of the Sustainable Development Goals (SDGs) 2030 which included water and sanitation, and reaching the agenda related to health, food security, resilience to disaster, climate change, and protection of the ecosystem among others. Dr. Ofosu-Adarkwa noted that ACARP had established an effective recycling plant, to move away from hazardous waste management systems and to curb environmental pollution. He reiterated that ACARP, a private company, saw academia as a strong partner to support policy, research and development and to explore employment opportunities in the waste management sector.

Dr. Richard Amponsah, Managing Director of ACARP, stated that the partnership was necessitated by the gap identified between theoretical knowledge obtained by students and the practical aspects of industry. He saw the MoU as a strategic corporate social responsibility. Prof. Samuel Nii Odai, the Pro Vice-Chancellor, stated that KNUST as a research institution was interested in addressing national challenges through research, innovation and modification, and pledged KNUST's support to industry.

PIC Invests in KNUST Dairy Research Station

Representatives of PIC and KNUST

A social investment fund, Peak Investment Capital (PIC) and Kwame Nkrumah University of Science and Technology (KNUST) have signed a joint-venture agreement, establishing the KNUST Dairy Company Limited. The agreement involves

investment by PIC to enhance the dairy research and production capabilities at KNUST's Dairy Research Station of the College of Agriculture and Natural Resources (CANR). The partnership is based on KNUST's extensive technical expertise to develop a sustainable dairy ecosystem. The KNUST Dairy Research Station, a leading research institute, has over the years developed dairy products and worked with local farmers to enhance dairy production.

Professor William Otoo Ellis, the Vice-Chancellor, stated that an institution of higher learning needed capital and investment in specific areas, and PIC was helping to address this need. This, according to the Vice-Chancellor, fulfilled the institution's objective of partnering industry and creating opportunities. It is expected that the partnership would inject new technology, develop innovative dairy products, build research capacity and improve economic activities in the University. Mr. Kobbina Awuah, Executive Director of PIC, expressed his team's excitement at the opportunity of partnering a prestigious research institution like KNUST. He said the first phase of the partnership would focus on capacity building of staff, fixing production equipment and critical improvement in marketing, branding and packaging of dairy products, hence providing employment and internship opportunities for KNUST students.

After a year, the partnership has yielded visible results. Research, rebranding and marketing strategies, food tasting surveys and product innovations have resulted in improved dairy products. The KNUST fresh yoghurt has been rebranded as 'Icy Cup', incorporating proper packaging and good customer service. One new Icy Cup flagship sales outlet has officially been opened on campus, with a second to be opened soon.

Desert Lion International to help Commercialise KNUST Research

Desert Lion International (DLI), a multinational and a leading manufacturer and importer of quality farming inputs has signed a memorandum of understanding with Kwame Nkrumah University of Science and Technology (KNUST) to set up a manufacturing company to support the agricultural sector.

Both parties have agreed to use appropriate technology to provide environmentally friendly inputs and spare parts through the establishment of an ultramodern assembly/management plant. The project is ultimately geared towards building the capacity of local engineers and technicians to support the transformation of the cocoa industry.

As part of its obligations, DLI shall manufacture and assemble agricultural machinery. This includes motorised spraying machines such as Desert Lion-Port 500 and Desert Lion-Still and Desert Lion-Super among others. They shall also manufacture manual knapsack sprayers, motorised pruners, generators and solar products for rural farmers and spare parts for various sprayers.

Mr. Kwame Tweneboa Kodua, President and Chief Executive Officer of the Desert Lion Group, stated that it was a privilege to partner the University to transfer knowledge and expertise from the University to industry and to farmers in Ghana. He bemoaned the importation of inefficient technology and technical expertise in servicing machinery. He believed that local entrepreneurs and institutions could collaborate to improve productivity, income generation, livelihood of farmers and job creation, noting that DLI had employed some graduates from the College of Engineering and hoped to tap more from the Colleges of Engineering and Agriculture.

The CEO stated that DLI would also assist KNUST in the commercialisation of research findings and hoped the opportunity given them would help promote research uptake by assisting the University with the necessary resources to come out with innovative products which would benefit both parties, help drive the agricultural sector, bring employment and help the university to showcase its research.

Professor William Otoo Ellis, the Vice Chancellor pledged the University's support and stated that this partnership would build the capacity of local engineers, especially those in the manufacture of agricultural machinery and facilitate teaching, learning and research.

Improving Locally Fabricated Stoves and Ovens for Efficient Energy Use and a Clean Environment.

Researchers from the Technology Consultancy Centre (TCC), a research centre in the College of Engineering of Kwame Nkrumah University of Science and Technology (KNUST) have collaborated with artisans from the Suame Magazine to study locally fabricated cook stoves. This was supported by the Building Stronger Universities (BSU) II Project through its academia-industry linkage initiative.

As part of the study, tests were conducted using the traditional charcoal stove (a coal pot), a wood-burning stove and an improved charcoal stove (Gyapa type). These were used for laboratory analysis at the Cookstove Testing and Expertise Laboratory (C-Lab). It was found out that the traditional wood-burning stove emitted more CO, CO2 and particulate matter (PM2.5) than the traditional charcoal stove and the improved cookstove. Results indicated that the wood-burning stoves contributed five times more to global warming, while traditional charcoal stoves contributed two times more, compared to the improved cookstove.

The test results also indicated higher thermal efficiency of 30% for the improved charcoal Cookstove, compared to 23.3% for the traditional charcoal stove (coal pot) and 12.2%

for the wood-burning stove. A higher thermal efficiency indicates a greater ability to transfer the heat produced to the pot with reduced emissions into the environment.

The TCC organised a stakeholders' workshop which brought together fabricators and users of traditional cookstoves, representatives from the Ghana Standards Authority, the Environmental Protection Agency, the Ministry of Trade and Industry, traditional leaders and other key players in the usage of cookstoves.

Dr. George Yaw Obeng

Dr. George Yaw Obeng, principal investigator, briefed participants at the stakeholders' workshop on the research findings. He noted that inconsistencies in the fabrication of local stoves resulted in poor performance, low efficiency and high emissions. He explained that the study showed that local stoves were not fitted with safety, regulating and monitoring devices, and therefore called for standards and certification by the Ghana Standards Authority to address such challenges. He noted that due to lack of standards, fabricated stoves and ovens were not certified and this could be a potential source of risk to end-users and the environment.

Professor Ebenezer Mensah, a researcher at the Department of Agricultural Engineering, said the university's mandate besides teaching was research and extension services to the community and it was in this light that the study was conducted. Prof. Mensah noted that there was evidence that the burning of biomass in inefficient cookstoves had adverse effects on the environment and contributed to climate change at the local, regional and global levels.

He observed that smoke from cooking fuels was estimated to account for nearly 2 million deaths, more than 99 percent of which occurred in developing countries. He therefore called for a continuous study to improve locally fabricated stoves and ovens. As part of the workshop, there was a working group discussion on the fabrication, marketing and use of locally manufactured cookstoves and ovens.

Workshop Participants

Screening of Water Quality of Surface Water Bodies and the Impact of Anthropogenic Activities

Deterioration of water quality of most surface water bodies in the urban and peri-urban centres in the country has become a major issue of concern in the country. Surveys and screening of water quality of various streams in the urban centres and how anthropogenic activities influence quality have been and continue to be investigated. From the survey, sources of contamination, extent of deterioration, mapping of water resources and quality index of the water bodies have been determined.

Until recently, the introduction of Water Sanitation and Hygiene (WASH) technologies into the WASH sector of Ghana had not followed any formalised documented protocol. In this research an assessment framework (code named Technology Applicability Framework – TAF) has been developed by our research consortium of WASH actors for screening new technologies. In addition, guidelines have been developed to introduce new technologies in the WASH sector for successful uptake and scale up**.** This European Union FP7 sponsored project is being implemented by a multi-country consortium comprising the KNUST Department of Civil Engineering, WaterAid – Ghana, Training Research and Network for Development (TREND) - Ghana, SKAT Foundation - Switzerland, IRC- London, WaterAid - Burkina Faso and WaterAid - Uganda.

The first phase of this project conducted from 2011 – 2013, resulted in the development of a Technology Applicability Framework (TAF). The TAF is a participatory evaluation tool that identifies blockages likely to impact on the overall sustainability, scalability and performance of water, sanitation and hygiene technologies developed. In executing this project various WASH technologies operational in Ghana, Burkina Faso and Uganda were assessed from the users, producers and regulators perspectives. Several sustainability dimensions such as economic, technical, environmental, social, skills and know- how institutional & legal issues were considered. Instruments used to acquire the needed information included designed questionnaire, interviews and observations and literature / desk studies. In executing the project, another procedural tool, the Technology Introduction process (TIP) was developed. Presently the TAF and TIP are being used to assess the performance of the portable toilet systems facility being operated by the 'Clean Team – Ghana' that operates in Kumasi. The Civil Engineering team on the consortium is made up of **Dr. K. B. Nyarko, Dr. Richard Buamah** and **Dr. Ofosu Antwi**.

KNUST Collaborates with Akate Farms and Trading Co. Ltd

Officials at the Signing of the MOU

KNUST's relationship with Akate Farms and Trading Company Limited began in 2007 when two of the University's scientists, **Dr. O. S. Olympio** and **Dr. K. Adomako** began a breeding project aimed at developing naked neck and frizzle chicken. These birds have been tried and the are laying more eggs than the various exotic breeds being used in the country currently.

In 2013, the University signed an MOU with Akate Farms and Trading Company, with the purpose of expanding research and production in poultry. This has resulted in the production of large quantities of eggs by Akate Farms on KNUST campus, and currently, the second batch of production is in progress.

This Public Private Partnership (PPP) arrangement has been extremely beneficial to teaching and research. Training in poultry production and management, practical demonstrations and student internships are undertaken in the facility, hence providing practical applications for student learning. Postgraduate students are also able to use the production data for various on-farm research studies on poultry production and management.

Feed the Future Innovation Lab for Reduction of Post-Harvest Losses of Maize in Ghana

The $225,000 USAID-funded project "Feed the Future Innovation Lab for Reduction of Post-Harvest Losses of Maize in Ghana" with **Dr. E. A. Osekre** and his team, **Mr. James Kofi Danso** and **Ms. Naomi Manu** of the Department of Crop and Soil Sciences, are looking at reducing post-harvest losses (PHL) of maize in Ghana through field assessment and research where breakthroughs could lead to significant mitigation of PHL in maize cultivation. Key components of the project include organisation of education and training to share proven practices and information gathered from

the field assessment, and research activities to reduce PHL at the household and village levels.

Collaborating with PENS Food Bank at Ejura in the Ashanti Region, the team has so far performed a field assessment of post-harvest losses of maize in the middle and northern belts of Ghana. Scientific research into loss mitigation measures have almost been completed, and some key interventions to mitigate PHL have been identified and are being run on a pilot basis. Various storage structures have also been evaluated so that suitable ones could be recommended to farmers and aggregators to ensure more appropriate storage of maize. The project is expected to reduce or halve post-harvest losses of maize to make more wholesome maize available to Ghanaians.

The PHL Team

Taking Moisture Content in Kikapu with JD Meter

KNUST RESEARCH FUND (KReF)

KNUST RESEARCH FUND (KReF)

The establishment of the KNUST Research Fund (KReF) was driven by the desire to increase research activity at KNUST in order to contribute to the socio-economic and human development of Ghana and Africa. The University recognises the significant role it is expected to play in conceiving and developing interdisciplinary research in partnership with external stakeholders, especially industry, to help solve the problems of Ghana. This role is expected to encourage researchers and students of KNUST to be more innovative in identifying research concepts, which will lead to actual project development for implementation. These research projects are expected to produce readily implementable outputs for the economic and human development of Ghana and Africa. The establishment of KReF was also motivated by the University's commitment to building the capacity of its staff, not only in the conduct of research but in grant application and management processes as well as to foster linkages among the various disciplines across the University.

Two types of awards are made available under each round of funding. The Seed Grants are for small pilot or exploratory research projects focusing on exploring the feasibility of new research approaches, allowing investigators to collect preliminary data to subsequently develop major grant applications, or for completing short-term research studies. Funding for this type of award is up to GH¢10,000.00 (Ten Thousand Ghana Cedis) per award. The second type is the multi-disciplinary grant which is for research that addresses a national developmental issue capable of shaping or influencing policy and practice in Ghana. Funding this type of award is currently up to GH¢30, 000.00 (Thirty Thousand Ghana Cedis) per award. In all applications, the lead researcher must be a staff of KNUST.

The application and the award process are as follows:

- Request for proposals is widely advertised throughout the University by the Office of Grants and Research (OGR).
- Completed applications are submitted as stated in the announcement
- Applications received by the stated deadline are processed by OGR.
- The KReF Scientific Committee identifies suitable reviewers for each application.
- The selected independent reviewers assess each application and score them using agreed upon criteria.
- Reviewed applications are collated by OGR and forwarded to the Committee
- Based on the review, all applications are evaluated and ranked by the Committee.
- The Committee selects awardees based on the strength of the application as well as the availability of funds.

During the 2015 call, thirty-one (31) proposals were received, out of which eight (8) were selected for funding. Table 1 shows the details of the awards.

Award Winners of the 1st Call for proposals

No.	Title	Grant Type	Amount GH¢	PI	Department	College
1	Preliminary studies on the breeding, hatchability and larval growth of the African River prawn, *Macrobrachium vollenhovenii*	Seed	10,000.00	Dr. Daniel Boateng	Fisheries & Watershed Management	College of Agriculture and Natural Resources (CANR)
2	The impact of the District Assembly Common Fund allocation to people with Disability at the Metropolitan, Municipal and District Assembly level. A comparative study of five (5) District in Ghana (IDACFund-Disability)	Multi	21,450.00	Dr. Ronald Adamtey	Planning	College of Art and Built Environment (CABE)

No.	Title	Grant Type	Amount GH¢	PI	Department	College
3	Assessing the impact of Climate Change on Small Scale Reservoir Irrigation Projects in the Sahelian Region of Ghana	Seed	10,000.00	Dr. Kwaku Amaning Adjei	Civil Engineering	College of Engineering (CoE)
4	Development of a Gastroretentive Polyherbal Tablet that reduces multiple dosing for pain Management in the Elderly	Multi	19,050.00	Prof. Eric Woode	Pharmacology	College of Health Sciences (CoHS)
5	Anticonvulsant, antidepressant and antipsychotic effects of the leaf extract of *psydrax subcordatum* (DC.) Bridson (family Rubiaceae) in animal models	Seed	10,000.00	Dr. Wonder Kofi Mensah Abotsi	Pharmacology	College of Health Sciences (CoHS)
6	Victims of Sexual Abuse in Kumasi: Challenges and Coping Strategies	Seed	9,260.00	Dr. Esmeranda Manful	Sociology	College of Humanities and Social Sciences (CoHSS)
7	Production and Training on Okra Genotypes for their Potential Food and Medicinal Qualities	Seed	10,000.00	Dr. Jacob K. Agbenorhevi	Food Science	College of Science (CoS)
8	Mobile Health Technology for blood pressure control in Ghana	Seed	9,840.00	Dr. Arti Singh	KNUST Hospital	KNUST Hospital

Preliminary Studies on the Breeding, Hatchability and Larval Growth of the African River Prawn (Macrobrachium Vollenhovenii)

Dr. Daniel Adjei-Boateng of the Department of Animal Science together with Dr. Regina Edziyie and Dr. Kwasi Adu Obirikorang set out to establish a breeding population of the African river prawn (*Macrobrachium Vollenhovenii*) in captivity, determine the hatching and survival rates of larvae to postlarvae stages and breed larvae to juveniles for on-growing in ponds. A year's project which kicked off in January 2016 obtained its first batch of prawn breeders from Atimpoku (Eastern Region). The prawns were conditioned to feed on formulated diets under culture conditions in tanks.

The gravid conditions of prawns in their natural state have been studied with the assistance of fishermen and compared to the survival of breeders under culture conditions. Another set of gravid females have been acquired and are currently being hatched for larval rearing trial to determine the survival rates from larvae to post-larvae stages.

This project has revealed an established procedure for safely transporting and disinfecting adult prawns, developed quality feed for prawns with good feeding response and suitable water quality conditions for survival of prawns in ponds, tanks and hapas.

It is expected that at the end of the trial, a breeder population of M. vollenhovenii will be established for further research on the development of commercial prawn production. Postlarvae M. vollenhovenii will also be available for growth trials in ponds.

Prawns being Conditioned in Bamboo Hideouts

Freshly Harvested Prawns

The Impact of the District Assembly Common Fund Allocation to People with Disability at the Metropolitan, Municipal and District Assembly Levels: A Comparative Study of Five (5) Districts in Ghana Fund

Dr. Ronald Adamtey and his team comprising **Prof. Imoro Braimah** and **Dr Charles Y. Oduro** of the Department of Planning received GH¢21,450.00 (Twenty-One Thousand, Four Hundred and Fifty Ghana Cedis) from the KNUST Research Fund to assess the Impact of the District Assembly Common Fund (DACF) Allocation to People with Disability (PWD) at the Metropolitan, Municipal and District Assembly (MMDA) Levels.

The aim of the project is to assess the effectiveness of implementation strategies, challenges and other issues relating to the DACF allocation to PWDs by MMDAs and identify measures to improve the effectiveness of the implementation of the policy by MMDAs.

Tasks accomplished so far include contacts with District Chief Executives, District Coordinating Directors, District Planning Officers, District Finance Officers and Directors of Community Development and Social Welfare of four districts namely, Ho Municipality, Ga West Municipality, Adansi South and Assin North. 100 persons with disability were engaged in focus group discussion under strict anonymity. This included forty (40) visually impaired and sixty (60) persons with other physical disabilities. Twenty-four (24) officials made up of four (4) District Chief Executives, four (4) District Coordinating Directors, four (4) District Finance Officers, four (4) Planning Officers were interviewed. Four (4) Budget Officers and four (4) Directors of the Department of Social Welfare and Community Development were also interviewed. The team also obtained data on persons with disability and disbursement of funds for beneficiaries. Two research assistants were taken through the research instruments to understand and interpret the questions to be able to record answers in a uniform manner before the exercise. The team is working on the validation of the report for dissemination.

The projected period for the research is from March 2016 to February 2017.

Interaction with Disabled Persons

Meeting District Assembly and Social Welfare Officials

Assessing the Impact of Climate Change on Small Reservoir Irrigation Projects in the Savannah Regions of Ghana

The KNUST Research Fund (KReF) supported the project "Assessing the Impact of Climate Change on Small Reservoir Irrigation Projects in the savannah regions of Ghana" with an amount of GHC 10,000.00 (Ten Thousand Ghana Cedis).

Dr. Kwaku Amaning Adjei of the Department of Civil Engineering is leading the project which started in February 2016 and will end in January 2017. He is working with **Dr. Emmanuel K. Appiah-Adjei** of the Department of Geological Engineering and **Dr. Kafui Afi Ocloo** of the Department of Planning.

The project aims to:

1. Quantify potential climate change in the Savannah Regions
2. Assess the effects of climate change on small reservoirs in the region
3. Assess the current farming practices and the uses of small reservoirs in the region
4. Evaluate strategies that local farmers have been using to manage their water resources against climate change.

The project has currently quantified about 70% of potential climate change in the region as well as assessed the effects of climate change on small reservoirs. The field-based activities have been planned for July and August, 2016.

It is anticipated that about 15 farmers, agricultural extension officers, NGOs and other stakeholders will receive professional training in climate change and adaptation strategies in the savannah regions of Ghana by the end of the project.

Anticonvulsant, Antidepressant and Antipsychotic Effects of the Leaf Extract of Psydrax Subcordatum (DC.) Bridson (Family Rubiaceae) in Animal Models

With a GHC 10,000.00 (Ten Thousand Ghana Cedis) award from the KNUST Research Fund (KReF), **Dr. Wonder Kofi Mensah Abotsi** from the Pharmacology Department, and his team of researchers, are working on "Anticonvulsant, Antidepressant and Antipsychotic Effects of the Leaf Extract of Psydrax Subcordatum (DC.) Bridson (Family Rubiaceae) in Animal Models."

The project which started in May 2016 will end in April 2017. The project seeks to assess the anticonvulsant activity of Psydrax subcordatum in the PTZ, picrotoxin and maximal electroshock seizure tests; assess the antidepressant effects of Psydrax subcordatum in tail suspension and forced swim tests; and validate some animal models of psychosis and to assess the antipsychotic effects of Psydrax subcordatum in these models.

The research team has so far evaluated the antidepressant activity of Psydrax subcordatum in two animal models (tail suspension and forced swim tests) and assessed the anticonvulsant activity in the PTZ-induced and picrotoxin-induced seizure tests. The result of this study confirms the anticonvulsant activity of the plant extract as claimed by traditional medicine practitioners.

Victims of Sexual Abuse in Kumasi: Challenges and Coping Strategies

Sexual abuse is forcing undesired sexual behaviour by one person upon another, sometimes resulting in devastating effects. **Dr. Esmeranda Manful** of the Department of Sociology and Social Work, together with a team of six members comprising **Dr. Francess Dufie Azumah, Mr. Jonas Asamanin Barnie, Dr. Kwadwo Ofori-Dua, Dr. George Oheneba Mainoo, Mr. Nelson Gyasi-Boadu** and **Dr. John Boulard Forkuor** are researching into the challenges and coping strategies of victims of sexual abuse in Kumasi.

Data Collection exercise

Collaborating with the Regional Police Command, Domestic Violence and Victims Support Unit (DOVVSU) and with a GH¢9,260.00 (Nine Thousand, Two Hundred and Sixty Ghana Cedis) award from the KNUST Research Fund, the researchers seek to investigate and analyse the key challenges facing victims of sexual abuse and explore the various strategies being used to cope with the challenges.

The period for this project is from February 2016 to January 2017. So far, relevant literature has been reviewed and research instruments prepared. These informed four days of training for research assistants to enable them participate in the field work and assist in the data coding and analysis. Victims, family members and witnesses comprising 540 respondents have been reached and data from the two different sets are being analysed.

The finding(s) for this research will serve as empirical evidence for establishing a Social Work practice intervention model for working with victims of sexual abuse. The research will also validate the need for establishing a shelter that would house the victims of sexual abuse within the Kumasi Metropolis.

Training of Research Assistants

Okra Production and its Effect in Ghana

Dr. Jacob K. Agbenorhevi with his team from the Department of Food Science and Technology of the College of Science, submitted a proposal on production and training on okra genotype for its potential food and medicinal qualities.

Okra (Abelmoschus spp.) is an underutilised crop in Ghana although its polysaccharide content (known as pectin) is of major technological interest for food, non-food and medicinal applications. This project which started in February 2016 and is supposed to end in January 2017 will study the effect of production methods and genotype on yield and polysaccharide properties of okra. This is to be achieved by firstly producing different okra genotypes and assessing the impact of methods on yield, morphological features and polysaccharide properties/food applications, and secondly characterising polysaccharide extracts from the different okra genotypes based on their physico-chemical, functional and rheological properties for specific food applications.

Currently six (6) different okra genotypes have been cultivated and their fruits/pods collected for analysis.

Okra of Different Genotypes

Students Working on Okra Samples in the Laboratory

Mobile Health (mHealth) Technology for Blood Pressure Control in Ghana

Dr. Arti Singh and a team of doctors at the KNUST Hospital undertook the project titled "Mobile Health Technology for Blood Pressure Control in Ghana". The project, which is expected to run from January 2016 to February 2017 was funded by the KNUST Research Fund (KReF) with an amount of GH¢ 9,820.00 (Nine Thousand, Eight Hundred and Twenty Ghana Cedis).

The project seeks to:

- assess the acceptability and usability of mobile health technology (such as SMS, automated and live calls) between hypertensive patients and health care providers.
- explore barriers, facilitators and recommended mHealth intervention strategies to control hypertension and identify strategies to develop a successful culturally sensitive mHealth intervention in Ghana.
- use these findings to make recommendations for implementation of the use of mHealth technology in hypertension control in Ghana.

The project has so far developed a focus group and a key informant interview guide. Twenty (20) patients with hypertension have also been recruited from KNUST Hospital. Key informants for the study have been identified and documents for ethical approval prepared and submitted to the Committee on Human Research and Publication Ethics (CHRPE) office (SMS).

It is envisaged that at the end of the project, preliminary evidence will be gathered as to how mHealth programmes in Ghana could be developed, refined and tested. Information on social demography and health literacy will also be collected to provide a blueprint upon which future trials on mHealth technology could be conducted.

Public Education on Blood Pressure Control

Development of a Gastroretentive Polyherbal Tablet that Reduces Multiple Dosing for Pain Management in the Elderly

Prof. Eric Woode and a team of researchers (**Dr. Edmund Ekuadzi, Dr. Mrs. Priscilla Kolibea Mante, Dr. Mrs. Mariam El Boakye-Gyasi**) are undertaking the project titled "Development of a Gastroretentive Polyherbal Tablet that Reduces Multiple Dosing for Pain Management in the Elderly". The project was funded by the KNUST Research fund (KReF) with an amount of GHC 19,050.00 (Nineteen Thousand and Fifty Ghana Cedis) in January 2016 and it is expected to end in February 2017.

The project hopes to develop a preclinical polyherbal therapy for the management of chronic pain in the elderly. This is to be achieved through conducting a brief pain inventory of the elderly living in and around KNUST, to identify at least three herbal plants with requisite biological activity from a pool of preselected plants, to standardise the individual medicinal plants that will constitute the poly-herbal products chemically and biologically, to formulate a gastro-retentive dosage form of a poly-herbal product and studies of its distribution parameters, to standardise the formulated products chemically and biologically and to design and implement a pilot scale production of a controlled release formulation of the polyherbal product.

A brief pain inventory of the elderly has been undertaken and results are being processed. Three (3) medicinal plants have been selected. The most important consideration was for plants that have wide use in herbal products for pain management. The selected medicinal plants are still being collected.

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RESEARCH ACTIVITIES IN THE COLLEGES

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES

Strengthening Root and Tuber Value Chains in Ghana

To contribute to national research capacity by providing scientific knowledge, solid baseline data, and proven methodologies to monitor performance of root and value chains in Ghana, **Dr Robert Aidoo** of the Department of Agric. Economics, Agribusiness & Extension and his team have researched on the topic "Strengthening Root and Tuber Value Chains in Ghana" under the sponsorship of DANIDA with an amount of DKK 4,999,527 (Four Million, Nine Hundred and Ninety-Nine Thousand, Five Hundred and Twenty-Seven Danish Krone).

The study focused on strengthening the value chains of cassava, yam, cocoyam, and sweet potato. The team has come out with the following:

- Analyses of consumer preference and acceptance of existing root and tuber products;
- The evaluation and prioritization of constraints in primary production, processing and marketing;
- Proposals for solution(s) to constraints in primary production, processing, marketing and consumption;
- At least two existing products and two novel products from each root and tuber **crop** improved/developed and tested;
- Six different papers presented at both local and international conferences;
- Improved and novel products developed from root and tubers exhibited at conferences, workshops and other programmes.

The other team members for the project are **Dr Kwasi Ohene-Yankyera** (Department of Agric. Economics, Agribusiness & Extension), **Prof. Robert Clement Abaidoo** (Department of Biological Science) and **Mr Samuel Akomea** (School of Business). The Danish Consortium collaborating with KNUST on this project include researchers from DTU, Aalborg University and University College Nordjylland.

The project period is from January 2013 to December 2015 with a one-year extension to December 2016. So far, over

70% of the Food Science related activities have already been undertaken and as a way of capacity building, two PhDs and four Masters students in Food Science and Technology and Agribusiness are being sponsored.

Enhancing the Nutritional Value of Tilapia for Human Health

Students Preparing to Feed Fishes

KNUST and the University of Pine Bluff, Arkansas are collaborating on "Enhancing the Nutritional Value of Tilapia for Human Health" project. It is funded by the USAID Aquafish Innovative Lab with an amount of $100,000 (One Hundred Thousand US Dollars), and is scheduled to last from April 2014 to December 2016.

The project seeks to increase the human health benefits by increasing the levels of omega-3 and other beneficial fatty acids in tilapia. So far, a survey to determine availability and distribution of potential fish feed ingredients containing omega-3 fatty acids has been conducted and proximate, fatty and amino acid composition of seven ingredients determined. Initial feed trial has also been conducted. One BSc. student on the project has graduated and one MSc student is currently still on the project.

It is expected that at the end of the project, the following outcomes would be realised:

- Information on nutritional composition of local ingredients
- Proximate and fatty acid composition of tilapia will be improved
- Nutritional health of tilapia consumers will be improved with the formulation of diets with healthier lipids
- Research capacity of project students and staff improved.

Dr. Regina Edziyie and **Dr Nelson Agbo** of the Department of Fisheries and Watershed Management are the researchers working on the project.

Cage Aquaculture in Northern Ghana: Enhancing Food Security and Livelihoods

The "Cage Aquaculture in Northern Ghana: Enhancing Food Security and Livelihoods" project aims to harness the potential of the Bontanga, Golinga and Libga irrigation reservoirs in Northern Region to grow fish for local consumption, enhance food security, provide employment and reduce poverty. The project led by **Dr. Regina Edziyie and Dr. Daniel Adjei-Boateng** of the Department of Fisheries and Watershed is funded by the Australian Embassy (Direct Aid Project).

The project is being engineered in collaboration with the Ghana Irrigation Authority (GIDA), District Assemblies, welders, fishermen and farmers. Other members for the project include **Dr. Benjamin Campion** and **Dr. Kwasi Adu Obirikorang** also from the Department of Fisheries and Watershed Management.

A total amount of 59,740 AUD (Fifty-Nine Thousand, Seven Hundred and Forty Australian Dollars) was awarded to train 10 artisans in cage construction using locally available materials, 6 extension staff and 40 prospective fish farmers in cage culture, record-keeping, marketing and best management practices in cage fish farming. One of the objectives of the project was also to conduct a cage trial on 3 reservoirs with the active participation of prospective farmers, extension agents, District Assemblies and traditional authorities. Additionally, the project aims to establish a hapa-based tilapia hatchery for the production of 30,000 fingerlings per month in Northern Ghana. The projected period for the project is from February 2016 to March 2017.

So far, the three communities have been mobilised for the project and prospective fish farmers identified with assistance from GIDA, assemblymen and local reservoir communities. Welders have also been trained and cage frames fabricated. A training of trainers' workshop on cage netting sewing has been completed and trainers are currently in the field, training the local communities. Additionally, fingerlings for the growth trials have been procured to start in mid-July 2017.

Some of the anticipated outcomes of the project include:

- About 300% increase in fish production and supply to the communities around the reservoirs and Tamale.
- The training of ten (10) artisans in cage construction, forty (40) people in commercial fish production, marketing, proper farm inventories and management.
- Six District Fisheries Extension Officers would be trained in reservoir cage farming.
- A manual on cage culture in reservoirs in Northern Ghana would be developed.

- One tilapia hatchery would be established.
- An environmental and social impact assessment report on reservoir cage culture will be produced.

Sustainable Fish Feed Development in Ghana

Prof. Steve Amisah and his team members are working on the project titled "Sustainable Fish Feed Development in Ghana". The team is working in collaboration with the Technical University of Denmark (DTU Aqua) with an amount of 4,999,162 DKK (Four Million, Nine Hundred and Ninety-Nine Thousand, One Hundred and Sixty-Two Danish Krone), funding from DANIDA. The project, which started in April 2016 is expected to end in March 2017.

The objectives of the project include formulating cost-effective tilapia feed based on digestibility, nutritional value and amino acid profiles of local feed ingredients, promoting the production and application of locally developed high quality feed; and achieving a zero change in nutrient discharged to the environment through the application of balanced feed and efficient feeding strategies.

The project has so far completed proximate, amino acid and anti-nutritional profiles of local agro by-products and tested the effect of pre-treatment on protein, amino acid and anti-nutritional profiles. Nine diets formulated with combinations of four different plant ingredients have been formulated and tested in a recirculation system with the optimisation of the two best performing diets underway.

By March 2017, it is expected that optimal diet formulae based on local raw materials i.e. soybean cake, copra, palm kernel cake, cotton seed, groundnut cake and groundnut husk will be established. Also, optimised feed based on local raw materials for cage and green water (pond) production of tilapia will be identified. These are expected to reduce levels of ammonia and phosphorus released from fish ponds and cages into natural water bodies to ensure environmental sustainability. KNUST will also have enhanced its capacity in playing a lead role as well as anticipating and addressing future challenges in the development of aquaculture in Ghana.

Towards an Improved Understanding of Mineralogical and Climatic Controls on Soil Carbon Stocks in West Africa

A consortium involving KNUST, Imperial College London, University of Aberdeen, Scotland and the Natural History Museum London is working on the project "Towards an Improved Understanding of Mineralogical and Climatic Controls on Soil Carbon Stocks in West Africa". The project which started in February 2016, and is funded by the Royal Society of UK with an amount of £18,640 (Eighteen Thousand, Six Hundred and Forty Pounds), will end in January 2019.

The project will provide hands-on skills training in advanced clay mineralogy and state-of-the-art soil carbon modelling to two Ph.D. students and one academic staff of the Department of Crop and Soil Sciences, KNUST in two UK based Institutions of Natural History Museum, London and the University of Aberdeen, Scotland. It will also apply the acquired skills in carbon management in Ghana in an informed quantitative framework.

The two Ph.D. students nominated for the training programme are in advanced stages of their field and laboratory work and are scheduled for intensive skills training in the two UK-based Institutions.

The project presents a mixture of knowledge transfer/ capacity building in Soil Science and new science in soil carbon management in Ghana. **Prof. Jonathan Lloyd** of Imperial College London and **Dr. Vincent Logah**, KNUST are lead investigators.

The Science Underpinning the West African Forest Island Phenomenon

Dr. Vincent Logah from the Department of Crop & Soil Sciences is coordinating the Royal Society-DFID funded, project on the theme "The Science Underpinning the West African Forest Island Phenomenon". **Professor Jonathan Lloyd** of the Imperial College London, UK as the lead investigator is working with the Ghana Sources Of Forest Islands In Africa (SOFIIA) team members on this project worth £1,132,162.00 (One Million, One Hundred and Thirty-Two Thousand, One Hundred and SixtyTwo Pounds) which will run for five years, from January 2015 to January 2020.

SOFIIA is a consortium consisting of three African Institutions – KNUST, Federal University of Agriculture, Abeokuta (FUNAAB) Nigeria, and the Environmental Institute for Agricultural Research (INERA) Burkina Faso in collaboration with Imperial College London.

The objectives of the project are to:

I. Generate new knowledge of biogeochemical mechanisms underlying the creation of forest islands and to inform agronomic practices and carbon offset programmes in Africa in the era of climate change.

II. Train three Ph.D. students and about 15 MPhil students in Soil Science in the three African institutions of Ghana, Burkina Faso and Nigeria within the five-year period.

III. Build the capacity of postgraduate students, staff and technicians in the three African institutions through a series of capacity building workshops.

George Martin Hodnett in Field Measurement with Participants

The project has to date, supported three Ph.D. and seven MPhil students in the three African institutions with three capacity building workshop organised at KNUST and similar ones in the other two African institutions. State-of-the-art laboratory equipment has been purchased for KNUST and the other institutions and a conference paper ''Biogeochemical Processes Underlying the Forest Island Phenomenon: A Recently Initiated Study" has also been presented at the 5th International Symposium on Soil Organic Matter held at the University of Gottingen, Germany.

It is expected that at the end of the project, all Ph.D. and MPhil students would have been trained in Soil Science in the three African institutions and the capacity of over 600 postgraduate students and staff enhanced in modern science, with about 250 of them coming from KNUST. The project would also enhance the output of the Soil Science laboratory of KNUST and the two other African institutions through the acquisition of modern scientific instruments.

Participants of the 1st SOFIIA Ccapacity Building Workshop

Improved MSc in Cultivar Development in Africa (IMCDA)

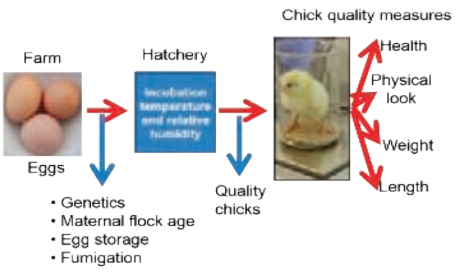
This initiative seeks to increase the availability of a new set of plant breeders who can better service Africa's seed sector by developing improved quality seed for improved yields. **Prof. Richard Akromah** is the principal investigator of the programme, which aims to build capacity in plant breeding and seed science for the seed industry in Africa The Alliance for a Green Revolution in Africa (AGRA) is the funding agency supporting this programme with a grant of $ 2.67million (Two Million, Six Hundred and Seventy Thousand US Dollar).

The programme which started in 2014 and ends in 2019 hopes to train ninety (90) students in three regional training hubs in Africa – Ghana (Kwame Nkrumah University of Science and Technology), Uganda (Makerere University) and South Africa (University of Kwazulu Natal). Thirty (30) of these students will be trained in KNUST, Ghana and will be selected from Ghana, Nigeria, Mali, Burkina Faso and Niger.The students will enrol in the Improved MSc in Cultivar Development for Africa (IMCDA) programme which has a revised practical training and internship approach to enable students to be more productive and useful to the private and public sectors.

Farmers Planting Seeds

Serving Farmers: Reasons to Optimize Day Old Chick Quality to Stimulate Higher Poultry Business

The quality of day old chicks is the main cornerstone of the poultry production chain, besides feed. Research into optimising the quality of day-old chicks in order to stimulate higher poultry business has been conducted at the Department of Animal Science. A study was conducted using locally hatched as well as imported broilers from day one to 21 days after hatch. In two separate experiments 25 chicks from broilers were analysed each week for three weeks and their physical development, haematological, immunological, histological and bacteriological indices measured to evaluate chick quality and suitability for survival during broiler production which is usually between 6 to 8 weeks post -hatching.



Flow of Hatchery Activities and Chick Quality Indication

It was observed that in comparing local broiler day old chicks (Lbdoc) to foreign broiler day old chicks (Fbdoc), the live weight of the Fbdoc were higher than the Lbdoc on day one. The same result was also observed on days 14

and 21. The chick length and shank length of the Fbdoc were also higher than that of the Lbdoc chicks. The navel score, or how large the navel opening was which could allow entry of bacteria to cause disease and consequently increase early chick mortality was graded better in the Fbdoc. The resultant poor navel condition of the local day old chicks also impacted negatively on the internal organ quality and the absorption of nutrients during incubation, which may have caused lower body weight. Also, haematological and immunological analysis showed higher red blood cell and white blood cells counts in the local day old chicks on days seven and twenty-one, an additional evidence that the local chicks may have compromised immunity more than the foreign hatched day-old chicks. On the ability to control disease, the local day old chicks showed indications of higher bacteria load but lower competence to fight. E. coli bacteria were isolated on day 21 in both local and foreign chicks, but in the local chicks, Proteus and Streptococcus sp were also isolated. The results of our study confirm the perennial problem with day-old chick quality from local hatcheries, emphasizing the urgent need to optimise chick quality and revamp the hatchery and the entire poultry industry in Ghana. Fortunately, KNUST has built the research capacity and experience in hatchery and poultry embryology, and is willing to work with the relevant stakeholders in addressing these problems. This project was undertaken by **Dr. Jacob Hamidu** and **Ms. Priscilla Pomaa Yeboah.**

Excellence in Higher Education for Liberian Development (EHELD)

The Research Triangle Institute (RTI) International, North Carolina USA, is collaborating with University of Michigan, Rutgers University, North Carolina State University, KNUST and Associates in Rural Development to work on the project "Excellence in Higher Education for Liberian Development (EHELD)" The project is funded by the United State Agency for International Development (USAID) with US$18.5 million (Eighteen Million, Five Hundred Thousand US Dollars) fund. The project started in 2011 and will end in 2017. The team members working on the project are Prof. J. Simons (Rutgers University), **Dr. Rodolfo Juliani** (Rutgers University), **Prof. Balaguru, Prof. David Jordan** and **Prof. Peter Donkor** (KNUST).

The project is assisting Liberia in equipping its young women and men for professional careers as leaders, managers, extension agents, researchers and small business owners in agriculture and engineering. It is also strengthening the capacity of faculty at Cuttington University and University of Liberia.

The expected outcomes are to establish and support centres of excellence in Agriculture and Engineering at Cuttington University and University of Liberia to enable the institutions to be more responsive to current and future workforce demand in the private, (NGOs) and public sectors.

The project is also establishing green house facilities at Cuttington University and University of Liberia. It will also install solar panel systems to offset each University's dependence on fossil fuel and also serve as a teaching tool for students, teachers and staff. The project has so far, rehabilitated classrooms and labs at Cuttington University and University of Liberia. Students and lecturers have been supported to participate in exchange programmes with the University of Michigan (UM), North Carolina State University (NCSU), KNUST, and other U.S universities. 20 Liberian students have also enrolled for various post graduate programmes at KNUST for the past four (4) years.

Fish Farm

Following the commercialisation of its ponds in 2011, the Department of Fisheries and Watershed Management developed a market in order to generate income to maintain facilities in addition to serving as a training and research facility. The farm, in the period from June 2014 to November 2015, generated GHC 25,000 from the sale of tilapia and catfish to the university community and the general public.

The Department constructed 15 additional ponds (15m x10m) for students' research and practical training in 2015. This has increased the total pond area at the farm to 8,350m^2. The ponds are normally fed with spring or rain water. However, two boreholes have recently been sunk to provide water during the dry season. Owing to the year-round availability of water, the farm is able to undertake two production cycles annually. The two main species of cultured fish are *Oreochromis niloticus* (Tilapia) and *Clarias gariepinus* (catfish). During production, ponds are fertilised optimally and feed applied between 50 to 75% of the recommended rate to reduce production cost.

Another strategy used to reduce the demand for water for pond filling, and to cut down on the volume of effluents discharged is water re-use. This is where water used to fill the ponds are recycled once to grow fish before being discharged. Presently, pond effluents and sediments are being recycled to grow vegetables according to best management practices where vegetable production is integrated with fish farming to reduce fertiliser use.

The fish farm, located on KNUST campus near the waste treatment plant, started modestly in the early 1980's with two mechanically constructed ponds. Subsequently, 13 manually constructed ponds were added between 1987 and 1988. The farm was established with the core objective of providing practical training to graduate and undergraduate students. The farm, until October 2015, had 15 earthen ponds (total pond area of 6,100m^2) of varying sizes. Four

of them are 900m^2 each, three are 300m^2 each and eight are 200m^2 each. A farmhouse – brick structure – was later constructed through European Union funding facilitated through a UK volunteer, the late **Chris Morrice**, who served at the Institute of Renewable Natural Resources in 1988. The farm house has a wetlab and storerooms for feed and equipment and a washroom facility.

Currently, there are twelve 1m^3 (1m x 1m x 1m) cages for fish production in one of the deepest ponds at the farm to help train students in cage culture. Through its collaboration with the USAID-funded AquaFish Innovation Lab (formerly, AquaFish CRSP) the wetlab has been equipped for cutting-edge research in water quality, fish nutrition, climate change, fish genetics etc. and enhanced students training. The Department has recently received a container-based fish digestibility facility through its collaboration with the Danish Technical University (DTU Aqua) under the DANIDA-funded project 'Sustainable Fish Feed Project'. There is also an on-going collaboration with Oregon State University on research in solar-powered and affordable aerators suitable for increasing production levels in ponds. Prototypes are being tested on the farm. Through collaborations with AquaFish Innovative Lab and BSU outreach, the department has held several outreach programmes aimed at strengthening the capacity of fish farmers around Ghana to increase their production levels and maximise profit. All these facilities have immensely improved undergraduate and postgraduate training and research.

CONFERENCES

International Conference on Animal Nutrition

A 2-day International Conference on animal nutrition was held on the theme, "Agro By-products in Animal Feed Production in West Africa" from the 8th to 9th August, 2016. The Conference was organised to bring together knowledge, information and data on agro by-products for dissemination across the sub-region for a holistic approach to identifying options for optimising animal protein production.

The conference is part of the Fish Feed Project (13-PO1-GHA) aimed at improving aquaculture in Ghana by producing cost effective fish feed using agro-products. The project tackles two main bottlenecks to aquaculture production: high cost of feed and environmental impact of high protein feeds.

Aquaculture is a priority in Ghana's economic development agenda, since it is a major source of protein. A national policy on aquaculture was adopted in July 2013 with the objective of increasing aquaculture production from the current 13, 000 tons to 40, 000 tons by 2018. As a result of the prohibitive cost and limited availability of fishmeal-there is the need to develop suitably complete and supplementary diets using locally available plant by-products for the fish farmers in Ghana for use in grow-out facilities. Surveys conducted suggest that Ghana has sufficient agro-products, particularly oilseed cake resources to satisfy current and future demands from aquaculture.

In attendance was **Prof. Richard Akromah**, Provost of CANR, **Prof. Steve Amisah**, KNUST, **Prof. Oyedapo Fagbenro**, Federal University of Technology, Nigeria, who was also the keynote speaker, and other faculty members of KNUST.

Prof. Oyedapo Fagbenro Giving Key Note Address

List of Active External Grants in (CANR)

No.	Name of Project	Principal Investigator	Department	Funder	Amount	Period
1	N2 Africa Phase II	Prof. R.C Abaidoo	Crop and Soil Science	The International Institute of Tropical Agriculture (IITA)	$ 18,618.50	2014 - 2018
2	BSU Phase II	Prof. R.C Abaidoo	Provost's Office	DANIDA	$ 1,500,000.00	2014 - 2016
3	Root & Tuber Project	Dr. Robert Aidoo	Agricultural Economics, Agribusiness and Extension	DANIDA	$ 246,405.38	2013 - 2016
4	University Of Arkansas Pine Bluff (UAPB PROJECT)	Dr. Regina Edziyie	Fisheries and Watershed	USAID AQUAFISH INNOVATION	$ 31,830.00	2014 - 2016
5	Food Policy Project	Dr. Ohene Yankyera	Agricultural Economics, Agribusiness and Extension	International Food Policy Research Institute in Washington DC.	$ 14,960.00	2012 - 2014
6	Alliance For Food Security	Dr. Enoch Osekere	Crop and Soil Science	USAID, Oklahoma State	$ 5,370.37	2014 - 2018
7	Smallholder Agricultural Productivity Enhancement And Commercialisation (SAPEC)	Dr. Charles Kwoseh	Crop and Soil Science	African Development Bank through Liberia	$ 67,120.00	2014 - 2016
8	Enhancing Soil Health in Northern Ghana: Inoculants Production, Distribution and Utilization through Private-Public Partnerships	Prof. R.C Abaidoo	Crop and Soil Science	CSIR-SARI	$ 100,710.54	2014 - 2017
9	Excellence in higher Education for Liberian development (EHELD)	Prof. A. Donkor	Animal Science	USAID	US $ 18,500,000.00	2011 - 2017
10	Soils of Forest Island in Africa	Dr. Vincent Logah	Crop and Soil Science	Imperial College, UK	£ 1,132,162.00	2015 - 2020
11	Mineralogical and Climatic Controls on Soil Carbon Stocks in West Africa	Dr. Vincent Logah	Crop and Soil Science	The Royal Society, UK	£18,640.00	2016 - 2019
12	Improved MSc in Cultivar Development in Africa	Prof. Richard Akromah	Crop and Soil Science	Alliance for Green Revolution in Africa (AGRA)	$2,670,000.00	2014 -2019
13	Development of Innovative Project-Based mode and modules to train dairy producers processors in Ghana	Prof. E. L. K. Osafo	Animal Science	Council for Technical and Vocational Education and Training (COTVET)	GHC 1,000,000.00	2016

COLLEGE OF ART AND BUILT ENVIRONMENT

Promoting the Digital Painting Technology in Art Institutions in Ghana

Even though computer art dates back to the 1960s, digital painting has not gained popularity both in academia and in practice in Ghana in spite of the popularity of virtual art galleries on the world wide web (www) as well as some international museums displaying outstanding digital paintings. **Dr. Godfred Annum's** exploration of the computer as a tool for painterly expression was prompted by his quest to demonstrate his capabilities for creating fascinating paintings, comparable to works resulting from traditional easel painting modes. It was a mission to contest the notion that digital painting, as it is generically termed, is just a technological craft that is generated from the computer for commercial considerations. It was also aimed at proving the view held by sceptics that digital painting technology only generates digital graphical images which are superficial, without depth and of limited artistic value wrong. Dr. Annum, through this study seeks primarily to dispute the argument that digital painting lacks innovation and quality and can therefore not be given a place in the fine arts.

His exploration led to the introduction of Digital Painting as a course of study in the Department of Painting and Sculpture at KNUST in 2005 to help foster computer literacy among fine art students and impart the skill for creative digital painting practice. His digital painting exposition in 2014 under the curatorship of Alliance Francáis in Kumasi was the first of its kind by any academically trained fine artist in Ghana. His exciting exposition was aimed at inspiring public acceptance of digital painting and to advocate the adoption of this technology to complement existing traditional modes of fine art painting in art academies, and among painting practitioners in Ghana.

His digital painting style is the result of the combination of two of the major computer art techniques: '*Digital Photo-art*' and '*Traditional Digital Painting*'. He employs Adobe Photoshop's painting and filtration tools and the use of the computer mouse to apply virtual colours to render and capture moods in fascinating colour schemes with the same dexterity as he handles traditional studio painting applicators. His painterly effects, which he classifies as *colouristic impressionism*, depict non-stereotyped painting styles that show complete deviation from the photo enhancement strategies often associated with most digital painters. Through this course, KNUST has been churning out fine art graduates with digital painting skills to meet the creative and aesthetic needs of society.

Digital Painting

Effective Collaboration Between Academia and Large-Scale Clothing & Textile Industries: Its Impact on Curriculum Development

The vision of this research was to conduct an in-depth study into the curricula of tertiary academic institutions offering Clothing and Textile as a course of study, to ascertain whether or not their curricula meet the demands of and are in sync with what large scale textile industries are doing. Again it was to explore how effectively academia could collaborate with large-scale clothing and textile industries. It is envisaged that effective collaboration of academia and industry will bring about sustainability to minimise unemployment in the textile sub-sector.

Industries are looking up to students from academic institutions to contribute to higher job efficiency and productivity in terms of ability and skills to work. There is the need therefore to identify and bridge the gap between the practice in industry, and training in academia. Technology keeps changing and academic institutions do not have all the necessary machines and equipment for training students. Therefore, there is the need for a strong industry and academia collaboration.

Manual Printing of Fabric

The study examines the relevance of the curricula of selected clothing and textile institutions in Ghana, vis-a-vis the production operations of selected large–scale clothing and textile industries, and explores the challenges to effective collaboration between large–scale clothing and textile industries and academia.

Manual Screen Coating

The study shows that the respondents largely deem the curricula of the Clothing and Textile institutions selected for the study to be relevant to the industry. The respondents also think that the curricula studied would require updates to make them responsive to contemporary needs of the industry. Respondents mentioned a few relevant skills that are needed in the industry. These competencies would need to be integrated into the curricula and training of Clothing and Textile students.

Industrial Screen Coating Machine

Again, the study shows that industrial attachment or internship constitutes the main fulcrum around which collaboration between Clothing and Textile institutions and industries revolve. Existing cordial relationship between the two bodies, during the industrial attachment period, constitutes a spring-board for further strengthened collaborative efforts that would ensure active involvement of industry in many areas of students training. The study was undertaken by **Mr. Joseph Osei** with **Dr. P. Osei-Poku** and **Dr. E. Kofi Howard** as supervisors.

5-STAR STREET Project

The issue of environmental sanitation in the major cities of Ghana (especially Kumasi) has reached such an alarming situation, with its related health, environmental and economic implications. The managers of the city have tried all means of maintaining a clean environment. Recent efforts of "National Sanitation Day" have achieved some level of success but the task seems to be daunting and is threatened by unsustainability. One of the main reasons for this challenging situation stems from the attitude of the citizens, who seem unable to change their behaviour, and appears to be ineffective especially in the context of some underserved areas such as the Zongo communities. It is against this background that the Department of Communication Design, led by **Dr. Edward Appiah** and **Mr. Patrick Gyamfi,** an MPhil Communication Design student, is piloting a project dubbed: "5-Star Street Project" through a design thinking approach with inhabitants of Moshie Zongo, a Muslim community in Kumasi. The aim of this project is to use participatory design-thinking approach within the ambits of Design for Social Innovation, in having a sustainably clean environment, by co-designing and co-creating with the community - as a way of changing the mind-set and behaviour of the citizens to create a sustainably clean environment. This will mean:

- Obtaining a deeper and clearer understanding of the factors influencing how the citizens and residents behaving the way they do; and
- Identifying and exploring views on the problems/ challenges and the potential benefits concerning the development of design-thinking approach for Social Innovation;

The research also seeks to explore the role of the design approach in stimulating and supporting sustainable environmental sanitation by optimistically changing the behaviour of inhabitants. Since there are no judgments in design thinking, it eliminates the fear of failure and encourages maximum input and participation by all stakeholders. The intervention code-named "5-Star Street Project" draws on the motivation of awarding each street with a star, which will be tagged to the street's name after fulfilling basic sanitation and environmental instructions.

Team meeting

A 3-Star Street will imply such a street where residents and all users on that street, are more environmental and sanitation conscious than a 1-Star Street. It will also mean a 3-Star Street is much superior to a 1-Star or no-star street. A 5-Star Street will seem to be above all standards, and hence, have an ultimate superiority tag. Currently, residents through their community leaders, have established major rubrics through which two streets have been earmarked and will be awarded various star-rated performances. Residents in this case are therefore responding to consistent and conscious efforts to maintain the status of their streets since there is a probability of a 4-Star Street being downgraded or elevated. The design intervention is grounded on the premise that residents take a more responsible and accountable approach to decision-making processes. Taking a 'whole life cycle approach' (how materials are specified and products are disposed of at the

end of their use) and a 'cradle to cradle' approach (where economic, societal and environmental benefits are designed into the product-service system) ensuring the benefits are demonstrated in the bottom line – helping to re-address the common perception of 'sustainable = expensive'. This can contribute to raising awareness about 'design equity'; (how design can add value in its own right) and stimulating debate about the relationship between design equity and brand equity of a named street (a measurement system that is already familiar to the world of business).

Towards the Development of Tender Price Indices for the Construction Industry of Ghana

Dr. Theophilus Adjei-Kumi self-funded the project titled, "Towards the Development of Tender Price Indices for the Construction Industry of Ghana". With an amount of about Gh¢65,000.00 (Sixty-Five Thousand Ghana Cedis), he is working with **Mr. Ernest Kissi** and **Prof. Edward Badu** to develop tender prices for effective cost planning in the construction industry in Ghana.

It is envisaged that at the end of the project, the team would come out with publishable tender price indices, which would provide the basis for planning the cost of future infrastructural projects based on historical cost information.

The project which will run for three years is currently at the data collection stage.

Controlling Rising Damp in New Buildings: Field Trials of Proposed Treatment Methods

A study aimed at exploring more effective treatment methods to control the problem of rising dampness in buildings, through field trials is being implemented. The study is being conducted by a team of researchers led by **Professor Joshua Ayarkwa**, Department of Building Technology; **Dr. Christian Koranteng,** Department of Architecture with **Dr. Kofi Agyekum,** from the Department of Building Technology.

Ghana, a tropical country characterised by high rainfall with relatively high temperatures, experiences dampness in many public and private buildings. Investigations and field surveys conducted on buildings have revealed that the problem of rising damp has assumed an alarming dimension in residential buildings in Ghana, as it affects one out of every ten residential buildings. Despite the several methods proposed to control the problem of rising dampness, its removal from both historic and modern types of buildings still remains extremely challenging. This has led to the adoption of various control methods such as the construction of aprons around wall bases, tiling of wall bases and re-plastering the affected areas. The significance of the problem is also reflected in the diversity of products on both local and international markets to deal with the problem. This diversity and the scarce and fragmented scientific information on the effectiveness of such methods have become very difficult for professionals working in the field to choose suitable interventions to deal with instances of rising dampness.

An experimental approach was employed. Fourteen prototype walls (test walls) made up of seven standard manufactured sandcrete block walls (SB) and seven commercially manufactured sandcrete block walls (CB) were constructed, conditioned and subjected to various treatments and monitored for a period of 10 months (300 days). The monitoring was carried out with reference to the two major seasons in Ghana: the rainy and dry seasons. The findings from the study revealed that as at the time of monitoring, although all the treatments applied were performing well, the damp-proof coatings applied to treat the walls, together with the dense concrete base walls were performing better than those treated with the polyethylene damp-proof courses. The monitoring is still on-going and it is hoped that after a given period of time, detailed conclusions could be drawn and more reliable recommendations made to educate professionals and the public on how to control this worldwide problem.

CENTRE FOR SETTLEMENT STUDIES

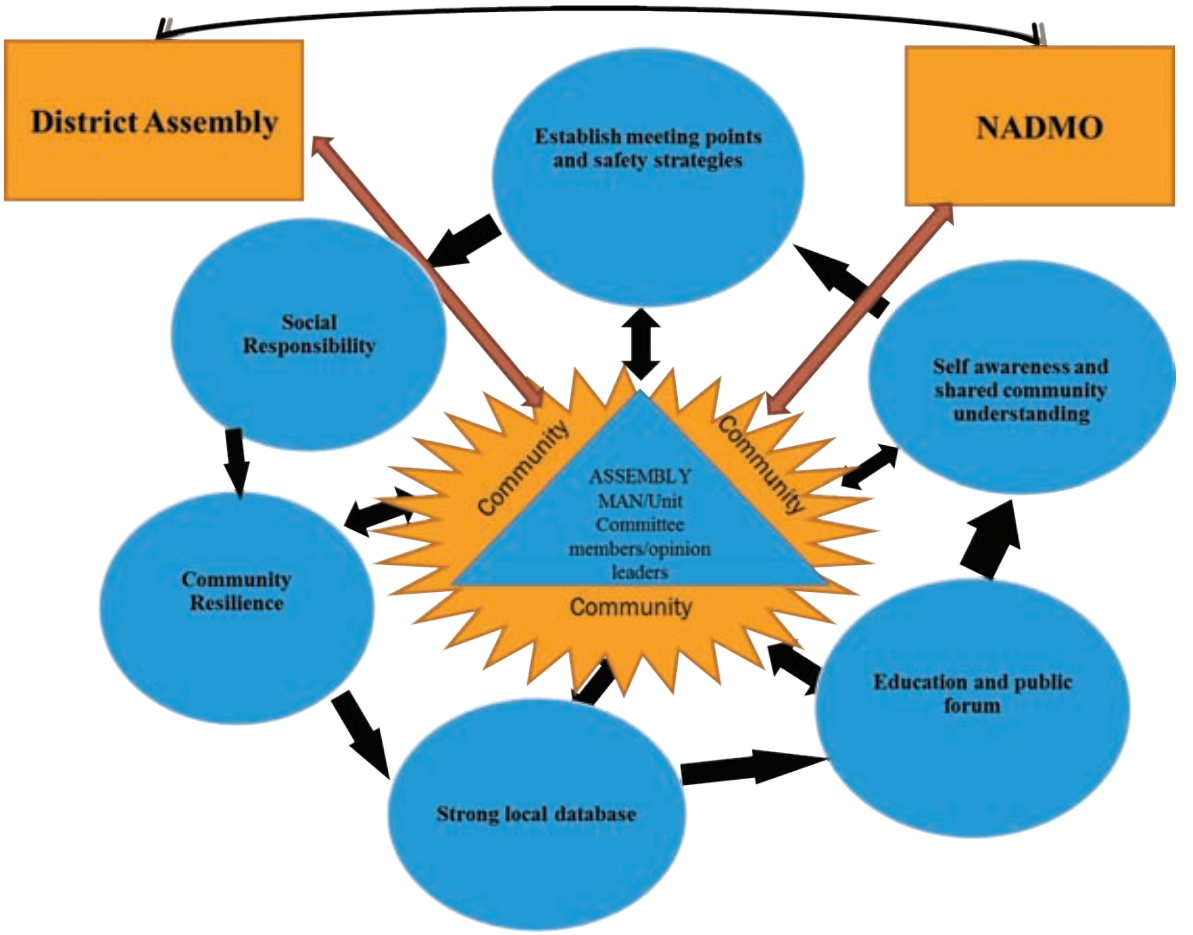
Flood Risk Perception, Coping and Management in two Vulnerable Communities in Kumasi, Ghana

Flood hazards are expected to increase as a result of climate change, urbanization and increasing human activities. Moreover, developing countries such as Ghana are at more risk and require robust integrated flood risk management approach focusing on building resilient communities.

It is against this background that **Dr. Divine K. Ahadzie,** Centre for Settlements Studies and his team members report on the findings of Focus Groups Discussions (FDGs) of two high risk communities; Sepe-Buokrom and Atonsu Ahinsan, in Kumasi, Ghana to establish their preparedness to deal with floods through community initiatives. The findings suggest that the two urban communities are aware they are at high risk to flooding and live in a constant state of anxiety during the wet seasons. However, there is no evidence of any systematic coping and management strategies and the communities feel there is nothing they can do without government support.

The project started in from November 2015 and with in April 2016, with an amount of US$ 5,200.00 (Five Thousand, Two Hundred US Dollars) from Engineering and the Built

Environment, Birmingham City University, UK. The research projected that government should use the leverage of the local government system especially the institution of the locally elected representatives (assemblymen) to help engender a stronger sense of community empowerment and involvement towards building resilient communities that can respond to flooding through perceptions, social responsibility and appropriate public relation models. A community-based framework was proposed as shown in the diagram. This is to be used as the Centre's outreach and community development projects.



Community Based Framework for Flood Risk Management

Transactions in Land Acquisition for Self-Build House projects in Ghana: Frustrations of the Vulnerable/Low Income Earners in Peri-Urban Kumasi.

The problems of land acquisition for infrastructural development in Ghana is an enigma. Despite several local and international initiatives to help stem the tide, little progress has been made, with numerous problematic cases often reported in literature. However, many of the reported cases are skewed towards high profile developers who often have the resources to fight for their rights legally. Moreover, high profile developers often have the support systems to deal with the traumas that follow. Contextually, literature is silent on the cases of vulnerable individuals both theoretical and empirically thus diminishing the impact of the challenges they face and hence strategies for specific market information and management assistance.

Dr. Divine K. Ahadzie from the Centre for Settlements Studies as the lead researcher on the project and his team members address this lacuna by exposing how vulnerable groups are frustrated in their attempt to acquire land for self-built houses. Using case studies, the findings reveal a telling insight of deliberate total disregard for the feelings of the vulnerable as victims by landowners acting with impunity because of allegiance to traditional so-called "divine right" of the chieftaincy regime in Ghana. The study recommends the need for the Government of Ghana, as a matter of urgency, to re-examine the legal, administrative and market information regime relating to customary land management practices targeting specific and appropriate support systems for the vulnerable and low-income earners.

This project was a cost shared agreement of an amount of US$ 4,300.00 (Four Thousand, Three Hundred US Dollars) between the Centre for Settlement Studies and African Urban Research Initiative (AURI) which started from April 2015 to March 2016.

This research has been adopted and will be published in a special edition of AURI publication. Following this publication, this research has been expanded and is currently being undertaken as an MPhil programme in the Urban Management Studies run by the Centre for Settlements Studies and Department of Planning.

Prototype of Burglar-Proof Louvre Window with Opening for Means of Escape in Case of Emergency

According to Clause 90 of the National Building Regulations LI 1630 (1996), all buildings including residential buildings should have at least one emergency exit apart from openings created in doorways so that occupants can escape in the event of fire. However, for many decades, the traditional burglar-proof louvre framed window which is very popular in house building in this country has no opening as a means of escape and thus violates the tenets of the Building Regulations and also the safety of occupants.

It is against this background that **Dr. Divine K. Ahadzie** and **Mr. Henry Boafo**, Centre for Settlements Studies, developed an innovative prototype window over the traditional burglar proof louvre framed window which for a long time has had the problem of the lack of opportunity for means of escape.

With this innovation as shown in the picture, home owners who want to rely on the traditional burglar proof window should now heave a sigh of relief that they now have means of escape in the case of emergencies especially fire.

This project was undertaken within the period August 2016 to February 2017 with an amount of GH¢ 2,000.00 (Two Thousand Ghana Cedis) from Internally Generated Fund of the Centre for Settlements Studies. A prototype of the project is out and currently being exhibited to bring this design to the public domain.

Burglar Proof Louvre

Climate Change Implications of the Dependence on Air Conditioning for Cooling Buildings: Empirical Evaluation of Public Buildings.

Given the adoption of the Sustainable Development Goals (SDGs) by the United Nations September 2015, there is the urgent need to accelerate the promotion of climate change adaptation measures in urban areas in low- and middle- income nations. These nations have most of the world's urban population, most of the high-risk urban sites and the largest deficiencies in adaptive capacity, and therefore the most vulnerable to climate change. Indeed, low - and middle-income nations now have three-quarters of the world's urban population and they suffer from all problems of urbanisation such as exclusiveness, informality, flooding, insecurity, unemployment, among others. This calls for an urgent need to rethink the way resources are used including energy use for the African urban agenda.

Dr. Rudith King and Dr. Divine Ahadzie both of the Centre for Settlement Studies and their team focus on contributing to addressing the three SDG goals (Goals 7, 11 and 13) relating to efficient energy use in buildings by addressing issues related to efficient building designs that can minimise excessive reliance on air conditioners. Rethinking building and urban designs therefore should be able to address questions like how buildings can be designed to make them cooler in view of climate change by reducing the tarmacs and concrete floors and how buildings can be designed to reduce the over-reliance on air conditioning for indoor cooling.

This research project is expected to produce a policy a document on efficient energy use in educational buildings for Ghana. Lessons learnt from this study will be expanded to a large scale nation-wide study towards engendering a holistic energy policy for infrastructure development in the country. It is expected to begin from December 2016 to June 2017. A total amount of GH¢35,000.00 (Thirty-Five Thousand Ghana Cedis) was secured from the Energy Commission Ghana for this project.

List of Active External Grants in CABE

No.	Name of Project	Principal Investigator	Department	Funder	Amount	Period
1	Architecture and Planning in the Tropics: From Imperial Gold Coast to tropical Ghana (International Partnership and Mobility 2015)	Dr. Rexford Asassie	Department of Architecture	British Academy	€ 29,620.00	2015 - 2018
2	Flood Risk Perception, Coping and Management in two Vulnerable Communities in Kumasi, Ghana	Dr. Divine K. Ahadzie	Centre for Settlement Studies	Engineering and the Built Environment, Birmingham City University, UK	US$ 5,200.00	2015 - 2016
3	Transactions in Land Acquisition for self-build House projects in Ghana: Frustrations of the vulnerable/low income Earners in Peri-Urban Kumasi.	Dr. Divine K. Ahadzie	Centre for Settlement Studies	African Urban Research Initiative (AURI)	US$ 4,300.00	2015 -2016
4	Climate Change Implications of the Dependence on Air Conditioning for Cooling Buildings: Emperical Evaluation of Public Buildings.	Dr. Rudith King	Centre for Settlement Studies	Energy Commission, Ghana	GHS 35,000.00	2016- 2017

COLLEGE OF ENGINEERING

An Optimization Model for Sizing Rainwater Harvesting Tanks

Dr. Emmanuel A. Donkor of the Department of Civil Engineering, together with his project students, have undertaken a project on "Optimization Model for Sizing Rainwater Harvesting Tanks". This project was solely funded by Dr. Donkor and was implemented between February and June 2016. The aim of the project was to develop a spreadsheet model that could be used to determine the optimal storage tank required for harvesting rain for domestic water supply purposes.

The project has been completed and the developed model is to be used to improve household decision-making on sizing rainwater harvesting tanks.

Optimal Number and Location of Fire Stations in the Regional Capitals of Ghana

Dr. Emmanuel A. Donkor of the Department of Civil Engineering and his project students are researching into "Optimal Number and Location of Fire Stations in the Regional Capitals of Ghana".

The project is to evaluate whether the fire stations in the major cities in Ghana are optimally located. Specifically, the research is to determine the percentage coverage by existing number of service locations, as well as create a model to be used to determine the required number and locations that will provide 100% coverage. The outcome of the research will improve fire coverage and reduction of fire losses/fatalities.

The project period was from February 2016 to June 2016. So far, the main study of the project has been completed with an outreach yet to be organised. The technical report is yet

to be completed and launched. A workshop to disseminate results of the study to Metropolitan District Assemblies (MDAs) and the National Fire Service would also be organised.

Time Series Forecasting of Monthly Water Supply Data for the Ghanaian Drinking Water Industry

Dr. Emmanuel A. Donkor of the Department of Civil Engineering with his project students undertook a project on "Time Series Forecasting of Monthly Water Supply Data for the Ghanaian Drinking Water Industry".

Collaborating with over 20 selected small town water systems in Ghana and the Ghana Water Company Limited, the project sought to determine the water supply variables that would help water systems forecast. The project would also determine the forecasting method(s) used by utility managers and how reliable the methods have been. In addition, the project would also develop a forecasting model that each system can use to improve system management.

The project was scheduled for February 2016 to June 2016. So far, the main study has been completed with the technical report yet to be completed and launched.

The results are intended to be published in a technical report for the benefit of the drinking water systems industry in Ghana. The project outcome is to improve the forecasting ability of drinking water systems for better system management.

Clean Cooking and Air Pollution

Mr. Michael Commeh of the Technology Consultancy Centre (TCC), is the lead researcher in the "Clean Cooking and Air Pollution" project. The project is funded by Rayben, Commeh & Associates Diagnostic Centre with an amount of GH¢ 10.000 (Ten Thousand Ghana Cedis) for one year. The project aims to detect the effect of smoke in the bloodstream of women processing palm kernel oil and replace the polluting, inefficient stoves with efficient ones. The team will also measure smoke levels, fuel reduction, etc.

So far, air pollution measurement and blood analyses have been done. Clean and efficient stoves are also being built.

The overall outcomes of the project would be to lessen smoke in the bloodstreams of women processing palm kernel oil, and to give them clean air to breathe during the processing stages. The project would also reduce the amount of fuel used during processing and reduce the amount of smoke that goes into the oil, thereby improving its taste. The women will also gain additional income through the use of the new product.

Mr. Michael Commeh and his team have estimated that about GH¢ 25,000 would be needed to finish the entire project.

A Woman Using Institutional Cookstove for Cooking

Propagation Path Loss Modelling for 4G-WiMAX Networks in Ghana

With a grant of GH¢ 10,000.00, (Ten Thousand Ghana Cedis) the MTN-KNUST Innovation Fund Research Initiative has initiated a project titled "Propagation Path Loss Modelling for 4G-WiMAX Networks in Ghana". **Dr. Eric Tutu Tchao** with **Dr. Griffith Selorm Klogo** of the Computer Engineering Department and **Mr Kwame Agyeman-Prempeh Agyekum** of the Telecommunications Department is undertaking this project.

The project aims to conduct a coverage analysis and field trial measurement of a fourth generation worldwide interoperability for microwave access (4G-WiMAX) networks in Ghana. The general objective of this research is to correct and model offset values for Hata-Okumura models used in planning high capacity 4G networks in Ghana. The specific research objectives for this study are:

- To model the propagation environment for accurate estimation of pathloss values for the peculiar Ghanaian terrain profiles. The results will serve as a model for planning future network expansions.

- To provide indicative performance comparison of measured network parameter (pathloss) values in outdoor environments with the simulated results.
- Adopt appropriate algorithms and error estimators to find a fitting parameter to correct and find offset values for the Hata-Okumura model.

It is hoped that the findings from this research would result in possible correction of parameters that may be used in achieving a better fit to optimize propagation pathloss models for WiMAX networks in Ghana. Since the underlying technologies of internet protocol (IP) based broadband wireless networks (LTE, WiMAX, 5G) are similar, an optimized pathloss model will help immensely in future deployments of communication networks with improved network performance in Ghana. Furthermore, results from the measurements might form the basis for developing a network planning tool for our peculiar environment.

The project period is from April 2016 to December 2016. So far, the analytical evaluation which would serve as a basis for the propagation field trial measurements has been completed with the field trial measurements in the deployed data-centric WiMAX networks in urban and sub-urban environments are currently ongoing.

The Regional Water and Environmental Sanitation Centre, Kumasi (RWESCK)

Launching of workshop

RWESCK was established to address the developmental challenges highlighted in the Africa Water Vision 2025, and the Sustainable Development Goals in order to build quality human resource capacity in Ghana and the West African sub-region. Its establishment was made possible through a loan facility from the World Bank to the government of Ghana under the African Centres of Excellence (ACE) programme.

The Centre sets out to solve the challenges of inadequate toilet facilities and low coverage of potable water supply in rural communities, low human resource capacities in the water supply and environmental sanitation sector and limited opportunities for postgraduate research, training and academic work. The Centre also offers short courses in environmental sanitation.

Under the initiative of RWESCK, 230 Masters and 15 PhD students have been trained. Since 2015, 20 PhD students comprising 6 females, 14 males and two regional students have been enrolled. Prof. Samuel Nii Odai is the director of the Centre and it is being hosted by the Department of Civil Engineering at the College of Engineering.

ENERGY CENTER

Potential of Distributed Grid-Connected Solar Photovoltaic (PV) Systems in Rural Electrification in Africa

The African Union (AU) is funding the project "Potential of Distributed Grid-Connected Solar Photovoltaic (PV) Systems in Rural Electrification in Africa" with **Mr. Emmanuel Kweku Anto** from the Department of Electrical and Electronics Engineering as the principal investigator. The team is working with University of Botswana and University of Flensperg, Germany to demonstrate the potential of distributed grid-connected solar PV systems in rural electrification schemes/ projects for improved affordability and sustainable energy access. They are also investigating the engineering challenges associated with distributed grid-connected solar PV systems in rural Africa as well as determining the conditions under which distributed grid-connected solar PV systems can be economically attractive to both system operators and rural electricity consumers.

The project period is four years – from March 2012 to March 2017 – with an overall funding of €934,056.60 (Nine Hundred and Thirty-Four Thousand, Fifty-Six Euros and Sixty Cents), out of which KNUST would receive €186,811.30 (One Hundred and Eighty-Six Thousand, Eight Hundred and Eleven Euros, Thirty Cents). The project is ongoing and the grid solar system is now connected to the grid at Walewale. The project has the potential for GHG mitigation and the distributed solar-PV has potential for rural electrification in Ghana if the solar PV system costs below US$3/Wp.

Consolidation of the ECOWREX GIS over ECOWAS Member States / Development of Energy Access Maps

KNUST is collaborating with the ECOWAS Regional Centre for Renewable Energy and Energy Efficiency (ECREEE), NOVELTIS S.A.S, University of Geneva and the Ministry of Energy, Cape Verde on the project titled "Consolidation of the ECOWREX GIS over ECOWAS Member States / Development of Energy Access Maps". The EU-ACP Commission (EDULINK) through

ECREEE, is funding the project with €1,090,878.71 (One Million and Ninety Thousand, Eight Hundred and Seventy-Eight Euros, Seventy-One Cents), with KNUST expecting € 40,600.00 (Fourty Thousand, Six Hundred Euros) for a two-year period, from April 2014 to August 2016. The Principal Investigator is **Mr. Daniel Kwame Ladzagla** of the Energy Centre.

The objective of the project is to develop energy access maps on the model of the "GEAR GIS toolkit" to help identify the gaps and cost effective technologies for improving energy access in the ECOWAS region. The first part of the work which involves the use of ESRI'S ArcGIS platform and techniques to access and manipulate primary data from ECOWAS member states has been completed.

Biofuel Production from Lignocellulosic Material (2GBIONR G Project)

To develop sustainable technologies for the production of second generation biofuels (biogas, bioethanol and biodiesel) from lignocellulosic waste material in developing countries in Africa, **Dr. Francis Kemausuor** in collaboration with three institutions undertook this project titled "Biofuel Production from Lignocellulosic Material (2GBIONRG Project)".

The three institutions are Technical University of Denmark (DTU), Centre for Scientific and Industrial Research, Ghana and Zoomlion Ghana Limited with funding of DKK 507,589 (about 68,000 Euros) from DANIDA.

The project began in June 2011 and ran for 4 years. So far, some of the PhD students have completed their research and the others are still on the programme.

Utilising Renewable Energy to Improve Rural Livelihoods through Energy Efficient Rural Food Processing

Utilising Renewable Energy to Improve Rural Livelihoods through Energy Efficient Rural Food Processing is a project funded by the University of Newcastle. The project ran for 36 months, from June 2013 to May 2016. The overall cost of the project was €824,069.00 (Eight Hundred and Twenty-Four Thousand and Sixty-Nine Euros) out of which KNUST received €73,720.00 (Seventy Three Thousand, Seven Hundred and Twenty Euros).

The project was in collaboration with Njala University, Sierra Leone; Jomo Kenyatta University of Agriculture and Technology, Kenya; Stellenbosch University, South Africa; Kassel University, Kassel, Germany; Practical Action Consulting Limited, Bourton-on-Dunsmore, Rugby, Warwickshire and Environmental Foundation for Africa, Freetown Peninsula, Sierra Leone.

The project is aimed to provide research which would support rural community business models for low and renewable energy input into optimised food processing which would minimise loss and waste in the food value chains selected. So far, the construction of a two-tonne solar-biomass-assisted maize dryer at Ejura has been completed and. The researchers will investigate the opportunities and barriers to the use of renewable energy for rural food processing as well as optimisation of the processes and explore the opportunities for rural livelihoods in reducing post-harvest losses.

Dr. Lena D. Mensah of the Department. of Mechanical Engineering together with J. O. Akowuah of the Dept. of Agricultural Engineering undertook this project.

Promoting Renewable Energies in West Africa by Knowledge Exchange with Interactive Online Map.

"Promoting Renewable Energies in West Africa by Knowledge Exchange with Interactive Online Map" is a project initiated by the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) in collaboration with Verein repowermap.org, Neufeldstrasse 21, 3012 Berne, Switzerland and 2iE, Burkina Faso. The project, funded with a total amount of €37,653.00 (Thirty Seven Thousand, Six Hundred and Fifty-Three Euros), will run for 6 months with KNUST receiving €7,149.50 (Seven Thousand, One Hundred and Forty-Nine Euros and Fifty Cents).

The objective of the project is to promote the use of renewable energies in West Africa by improving knowledge exchange and raising awareness. So far, an Interactive Online Renewable Energy Map has been set up in the link below: **http://energycenter.knust.edu.gh/repowermap/**

Mr. David Ato Quansah of the Department of Mechanical Engineering is the principal investigator.

Upgrading Education and Research Capacity in Renewable Energy Technologies (UPERC-RET) in Ghana

Collaborating with Norwegian University of Life Sciences and Alesund University College, **Dr. Lena Dzifa Mensah** is lead investigator on the project "Upgrading Education and Research Capacity in Renewable Energy Technologies (UPERC-RET) in Ghana" to upgrade education and research capacity in Renewable Energy Technologies (RETs) at KNUST

The project which is funded by the Norwegian Agency for Development Cooperation (NORAD) will run for 4 years and will end in July 2019 with an amount of NOK: 8 500 000. The project is to mainly develop the capacity of

KNUST staff to sustain the current master's programme in Renewable Energy Technologies. So far, documents for the following proposed graduate programmes in renewable energy technologies are being reviewed.

- MSc. Renewable Energy Technologies
- MPhil. Renewable Energy Technologies
- PhD. Sustainable Energy

Climate and Resource Protection for Sustainable Economic Development in Ghana

A research team from KNUST Kumasi, TU Dortmund University and Westphalian University of Applied Sciences have undertaken this project funded by the German Federal State of North Rhine-Westphalia and Deutsche Gesellschaftfür Internationale Zusammenarbeit (GIZ) GmbH with an amount of €87,441 (Eighty Seven Thousand, Four Hundred and Forty-One Euros).

The project aims to:

- ensure a reliable, stable energy supply at KNUST through the integration of renewable energies and to develop innovative measures for this purpose
- establish pilot and demonstration plants in the fields of renewable energies as well as energy and resource efficiency on KNUST campus in order to strengthen practice-oriented, applied tuition and research in this areas and to grow the competence portfolio of the partners.
- expand the competencies of University teaching staff, PhD candidates and students of the partner institutions in the focus subjects of the cooperation.

The project is expected to make KNUST a centre of excellence for renewable energy, energy efficiency, waste management and resource protection in the long term. The construction of the smart energy system and solar thermal training centre are almost complete and a biogas laboratory has been set up with state-of-the-art equipment. There has also been tree planting activities and educational campaigns on the environment among schools in Kumasi.

The project which started in December 2013 is still in progress and has **Dr. Gabriel Takyi** as the principal investigator.

Photovoltaic Reliability Evaluation in Sub-Saharan Africa (PRESSA)

To determine solar photovoltaic reliability in sub-Saharan Africa, **Dr. Gabriel Takyi** in collaboration with the University of Arizona is undertaking this project, "Photovoltaic Reliability Evaluation in sub-Saharan Africa (PRESSA)". It is a USAID-sponsored project through the US National Academy of Sciences with an amount of US$171,419 (One Hundred and Seven One Thousand, Four Hundred and Nineteen US Dollars). The project started in September 2014 and will end in August 2017. The overall objectives of the projects are to:

- determine the solder joint degradation effect on the performance and efficiency of the PV module installed in the sub-Sahara region.
- verify and validate the annual power degradation rate of 0.5 to 10%.
- study the effect of the zoned climatic and weather conditions of sub-Saharan Africa on the degradation of power.

Building a Reliable Energy Access Database to Promote Sustainable Energy Expansion in Ghana

The Energy Commission has collaborated with KNUST on the project "Building a Reliable Energy Access Database to Promote Sustainable Energy Expansion in Ghana". The Energy Commission is co-funding this project. The other collaborator and co funder of the project is the Renewable Energy and Energy Efficiency Partnership (REEEP) Vienna, with a total amount of €90,923 (Ninety Thousand, Nine Hundred and Twenty-Three Euros) with KNUST expecting € 73,323 (Seventy Three Thousand, Three Hundred and Twenty-Three Euros), for a one-year award.

The objectives of the project are to:

- provide a forum for meetings of the Energy Access Data Task Force established by the national forum of energy-sector Board Chairs and CEOs;
- use the Task Force as a mechanism for collection, collation and systematization of historical energy access data; and
- disseminate the data to key stakeholders at district, national and international levels via meetings of District Planning Officers, Task Force Members' publications and websites, etc.

At the end of the project, a forum for meetings of the Energy Access Data Task Force established by the national forum of energy-sector Board Chairs and CEOs will be provided. **Ms. Gifty Serwaa Mensah** is the Project Director.

Development of a Cost-Effective, Modular and Dry Concentrating Solar Power for Africa: Design and Tests of Components (CSP4Africa)

Dr. Emmanuel W. Ramde undertook this project on the theme "Development of a Cost-effective, Modular and Dry Concentrating Solar Power for Africa: Design and Tests of Components (CSP4Africa)" in collaboration with SireaEnergie and ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE).

The African Union (AU) funded this project with an amount of €81,686.00 (Eighty One Thousand, Six Hundred and Eighty-Six Euros) for a period of 3 years from March 2012 to March 2015. The aims of the project were to increase access to energy services for rural and peri-urban populations in Africa; improve security of energy supply in peri-urban and rural areas through electricity generation by solar energy; and reduce the environmental impact of energy services by providing clean and sustainable solutions thus reducing greenhouse gases. It was also to develop a pilot project using local low-cost and cost-effective materials to design and experiment with solar power plants for electricity generation.

The project has been very successful and the concrete foundation which will support the test equipment for the CSPA Africa project has also been constructed.

Supporting Green Industrial Development in Ghana: Biogas Technology and Business for Sustainable Growth

A three-year project funded by the United Nations Industrial Development Organisation (UNIDO) with an amount of €1,280,000 (One Million, Two Hundred and Eighty Thousand Euros) is underway with **Mr. Edward Awafo** as the project director.

The project "Supporting Green Industrial Development in Ghana: Biogas Technology and Business for Sustainable Growth" is a collaboration with the ECOWAS Regional Centre for Renewable Energy and Energy Efficiency, the Ministry of Trade and Industry, the Ministry of Energy and the Council for Scientific and Industrial Research (CSIR) to promote the transfer of biogas technology from Korea to Ghana through some interlinked interventions.

The project is expected to construct a large scale biogas plant to enable research. The large scale biogas plant is currently under construction at the Kumasi Abattoir.

Africa Low Emissions Development Strategies Modelling, Implementation and Peer Learning Project

"Africa Low Emissions Development Strategies Modelling, Implementation and Peer Learning Project" is a European Union funded project of US$ 63,276.00 (Sixty Three Thousand, Two Hundred and Seventy-Six US Dollars) and US$1,793,000.00 (One Million, Seven Hundred and Ninety-Three Thousand US Dollars), running from November 2015 to November 2018.

In collaboration with National Renewable Energy Laboratory and Unsuited Nations Environmental Programme, the project and the Africa LEDS Partnership (AfLP) is working to promote low-carbon, climate-resilient development to support poverty alleviation, job creation and environmental management in Africa.

The Energy Center, KNUST hosts the secretariat of the AfLP, responsible for the overall coordination of activities of the partnership. The activities and secretariat services are currently funded by the US State Department, the Department for International Development (DfID), UK and the European Commission with **Mr. Edward Awafo** as the project director.

Assessment and Development of Sanitation Technology Options Manual for Urban and Peri-Urban Areas

The provision of basic sanitation services, has not kept pace with the rapid urban population growth, and is particularly affecting people living in low-income areas. Poor sanitation imposes significant cost to households; currently it is estimated that poor sanitation in Ghana costs about US$ 12 per person per year (WSP, 2012). To address the above concerns, the Department of Civil Engineering of KNUST with financial support of GH¢ 284,566.18 from UNICEF Ghana, assessed all available types of sanitation technology and waste water treatment options that are constructed and used by households and institutions in three Metropolitan/Municipal/District Assemblies (MMDAs) in Ghana. The project was led by **Dr. Kwabena Biritwum Nyarko** and supported by **Dr. Richard Buamah** (Department of Civil Eng.), **Mr Francis Nunoo** (Department of Publishing), **Eugene Appiah-Effah** (Department of Civil Eng.), **Kobina Mensah Afful** (Department of Civil Eng.), **Nehemiah Samwini Addae** (Department of Civil Eng.) and **Abigail Owusu-Boakye** (Department of Civil Eng). A key output of the assignment was the development of a Latrine Technology Manual to serve as a reference document for sanitation practitioners

Latrine Technology Manual

Photobook on Latrine Technologies

CONFERENCES

Engineering in Society (Ceng 291) 2016 Clinic

Clinic Participants

The Engineering in Society programme (CENG 291) offers students and practising engineers an opportunity to bring their expertise to bear on solving the problems of our communities. The course has been running for the past 3 years and is structured in three key blocks. The first block involves a 4-day clinic which gives students an orientation of what engineering is about and also provides them with the needed training to be able to identify engineering problems in their communities and attempt a solution to them. The second block involves the actual field work which requires the students going to their communities to identify an engineering problem and attempting a solution under the guidance of their departmental coordinators and other lecturers. The third and final block involves compiling a report on what has been done in the field, and defending the report before a panel of experts in the department. This report throws more light on the just ended CENG 291 Clinic 2016 which sought to equip the students for the task ahead.

The programme of activities for the CENG 291 2016 was launched on the 15th of April 2016 by Ing Prof. S.I.K Ampadu the Provost of the College of Engineering. He mentioned that since its inception in 2013, the Engineering in Society program has focused on inculcating in students an appreciation of the fact that the purpose of engineering is to solve problems. He also stressed the fact that the program is designed to encourage students to draw a link between their chosen field of engineering and the application of that field to the challenges that the society faces daily. He encouraged the first year students never to underrate themselves or let any other person do so especially regarding their intellectual capabilities. The CENG 291 Clinic began on the 10th of May, 2016 with an opening ceremony in which Ing. Prof. Mark Adom Asamoah the acting Provost served as its keynote speaker. In his opening speech he encouraged the students to take advantage of the opportunity the clinic offers and see it as an avenue to write their names among the stars. He stressed that engineering goes beyond solving differential equations and must bring positive change in the lives of others.

Clinic Participants

The 39th Water, Engineering and Development Centre (WEDC) Conference

KNUST in collaboration with the Water, Engineering and Development Centre (WEDC) Loughborough University, UK organised the 39th WEDC International Conference from 11th -15th July 2016, under the theme "*Ensuring Availability and Sustainable Management of Water and Sanitation for All*". The College of Engineering hosted the conference with valued and respected platform for researchers for reflection, debate and exchange of knowledge and ideas that are rooted in practice.

The conference programme included three days of presentations and discussion of peer-reviewed content. This was alongside two days of focused capacity development workshops designed to develop skills and knowledge in relevant areas, which had been jointly identified and developed with sector stakeholders. It was attended by member universities, institutions, organizations and practitioners committed to water, sanitation and hygiene (WASH) with a total of 507 participants. A total of 121 pagers were presented.

The main purpose of WEDC conferences is to facilitate and support knowledge sharing at the international, regional and national levels in the WASH sector.

Conference Participants

The 5Th African Young Geotechnical Engineering Conference

KNUST, through the College of Engineering, hosted the 5th African Young Geotechnical Engineering Conference from 9th to13th August 2016, on the theme "Building the Capacity of Young Geotechnical Engineers in Africa". The conference has been widely accepted as an important event by Geotechnical Societies to promote geotechnical engineering among the younger generation. The objective is to encourage the younger generation of geotechnical practitioners to carry forward the aims and ideals of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE).

This conference brought together young geotechnical practitioners, researchers and academics from the region to share their work. The conference had participants from Nigeria, Sudan, Egypt and other institutions in the country. The conference was sponsored by ISSMGE, The Ghana Chapter of International Geosynthetics Society (IGS) and The Civil Engineering Department of KNUST.

Prof. S.I.K Ampadu Welcoming Participants

Participants at the 5th African Young Geotechnical Engineering Conference

List of Active External Grants in CoE

No	Name of Project	Principal Investigator	Department / Unit	Funder	Amount	Period
1	Biofuel Production from Lignocellulosic Material (2GBIONRG) Project	Mr. Francis Kemausour	The Energy Centre	Danida	€ 68,079.00	2012 - 2016
2	Energy Efficient Rural Food Processing Utilizing Renewable Energy to Improve Rural Livelihoods (RE4Food)	Mr. Joseph Akowuah	The Energy Centre	Newcastle University	€ 824,096.00	2013 - 2016
3	KNUST Cookstove Testing and Expertise Lab.	Mr. Michael K. Commeh	Technology Consultancy Centre	UNDP	USD$ 90,000	2013 - 2018
4	Upgrading Education and Research Capacity in Renewable Energy Technologies (UPERC-RET) (NMBU-KNUST)	Dr. Lena Dzifa Mensah	The Energy Centre	Norwegian Agency for Development Cooperation (NORAD)	NOK 8.5 million (US$ 1.3 million)	2015 - 2019
5	Promoting Sustainable Energy Access through the use of Geospatial Technologies in West Africa	Dr. Francis Kemausour	The Energy Centre	ACP-EU	€ 1,090,878.71	2014 - 2016
6	ACE-Africa Centre of Excellence	Prof. S. N. Odai	Civil Engineering	World Bank	USD$ 8,000,000.00	2014 - 2019
7	WASCAL-CCLU-Climate Change and Land Use	Prof. S. N. Odai	Civil Engineering	German Federal Ministry of Education and Research	€ 1,900,000.00	2011 - 2016
8	Potential of Distributed Grid-Connected Solar Photovoltaic (PV) Systems in Rural Electrification in Africa	Mr. Emmanuel Kweku Anto	The Energy Centre	European Union	€186811.30	2012 - 2017
9	Engineering Students Competition/GESA Makers Fair	Mr. Johnson Asante	Technology Consultancy Centre	MIT/TCC	USD$ 8,100.00	2015
10	Sanitation for the Urban Poor (SANI-UP)	Dr. Kwabena B. Nyarko	Civil Engineering	Bill and Melinda Gates Foundation	USD$ 385,000.00	2012 - 2016
11	Jatropha Energy Facility	Dr. George Y. Obeng	Technology Consultancy Centre	European Commission ACP-EU	€ 15,000.00	2012 - 2017
12	Consolidation of ECOWREX GIS	Mr. Daniel Ladzagla	The Energy Centre	European Union	€40,600.00	2014 - 2016
13	International Development Innovation Network	Dr. George Y. Obeng	Technology Consultancy Centre	USAID	USD$ 800,000.00	2012 - 2017

COLLEGE OF HEALTH SCIENCES

Primary Health Care Performance in Developing Countries

Primary Health Care (PHC) is the bedrock of health systems the world over. However, especially in developing countries, weak health systems have made it impossible for populations in the greatest need to receive best-bet best-buy interventions. Therefore, PHC PI as a project led by **Dr. Easmon Otupiri** seeks to measure the performance of PHC in developing countries with the view to providing evidence towards efforts to improve health systems.

Four (4) rounds of nationally representative surveys are planned for the period 2016 – 2020. Households and service delivery points (private and public) will serve as data collection points (private and public). Currently, mobile phone-based data collection tools have been developed in ODK, and are ready for piloting after Institutional Review Board (IRB) approval.

It is expected that this study will serve as an account of PHC performance in Ghana based on the conceptual framework for PHC performance. Also having served as proof of the concept activity, plans are to extend to other countries making it an international, multi-centre study. This project is being funded by Bill and Melinda Gates Foundation and Johns Hopkins University. Gates Institute, Harvard T. H. Chan School of Public Health are the collaborating institutions.

Artificial Antibodies (Aptamers) that Bind to Mycolactone and Serve as a Point of Care for Diagnosing Buruli Ulcer

Buruli ulcer (BU) is a neglected tropical disease. Early case detection and management is very important to reduce morbidity and the accompanied characteristic disfiguring nature of BU. The introduction of anti-mycobacterial treatment has made laboratory confirmation of clinically suspected cases

very crucial for clinical management of BU. The current WHO gold standard Polymerase Chain Reaction (PCR) method is expensive, requires infrastructure and expertise usually not available at the peripheral centers where BU cases are managed. Moreover, current efforts aimed at developing point of care diagnostics are saddled with major drawbacks. There is therefore the need to research into the development of simpler methods that can be applied at the point of care.

In this regard, **Dr. Sakyi** of the Department of Molecular Medicine with funding from Bill and Melinda Gates Foundation through the post-doctoral fellowship at the Noguchi Memorial Institute of medical research and technical support from Aptagen LLC in Jacobus, Pennsylvania USA is leading this research into "Artificial antibodies (aptamers) that bind to mycolactone and serve as a point of care for diagnosing buruli ulcer disease".

Determinants of Outcome of Prevention of Mother-to-Child Transmission (PMTCT) Measures at Three ART Centres in Kumasi over a Three-Year Period

Under the Medical Education Partnership Initiative (MEPI) programme, **Dr. Nana Kwame Ayisi-Boateng** and his team collaborated with Kumasi South Hospital, Bomso Clinic (Kumasi) and the National AIDS Control Programme (NACP) to work on "Determinants of Outcome of PMTCT Measures at Three ART Centres in Kumasi over a Three Year Period."

Research Assistants reviewing data

The team members include **Dr. Osei Kwaku Wusu-Ansah,** University Hospital, KNUST; **Dr Anthony Enimil**, Child Health Department, KATH; **Dr Alberta Britwum-Nyarko**, Kumasi South Hospital; **Mr Isaac Acheampong**; University Hospital, KNUST; **Isaac Nkrumah**, University Hospital, Kumasi and **Miss Akua Dufie Wiafe**; NACP, Kumasi.

The team worked for three months from 02/02/2016 to 26/04/2016 with an amount of GHC 10,000.00 (Ten Thousand Ghana Cedis) to review a data collected over a 3-year period. The objectives of the project were to determine:

1. the prevalence and transmission rates of HIV infection among pregnant women at the University Hospital, Kumasi South Hospital and Bomso Clinic over a three-year period.
2. whether the gestational age at which antiretroviral therapy (ART) is initiated for pregnant women impact the outcome of PMTCT measures at the University Hospital, Kumasi South Hospital and Bomso Clinic.
3. the impact of mode of delivery and breastfeeding option on the outcome of PMTCT measures at the three ART centres.

The study would impact policy on PMTCT at the three health facilities and contribute immensely to the national and global efforts to achieve the target of eliminating mother–to-child transmission of HIV infections. The study would also give a better understanding to health workers in the hospitals on practices that determine the outcome of HIV preventive measures and highlight the problem of inadequate documentation of patient records at the three ART centres.

Workshop Facilitators

The project was completed on schedule and a final report including a detailed financial statement has been submitted to funders. A dissemination and stakeholders conference was also scheduled to take place on 2nd September, 2016.

First-Stage Genome Wide Association Study (GWAS) of Lymphatic Filariasis Pathology

Dr. Alexander Yaw Debrah with his team of researchers is collaborating with Bonn University Hospital, Bonn, Germany to investigate the "First-Stage Genome Wide Association Study (GWAS) of Lymphatic Filariasis Pathology". The team members include **Dr. Linda Batsa Debrah, Jubin Osei-Mensah** and **Yusif Mubarik,** all of Kumasi Centre for Collaborative Research in Tropical Medicine (KCCR).

Filarial nematodes infect approximately 120 million people in developing countries and cause lymphatic filariasis. The majority of infected individuals have no or just mild, transient clinical symptoms such as recurrent debilitating fever, while others suffer severe clinical diseases including lymphedema (estimated worldwide prevalence of 7% in infected men and women) or hydrocele (estimated prevalence of 30-50% of infected men). Pathology and parasite load are inversely correlated, suggesting that containment of parasites by the immune system leads to inflammation-related diseases. Studies have consistently shown that susceptibility to infection, parasite load and lymphatic pathology cluster in families independent of household and environment pointing to genetic factors involved in disease pathology.

Funded by the German Research Foundation (DFG) with an amount of €418,560 (Four Hundred and Eighteen Thousand, Five Hundred and Sixty Euros), the research aims to study genotype lymphatic filariasis patients through genome wide association study to identify genetic markers responsible for the development of pathology of lymphatic filariasis.

The project is expected to lead to identification of genetic markers of filarial pathology. Knowing genetic markers for lymphedema and hydrocele could provide a way to identify persons at risk before pathology is seen and might become the basis for development of a rapid screening test that in the case of lymphedema which develops early in life, might be applied to school-going children.

The project period is from November 2015 to October 2018 and so far, recruitment of study participants is ongoing.

Training for Early Career Researchers through Mentored Research Projects

The Medical Education Partnership Initiative (MEPI) has taken nine (9) early career researchers through extensive health research training using mentored research projects. MEPI aims to improve the provision of emergency care as well as research in emergencies and HIV/AIDS through training.

MEPI offered the opportunity to young health researchers to compete for a seed funding of $5,000 USD (Five Thousand US Dollars), to undertake a mentored team-oriented pilot research project focusing on locally relevant clinical and operational issues in emergency care in Ghana. This was aimed at enabling health care workers and faculty to source for external funds to continue to engage in locally relevant emergency-related research. The applicant teams were required to comprise various cadres of health professionals (doctors, nurses, biomedical scientists, etc.), led by a principal investigator and guided by an experienced researcher with expertise in the chosen area of research. Three (3) awards were made as listed below and the research groups duly completed their projects on schedule.

Award winners of MEPI pilot project in KNUST

No.	Principal Investigator	Title of Research	Name of Mentor
1	Dr. Maxwell Osei-Ampofo (Directorate of Emergency Medicine, KATH)	Emergency Medical Services (EMS) Patient Transfers in the Ashanti Region of Ghana	Dr. Ahmed Zakariah (National Ambulance Service)
2	Dr. Joseph Bonney (Directorate of Emergency Medicine, KATH)	The use of mobile phone telephone technology to improve patient flow in a low resource setting - Emergency Departmentof KATH	Dr. George Oduro (Directorate of Emergency Medicine, KATH)
3	Dr. Augustina Angelina Sylverken (Kumasi Centre for Collaborative Research (KCCR) KNUST)	Emergency Response to Deadly Ebola Virus Disease: How prepared are our Health care Workers?	Prof. Ellis Owusu-Dabo (KCCR)

In addition, MEPI organised an intensive five-day training in advanced research methods with a focus on qualitative research, proposal writing, grant writing, data management, report writing, project evaluation, and ethical issues related to human subjects research for health personnel in KNUST and KATH. The focus of the training was to update trainees on HIV/AIDS research trends and proposal writing for HIV research. Participants were required to submit an abstract of a draft proposal on HIV/AIDS at any stage that required the use of qualitative methods. The training attracted emergency physicians and nurses, biomedical scientists, health promotion specialists, pharmacists, research fellows and lecturers. Following the research training, a call for proposals offered participants and other interested persons the opportunity to competitively apply for limited funding support of GHC10, 000.00 (Ten Thousand Ghana Cedis) to undertake pilot mentored research projects on HIV-related topics using a team approach. Following the review of the applications, six (6) of the fourteen (14) applicants listed below were awarded the grants, and successfully completed their projects by April 2016.

All the teams have initiated the process of publishing their findings. This mentored training programme has not only built the capacity of these young researchers in the conduct of research but also applying for and managing research grants.

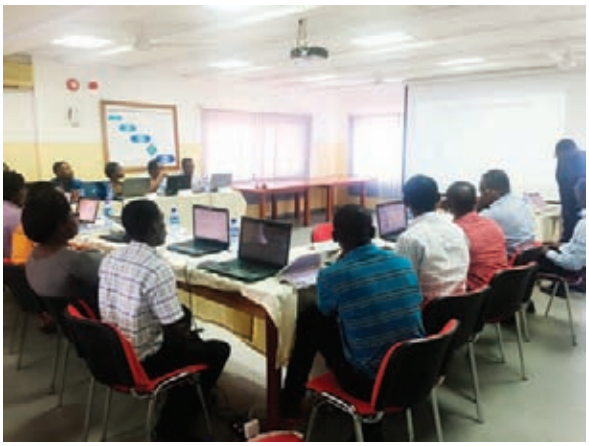
Award winners of MEPI mentored Research

No.	Principal Investigator	Title of Research	Name of Mentor
1	Dr. Nana Kwame Ayisi-Boateng (University Hospital, KNUST)	Determinants of the outcome of Prevention of Mother to Child Transmission measures at three Antiretro-viral centres in Kumasi over a 3-year period	Dr. Anthony Enimil (Department of Child Health, KATH)
2	Dr. Denis Dekugmen Yar (Kumasi Centre for Collaborative Research (KCCR) KNUST)	Non-Commu-nicable disease co-morbidities among people living with HIV/ AIDS (PLWHA) in the Kumasi Metropolis	Prof. Ellis Owusu-Dabo (KCCR, KNUST)
3	Ms. Anne Boakyewaa Anokye (Pharmacy Department, KATH)	Factors enhanc-ing low adher-ence among adolescents with perinatal infected HIV	Dr. Anthony Enimil (Department of Child Health, KNUST/KATH)
4	Dr. Chris Kwaku Oppong (Directorate of Emergency Medicine, KATH)	Stigmatization of PLWHA by healthcare workers: An advancement in care at the emergency settings	Dr. George Oduro (Emergency Medicine Consultant, KATH)
5	Dr. Kwabena Owusu-Danquah (Department of Medical Laboratory, SMS, KNUST)	Investigating the pharmaco-genetic basis of Nevirap-ine-induced Stevens-John-son syndrome among selected HIV patients in Ghana	Dr. William Owiredu (Department of Molecular Medicine, SMS, KNUST)
6	Dr. Paa Kobina Forson (Directorate of Emergency Medicine, KATH)	HIV/AIDS awareness, knowledge and practice among patients with Sexually Transmitted Infections at KATH	Dr. George Oduro (Directorate of Emergency Medicine, KATH)

The Role of Candidate Micro RNSa in T-cell Response during Acute Tuberculosis and Latent M tuberculosis Infection (Tb6)

Facilitator giving an Explanation at a Workshop

The study is a combined clinical and basis immunology project that aims at determining the influence of candidate micro RNAs on the treatment success in acute tuberculosis and the disease progression risk latent M. tuberculosis infected household. This research, which started from March 2013 and ended September 2015, was sponsored with an amount of €316,291.00 (Three Hundred and Sixteen Thousand, Two Hundred and Nintey-One Euros) by the Deutsche Lepra und Tuberkulosehilfe (DAHW). **Dr. Marc Jacobsen, Prof. Bernhard Fleischer** and **Prof. Ellis Owusu-Dabo** are the team working on the project.



Participants at Workshop

Factors Enhancing Low Adherence Among Adolescents with Perinatal Infected HIV

Sexual activity among adolescents with HIV, a higher percentage of which may possibly be unprotected, has a potential of spreading resistant virus. Adherence to antiretroviral therapy (ART) is therefore extremely important in ensuring a reduced viral load which reduces the risk of transmission. Ensuring a 95% adherence to ART which has been shown to significantly reduce HIV viral load and CD4 count is crucial in maintaining a relatively healthy life and enable adolescents pursue their academic and social goals. A research team led by **Ms. Anne Boakyewa Anokye,** KATH under the supervision of **Dr. Anthony Enimil** carried out a study to determine the adherence level and identify factors associated with low adherence among adolescents with perinatal HIV infection attending ART clinic at KATH. The type, frequency and taste of medication, forgetfulness, school schedule, travelling, feeling well/good, lack of caregiver support, stigmatisation and inability to come for medication refill were identified as major factors influencing adherence. The research outcome has revealed a need to review the medication refill scheduling for the adolescent. The schedule should be based on individual needs and accommodation made for those unable to meet the scheduled refill dates. Interventions to improve adherence should target forgetfulness, school schedule, fear of side-effects and inability to come for medication refill. Building the capacity of caregivers, school teachers and health workers to counsel is also essential in overcoming low adherence issues with these adolescents. The research team included **Ama Abrafi Amo, Nicholas Karikari Mensah** and **Barbara Baaba Gariba** who are personnel at KATH. The research was supported with GH¢ 10,000.00 (Ten Thousand Ghana Cedis) by the Medical Education Partnership Initiative (MEPI) in the College of Health Sciences.

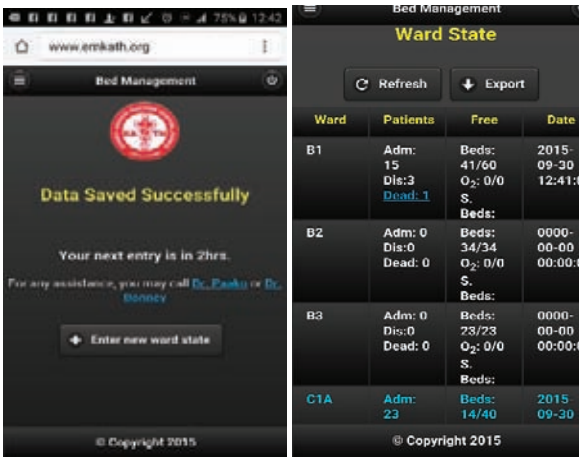
A Doctor Attending to a Patient

The Use of Mobile Telephone Technology to Improve Patient Flow in A Low Resource Setting Emergency Department of Komfo Anokye Teaching Hospital, Kumasi, Ghana

To institute a system where round-the-clock monitoring of bed states and patient transfers are improved using mobile telephone technology, **Dr. Joseph Bonney** of the Accident & Emergency (A&E) Unit at KATH, developed a web-based android mobile phone application designed with the needs of the bed manager. The phones were sent to all wards where patients from the A&E were admitted after being stabilised. Health care personnel in the wards under study used the phones to send bed states at two-hour intervals. Information was collated by the bed managers at the A&E and used as a basis for patient transfer. The mobile phone system has been put in place for continuous monitoring of all the bed states being sent from the wards. The good work of the project has increased the interest of the management of KATH to reinforce the position of the bed manager and to work with the research office as a bed management team to improve the flow of patients. Personnel assigned to the research office have a daily task of going to all the wards to solve issues with the phones and data. Monthly progress reports are sent to all the wards. This has been sustained even months after the project ended.

The project was supported with $5,000.00 by the Medical Education Partnership (MEPI) in the College of Health Sciences. The research team included **Dr. Paa Kobina Forson, Mr Francis Atuahene Akuoku, Mrs. Patience Yeboah Ampong, Dr. Nana Serwaa Quao, Dr. Nkechi Dike, Mrs. Freda Sagoe, Sonia Cobbold** and **Joycelyn Sarfo-Frimpong** who are personnel at KATH and supported by **Esi Leeward-Amissah, Tracy Eyram Tsa** and **Asare Baah Pusuo**. The project was executed under the supervision of **Dr. George Oduro**, A&E, KATH.

One-on-one Training of the Bed State App



Screenshot of Bed State App

Knowledge and Awareness of HIV/AIDS Infection Among Patients with Sexually Transmitted Infections (STIs) at KATH Polyclinic

Dr. Paa Kobina Forson (Accident and Emergency Department, KATH) was awarded a seed fund of GHC 10,000.00 (Ten Thousand Ghana Cedis) by the Medical Education Partnership Initiative (MEPI) in the College of Health Sciences to conduct a study of patients with sexually transmitted infections (STIs) who visited the KATH primary health care clinic (Polyclinic). The study was carried out to assess the knowledge and awareness of HIV/AIDS among these patients. Study participants were interviewed after being diagnosed with an STI by a physician to assess their knowledge of HIV/AIDS and the practices of risky behaviour. Study outcomes showed that although patients with STIs have knowledge about STIs and HIV/AIDS, their knowledge of risky sexual practices which predisposes them to HIV/AIDs was low and they continue to exhibit risky sexual behaviour and practices. Public education on STIs is particularly useful for informing decision and modifying sexual behaviour and practices. An educational leaflet which was developed by the research team using peer reviewed resources was used to educate and train study participants on HIV/AIDS and its connection with STIs. Findings from this study revealed that STIs are more common in the young population. Participants had had an average of 3.5 lifetime sexual partners, and some had had sexual intercourse with partners who had tested positive for HIV/AIDS. 27% of the participants admitted to intravenous drug use in their lifetime.

Frequent education for this high risk group will be useful in changing behaviour and reducing the transmission of STIs and HIV/AIDs. One modality that may be useful to enhance public education is the employment of mHealth tools. Mobile phone penetration in Ghana is currently over 90% and many young people in Ghana may have smart phones. Therefore, there are plans of developing a freely available mobile phone application with HIV/AIDs and STI information as a means for public education. This application will be made available and will serve as an interactive portable advisory tool that will educate people on STIs and HIV/AIDS and risky sexual behaviours.

Other investigators for this research were **Mr. Emmanuel Acheampong, Ms. Abena Agyekum Poku, Gabriel Ofori Adjei, Hajia Amina Alhassan** who are personnel at KATH. The team conducted the research under the supervision of Dr. George Oduro (A&E, KATH).

STIs and HIV/AIDS Tools

Phenotypic and Molecular Characterisation of Gentamicin Resistant Genes among Klebsiella and E. Coli Strains Isolated in Children at Komfo Anokye Teaching Hospital

"Phenotypic and molecular Characterisation of Gentamicin Resistant Genes among Klebsiella and E. Coli strains isolated in children at Komfo Anokye Teaching Hospital" is a seven-member project, running for three months and led **by Prof. Francis Agyemang-Yeboah.**

Collaborating with KCCR and funded by Building Stronger Universities (BSU) with an amount of DKK 30,000, the project seeks to investigate whether or not there are significant differences in the clinical or demographical variables in children that predispose or contribute to gentamicin resistance phenotype among Klebsiella and E. Coli strains isolated in sepsis cases among children at Komfo Anokye Teaching Hospital.

It is envisaged that at the end of the project both the phenotypic and molecular characterisation of gentamicin resistant genes among klebsiella and E. Coli strains would have been isolated and sequenced for targeted patient treatment and monitoring. The project is at the pilot phase recruiting patients and collecting specimens.

Stigmatization of People Living with HIV/AIDS by Healthcare Workers: Advancement in Care in the Emergency Setting

Reduction in stigma is important in the fight against HIV/AIDS in Africa since stigma may affect patient attendance at healthcare centres to obtain antiretroviral (ARV) medications and receive regular medical check-ups. It has also been suggested that reduction of HIV/AIDS-related stigma and discrimination among healthcare workers (HCW) would be helpful not only for patients, but also for healthcare professionals with HIV who often show reluctance and delay in accessing healthcare because of the fear of the stigma and discrimination. It is against this background that **Dr. Chris Kwaku Oppong** (KATH) under the supervision of **Dr. George Oduro** led a research team to assess the level of stigmatisation of People living with HIV/AIDS (PLWHA) by HCW at the KATH A&E. Questionnaire administration and in-depth interviews were employed by the team to assess the level of stigmatisation of PLWHA by HCW at the A&E Department. Refusal of care and/or provision of sub-optimal care to patients, excessive precautions and physical distancing by HCW, testing of clients by HCW and disclosure of the test results without consent were the forms of stigma which were highlighted by HCW. The findings of this study expose the gravity of stigma and discrimination in the care of HIV patients in the emergency setting. Training which is targeted at the issues raised will reduce stigma thereby enhancing HIV care in Ghana. Policies that will be developed to reduce HIV stigma should also consider the peculiarity of emergency settings and recommend higher HCW safety standards with respect to personal protective clothing. Staff of emergency units should be engaged in designing interventions targeting stigma in emergency settings. Further studies are recommended to investigate the views and concerns of HIV patients who visit the emergency unit.

A Research Assistant conducting an in depth interview with an Emergency Physician

The research was sponsored with GHC 10,000.00 by the Medical Education Partnership Initiative (MEPI) in the College of Health Sciences. The research team included **Ms. Marie Ntow, Dr. Maxwell Osei-Ampofo** and **Dr. Emmanuel K. Oppong** who are personnel at the Accident and Emergency Department of KATH.

Emergency Response to the Deadly Ebola Virus Disease (ERDED): How Prepared are our Health Care Workers›

The recent Ebola Virus Disease (EVD) epidemic that hit some countries in West Africa underscores the need to train front line high-risk health workers on disease prevention skills. Although Ghana is yet to record any case and several health workers have received numerous training schemes; there is no record of any study that assesses preparedness of health staff regarding EVD and indeed any emergency prone disease (EPD) in Ghana. **Dr. Augustina Angelina Sylverken** of the Kumasi Centre for Collaborative Research in Tropical Medicine (KCCR), under the supervision of **Prof. Ellis Owusu-Dabo** therefore conducted a hospital-based cross sectional study to assess the level of preparedness, awareness and knowledge among health care workers (HCWs) in emergency response to Ebola Virus Disease (EVD) cases in the Kumasi Metropolis of the Ashanti Region, Ghana. The study was carried out between the period of October 2015 and March 2016. The overall knowledge gaps and preparedness of one hundred and one (101) HCWs from two (2) health facilities in Kumasi were assessed using an adapted WHO (2015) and CDC (2014) checklist for Ebola preparedness. This study revealed the ill-preparedness in terms of knowledge and use of the right tools to handle emergency cases of EVD among the selected health facilities. It highlights that beyond knowledge acquisition, there is the need to perform dummy exercises to fully prepare the Ghanaian health worker to handle any possible EVD cases. The output of this study will inform policies on training needs of HCWs to fully equip and prepare them with the requisite tools and knowledge to ensure competence to handle any epidemic prone disease. There are plans to

enroll a student to employ similar methodology to study the preparedness of HCWs and facilities towards the annual cholera outbreaks in Ghana.

The research was sponsored with an amount of $5,000.00 by the Medical Education Partnership Initiative (MEPI) Project in the College of Health Sciences as part of its initiatives to promote research focusing on locally relevant clinical and operational issues in emergency care. Other investigators for the research were **Dr. Denis Yar,** KCCR; **Dr. Michael Owusu**, KCCR; **Dr. Paa Kobina Forson**, KATH and **Dr. Eno Biney,** KATH.

Non-Communicable Disease Co-Morbidities among People Living with HIV in Kumasi Metropolis, Ghana

Co-morbidity in HIV infection is common and often under-detected in HIV care settings. Moreover, treatable HIV disease is compounded with increased risk from non-communicable diseases (NCDs), particularly cardiovascular diseases and Type II diabetes mellitus that exacerbate HIV disease progression. This raises the concern which if unaddressed could lead to morbidity and mortality among people living with HIV (PLHIV). A team led by **Dr. Denis Dekugmen Yar,** Kumasi Centre for Collaborative Research in Tropical Medicine (KCCR) conducted a study to assess the prevalence of NCDs (using diabetes and hypertension as proxy for NCDs) co-morbidity among PLHIV on antiretroviral therapy (ART) in the Kumasi Metropolis, Ghana. Two hundred and thirty-nine (239) HIV patients between the ages of 25-70 years attending ART clinic at the Kumasi South Hospital and Suntreso Government Hospital (SGH) were examined to determine the prevalence of diabetes and hypertension; and the association between ART use duration and NCDs co-morbidities. The study revealed that the prevalence of previous and undiagnosed diabetes and hypertension were 3.8% versus 13.1% and 8.4% versus 26.4% respectively ($p \leq 0.05$). The study also shows that ART use duration generally increases the risk of diabetes and hypertension. ART use duration ≥3 years increased the risk of hypertension nine-fold [OR 8.917; 95% CI 1.506-5.796; p=0.016]. Hence, long-term treatment with ART among PLHIV increased their risk of developing NCDs.

The study outcome is vital to the Ghana AIDS Commission to know the magnitude of NCDs co-morbidity among PLHIV on ART for her program implementation and would give impetus for policy consideration and further research in transforming the hitherto vertical HIV programmme into a horizontal chronic disease care systems. This calls for NCD screening as part of the routine services for PLHIV on ART while searching for specific ART with minimal long-term effects for NCD occurrence.

The research was funded with GHC 10,000.00 (Ten Thousand Ghana Cedis) by the Medical Education Partnership Initiative (MEPI) project in the College of Health Sciences. The research team included **Dr. Augustina A. Sylverken**, KCCR; **Mr. Samuel Nkansah Darko,** KCCR; **Dr. Akosua Gyimah** (Kumasi South Hospital); **Dr. Sheila Bawa** (Suntreso Government Hospital) and **Mrs. Juliana Atinaba** (Kumasi Metropolis) and was under the supervision of **Prof. Ellis Owusu-Dabo,** KCCR.

Blood Pressure of Study Participant being Taken by Research Assistant

The Pharmacogenetic Basis of Nevirapine-Induced Stevens-Johnson Syndrome among Selected HIV Patients in Ghana

A group of researchers (**Dr Betty Normah**-Department of Medicine, KNUST, **Dr William Kudzi**-University of Ghana and **Mr Ali Abbas**-MSc Student-KNUST), led by **Dr Danquah,** was awarded a MEPI grant to investigate the pharmacogenetic basis of nevirapine-induced Stevens-Johnson syndrome among selected HIV patients in Ghana.

A Patient Showing Mild Rashes after NVP-based Treatment

HIV/AIDS is a global pandemic, affecting millions of people especially those living in sub-Saharan Africa. A cocktail of antiretroviral drugs, including Nevirapine (NVP), is used in reducing the viral load of people living with HIV Type 1. However, some HIV patients respond badly to nevirapine-based treatment (as well as other non-nucleoside reverse transcriptase inhibitors), leading to skin rashes and liver damage, which discourages them from continuing with

treatment. Although rare, this adverse drug reaction can be fatal and is often difficult to treat, leaving the affected patient with a lifelong sequela in most severe cases. It is widely accepted now that the individual's response to drugs is largely dependent on their genetic makeup.

The overall goal of this study is to effectively develop a method by which HIV patients with the high risk of developing severe forms of this adverse reaction to NVP could be detected quickly and before treatment to either avoid the drug entirely or be kept under strict surveillance when necessary. It is our hope that over time the medical landscape in Ghana will come to embrace the need for such ***personalised medical*** approaches to help extend medical care to the unfortunate minority who often suffer from these medical peculiarities.

To achieve this, blood samples were collected and genomic DNA was extracted, in which HLA-A, HLA-B and CYP2B6 genes were PCR amplified. The amplicons were enzymatically digested to determine if they had any relevant and specific single nucleotide polymorphisms (SNPs). Restricted fragment length (RFL) analysis, which lacks robustness, did not reveal any polymorphism. However, awaited sequenced data will reveal if there is any strong association between unique SNPs and nevirapine - induced skin rashes. We hope to continue this study using different hospital settings in Kumasi to increase the sample size of NVP induced skin rash to determine whether there are common SNPs. However, a pilot study on the survey of NVP usage and its side effects conducted in two other hospitals (Juaben Municipal Hospital and Emena Hospital) did indicate that anaemia is most prevalent among NVP users especially among pregnant women. This calls for urgent attention for pregnant HIV women who are on NVP based HAART.

The Cancer and Infection Research Facility has provided an excellent platform for researchers and students in the field of biological and biomedical sciences at KNUST to share ideas and experiences through presentations, Molecular Biology forums, Annual Summer Molecular Biology Workshop.

A Research Team Member Working in the Cancer and Infections Research Facility, SMS

Genomic Era in Infectious Diseases: A Journey to Personalize Antiretroviral Therapy for HIV Patients

Cancer and Infection Research Facility (CIRF), currently housed at the Physiology Department of the School of Medical Sciences, was established and headed by **Dr Kwabena Owusu Danquah,** with support from the Faculty of Allied Health Sciences and School of Medical Sciences in 2014. CIRF has a core research focus in the interface of infectious agents/parasites and cancer (host cell interactions). CIRF has basic laboratory equipment for molecular and cellular biology techniques (DNA extraction and quantification, PCR, agarose gel electrophoresis, genomic and plasmid modification, protein expression and purification, SDS-PAGE and Western blotting) as well as developing yeast model for toxicological, infectious and cancer studies.

KCCR RESEARCH PROJECTS

National Anti-Tuberculosis Drug Resistance Survey (DRS) for Ghana

In Ghana, there is currently no reliable countrywide data on anti-tuberculosis drug resistance. As such, the National Tuberculosis Control Programme (NTCP) in collaboration with the Kumasi Centre for Collaborative Research in Tropical Medicine (KCCR) as a technical agency and the National Reference Laboratory, Korle Bu, is conducting, for the first time, a nationwide survey on drug resistance of TB in Ghana.

The survey began in October 2015 and is ongoing. A total of 33 TB diagnostic facilities have been selected as survey sites based on probability-proportional-to-size approach. With the goal of minimising delays, the survey engaged the services of the Ghana Private Road Transport Union (GPRTU) for the transportation of samples from the survey sites to the laboratories of KCCR. Capacity building workshops have been conducted for 28 survey sites. On-site coaching and hands-on approaches are the mainstay of these workshops.

The main outcome of this survey will be the generation of a representative empirical countrywide baseline data on the proportion of TB cases with drug-resistant TB. Based on this, policies and recommendations towards the management of drug resistant TB would be drawn. Additionally, KCCR will have an enhanced capacity towards effective surveillance of drug resistance.

Pre-Study Assessment by the Supra Reference Laboratory in Borstel, Germany

A Practical Session during a TB DRS Capacity Building Workshop in Kumasi.

BAT BONN II project

The "one-health" concept focuses on understanding and studying both human and animal infectious diseases and finding solutions arising at their interface. This reflects a growing awareness that majority of emerging human infections are zoonotic. Such a realisation has implications not only for understanding the pathogenesis of infections but also for disease surveillance, monitoring and public health. The processes by which viruses, which hitherto were adapted to animals, leave their hosts and adapt to new species, such as livestock and humans, are largely unknown and represent an important challenge in the study of emerging infections.

This project seeks to investigate the infection dynamics or patterns of viruses in humans and livestock by employing high virus detection methodologies. This data will be complemented by population surveys (questionnaire, focus group discussions) to delve into how and where humans and livestock have contact. This will be superimposed on biological data and interpreted for public health action.

A Visit to a Cattle Farm in Ejura, Ashanti Region

A total of 32 farms have been earmarked to be visited and livestock species (cattle, goats, sheep, swine, donkeys, camels) to be sampled. A total of 24 farms have been visited and approximately 7000 livestock species sampled.

Apart from capacity building, the implementation of this surveillance strategy for viruses in livestock and humans will allow for enhanced preparedness towards the emergence or re-emergence of pathogens with the potential to cause fatal mortalities, epidemics or pandemics. This will further help us to understand the factors that increase contact between livestock and humans and help in developing predictive approaches to the emergence of zoonotic viral disease.

Sensitisation Visit to a Farm in Bongo Soe in Upper East Region

A Goat being Bled at the Kintampo Goat Bleeding Station

ORDISS

Prof. Solomon Acquah, Dr. Paintsil and Prof. Owusu-Dabo are working on "ORDISS"

The "ORDISS" concept is to better understand the process of sickle cell organ damage and be able to suggest biomarkers for vaccine and drug development in particular in relation to pain management. The project is funded by the University of Pittsburgh and it has been running since January 2015 and will end in December 2019.

The demographic and clinical data of 477 patients who were enrolled on the study have been taken. Blood and urine samples and some clinical data have been collected. The blood samples were processed for plasma, buffy coat, red cells and serum.

Team Meeting at KCCR

TRANSMAL

Prof. Ellis Owusu-Dabo of KCCR and his team of researchers assess the effect of schistosomiasis infestation on plasmodium falciparum transmission in co-endemic areas of Lameberence, Gabon and Kumasi, Ghana. This project has the main aim of determining immunological response in both schistosomiasis-infected and non- infected patients in a prospective study. German Research Council (DFG) is providing funds for the project.

Research Staff Collecting Mosquito Larvae

Prior to the commencement of this project, series of workshops and training activities were conducted to enhance the technical capacities and skills of the research team and to establish standard operation procedures (SOPs) for the two sites. Training on entomology, Molecular Biology-Polymerase Chain Reactions (PCR), construction of a wind tunnel and household surveys were carried out to augment the skills of the research team.

Workshop on Construction of a Wind Tunnel

A Wind tunnel

A pilot survey of school pupils was also conducted to herald the commencement of the study which indicated a prevalence of 6% of schistosomiasis popularly known as Bilharzia among school pupils. This study began in earnest, April 15, 2016 involving household surveys and enumerations, screening for schistosomiasis which are still ongoing.

Field Research Team on Household Survey

During the screening phase, more than 500 pupils were screened for schistosomiasis and malaria and those that had schistosomiasis were treated and counselled.

Map2Co

This is a multinational and multicentre study which aims to determine the influence of M. perstans infection and their Wolbachia endosymbionts on host immunity against mycobacterial infection, BCG vaccination efficacy, and disease susceptibility in children and adolescents. Additionally, clinical and epidemiological aspects of the study will be studied. It is hoped that this study will influence strong public health interventions for the control of M. perstans. The German Research Council (DFG) is funding this project and the researchers involved are **Prof. Achim Hoerauf, Dr. Alex Debrah, Dr. Richard Philips** and **Prof. Ellis Owusu-Dabo.**

This project is in the last year and currently field and lab work are ongoing.

GWAS

This is the first study to assess Genomewide associations studies for lymphatic filariasis. The German Research Council (DFG) is providing funds for this project. **Dr. Alex Debrah** and **Dr. Kenneth Pharr** are the investigators on the project.

Research Staff Explaining Study Procedures to Participants

Research Scientist Explaining the Etiology of the Disease to Patient

Research Scientists conducting Microscopic Examination of Wuchereria Bancrofti Microfilaria

DOLF

Death to Onchocerciasis and Lymphatic Filariasis (DOLF) is a study that looks at the effect of single dose versus double dose treatment of both diseases using Ivermectin. The German Ministry of Education and Research (BMBF) is funding this project with **Dr. Alex Debrah and Prof. Achim Hoerauf** as principal investigators.

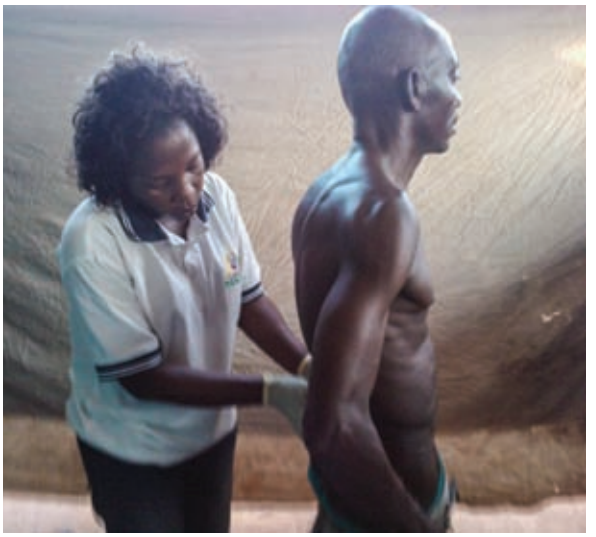
Currently researchers are on the field and conducting laboratory examination and determination

Participants Recruitment Session

Surgical Removal of Nodules

Skin Snipping

Filariasis Research Group



Palpation of Onchocercoma

List of Active External Grants in CHS

No.	Name of Project	Principal Investigator	Department / Unit	Funder	Amount	Period
1	UUICA	Dr. Daniel Ansong	Child Health	University of Utah	$ 300,000	2013 - 2016
2	H3Africa Bionet	Prof. Ellis Owusu Dabo	KCCR	National Institutes of Health/University of Cape Town	$329,080	2012 - 2017
3	MORION	Dr. Alex Yaw Debrah	KCCR	BONNFOR	€ 150,000	2015 – 2016
4	JANSEN	Dr. Alex Yaw Debrah	KCCR	Janssen-Cilag Pharmaceuticals	€ 43,744	2015 – 2016
5	GWAS	Dr. Alex Yaw Debrah	KCCR	Bill and Melinda Gates Foundation	€ 348,700	2015 – 2018
6	TRANSMAL	Prof. Ellis Owusu-Dabo	KCCR	German Research Council, (DFG)	€ 218,610	2015 – 2018
7	TB DRS	Prof. Ellis Owusu-Dabo	KCCR	Global Fund through national TB program, Ghana	$ 149,930	2015 – 2016
8	DZIF TB	Prof. Ellis Owusu-Dabo	KCCR	BMBF	407,625.00	2013 - 2015
9	Pathogenesis and management of M. ulcerans disease (Buruli_Ulcer) BURULIPATH	Dr. Richard Odame Philips	KCCR	Medical Research Council, UK	€ 44,336	2015 – 2016
10	Detection of chronic HCV infection and recovery among cohort of HCV positive blood donors in Kumasi (K-LUMC HCV study)	Dr. Richard Odame Philips	Medicine	Medical Research Council, UK	£210, 856.00	2013 - 2017
11	African Research Network for Neglected Tropical Diseases (ARNTD)	Dr. Richard Odame Philips	KCCR	VW foundation	€ 400,000.00	2015 - 2019
12	Virus biology, host ecology and human behaviour as determinants for coronaviral zoonoses (BAT II)	Prof. Yaw Adu Sarkodie	KCCR	German Research Council, (DFG)	€ 182,228.00	2015 - 2019
13	BAT-Ulm	Dr. Marco Tschapka and Prof. S. K. Oppong	KCCR	German Research Council, (DFG)	€ 136,040.00	2014 - 2017
14	Severe typhoid in Africa project (SETA)	Prof. Yaw Adu Sarkodie	KCCR	Gates Foundation /IVI	$ 695,774.00	2014 - 2017

No.	Name of Project	Principal Investigator	Department / Unit	Funder	Amount	Period
15	The influence of M. perstans infection and their Wolbachia endosymbionts on host immunity against mycobacterial infection, BCG vaccination efficacy, and disease susceptibility in children and adolescents (Map2Co)	Prof. Achim Hoerauf	KCCR	Bill and Melinda Gates Foundation through International Vaccine Institute (IVI)	$700, 000.00	2015 - 2017
16	A randomized clinical trial of 4 months Rifampicin vs. 9 months Isoniazid for latent TB infection-phase 3 effectiveness (4RIFvrs9INH)	Joseph Obeng Baah	KCCR	Canadian Institute of Health Research (CIHR)	CAD$ 41,516.75	2011 - 2016
17	ORDISS	Prof. Solomon Ofori-Acquah	KCCR	University of Pittsburgh	$ 250,000	2015 – 2019
18	Development of Immunity and Tolerance against Malaria (DITAM)	Dr. Maria Mackroth	KCCR	Bernhard Nocht Institute for Tropical Medicine	€ 10,340	2014 – 2016
19	Strengthening Injury Control research in Ghana and West Africa	Prof. Peter Donkor	Surgery	Fogarty International Centre, NIH	$135,615	2016 - 2020
20	Everlast	Dr. Stephen Sarfo	Medicine	NIH	$96,331	2016 - 2018
21	Enhancing the Public Health impact of Latent TB infection diagnosis and treatment: Apragmatic cluster randomized Trial (ACT 4)	Dr. Joseph Obeng Baah	KCCR	Canadian Institute of Health Research (CIHR)	CAD$ 78,979.00	2016- 2017
22	ARNDT General Assembly Meeting	Dr. John Amuasi	KCCR	VW foundation		2015-2019
23	Development of a Rapid test for Buruli ulcer (BU-RPA I)	Dr. Michael Frimpong	KCCR	ISID	$ 7,000.00	2016 - 2017
24	Documentations of aonoceriasis transmission and vector	Dr. Thomas Kruppa	KCCR	BNITM	€ 10,030.68	2016
25	Genetic determinants for the transmission of Cryptospridium spp. Among humans and animals	Dr. Daniel Eibach	KCCR	German Research Council (DFG)	€ 110,453.00	2016 - 2019

No.	Name of Project	Principal Investigator	Department / Unit	Funder	Amount	Period
26	DELGEME	Dr. Oumou Maiga-Ascofare	KCCR	Wellcome Trust through MRTC (Mali)	£ 213,900.00	2016 - 2021
27	KCCR Research Group on non-communicable diseases (EOD)	Prof. Ellis Owusu-Dabo	KCCR	BNI Hamburg	€ 140,000.00	2016 - 2017
28	Septicaemia in Intensive Care: Pathogens and Antibiotic utilization	Dr. Kirsten Eberhardt	KCCR	BNITM	€ 11,840.00	2016 - ongoing
29	Tackling the obstarcles of Filariasis and Podoconiosis Disease Control	Dr. Thomas Kruppa	KCCR	BNITM	€ 13,632.00	2016 -2017
30	Designing point of care diagnostics for the diagnosis of tuberculosis in children (APOC)	Prof. Ellis Owusu-Dabo	KCCR	University of Pennsylvania	$ 35,863.00	2016
31	ATP2	Dr. Christian Timmann	KCCR	DFG	€ 11904.00	2016
32	Esther Profile	Dr. Kirsten Eberhardt	KCCR	GIZ, Gesellschaft fur Internationale Zusammenarbeit	€ 110,500.00	2013 - 2016
33	NTD Genetics	Dr. Alex Debrah	KCCR	European Union	€ 100,000.00	2009 - 2016
34	Hepik II	Dr. Richard Odame Philips	KCCR	Liverpool University	18058.15	2015 -2017
35	NTD USAID	Dr. Alex Debrah	KCCR	USAID	$30,643.00	2016
36	MPV3	Dr. Samson Pandam Salifu	KCCR	Millennium Villages Project	GHS 15,600.00	2016
37	Ebola Extension	Prof. Christian G. Meyer	KCCR	Federal Ministry of Foreign Affairs, Germany	€ 280,000.00	2016
38	Pathophysiology of delayed haemolysis after treatment with parenteral artesunate in serve malaria, a double centre observational study (ART FU)	Prof. Yaw Adu-Sarkodie	KCCR	Brauns Foundation, Hamburg	€ 12,0000.00	2014 - 2016
39	HIV studies and Training on Barrier Nursing and Ebola Diagnostics (Esther Ebo giz)	Dr. Kirsten Eberhardt	KCCR	GIZ	€ 20,000.00	2016

No.	Name of Project	Principal Investigator	Department / Unit	Funder	Amount	Period
40	The role of candidate micro RNSa in T-cell response during acute tuberculosis and latent M tuberculosis infection. (Tb6)	Dr. Marc Jacobsen	KCCR	Deutsche Lepra und Tuberkulosehilfe (DAHW)	€ 316,291.00	2013 – 2015
41	Rodam	Prof. Ellis Owusu-Dabo	KCCR	European Union	€ 280,480.00	2012 – 2014
42	Assessing chronic wound infections and their microbiomes in outpatients in rural Ghana (Wound Study)	Dr. Denise Dekker	KCCR	DZIF	2,400.00	2014 – 2016
43	Genetics of Lymphoedema and Hydrocele in Filariasis" looks at the genetic polymorphisms of Lymphatic Filariasis. (DFG Genetics)	Prof. Ohene Adjei	KCCR	European Union	€ 270,604.00	2010 - 2015

COLLEGE OF HUMANITIES AND SOCIAL SCIENCES

The Concept of Consumer Protection: Historical Background and Ghanaian Perspectives.

Dr. (Mrs) Lydia A. Nkansah (Faculty of Law, KNUST) and her team undertook the project titled "The Concept of Consumer Protection: Historical Background and Ghanaian Perspectives".

The project which started in October 2015 and is scheduled to end in December 2016 was funded by the College of Humanities and Social Sciences to try and get consumers of goods and services sensitised about their rights and to publish a book on the various interests/rights of consumers. It was also to influence the Consumer Protection Bill currently pending before Parliament.

The expected outcomes/impact of the project include the following:

- To influence the respect for the rights of consumers in Ghana
- To empower consumers in the enforcement of their rights
- The research papers and the ultimate publication will serve as a great source of information and will add to the resources on consumer protection.

So far, the research has been divided into themes and each theme has also been divided into topics with each research

topic being undertaken by at least one researcher. Researchers have already presented the abstract of their work, researched into their topics and are working on their first drafts.

Researcher Engaging with Market Women

Facilitating the Development and Growth of the Culture & Arts Sector under EU-ECOWAS Economic Partnership Agreement

The European Union, through the African Caribbean and Pacific (ACP) Group of States is funding the project "Facilitating the Development and Growth of the Culture & Arts Sector under EU-ECOWAS Economic Partnership Agreement" with an amount of 498,513.63 EUR.

Mrs. Vesta Adu-Gyamfi and **Mr. Anthony A. Aidoo** are collaborating with the National Association of Nigerian Theatre Arts Practitioners (NANTAP), National Centre for Arts and Culture (NCAC), Gambia and Sierra Leone Film Industry, Labour and Marketing Guild (SFLILMGuild) to undertake the project which started in February 2014 and will end in February 2017.

The project aims to promote a viable arts and cultural sector in ECOWAS member states to contribute to poverty reduction and sustainable development. It also seeks to use the Economic Partnership Agreement (EPA) between ECOWAS and the European Union to develop the Arts and Culture sector which would boost its competitiveness and growth as well as attract investment and facilitate job creation for artistes and cultural entrepreneurs in the region.

The team has so far carried out a study of the cultural industries, the practitioners, stakeholders and policy makers in all four (4) partner states to identify areas of cooperation with partners and the EU under the Economic Partnership Agreement. The team has also organised series of conferences and business-to-business meetings to disseminate study findings and recommendations, drawn a plan of action for networking, and completed the signing of business agreements, and a memorandum of understanding (MoU) for an ECOWAS film project among the film artistes/producers. The team has additionally completed and submitted a 96-page Needs Assessment Report on facilitating the development and growth of the culture and arts sector under the EU-ECOWAS Economic Partnership Agreement to the funding agency and stakeholders in partner countries.

The third and last phase of the project will focus on workshops and capacity building and training programmes/activities on the EPA and other trade agreements for cultural intermediaries to enhance their advocacy skills for the mainstreaming of the recommendations of the study into policy and trade negotiation processes and subsequent implementations.

Microfinance for Poverty Reduction among Rural Women in Africa: Investigating Contextual Determinants of Success and Failure in Ghana and Kenya

Microfinance programmes for women have emerged and are increasingly being promoted as both a solution to women's limited access to credit and a strategy for poverty reduction and women's empowerment. In this regard, **Dr. John Kuumuori Ganle** is leading a team of 4 members from KNUST to undertake the "Microfinance for Poverty Reduction among Rural Women in Africa: Investigating Contextual Determinants of Success and Failure in Ghana and Kenya" project with the Department of Gender and Development Studies, Kenyatta University, Kenya.

The Association of African Universities' (AAU) Policy-Relevant Research Programme is funding this project with an amount of US$ 47,500.00 for 18 months, from July 2015 to December 2016. The objective of the research is to investigate and identify contextual factors that determine the success and failure of microfinance schemes for poverty reduction among rural women in Ghana and Kenya. The following activities have been completed for the first and second phases of the study.

Phase I concentrated on desk study, documentary analysis and reconnaissance visits and involved the following;

- Identification and selection of stakeholders: Micro Financial Institutions (MFIs), government agencies, women borrower groups/communities, and academics
- Reconnaissance visits to, and contact with selected stakeholders: MFIs, government agencies, women borrower groups/communities in Volta, Ashanti and Northern Regions, and academics in Cape Coast University and KNUST

Phase II concentrates on stakeholder consultation and initial qualitative research and it involves the following;

- Stakeholder consultation meetings and online discussions with selected MFIs, government agencies, women borrower groups/communities, and academics
- Design of instruments and preparation for initial qualitative data collection.
- Qualitative data collection. The qualitative data is being processed for analysis, validation of initial results, and dissemination of preliminary results.

The project would produce three main outcomes namely;

1. Answer the question. What are the key factors in the success and failure of microfinance schemes in Africa?
2. Develop and sharpen the research capabilities of the individual researchers undertaking this research and
3. Build and strengthen collaborative research and partnership between researchers in KNUST and Kenyatta University.

Mandatory Pre-Employment Medical Examination; The Practice and the Law: Is It Justifiable?

Alexander Oti Acheampong and **Chris Adomako-Kwakye** undertook the research titled "Mandatory Pre-Employment Medical Examination; The Practice and the Law: Is it Justifiable?"

The study which was conducted in two major public institutions whose identity must remain anonymous, aimed to evaluate the process of pre-employment medical examination, the law and the practice.

Employers would want to maximise their returns on investment including the health of their workforce. To this end, employers before engaging an employee seek to obtain a medical report on the prospective employee. The request for medical examination is to ensure that the prospective employee has no "grave medical condition" and that the employee is "physically and mentally" fit for the position offered.

In some cases, the demands of the work require that the prospective employee meets certain minimum medical standards to qualify for the position. Depending upon the medical report, a decision may be taken either to give or not to give the job to the prospective employee. Sometimes, the employee is informed in the appointment letter that his/her appointment will be confirmed subject to the ascertainment of satisfactory medical conditions. The crucial issue is, is mandatory pre-employment medical examination a necessary/legal requirement for a job in Ghana?

In Ghana, the Labour Act 651 has no provision for the collection and use of medical information by employers on prospective employees for purposes of recruitment. The legal risk is that the whole structure of using a medical report to accept someone as an employee over another, amounts to discrimination in employment. Indeed, the Labour Act 651 of Ghana frowns on "restrictive conditions of employment" [section 14 (e)]. The Act however makes provisions for the protection of the worker with respect to occupational health, safety and environment. These provisions generally ensure that the employer maintains a safe working condition for the employee and minimizes hazards at the work place.

It is evident that there is no law in Ghana which supports mandatory pre-employment medical examinations of prospective employees. In fact, most of the international laws from the developed countries do not also support the practice. There is therefore no legal basis based on Labour Act 651 Section 14 (e) for mandatory requests of medical examination reports of prospective employees. However, the laws have provisions for the practice especially if that job has some inherent risk to ensure that the working environment is safe. Medical reports according to the findings of the study do not take into consideration the job description of the prospective employee and therefore the reliance on the medical report to determine the fitness of the prospective employee for a particular job is not based on fair evaluation and thus not justifiable. Most of the medical practitioners who conduct the medical examinations are not occupational health doctors trained to do examination related to the demands of the work.

The idea behind the indiscriminate demand of pre-employment medical reports of prospective employers is good. However, there should be proper legislation to support the practice and it should be done in accordance with the laws of Ghana. Again, the examination where necessary should be specific to the job description and the working environment. Medical reports should also be submitted to the medical board of choice of the employer and the identity of the individual should be protected as demanded by the Data Protection Act 2012, Act 843 of Ghana.

Inequities and Inaccessibility to and Utilization of Maternal Health Services in Ghana After User-Fee Exemption

Ghana is one of the few countries in Africa to have actively implemented both universal maternity care and health insurance policies at the national level. In an effort to achieve the Millennium Development Goal (MDG) 5 the government of Ghana implemented a policy that provided free maternal health services in all government, mission, and selected private health facilities.

In sub-Saharan Africa, the risk of maternal death is very high at 1 in 38, unlike the developed world where the risk is 1 in 3700. MDG 5 calls for steep reductions in maternal mortality and universal access to reproductive health, crucial to achieving MDG 3 — to promote women's empowerment.

The study sought to examine the extent to which maternal health services are utilised in Ghana, and whether inequities in accessibility to and utilisation of services have been eliminated following the implementation of a user-fee exemption policy, that aims to reduce financial barriers to access, reduce inequities, and improve access to and use of birthing services.

Findings demonstrate that **many women continue to deliver their babies at home or outside government and non-government healthcare facilities without skilled care. Again, it suggests** that differences in educational attainment, wealth, type of residence, geographical region, religious affiliation, and ethnic background play a crucial role in the continued practice of maternal health services. **In the context of Ghana where maternal health services are provided free at the point of delivery, poverty, unavailability of maternal health services, high transportation costs, limited appropriate transportation, and social costs associated with maternal health seeking** might explain the rich-poor gap in service accessibility and utilisation. Exempting patients seeking maternal health services from paying user-fees is a promising policy option for improving access to maternal health care, but it might be insufficient on its own to secure equitable access to maternal health services in Ghana.

The study was funded by a Wellcome Trust Doctoral Studentship as part of a Wellcome Trust Enhancement Award and was led by **Dr. John K. Ganle** as the principal investigator.

CONFERENCE

11th Inter-University Conference for Doctoral Studies in French

Conference Participants

The Department of Modern Languages has organised a four-day Inter-university conference for Doctoral Studies (ICDS) in French on the theme "Doctoral Research in the 21st Century: The Role of Language Science, of the Science of Literature, of Information and Communications Technology (ICT)". The conference seeks to initiate, follow-up and promote all relevant scientific or pedagogical activities in doctoral studies and research in Ghanaian universities.

This conference came about as a result of a memorandum of understanding (MoU) signed among four (4) public institutions in Ghana: University of Education, Winneba (UEW); University of Ghana, Legon (UG); Kwame Nkrumah University of Science and Technology, Kumasi (KNUST); University of Cape Coast, (UCC) and L'Université de Strasbourg, Strasbourg, France (UNISTRA).

Prof. Kofi Osei Akuoko, Chairman

Professor Kofi Osei Akuoko, Chairman of the conference, stated that the signatory institutions had identified the common need to increase the number of lecturers and researchers and upgrade their training in Ghanaian universities and therefore the need for ICDS. He added that it sought to promote collaborative work between students, researchers and lecturers of the Republic of Ghana and their French counterparts.

He mentioned that ICDS supported the implementation and coordination of activities for the Doctoral School of French Studies, the training and promotion of researchers of partner institutions in order to enhance mobility, creating access to multidisciplinary documentation, particularly in French, organizing inter-university doctoral and scientific training that promoted and sharpened the skills and expertise of researchers.

Prof. Akuoko observed that ICDS was a consortium that could be joined by new members, either from the Anglophone or Francophone countries. He made the audience aware that doctoral candidates would have the opportunity to present their work and in turn benefit from the inputs made by the resource persons in order to improve their work.

Professor Samuel Nii Odai, Pro Vice-Chancellor, stated that French was important to the Ghanaian community because

we are surrounded by Francophone countries and therefore we need it to break language barriers in international relations. He added that the conference was a great opportunity since it covered participants across the various universities in Ghana. He urged candidates to encourage French speaking in their various communities.

Professor Robert Clement Abaidoo, Dean of School of Graduate Studies, expressed his gratitude to the organisers for pooling resources to enhance postgraduate studies. He declared that ICDS was prepared to register more participants so as to extend French to the younger generation. He said that the participants would be trained in supervision through various guidelines and practices so that the younger ones could be served better in French studies.

List of Active External Grants in CoHSS

No	Name of Project	Principal Investigator	Department / Unit	Funder	Amount	Period
1	Facilitating the Development and Growth of the Culture & Arts Sector under EU-ECOWAS Economic Partnership Agreement	Anthony A. Aidoo	Centre for African Studies	ACP- EU	€ 116,918.91	2014 - 2017
2	Microfinance for Poverty Reduction among Rural Women in Africa: Investigating Contextual Determinants of Success and Failure in Ghana and Kenya	Dr. Alexander Yao Segbefia	Geography and Rural Development	The Association of African Universities (AAU)	US$ 47,500	2015 - 2016

COLLEGE OF SCIENCE

Improving Shelf Life of Processed Cereal-based Foods by Cereal Processing Companies

Under the pilot study of the Building Stronger Universities (BSU) II project – WP2 entrepreneurship and job-creation funding – **Dr Herman Lutterodt** and his team in collaboration with Premium Foods Ltd (PFL), Kumasi are working on the project "Improving Shelf Life of Processed Cereal-based Foods by Cereal Processing Companies" with an amount of US$ 10,000 for the period between January 2014 and May 2017.

The project team includes **Mr. William Ofori Appaw, Miss Nadia Oppong, Miss Pearl Agyekum, Mr Benjamin Sackey,** all of the Department of Food Science and Technology and **Mr Kwame Kwarteng** of the Business School.

The aim of the project is to formulate and improve the shelf life of nutritious ready-to-eat breakfast meals produced from locally grown cereals. So far, a standardised formulation protocol has been developed and adopted for use. A corn/soy blend of 60% corn flour and 40% soya flour which meets the WHO international standards supported by laboratory results has also been formulated. There has also been a shelf study of formulated cereal packaged and stored using different packaging materials and storage conditions (varying % humidity and temperature), as well as food safety audit of PFL processing facility.

Cereal Samples

The impact of the project is the formulation of nutrient-dense ready-to-eat breakfast cereals as well as improved shelf-life stability of products (with a view to the export market) and market value of cereals for food processing companies and small-holder farmers. Staff of PFL would be trained on food sanitation and safety.

This BSU II funded project is also supporting theses research for a BSc Food Science & Technology and Business & Marketing Students.

Malnutrition eLearning Evaluation Project – September 2014 to 2016

Under-nutrition is associated with 3.1 million child deaths annually. In a recent report, scaling-up the management of Severe Acute Malnutrition (SAM) was identified among the nutrition interventions with the largest potential to reduce child mortality. Lack of operational capacity at all levels of the health sector, however, constrains scale-up. In countries most affected by SAM, training and curricula are outdated or non-existent, and misaligned with strategic and operational needs, leading to a workforce ill-equipped to identify and treat malnourished children.

The rapid spread of the internet across the developing world provides exciting new opportunities for delivering training in a way never before possible. If utilised effectively, eLearning can make a significant contribution to building capacity for improved malnutrition management, supporting the aims of the Scaling Up Nutrition (SUN) movement, through training of relevant personnel all around the world. It is against this background that the International Malnutrition Task Force and the University of Southampton have developed an interactive eLearning on the management of acute malnutrition in infants and young children. The course is accessible at **www.som.soton.ac.uk/learn/test/nutrition**. **Dr. Reginald A. Annan** is the principal investigator from the Department of Biochemistry and Biotechnology KNUST, Ghana.

The Department of International Development, UK through the Nutrition Embedding Evaluation Programme is supporting a 24-month evaluation of the malnutrition eLearning course with the University of Southampton, UK, in partnership with Kwame Nkrumah University of Science and Technology (KNUST) in Ghana, Guatemala and El-Salvador. The aim of the project is to investigate the effectiveness of the course in equipping health professionals with core knowledge and competencies to identify and accurately treat and manage SAM in hospitals and in the community, and so contribute to reducing child morbidity and mortality.

Participant Accessing the Course

A Participant Accessing the Course

Assessment after the Training

Participants Sharing Experiences on Malnutrition eLearning after Training

In Ghana, over 300 health professionals in nine district hospitals and their surrounding health centres in Ashanti Region, and 600 students in seven pre-service training institutions across the country are involved in the study. The hospitals/health centres include Maternal and Child Health, Kumasi South Hospital; St Michael's, Pramso; St. Patrick, Offinso; Agogo Presbyterian Hospital; Manso Nkwanta Hospital and Government hospitals at Konongo, Ejura and Mankranso. The training institutions involved are the Christian Service University College, Kwame Nkrumah University of Science and Technology, University of Allied Health Sciences in Ho and Hohoe, Community Health Nurses Schools at Kokofu and Fomena, Kumasi Nurses Training College, Sunyani Catholic University College, and Kintampo Health School. In all, over one thousand pre- and in-service health professionals in these institutions/hospitals, made up of nurses, public health practitioners, nutritionists, dieticians and doctors have been trained on the course. The impact of the training on their knowledge, understanding, practices and competencies in SAM, and child morbidity and mortality are being tracked.

Initial findings show that the course improves knowledge and understanding, and this improves practice in the care of malnourished children in hospital wards and outpatient departments. Improvement in knowledge and understanding builds confidence among health professionals, and it changes their perception and attitude about SAM. Data on impact on child morbidity and mortality are being analysed. The project will end in September 2016.

Bioprospecting for Bioactive Agents from Ghana's Rich Flora

This research work, supported with funding from the International Foundation for Science, is a collaborative research comprising scientists from Ghana, Nigeria, Uganda and Tanzania. It seeks to unearth potent anti-plasmodial agents from Africa's numerous medicinal plants and use that as a basis for biodiversity conservation in line with the goals of the Convention on Biological Diversity. The strategy is to screen commonly used plants in malaria physiotherapy and isolate potent anti-plasmodial compounds from plants that give us good anti-plasmodial activity. To this end, 50 medicinal plants have been collected, and authenticated. Initial screening of the crude extracts has provided promising results which will be the basis for isolation experiments. Interestingly, the medicinal plants that have been collected are also used in other traditional therapeutic areas. Therefore, the project is also looking at the antimicrobial, anti-inflammatory, cytotoxic and anthelminthic properties of these extracts as well. The team hopes to unearth compounds with potentials as leads in drug discovery programmes. **Dr. L. S. Borquaye** of the Department of Chemistry leads this project.

From Waste to Use: Isolation of Native Lignocellulolytic Fungi for Use in Biofuel Production

Global climate change driven mainly by fossil fuel combustion is an increasing concern for all countries. Production of bioethanol from lignocellulosic material, particularly when renewable biomass resources exist locally, offers a method to reduce dependence on crude oil, decrease emission of fossil derived carbon dioxide and complement waste-to-energy efforts. Lignocellulose conversion to bioethanol is a more sustainable alternative to first generation bioethanol, and may become economically viable, particularly for the developing world. Pre-treatment of plant biomass, which could be physical, chemical or biological, is an important step in the conversion of cellulosic material to ethanol. Biological pre-treatment, which employs enzymes is far cheaper and more environmentally friendly than the chemical and physical pretreatments. These notwithstanding, enzymes produced by specialist enzyme suppliers are costly. Wood-decay fungi such as white and brown-rot fungi have been examined for their cellulolytic abilities.

The goal of the project is to identify native Ghanaian fungal strains that have high lignocellulose conversion efficiencies. This project is currently being funded by a pilot grant from the DANIDA-funded Building Stronger Universities II programme and is a collaboration with **Dr. Edmund Ekuadzi** (Department of Pharmacology), **Mr. Jim Mensah** (Department of Chemical Engineering), **Mr. John Lawer Terlabi** (Department of Theoretical and Applied Biology), **Mr. T.M. Pascal** (Department of Optometry), **Mr. Emmanuel Asiedu** (Faculty of Agriculture) and **Dr. Moses Mensah** (Department of Chemical Engineering). The team has thus far isolated a number of fungi with amazing delignification and saccharification efficiencies. Identification and characterisation of these fungi strains are ongoing. The team hopes to extend this work by identifying fungi that can break down seaweed to the simple sugars. Such fungi are desired because of the increasing demands for seaweed

bio refineries. **Dr. L. S. Borquaye** of the Department of Chemistry, is leading this project.

Environmental Monitoring: Pollutants in the Environment

Pharmaceutical and Personal Care Products(PPCPs) have been labelled as emerging environmental pollutants due to their presence in environmental samples analysed in various parts of the world. Though found in very low concentrations in soil and water samples, the harmfulness of PPCPs stems from the fact that they have been designed to elicit responses from specific biological targets. In the absence of these targets, the effects of these pollutants are elusive, and can be only speculated on/about. This project is developing simple, robust and low-to-medium screening protocols for the quantification of these analytes in soil and water samples. Models that will permit us to predict the fate of these PPCPs in our environment are also under investigation. This is another project being funded by the Building Stronger Universities II programme with **Dr. Godfred Darko** (Department of Chemistry), **Prof. Eric Woode** (Department of Pharmacology) and **Dr. Edmund Ekuadzi** (Department of Pharmacognosy) as collaborators. **Dr. L. S. Borquaye** of the Department of Chemistry, leads this project.

DACCIWA Project in KNUST

The population of the southern part of West Africa is experiencing growth of 2-3% per year (United Nations Economic Commission for Africa, 2010). According to the UN this will result in an estimated 50% growth of the population by the year 2050. Accompanying this largely urban population growth will be an improvement in economic conditions and thus an increased demand for energy. It is expected that the emission of polluting aerosols will grow over the period. Such changes in the composition of the atmosphere over Southern West Africa (SWA) are regionally relevant, given the likely, yet largely unstudied influence of the climate of southern West Africa on the larger West African Monsoon.

Dr. Leonard Amekudzi and Dr. Mrs. Barbara Brooks

The Dynamics-Aerosol-Chemistry-Cloud Interactions in West Africa (DACCIWA), a EU-funded project, which is a collaboration with the University of Leeds, Atmospheric Council and Karlsruhe Institute of Technology, Germany and Kwame Nkrumah University of Science and Technology has therefore started work to study the phenomenon. DACCIWA will conduct extensive fieldwork in SWA to collect high-quality observations, spanning the entire process chain from surface-based natural and anthropogenic emissions to impacts on health, ecosystem and climate.

The broad goal of DACCIWA is to provide "a comprehensive scientific assessment of the impacts of the projected rapid increases in anthropogenic emissions on air quality, human health, ecosystems, agricultural productivity, water availability, energy production and local to regional climate." This is to be achieved through a combination of further long-term observations, an intensive field campaign, satellite analysis and targeted modelling studies.

Currently, an intensive field campaign is ongoing. The main goal of the ground observations is to characterize the diurnal evolution of the planetary boundary layer and its relationship to changes in cloud macro- and micro-physical properties and rainfall. There is also a sizeable modelling component to DACCIWA, including realistic and sensitivity experiments on a variety of spatial and temporal scales. New field observations would be compared with model output in the attempt to achieve the goal of improving parameterizations of the planetary boundary layer, chemistry, moisture convection, cloud microphysics and radiation within SWA.

In achieving the set goals of the DACCIWA project, two supersites have been set up at KNUST, Kumasi and Save, Benin with an additional field in Ghana, located at the Ghana Meteorological Agency (GMet) head office in Accra.

Dr. Leonard Amekudzi is the project coordinator and **Dr. Mrs. Barbara Brooks** is the leader of DACCIWA Work Package One Group. The project has found out that it is only by increasing ground-based measures, that Ghana and West Africa can improve on their models in order to help deal with population growth and its implications on the climate, based on the UN prediction.

The Possibility of Fungal Toxin Found in Cocoa Beans in Ghana

Many communities in Ghana produce cocoa beans as their main economic activity. Ochratoxin A is a potentially carcinogenic fungal toxin found in a variety of foods. One such food product is cocoa beans. It is against this background that **Dr. R. B. Voegborlo** from Chemistry Department is collaborating with **Mr. A. Yamoah** and **Mr. W. A. Jonfia-Essien** both from the Research Department, COCOBOD, to assess the levels of Ochratoxin A in cocoa beans from

Ghana and the levels of exposure by the population to this toxic substance.

Sampled cocoa beans were selected from districts in four regions of Ghana and were analysed for Ochratoxin A using HPLC with fluorescence detector after clean-up using immunoaffinity column. After a careful study of the data, the project found that consumption of cocoa beans from Ghana is unlikely to cause any major toxicological effects and therefore Ochratoxin A represents a low level public health risk.

Prevalence of Pre-Diabetes/Diabetes and Associated Risk Factors among Selected Staff in KNUST

Diabetes is one of the most common non-communicable diseases in nearly all countries, and its incidence continues to increase world-wide. Knowledge of pre-diabetes/diabetes offers the opportunity to reduce risk by some interventions so as to delay, or stop the progression from pre-diabetes to diabetes. This informed **Dr. F. O. Mensah** from Biochemistry and Biotechnology Department and his team to attempt to determine the prevalence of pre-diabetes/diabetes and associated risk factors among selected workers in KNUST, mainly junior staff.

Demographic data, information on physical activity and knowledge of diabetes, blood pressure and anthropometric measurements were assembled from participants. Blood samples of participants were analysed to determine fasting blood glucose (FBG), low density lipoprotein (LDL), high density lipoprotein (HDL), triglyceride and total cholesterol levels.

The prevalence of pre-diabetes (13.8%) and diabetes (3.1%) were the results. Pre-hypertension (55.0%) and hypertension (28.8%) were the most predominant risk factors among the participants. Other risk factors included overweight (35.6%), obesity (6.3%) and family history (17.5%). Taking cognizance of the non-modifiable factors while monitoring the modifiable risk factors can lead to modification of lifestyle and reduce the complications and high mortality rate associated with diabetes.

Production and Characterisation of Enriched Pasta Based on African Rice

Dr. I Amoah from Biochemistry and Biotechnology Department and his team have been involved in the study of production and characterisation of enriched pasta-based on African rice. Rice has gained much popularity as a staple food in West Africa. Despite strong improvements in rice production trends, African rice suffers from very low consumer acceptability due to poor grain quality, sensory properties, and cooking performance. In this frame, the development of innovative enriched rice products is a promising way to exploit low-grade African rice varieties. Rice-based pasta was produced at the experimental pasta-making plant at the University of Milan, Italy by extruding dough prepared with pre-gelatinised rice flour and liquid egg albumen, and enriched with African soybean flour (cv Jenguma) and/or African sweet potato flour (cv Apomunden).

Results from e-sensing experiments show electronic nose response were sample-specific and strongly depended on the presence/absence of soybean. The taste assessed by the electronic tongue of the various samples was influenced by their peculiar enrichment. It was found that soybean gives a typical umami taste, while sweet potato leads to astringency. Protein aggregation and accessible thiols tests indicated improved network-forming ability results from soybean enrichment in part due to stabilisation by hydrophobic interactions and disulfide bonds. Physico-chemical tests showed that pasta texture is significantly impaired as a result of sweet potato enrichment. In conclusion, the characterisation of differently enriched rice-based pasta depends on the specific ingredient combinations. This information can offer some guidelines for designing and producing foods that meet consumer expectations, which may also add value to African raw materials.

Application of Mosquito Repellent Coils and Associated Self-Reported Health Issues in Ghana

The use of mosquito coils has gained widespread patronage in malaria endemic countries, even though it is not a recommended preventive measure for avoiding mosquitoes. Mosquito coils contain insecticides, which are expected to vaporise slowly once the coil is lit to provide protection against mosquitoes. The base material for the production of mosquito coils contains a variety of compounds capable of burning slowly to gradually release the insecticide. The smoke of the mosquito coil, however, is potentially a source of indoor air pollution with implications for Acute Respiratory Infections (ARI) and other illnesses.

It is against this background that **Dr. J. N. Hogarh** from the Department of Environmental Science and his team investigated the application of mosquito coils and associated self-reported health issues in Ghana. A cross-sectional study was undertaken in which questionnaire was randomly administered to 480 households across four districts in Ghana. Respondents who exclusively applied mosquito coils were grouped as test cohort, while those who did not apply any mosquito repellent methods constituted a control cohort.

The test group that applied mosquito coils reported malaria incidence rate of 86.3 %. The control group that did not apply any mosquito repellent methods reported a 72.4% malaria incidence rate. Chi square analysis suggested that the observed difference was statistically significant (x^2= 4.25; p = 0.04). The number of respondents who reported symptoms of cough from mosquito coil application (52.6% incidence rate) was marginally greater than their counterparts who did not apply coils (46.1 % incidence rate). It was also found that respondents with shortness of breath, which was used as a proxy for ARI, were more likely to have applied mosquito coil.

The application of mosquito coils did not necessarily reduce the incidence of malaria in the study communities. It however presented a potential respiratory risk factor, which should be further investigated by critically examining exposure to particulate matter emissions from burning coils.

Mycotoxins Lab

Mycotoxins are a group of naturally occurring chemicals (secondary metabolites) produced by certain fungi. The Food and Agricultural Organization (FAO) estimates that 25% of the world's crops are affected by mycotoxins, of which the most notorious are aflatoxins. These potent toxins have severe effects on animal and human health, e.g. cyto nephron or neurotoxic, carcinogenic, mutagenic, immuno-suppressive and estrogenic effects. Other adverse economic effects of mycotoxins include reduced livestock productivity, losses of valuable foreign exchange earnings, costs of monitoring and detoxification efforts etc. Mycotoxins also contribute to early childhood growth faltering with epidemiological data providing evidence between mycotoxin exposure, stunting and underweight.

Testing Samples

The infestation of mycotoxin in the food supply of Ghana is poorly monitored. Hence, the supply of cereal grains, legumes, animal and animal products etc are questionable in regards to consumer safety. Ghana is unable to competitively export the aforementioned crops because of the uncertainty of toxin levels. This amounts to a large loss in revenue and jobs that could be acquired from a robust export industry. In addition to the export industry, there is the need to also make sure food supply for local consumption and industry are also safe.

Based on this background and KNUST's experience in mycotoxin research, the laboratory was established through a private public partnership between USAID-ADVANCE, KNUST, Agro Food Processing Companies and Ghana Poultry Industry. Given Ghana's strategic location and access to the West African market, the establishment of the laboratory is seen as a major step towards the development of a viable agro-processing industry where standardisation acts as a business development catalyst.

The laboratory is equipped with mycotoxin and chemical analytical capability for testing raw materials and end products within the food industries, poultry and livestock especially in the central and northern parts of the country. This is to help respond to the lack of commercial and research responsive analysis system that will serve the industry to meet demands of increasingly more sophisticated markets.

Mycotoxin analysis carried out in the laboratory include Aflatoxins (AFLA), Ochratoxins (OTA), Fumonisins (FUM) and is currently adding Zearalenone (ZON), Aflatoxin M1 and Deoxynivalenol (DON) to its portfolio. Chemical analysis tailored to meet client's needs include Bisphenol A, Acrylamide and PAH

Testing Samples

The laboratory renders analytical and consultancy service to clients and stakeholders from the food and agro-processing industries, NGOs, regulatory agencies (Food and Drugs Authority), donor agencies, research institutions, students and the general public.

The Mycotoxin Laboratory has and is currently working with both local and internationally sponsored projects such as USAID-CRSP, Feed the Future – Peanut and Mycotoxin Innovative Labs (PMIL), Bill Melinda Gates Grand Challenge Explorations via Mobile Assay Inc., Premium Foods Ltd, CSIR-CRI, CSIR-SARI etc.

Optometry Eye Clinic

The eye clinic was opened to students and the general public on the 14th of September with an average attendance of 15 patients on the first day. Notices were put up to inform all students in the College of Science to partake in an eye screening exercise. Students were charged GH¢2.00 per an eye-screening session.

The Optometry Eye Clinic was set up to serve as an 'Academic Vision Centre' to facilitate teaching of optometry students and provide quality eye-care service to all staff and students of KNUST, as well as neighbouring communities. It provides subspecialty optometric care such as low vision, binocular vision, and contact lens to patients.

Attendance recorded during the past month was 1, 504 with a mean attendance of 15 per day. The table below illustrates the attendance for the various departments. Most of the students who attended the eye clinic were from the College of Science (67%) with a few from the College of Engineering, College of Health Sciences and College of Arts and Social Sciences (33%) [Table 1].

Table 1. *Distribution of attendance to clinic by various departments*

Department	Number of Cases	Percentage (%)
Optometry and Visual Science	32	2.13%
Chemistry	68	4.52%
Biology	188	12.50%
Environmental Science	20	1.33%
Food Science	60	3.99%
Biochemistry and Biotechnology	88	5.85%
Physics	72	4.79%
Computer Science	60	3.99%
Actuarial Science	76	5.05%
Mathematics	240	15.96%
Statistics	88	5.85%
Departments outside CoS Patients outside university community	496	33. 00%
Total	**1504**	**100. 00%**

Optometry Student Checking a Participant's Eyes

Refractive anomalies and/or accommodative and vengeance dysfunctions were the highest recorded cases. Patients diagnosed of refractive errors received prescriptions to purchase at their convenience. Similarly, cases of pathology were managed by giving prescriptions to the respective patients to buy, and referrals given when needed. All referrals were made to KNUST Hospital. Cases of pathology diagnosed include Conjunctivitis, Dry Eye Syndrome, CVS, Glaucoma suspects, Uveitis, and Lid abnormalities. The table 2 below shows the distribution of the various conditions diagnosed.

Optometry Student Checking a Participant's Eyes

Table 2. *Distribution of conditions diagnosed*

Conditions	Number of cases	Percentage
Refractive error/ Accommodative, Vergence dysfunction/ Amblyopia	474	31.52%
Pathology	369	24.53%
Healthy Eyes	661	43.95%
Total	**1504**	**100.00%**

CONFERENCE

First National Conference on Food Fraud

Conference Participants

The Department of Food Science and Technology of Kwame Nkrumah University of Science and Technology (KNUST) in collaboration with Litfahm Consultancy Services held the first national conference on food fraud on the 27th of January, 2016. The Conference was on the theme "Combating Food Fraud: A Multi-Disciplinary Approach". The goal of the event, among other things, was to sensitise both industry players and consumers about food fraud and encourage new ideas and pragmatic steps on how to fight it effectively.

The conference attracted participants from the Ghana Standards Authority, Food and Drugs Authority, Customs, Excise and Preventive Service, food vendors, food processors, and other stakeholders.

Provost, College of Science

In his welcome address, Prof. Kwasi Obiri Danso, Provost of the College of Science, stated that food fraud had become topical especially with recent happenings in Ghana and the whole country was alarmed by it. The Department therefore found it necessary to expose the practice and draw attention to the need for education and protection of citizens. It was therefore a timely intervention for all and he hoped it would meet its intended objectives with discussions by all stakeholders.

Mr. Prince A. Opoku

Mr. Prince A. Opoku, regulatory officer at the Food and Drugs Authority who was the keynote speaker, citing Spink and Moyer (2011), defined food fraud as economically motivated adulteration which encompasses the deliberate and international substitution, addition, tampering or misrepresentation of food, food ingredients, food packaging or false or misleading statements made about a product for economic gain. Adulteration and misbranding, according to him also constitute food fraud.

Mr. Opoku, therefore called for intelligence gathering, information sharing, monitoring the traceability of food ingredients and improved food fraud detection methods to arrest the situation. He also assured Ghanaians that palm oil on the Ghanaian markets was now safe for consumption, since there was no Sudan IV dye in the oil. The FDA had retrieved all such products and had put in place the appropriate measures to ensure the safety of citizens.

Mrs. Gloria Ankar Brewoo

Mrs. Gloria Ankar Brewoo, a lecturer in the Department of Food Science and Technology, in her presentation indicated that a lot of street foods in the Kumasi Metropolis notably fried rice, fufu, ampesi among others were prepared in unhygienic environments within very small spaces and with just a few cooking utensils. She therefore called for stiffer regulations and sanctions, as a study conducted by the Department revealed that most regulations to ensure hygienic preparation of food were overlooked by commercial food vendors. Most food vendors and their helpers for instance had not undergone

health screening as required. She stressed the need for some serious attention, education and regulatory checks by all stakeholders, among the over two thousand (2000) food vendors in the Kumasi metropolis, to ensure the safety of foods sold, and the health of consumers.

There were oral presentations from some researchers on whether food fraud was a reality. Their presentations also revealed several instances of food fraud on the market especially with processed foods. Powdered pepper, fish, tomatoes, groundnut paste among others were found to be adulterated with cola nuts, dye, or tomato seeds, among others. These additives, according to sellers, made the powdered foods more attractive and thicker. Stakeholders and participants called on researchers for quick test kits to ascertain the quality of foods on the market.

List of Active External Grants in CoS

No.	Name of Project	Principal Investigator	Department / Unit	Funder	Amount	Period
1	Dynamics Aerosol Chemistry-Cloud Interaction in West Africa	Dr. Amekudzi & Prof. Danuor	Physics	EU – DACCIWA	€84,000.00	2014 - 2018
2	Malnutrition E-Learning Evaluation Project	Dr. Reginald Adjetey Annan	Biochemistry and Biotechnology	University of Southampton	£3,603.90	2014 – 2016
3	Molecular Modelling for Energy Efficiency	Dr. Evans Adei & Dr. Richard Tia	Chemistry	Leverhulme Trust – Royal Society / University College of London	£150,000.00	2012 – 2016
4	New Materials For a Sustainable Energy Future: Linking Computation With Experiment	Dr. Evans Adei	Chemistry	Royal Society – DFID /Cardiff University	£1,243,000	2015 - 2020
5	Developing Materials for Applications in Solar Cells	Dr. J. A. M Awudza	Chemistry	Royal Society – DFID / University of Manchester	£1.25m	2015 - 2019
6	Biodiversity Conservation through Bio-prospecting for Novel Anti-plasmodial Compounds from Africa's Rich Flora	Dr. Lawrence S. Borquaye	Chemistry	International Funds for Science (IFS)	$15,000	2015 - 2017
7	PACN MS Training Workshop	Dr. Nathaniel Boadi	Chemistry	Royal Society of Chemistry, UK	$18,600.00	
8	Intra ACP Academic Mobility	Dr. Francis Kofi Ampong	Physics	EU Africa Caribbean Pacific Mobility Scheme	$4,160.00	2012 - 2016
9	Malnutrition eLearning Evaluation Project	Dr. Reginald Adjetey Annan	Biochemistry and Biotechnology	MeLP Grant	$8137.41	2014 – 2016

STUDENT RESEARCH

Two KNUST PHD Students win a total of 48,000 USD Grant from Bill and Melinda Gates Foundation Under the SaniUP Project

Two PhD students, Mr. Eugene Appiah-Effah and Mr. Kobina Mensah Afful, both from the Department of Civil Engineering of Kwame Nkrumah University of Science and Technology, Kumasi, have won a 48,000 USD grant from the Bill and Melinda Gates Foundation, under the Stimulating Local Innovation on Sanitation for Urban Poor (SaniUP) Project. This is to support the practical application of aspects of their respective research works.

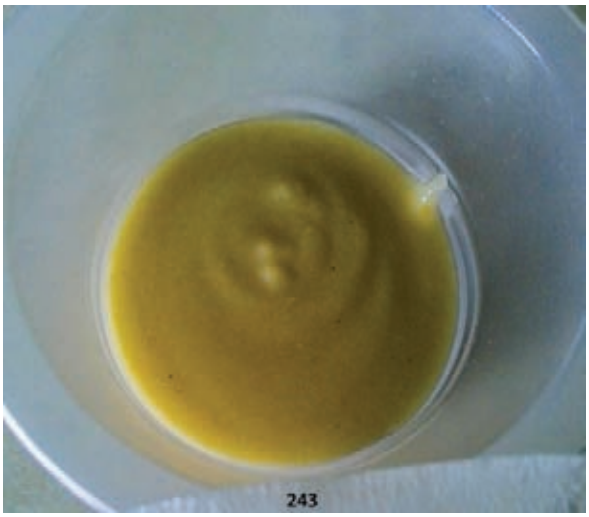
Eugene Appiah-Effah's dissertation focused on Rotary Drum Composting of Faecal Sludge from Peri-Urban Ghana. Eugene is being supervised by Professor (Mrs) Esi Awuah and Dr. Kwabena Biritwum Nyarko. As part of his work, Eugene designed and constructed a rotary drum with assistance from the Department of Mechanical Engineering, which he used for the compost process. The technology is being piloted with Urine Diverting Dry Toilets (UDDT) and other compost toilets, to improve the turning mechanism and enhance composting of faecal sludge. This will reduce the cost of hauling faecal sludge over long distances to treatment sites and significantly reduce the human-faeces contact, thus improving public health.

Kobina Mensah Afful's work focused on the Reduction and Control of Odour from Dry On-Site Sanitation Toilet Technologies in Urban Poor Ghana. Kobina is being supervised by Professor (Mrs) Esi Awuah and Dr. Sampson Oduro-Kwarteng. As part of his work, he carried out direct field odour measurements and generated odour contours in the process. This procedure involved the use of the human nose for objective odour measurement. The human nose integrates the odours of the various constituents, combining the myriad compounds from an odour source into a unitary odour percept, which can then be quantified as to intensity and identified based on perceptual quality. Thus, the most sensitive and reliable way to obtain data on the frequency, intensity, duration and quality of an odour is to use the human nose as the detection instrument, a well-established method known as olfactometry. This method is the most relevant for understanding the odour impact on a community that may serve as a barrier to the utilisation of a facility.

Once they receive their PhDs, they both hope to contribute to solving the sanitation challenges in Ghana and other developing nations.

Enhancing the Food Utilization of Cocoyam, a Marginalized Crop

As part of the research activities of the DANIDA-KNUST's "Strengthening Root and Tuber Value Chains Project", collaborating scientists from the Department of Food Science and Technology, Prof (Mrs) Ibok Oduro and Dr (Mrs) Faustina D. Wireko-Manu, have been tasked with, among other things, improving existing dishes/ products and developing new food products from the four main roots and tubers in Ghana. **Ms Abena Achiaa Boakye,** a PhD student on the project, is investigating the food properties of *Xanthosoma sagittifolium*, commonly called cocoyam in English and *mankani* in Twi.



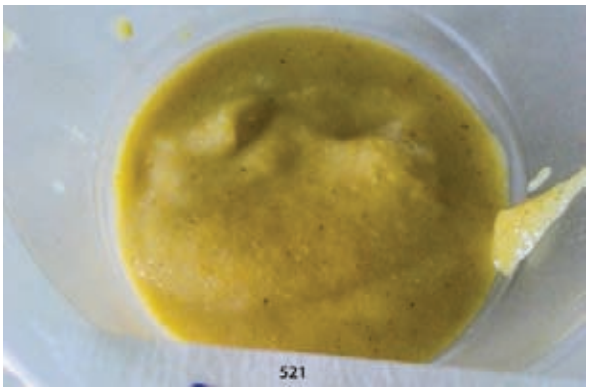
Insert Plate 1: Xanthosoma sagittifolium (Mankani) Roots

The research work commenced in August 2013 with a literature review to identify gaps in knowledge/ technology that needed to be addressed in seeking to advance the utilisation of cocoyam. A survey of major stakeholders along the value chain (producers, traders, processors and consumers), was undertaken in May 2014 for first-hand information on indigenous knowledge and uses, processing and consumption constraints and the need for new cocoyam food products in the three major cocoyam producing regions in Ghana - Eastern, Ashanti and Brong Ahafo - with the Northern Region, a non-cocoyam producing region as control.

The study has identified cocoyam to be neglected with respect to agricultural and research policies. This is a major drawback to its production trends and food use. Two out of the five known varieties are now extinct; one is known among few communities but not commercially cultivated and gradually becoming extinct while the remaining two are cultivated at subsistence level. To date, there is limited information on the food processing properties of these varieties resulting in a lack of interest by the local food industry. Hence, there is a lack of diversity in the available cocoyam food products.

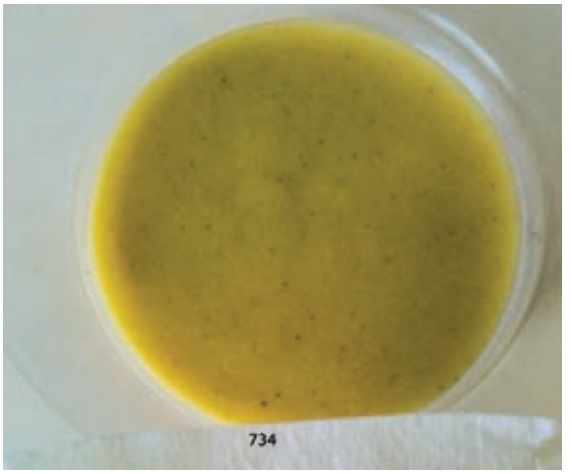
This study therefore focused on improving one traditional delicacy, cocoyam ɔtɔ, for convenience and developing a new complementary food to tap into the thriving baby food industry. Studies on having cocoyam leaves (*kontomire*) all year round have resulted in the development of a ready-to-use cocoyam leaves puree.

ɔtɔ-mix and Cocoyam Leaves Puree



Ready-to-prepare Complementary Food

In addition, a comprehensive laboratory analysis of the food processing properties of the two cultivated varieties of cocoyam was undertaken at the Food Institute of the Technical University of Denmark (DTU-FOOD) from 9th March to 18th September, 2015.



Insert Plate 4: Laboratory Studies at DTU-FOOD

Findings so far have been presented at six local and international conferences. A manuscript is under review for publication. One is currently being drafted and the analysis for another is underway. **The project team seeks collaborators from industry and businesses to take up the commercialisation of the developed products**. The commercialisation of the developed products will expand the utilisation base of cocoyam. This will create business opportunities to drive its production, with resultant income generation and improved livelihoods of small-holder farmers. It is hoped that the efforts of the researchers to ***'give cocoyam a voice in the food industry'*** will go a long way to enhance both local and regional food baskets, while simultaneously creating in-roads for tapping the full potential of cocoyam.

OTHER RESEARCH

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES (CANR)

Wood Residue Generation and Utilization: The Technical, Economic and Environmental Mix for some Selected Sawmills in Brong-Ahafo and Ashanti Regions, Ghana.

The recovery rates of sawmills in Ghana are low (about 28-64%), leading to pressure on the limited available resources. **Ms. Sylvia Adu** from the Wood Science and Technology Department set out to study wood residue generation and utilisation to address the situation. This study was carried out on four prominent sawmills in the Ashanti and Brong Ahafo Regions of Ghana with four frequently processed timber species at the sites. These are Cylicodiscusgabunensis (denya), Entandrophragmaangolense (edinam), Pterygotamacrocarpa (koto) and Triplochitonscleroxylon (wawa).

The first study involved a survey to determine the availability, types, quantity, production rates, composition and utilisation of wood residue. The second study determined the uses of wood residue and the economics of wood residue utilisation at the study sawmills. The third study was conducted using fieldwork, laboratory work and personal observations to determine the decomposition trends of wood residue. The fourth study determined the constraints in handling sawdust for power generation and its effect on the environment and human health.

The study recommends that wood residue producers should form partnerships to facilitate its transportation, storage and marketing. They could also consider its value-added manufacturing processes into finger joints, crafts and toys, floorings and garden fencing. Sawdust could be used to manufacture briquettes for household use or biochar for soil amendment to enhance nurseries, plantations and other agricultural interests for sustainable forest management purposes.

Again, the study consistently identified minimizing wood waste as a major point of departure for reducing the environmental impact of the timber sector of Ghana. There is the need to train workers to upgrade their skills to meet the new technological challenges that might arise in the area of production. The findings could be used in the future planning towards a more cost-effective management of wood flow of the selected species and their utilisation.

Constraints to Growth of Street Food Enterprises in Ghana and Effects of Targeted Business Interventions on Performance

The study by **Mr. James Osei Mensah** aimed at determining constraints to the growth of street food enterprises in Ghana and examining the effects of targeted business management interventions on the practices and performance of these firms. Data from a randomised field experiment of a freely offered business management course among 516 street food vendors in Kumasi and Tamale in Ghana were used to achieve the study objectives.

The street food sector, dominated by women with little or no formal education, suggested the following constraints to business growth: high cost of production, limited access to credit, input price variability, inadequate knowledge in business management and limited access to reliable electricity (power). The study confirmed that inadequate managerial skills and financial constraints were the most critical constraints to growth of street food enterprises. The study found formal education, the presence of trusted hands in the business and financial performance of firms to have a significantly positive effect on probability of participation while vendor involvement in other economic activities (beside food vending), distance from vending premises to training centre and location of vendor significantly decreased probability of participation.

The study however did not find any significant effects on business performance of treated enterprises although treated vendors with high education experienced a 10% increase in gross marginal ratio. The study explained the differences between effects of the treatments by the effects of extra module of formation and management of street food vendor organisations on collective action parameters such as organisational membership, membership commitment and cooperation with other vendors to pursue mutually beneficial goals. Although these parameters may not directly affect vendors' implementation of standard business management practices, they offer committed and cooperating members the platform and an opportunity for either further discussions among vendors on the training content or refresher training from external resource persons at virtually no fees.

Analysing Peri-urban Sanitation Market and Farmers' Perception on Excreta Re-use in Agriculture in Dangme West District, Ghana

Mr. Fred Nimoh of the College of Agriculture and Natural Resources sought to analyse a peri-urban sanitation market and farmers' perception on excreta reuse for agricultural purpose in Dangme West District of Ghana. The study specifically examined the constraints, motivations and strategies to the operation of the sanitation business among other things.

After gathering data using observations, interview guides and survey questionnaire, it was found that the majority of people practise open defecation though they prefer improved latrines, particularly the flush latrines and the ventilated improved pit latrines. A majority of the members of households were willing to pay for improved latrines via savings rather than the use of credit, although the financial institutions in the study area were interested in offering loans for household latrines. Again, the study revealed that a majority of farmers 'disagreed' that excreta was waste and that they could use excreta as fertiliser if sterilised as they 'agreed' that excreta could pose health risks.

The study recommends the need to address the constraints to the sanitation business for effective service delivery and to encourage households to consider cheaper, more feasible latrine technologies, and adopt joint-resource mobilisation strategies for their latrines. The study also advises stakeholders to consider the heterogeneous needs and location of households as well as the reuse potential of excreta in agriculture when programmes aimed at promoting improved sanitation are put in place.

Charcoal Production and its Implication for Woodland Degradation and Climate Change in the Forest/Savannah Transition Zone of Ghana: The Case of Kintampo Municipality

Commercial charcoal production plays a significant role in the socio-economic development of Ghana, serving as a source of household energy, income generation and poverty alleviation. There are also concerns of how this same charcoal production degrades woodlands and reduces climate change mitigation potential.

Halting charcoal production in Ghana would deny people of income and household energy. Allowing the business to thrive would also lead to long-term environmental degradation. Commercial charcoal production in Ghana therefore causes a major dilemma for both policy makers and researchers,

generating a debate as to whether the economic benefits are worth the environmental degradation associated with it.

An empirical assessment therefore, of the effects of charcoal production on woodlands to provide a basis for objective and decisive debate, as to the way forward for sustainable charcoal production in Ghana, would be in the right direction. To this effect, **Dr. Ramond Aabeyir** conducted the study, "Charcoal Production and its Implication for Woodland Degradation and Climate Change in the Forest/Savannah Transition Zone of Ghana" in the Kintampo Municipality, where charcoal production is a widespread socio-economic activity.

The study showed that commercial charcoal production in the Kintampo Municipality of Ghana could have negative implications on the extent, quality and climate change mitigation potential of woodlands. Again, intensive large-scale commercial charcoal production has the potential of degrading woodlands and the tendency to increase Carbon dioxide equivalent (CO2e) emission in Asantekwa and Kunsu communities.

The study recommends that harvested sites should be protected and allowed to fallow for longer periods to enable them regain the pre-harvesting state of the woodlands. The best allometric model was also recommended to be used to monitor the effects of commercial charcoal production on CO2e emissions. This would help to develop effective and efficient policies to minimize the long-term effects of commercial charcoal production on climate change.

Economic Efficiency and Productivity of Maize Farmers in Ghana.

The productivity of maize in Ghana is low, despite its economic importance. To shed light on this phenomenon, **Dr. Camillus Abawiera Wongnaa** examined the "Economic Efficiency and Productivity of Maize Farmers in Ghana". Using the multi-stage sampling technique, the researchers collected cross -sectional data from 576 maize farmers in eight districts in four agro ecological zones. The multinomial logit model and the stochastic frontier production function were adopted together with descriptive statistics for analyses.

With the technical efficiency scores revealed in the study, it is most economical to produce maize in the transitional belt of Ghana. The study found that generally, educational levels, experience, incomes, extension contact, gender, group membership, credit, household size, ready market, as well as the use of fertilizers, pesticides and improved seeds would increase the technical efficiency of maize farmers in Ghana. The study also found that whereas fertilizers, herbicides, pesticides, manure and land were under-utilised by farmers, capital was over-utilised.

With the scale efficiency analysis from the study, it can be concluded that an increase in educational levels, experience, access to good roads, extension contact, household size as well as the use of fertilizer and improved seeds would also increase the scale efficiency of maize farmers in Ghana.

The study recommends that policies aimed at addressing the efficiency challenges of maize farmers in Ghana should be targeted more at improving technical efficiency.

Retrieval of Integrated Water Vapour from GNSS Signals for Numerical Weather Prediction

Atmospheric water vapour is an important greenhouse gas and contributes greatly in maintaining the earth's energy balance. This critical meteorological parameter is not sensed by any facility in Ghana contributing weather data to the Global Telecommunication System of WMO. It is against this background that **Mr. Akwasi Afrifa Acheampong** presents a highly precise tool for water vapour sensing based on the concept of Global Navigation Satellite Systems (GNSS) meteorology and tests the computed results against global reanalysis data.

Conventional approaches used to sense the atmospheric water vapour or precipitable water (PW) or Integrated Water Vapour (IWV) such as radiosondes, hygrometers, microwave radiometers or sun photometers are expensive and have coverage limitations and are also affected by meteorological conditions. However, the GNSS meteorological concept offers an easier, inexpensive and all-weather technique to retrieve PW or IWV from Zenith Tropospheric Delays (ZTDs) over a reference station with very high temporal resolutions.

This study employed precise point positioning (PPP) techniques to quantify the extent of delays on the signal due to the troposphere and stratosphere media where the atmospheric water vapour resides. The KNUST GPS base station was used to log dual-frequency signals for approximately 260 days between the months of February 2013 to December 2014. Obtained PW values were compared with ERA-Interim, Japanese Meteorological Agency Reanalysis (JRA) and National Centres for Environmental Prediction (NCEP) global reanalysis data. Correlation analysis was ran on computed PW from logged GNSS datasets and downscaled reanalysis data.

Results show stronger correlation between the retrieved PW values and those provided by the ERA-interim. The computed amount of ZTDs varies perfectly with the weather pattern in the country. Again, a linear model was derived that could predict PW based on ZTD with standard errors of 6.01mm for JRA, 5.40mm for ERA-Interim and 6.34mm for NCEP reanalysis data. Finally, the study results indicate that with a more densified network of GNSS base stations the retrieved PW or IWV will greatly improve numerical

weather predictions and more specifically, precipitation forecasting in Ghana.

Geoinformation Modelling of Peri-urban Land Use and Land Cover Dynamics for Climate Variability and Climate Change in the Bosomtwe District, Ghana

A study by **Mr. Divine Odame Appiah** on the socioeconomic drivers and the actual land use and land cover (LULC) changes, with special reference to vegetation cover and local climate variability and change in the peri-urban Bosomtwe District of Ashanti Region of Ghana. A triangulation of qualitative and quantitative design was used among 270 household respondents. Using a multistage sampling technique, partially pre-coded questionnaires were administered in 14 communities.

Data was analysed using non-parametric tools such as Pearson's chi-square, Nagelkerke R2 and Cramer's V, and step-wise binary logistic regression analyses embedded in the Statistical Package for Social Scientists (SPSS v.16). Remote Sensing and Geographic Information System algorithms were used in ENVI, ERDAS, Imagine ESRI and ArcGIS environments, to classify LULC, using maximum likelihood classifier to analyse Landsat Thematic Mapper and Enhanced Thematic Mapper+ images, and Landsat 8, Operational Land Imager and Thermal Infrared Sensor (OLI/TIRS) images of 1986, 2002, 2007/2008, 2010 and 2014 respectively. The best Kappa hat statistic of classification accuracy is 83%. A Mann-Kendall trend analysis was also done on the climatic data, using MAKESEN Solver in EXCEL. At a confidence level of 99.9%, perceived drivers of peri-urban land use changes in the communities were significant at $p < .000$. The Cramer's V test of a strong association between two nominal variables was 0.412. The logistic regression model reported confidence intervals (CIs) of $1.218 \leq CI \leq 4.234$, for the three main predictors of the land use conversion outcome, indicating the odds of up to 4 times of conversion likelihood. The normalised difference vegetation indices (NDVIs) for forest cover, plantation and other cultivated lands ranged between 0.384 and 0.570; while recent fallows and grassland as well as bare lands had NDVI values of between 0.081 and 0.250. Over the period, dense forest decreased by 1380 ha in 2014, while low forest (which included some oil palm and citrus plantation farms), increased by 1766 ha in 2014. However, built up, bare and concrete land uses increased by 3360 ha, while recent fallows and grasslands decreased by 3356 ha, over the same period. Inter-quarterly rainfall and temperature anomalies depicted generally increasing trends in the mean monthly temperature over the last two inter-decadal periods (1990 to 2000, and 2001 to 2011). Land surface temperature profile extracted from the satellite images cohered with the LULC characteristics, expressed in the novel concepts of Rural Cool Troughs (RuCT) and Peri-urban Heat Troughs (PuHT). The study indicates major changes in the deteriorating livelihoods, easy access to, as well as changing demand for land are affecting the peri-urban landscape of the Bosomtwe District and suggests a strict enforcement of district land use plans by the Bosomtwe District Assembly.

Assessing Urban Flood Risks under Changing Climate and Land Use in Abidjan District, South Cote D'Ivoire

Climate change has become one of the global environmental issues more visible in recent decades. In Cote D'Ivoire, flooding which is a natural phenomenon combines with climate change to create effects that causes some of the most destructive damage. The district of Abidjan, located in the south of Cote D'Ivoire, which has heavy rainfall, rapid population growth, and uncontrolled urbanisation is not an exception to the problem of flood risk.

To identify, map and model areas of flood risk to facilitate decision-making for better land use planning under changing climate in this district, **Dr. Jean Homian Danumah** undertook the study "Assessing Urban Flood Risks under Changing Climate and Land Use in Abidjan District, South Cote D'Ivoire". The study used the maximum likelihood classification algorithm and post-classification change detection procedures. Statistical methods such as LARS-WG and rclimdex, Analytic Hierarchy Process (AHP) and Flood Hazard Index (FHI) models were also used.

The results revealed urban area expansion (15%) as a major land use change for the period 1990 to 2014. However, there was an important increase in urban area between 2002 and 2014, compared to 1990 and 2002. Regarding future weather-patterns the results showed that temperature would increase from 0.32oC to 2.54oC for the period of 2011 and 2100, as well as increase in rainfall in the same period from 4% to 10%.

The study also observed that consecutive wet days (CWD) and number of heavy rainfall days rose above 10mm (R10) from 2011 to 2100. Again, high and very high flood risk areas covered 34% of the study area while 25.09% was within the high FHI areas. The study concluded that eight out of thirteen (8/13) municipalities of Abidjan District are within high and very high flood risk areas. There is therefore the need for decision makers to call for optimal design of technical solutions and an effective preparedness strategy, to be developed, to tackle future flood occurrences within the District (South of Cote d'Ivoire).

A Low-cost Early Adoption Strategy for Implementing Secure Smart Energy Metering Systems in Developing Countries in Africa.

Electricity continues to be a great power behind the world's industrial revolution and an indispensable asset in everyday living. Its significance has necessitated the extensive rollout of electrification projects. Despite these rollouts, the continent of Africa is yet to enjoy reliable supply of electric power and its associated benefits. Due to Africa's high population growth and economic development, it is ever so plagued with extensive seasons of energy crises. The effect of these crises can be clearly seen in Africa's vicious cycle of poverty.

Mr. Eliel Keelson links the nemesis of these crises to the inability of Africa's utilities to conduct effective demand analyses on day-to-day consumption of electricity. These analyses are a prerequisite to avoiding unprecedented demand. To mitigate these crises, the project suggests the migration from standalone metering systems to smart metering systems. Bearing in mind that this migration has often come at a high expense to developed countries, it proposes a low- cost early adoption strategy for implementing secure smart metering systems in African developing countries. A key aspect of this proposition is a secure low-cost smart retrofit which furnishes existing standalone meters with smart metering capabilities.

The study proposes a security protocol and a datagram format for secure information exchange in the proposed smart metering system. Finally, the proposed system is applied in providing a Smart Quota Policy, which is an effective power rationing alternative to rotational load shedding (blackouts).

Development of Controlled Release Intramuscular Artemether-Loaded Poly (lactic co-glycolic acid) (plga) Microspheres for Treatment of Severe Malaria in Children

Malaria is a febrile disease caused by the plasmodium parasite and has plagued sub-Saharan Africa for many years. Severe or complicated malaria is a medical emergency and has very high mortality rates especially among children under the age of five years. These children are the most vulnerable to the disease.

Over the years many preventive and control measures have been used to combat this menace. The artemether which is a derivative of artemisinin antimalarial available as intramuscular injection has been used for the treatment of severe malaria in children. The improvement of current available treatment regimen for children will be a significant contribution to the management of malaria in children under age five.

Dr. Mrs. Mariam El Boakye-Gyasi therefore sought to develop controlled release of intramuscular PLGA microspheres of artemether to replace the multiple injection regimen of artemether drug currently available for children under five years of age, hence the topic "Development of Controlled Release Intramuscular Artemether-Loaded Poly (Lactic Co-Glycolic Acid) (PLGA) Microspheres for Treatment of Severe Malaria in Children".

Two resomers (RG503H and RG502H) of a biodegradable and biocompatible polymer, PLGA were used to formulate microspheres by the single emulsion solvent evaporation method. Experimental male Sprague-Dawley rats were also injected with formulated microspheres and the in vivo release of artemether was studied.

The declining molecular weight profiles, mass loss and water uptake profiles of the drug-loaded microspheres demonstrated that artemether released from the microspheres was due to polymer erosion and diffusion through the polymer. Preliminary in vivo tests conducted also showed that artemether is released in vivo and can be successfully quantified with liquid chromatography/tandem mass spectrometric method (LC-MS/MS).

Epidemiology and Diagnosis of Cervical Human Papillomavirus and Squamous Intraepithelial Lesions among Ghanaian women: The Role of HIV

In Ghana, cervical cancer is the number one cause of cancer-related mortality among women. Co-infection with human papillomavirus and human immunodeficiency virus has implications for infected persons and the health system in terms of organising screening and management services. For this reason, **Dr. Dorcas Obiri-Yeboah** investigated the epidemiology and diagnostic options of HPV DNA-based screening and reliance on cervical samples taken by clinicians.

Information was gathered from Cape Coast Teaching Hospital on 333 recruited women patients. Analysis showed HIV-negative women were more informed about HPV prior to enrolment and had had cytology screening. The prevalence of hr-HPV genotypes was higher among HIV-positive women as was multiple infections.

HV-positive women bear a significant burden of HPV infection and related disease. Due to this, the study recommends preventive and screening programmes to be deployed for such persons in Ghana. The careHPV test could offer a suitable alternative for HPV screening in Ghana and self-

collection could offer a good alternative for HPV screening using the careHPV assay among Ghanaian women.

The Role of Quality Improvement Process (QIP) in Enhancing the Effectiveness of Routine Health Information System for Health Service Planning in the Ejisu-Juaben Municipal Health Directorate of Ghana

Decision-making in health is influenced by the quality of health information generated by the health system. Routine Health Information System (RHIS) is one of such information and forms over 90% of health information. Yet RHIS is faced with huge challenges which reduce its decision making and planning yield. However, there is limited empirical evidence on the magnitude of dysfunction in the RHIS in most health districts, the Ejisu Juaben Municipal Health Directorate (EJMHD) in Ashanti Region being no exception.

It is against this background that **Dr. Richard Okyere Boadu** assessed the role of Quality Improvement Process (DQIP) in improving RHIS in planning and decision-making. A quasi-experimental, uncontrolled before-and after-study programme involving the development of a Data Quality Improvement Process (DQIP) training module to train health staff, establish a team with the quality improvement framework for monitoring over a twelve-month period in the EJMHD was put in place. The modelled Data Quality Improvement Process (DQIP) involved RHIS management assessment tool (adapted from the Performance of Routine Information System Management [PRISM] tool package) which was administered to 141 health and management staff in 18 health facilities in the Ejisu-Juaben Health Directorate before and after the intervention.

The study evaluated the impact of the modelled Data Quality Improvement Process (DQIP) on RHIS performance at the end of the intervention period through a cross-sectional survey. Health and management staff had relatively high confidence in undertaking RHIS tasks such as analysis, interpretation and use of data. On the contrary, the actual performance of RHIS tasks scored objectively, yielded low average scores. The baseline and endline results indicated improvement in competency gaps, after the intervention, in analysis (-37%:+3%), interpretation (-42%:+10%) and use of data (-45%:+3%) respectively. Performance in the use of RHIS at the facility level improved significantly from 30 percent in baseline to 90 percent in the endline; and similar trends were observed in other parameters.

The study concluded that Quality Improvement Process (QIP) drives the effectiveness and performance of RHIS. Scaling up DQIP in the health system will necessarily lead to improved RHIS performance.

Estimation of Malaria Transmission Intensity in Southern Ghana using Rapid Diagnostic Test Derived Sero-Prevalence Rates

Though many malaria interventions have been rolled out through research and programme activities, there are no current data to ascertain the veracity of interventions and guide further programme actions. An understanding of the epidemiology of malaria in such an area is critical for the design and evaluation of control efforts. **Dr. Alberta Amu Quartey** conducted a study to update and determine the complete epidemiology of malaria in the Dangme West District. The study was to consider prevalence, incidence and entomology of malaria.

There was minimal seasonality in blood slide positivity in the dry and wet seasons, with an average parasite prevalence of 6.5%, (Lakeside 2.7% to 8.5% Coastal). The dominant parasite species was Plasmodium falciparum (96%). The age-specific parasite prevalence was 9% in 0 to 9 year olds, 8% in 10 to 19 year olds, 5% in 20 to 29 year olds, 3% in 30 to 39 year olds, and 4% in those aged 40 years and above. The corresponding age-specific MSP-119 prevalence was 37%, 58%, 60%, 66% and 67% respectively.

8% of participants in the incidence study reported a history of fever in the last 48 hours, 3% used antimalarial drugs for perceived fever and 6% had used an ITN the night before home visits. The forest zone had an incidence rates of 85/1000py (slide), Coastal 41/1000py and Lakeside 13/1000py. The absence of a ceiling in a room was associated with an excess risk of 15%. The incidence rate was 119/1000py in 0 to 4 year olds, 136/1000py in 5 to 9 year olds, 50/1000py in 10 to 19 year olds, 9/1000py in 20 to 29 year olds, 18/1000/py in 30 to 39 year olds, and 24/1000py in those over 40 years.

The district EIR was 81 infective bites per person year (ppy). April had the highest EIR of 1/pp/night. The Lakeside zone had an EIR of 100/ppy, the Forest zone 81 ppy, and Coastal zone 30ppy for the same period. The main vector species was An. gambiae s.l, which constituted 95%, with An. funestus Giles forming the rest.

Overall rates had decreased by about 40% from the 1993 levels. The Lakeside zone had the lowest malaria incidence despite vastly irrigated fields. The forest zone, with the lowest verified ITN use, and the 5 to 9 year age group, bore the brunt of morbidity. There was reduction in malaria burden in the area in the last 20 years, with more marked reduction in the Lakeside than in the Coastal and Forest zones. The Lakeside with the highest ITN use had the lowest parasite prevalence and incidence rates. ITN distribution and use need to be improved in the Forest and Coastal zones, and access to testing and treatment with quality assured ACTs improved in the Osudoku zone. Research into effective combinations

of interventions to target the 5 to 9, and 10 to 19 year old groups needs to be conducted to address disease-burden and asymptomatic carriage in these age groups.

Retrenchment Process and the Coping Mechanisms of Employees from the Banking Industry in Ghana: The Case of Adot Bank Ghana Limited

Although there has been a great deal of work on retrenchment in other sectors like mining and general business, this has not been the case in the banking sector. **Dr. Rosemary Coffie** sought to fill this gap in the literature in Ghana, hence the topic, "Retrenchment Process and the Coping Mechanisms of Employees from the Banking Industry in Ghana: A Case of Adot Bank Ghana Limited"

The social and human capital theories were employed as the mediating variables to explain the coping mechanisms of retrenched staff. The study showed that the retrenchment process of the bank under study had an implementation gap at the selection criteria and severance package levels. There was also an indication that retrenched staff suffered loss of self-esteem and change in status. Retrenchees also experienced reduction in spending, as well as emotional breakdown.

The study further revealed that retrenched staff coped differently due to varying family backgrounds and environmental situations. They also resorted to the knowledge, skills and capabilities they had as well as friends, family, social organisations and religion.

In line with the findings, the study has bridged the gap by providing a comprehensive study on retrenchment that looks at the process through to the effects, coping mechanisms as well as the labour market reintegration of the affected employees. Again, the findings would be relevant for policy implementers in banks to look at issues in the retrenchment process especially the selection criteria and severance package.

The study recommends proper negotiations towards the establishment of consensus between the employer and employees as well as the trade union on the selection of the affected employee, to minimise the effects on the affected employees.

Farmers' Livelihoods in Rural Ghana: An Empirical investigation into Risk Perceptions and Attitudes

Agriculture continues to be the backbone of the Ghanaian economy. It contributes about 21.5% to GDP and employs about 50% of the labour force and contributes substantially to the foreign exchange earnings of the economy. Agriculture in Ghana is dominated by smallholder farmers who produce substantial amounts of the food needs of Ghanaians. Most of these smallholder farmers live in the rural areas.

Rural households in Ghana are very poor as poverty is basically a rural phenomenon in Ghana. Smallholder farmers have a wide range of risks that impede their ability to expand and increase their income and ultimately their welfare. These risks and farmers' attitudes towards them have profound impacts on their output and welfare as their perception and attitudes determine their responses to unfavourable conditions. In this regard, **Dr. Emmanuel Buabeng** studied the topic, "Farmers' Livelihood in Rural Ghana: Empirical Investigation into Risk Perceptions and Attitudes".

The results from examining the livelihood of rural farmers in Ghana, their risk perception, risk attitudes and how risk perceptions and attitudes impact on their livelihood showed that plantation crop farmers are more secure in terms of livelihood than food and vegetable farmers. Rural farmers in plantation crop producing areas have higher economic and overall security than other farming groups.

The results again showed that plantation crop farmers consider disease, pests and credit availability as the most important risks that they face whereas food crop farmers perceive yield variability, disease and pests as the most important risks. Vegetable crop farmers perceive output prices and yield variability as the most important risk conditions.

The standard of life is generally low in rural areas of Ghana but the study found that differences exist based on location of farmers and crop type. Risk aversion of farmers also varied with location, crop type and the kind of utility function employed.

The study recommends that Government institutes policies like the extension of scholarships to the children of all farmers, irrigation schemes and the establishment of small to medium-sized food processing firms for price stabilisation to enhance farming in the rural areas and guarantee the income of farmers and their overall livelihood. Any policy should take into consideration the differences in the risk perception and the attitudes of farmers to these risks, in order to make the policies work.

Strengthening the Existing Injury Surveillance System for the Development of Appropriate Injury Prevention and Control Strategies for Ghana: The Case of Ejura-Sekyeredumase District

The public health in rural Ghana is challenged severely with the occurrence of injuries and disabilities, yet little attention is given to injuries as compared with malaria and HIV/AIDS. Accurate and reliable data on injury is needed to support efforts to develop, implement and evaluate policies and interventions on injury prevention and safety promotion in rural Ghana.

Dr. Adofo Koranteng is of the opinion that strengthening the injury surveillance system is necessary to provide accurate injury data to inform interventions to promote safety in the Ejura-Sekyeredumase District. The district has persistently recorded various forms of injuries such as machete wounds, road traffic crashes, pedestrian knockdowns and gunshots, hence the study on the topic "Strengthening the Existing Injury Surveillance System for the Development of Appropriate Injury Prevention and Control Strategies for Ghana: The Case of Ejura-Sekyeredumase District".

The study found that the likelihood of reporting injury conditions among those with tertiary education was 16.9 times more than patients with basic education. Similarly, injury patients with high incomes recorded 7.8 times more than low income injury patients. The ability to pay for orthodox medical care informed patients with good economic status to seek injury care at the orthodox medical centres. Comparatively, severe injuries were much more reported than minor injury conditions. The difficulties involved in transporting injured people on bad roads, and trust in the traditional herbal practice were the main reasons why some injury conditions were not documented.

Again, institutional challenges facing injury-reporting institutions were lack of knowledge on injury management, and the difficulty in transforming injury data into safety. The outcome of an intervention in the form of staff training also showed a significant improvement in the staff capacity to manage injury data in conformity to WHO standards. Injury surveillance systems in least resourced settlements could be improved through public health education on the role of injury data in injury prevention and staff training on injury data management. Finally, the study established strategies to improve injury reporting as well as transforming injury data into injury prevention and safety promotion in rural settlements.

The study recommends the establishment of a community-based injury reporting desk which will register all injuries free of charge irrespective of the source of care and intensive public health education to enable people take absolute control of their health needs and to make appropriate decisions on choice of injury care.

Vegetation Dynamics in Southwest Burkina Faso in Response to Rainfall Variability and Land Use

Dr. Jean-Bosco Benewinde Zoungrara undertook a study on the topic "Vegetation Dynamics in Southwest Burkina Faso in Response to Rainfall Variability and Land Use". This, in his opinion is particularly crucial in the Sudan savannah of West Africa where vegetation dynamics remains poorly understood and is subject to debate.

In assessing vegetation dynamics for ensuring sustainable development especially in regions where natural vegetation is altered by anthropogenic land use and rainfall variability, it was found that multi-temporal land use/cover (LULC) classification significantly outperformed mono-temporal data classification. However, combining mono-temporal imagery and ancillary data significantly enhanced the accuracy to the level of multi-temporal classification. In the period 1999-2011, LULC dynamics in the study area was mainly characterized by expansion of agricultural area, bare surface and reduction of woodland and mixed vegetation. Between 1981 and 2012, the study area was frequently under near normal conditions of rainfall with intermittent occurrence of extreme events. A non-significant increasing rainfall trend was predominant mainly in the periods 1981-2012 and 2001 – 2012. Vegetation dynamics was also found to be strongly related to rainfall and NDVI slightly more sensitive to rainfall than EVI.

This research also showed that 83.8% of the study area was dominated by inconsistent dynamics of vegetation in the period 2000-2013. Decreasing trajectory (14%) was prominent among the detected trends and was particularly found in agricultural areas and also in areas under high and moderate human footprints. Greening trend (2.2%) was observed mainly in woodlands and areas less affected by human footprints. Human activity was identified as the main driver of vegetation trends. The perception of local population on vegetation was also in agreement with remote sensing observations. Generally, between 2000 and 2013, the vegetation was found to have reduced more because of unsustainable land use than rainfall conditions.

These findings call for more sustainable land use management practices in this part of Burkina Faso.

Studies on Economic Growth and Income in Sub-Saharan Africa

For several years, sub-Saharan Africa (SSA) has continued to struggle to achieve high growth rates and income necessary to pull its population from poverty and underdevelopment. This situation has resulted in high incidence of poverty and deteriorating standards of living among the majority of the people.

Despite implementation of policies and structural reforms over the years, the region still lags behind when matched with other regions such as East Asia, which started on the same growth path at the same time. It is against this background that **Dr. Michael Kwame Asiedu** carried out this study on the topic "Studies on Economic Growth and Income in Sub-Saharan Africa" to find out the key variables that drive the growth and income of sub-Saharan African countries.

The study suggests that investment in physical capital, population, democracy, trade openness and foreign aid were important determinants of economic growth in SSA over the period under consideration. This implies that growth policies should consider population control, expanding and improving the quality of education and enrolment especially at higher levels and strengthen democratic institutions.

College of Engineering Holds Career Fair

KNUST through the College of Engineering held a career fair on the theme "Engineering Excellence for National Development". The fair is aimed at exposing and helping to prepare students for industry as they go through their programmes.

The three-day Career Fair provided a platform for firms to introduce themselves to students and for students to discover opportunities available to them. The companies that participated in this year's event includes: CONSTRUCTORA NORBERTO ODEBRECHT, TROPICAL CABLES AND CONDUCTORS LIMITED, GE OIL AND GAS, HUAWEI TECHNOLOGIES GHANA LIMITED, NATIONAL COMMUNICATIONS AUTHORITY, VOLTA RIVER AUTHORITY, GRIDCo, GN ELECTRONICS, GNPC-TECHNIP, SCHLUMBERGER, VODAPHONE GHANA, GNPC, MTN AND GHANA HOME LOANS. These firms took turns to address students on their operations, career opportunities and what is expected of employees.

Prof. S. I.K. Ampadu opening the fair, stated that the event was a platform for students and the industrial partners of the College to meet to deliberate on projects, internships, national service opportunities and to conduct aptitude tests for recruitment.

He commended the industrial partners who have supported the event since its inception. He was also grateful for their support in organizing the College Awards.

Prof. S. I. K. Ampadu Opening the Career Fair

Tensile Properties, Water Absorption and Enzymatic Degradation Studies of Polyethylene/Starch Filled Hydroxyapatite Blend for Orthopaedic Application

Bernard Owusu Asimeng studied the topic "Tensile Properties, Water Absorption and Enzymatic Degradation Studies of Polyethylene/Starch Filled Hydroxyapatite Blend for Orthopaedic Application".

Linear low-density polyethylene (LLDPE)/starch blends filled with hydroxyapatite was synthesised by injection moulding to control the rate of biodegradation of LLDPE/ starch blends for bone screw fixation using hydroxyapatite (HA). The study varied hydroxyapatite contents from 1.0% to 3.0% in intervals of 0.5%, performed water absorption and enzymatic tests and determined tensile properties on seven different samples formed for the study. Results obtained showed that the incorporation of starch granules into LLDPE reduced the tensile strength but rather almost doubled the tensile modulus and this was attributed to starch granules expanding the amorphous tie chain of LLDPE.

The addition of hydroxyapatite into the blend returned an increase in the tensile strength. The increase in strength with increasing HA content was statistically significant at a p-value of 0.0008 and the improvement slowed the rate at which the blend degraded. Hydroxyapatite is suspected to have affected the intermediate phase of the LLDPE by the hydroxyl group through hydrogen bonding.

The water absorption by the blends showed that as hydroxyapatite content increased, there was a corresponding loss in tensile strength and modulus. Conversely there was a high gain in percentage elongation. Optical micrographs of the surfaces of the degraded samples showed higher erosion and more agglomerates. The samples that showed highest water uptake and highest percentage loss in tensile strength and those with less erosion and fewer agglomerates had less water uptake and less percentage loss in tensile strength.

Antibiotics in the Ghanaian Environment: Occurrence, Uptake, Model and Risk Assessment of Vegetables Irrigated with Low Quality Water

Hospital wastewater and effluents from waste stabilisation ponds in Kumasi, Ghana are directly discharged as low quality water into nearby streams which are eventually used to irrigate vegetables. In his studies on the topic" Antibiotics in the Ghanaian Environment: Occurrence, Uptake, Model and Risk Assessment of Vegetables Irrigated with Low Quality Water" **David Azanu** investigated the presence of 12 commonly used antibiotics in Ghana in water samples.

The occurrence of these 12 antibiotics in lettuce irrigated with low quality water in Kumasi was investigated in addition to performing greenhouse uptake studies of tetracycline and amoxicillin on lettuce and carrots. This was then used for modelling uptake antibiotics using STELLA software. The antibiotics in the water samples and plant samples were extracted and analysed on HPLC-MS/SM.

The results showed that the total load of antibiotics discharged through the WSP effluents and hospital wastewater was up to 3.1g/day. Low quality water used for vegetable irrigation considered for this study had antibiotics concentrations up to 0.2 ppb. Interestingly, the concentrations of antibiotics in irrigation water were not significantly different from that of the stream samples. The concentrations of antibiotics determined in lettuce collected from vegetable farms and markets in Kumasi ranged from 13.5 to 104.3 ng/kg. Seven out of the 12 antibiotics investigated were detected in at least one sample. Estimated daily intake of erythromycin and sulfamethoxazole from the consumption of lettuce was 6.4 × 10-7 and 2.0 × 10-7ug/kg body weight/d respectively. These estimated daily intake is several times lower than acceptable daily intake implying that there are no toxic effects on human consumption of the vegetables.

The outcome of this study suggests that there could be indirect exposure of humans to antibiotics through vegetable consumption and drinking water in Ghana. Although the levels found in lettuce could not cause toxic effects on humans, further research needs to be done since low levels of antibiotic in food and low quality water could contribute to development of bacterial resistance.

Team Silo Beats all in GESA Makers Faire 3

The Ghana Engineering Students Association (GESA) of the College of Engineering, KNUST has organised its Third Makers Faire. This came off at the Engineering Auditorium on 30th September, 2015 after a month of intensive research by the various teams to actualize their innovative and technological projects. The participants displayed their work to a panel of judges, lecturers and the students' body. The competition was aimed at improving agriculture, health, water resources and waste management, energy and rural education innovatively through technology.

The Technology Title was picked up by TEAM SILO, who designed and built a silo for maize conservation. To make their product relevant to the society, TEAM SILO spent days in a maize farming community to study their system to enhance their technology development. They emerged winners for Makers Faire 3 and in addition to winning the title, TEAM SILO also picked the most innovative award.

The other award winners were IngineX Helios for best Electronic Team, and FarmTech for the best Design team for coming out with a novel machine for the processing and storage of cassava.

The CEO of GN Electronics, the General Manager of GN Bank and a staff from Gold Coast Fund Management were present.

Team Silo Receiving Award for Innovation.

First Prize Winners (Team Silo) with Friends

Judges, Teams and Organisers of the Faire

IngineX Helios Demonstrating their Project to Judges

HONOURS/ACHIEVEMENTS

National Best Fish Farmer's Award

National Best Fish Farmer's Presentation

The **Department of Fisheries and Watershed Management** of Kwame Nkrumah University of Science and Technology (KNUST) won the 2015 National Best Pond Fish Farmer Award during the National Farmers' Day awards held on 4th December, 2015. The award included a certificate of honour, a 200-horse power tricycle, fishing nets, wellington boots and other farm implements.

Dr. D. A. Boateng

Again, the farm of the Department of Fisheries and Watershed Management came top after an assessment by the regional and national fisheries search committees. The assessment criteria covered the following: fish production figures, maintenance of ponds, expansion in facilities, innovative fish production systems, environmental and pollution mitigating approaches in fish production.

KNUST has trained over 400 Ghanaians and West African nationals at both undergraduate and graduate levels. More than 70 fisheries officers of the then Fisheries Department were trained by the Department.

African Academy of Sciences Affiliates

The African Academy of Sciences (AAS), a Pan-African association which recognises individuals who have reached the highest level of excellence in their field of study, at its 10th General Assembly (GA) held from 21st to 22nd June year in Kasane, Botswana, has inducted its 2014 and 2015 fellows and affiliates. The GA of the academy inducted the first cohort of AAS affiliates, a total of fifteen (15) young scientists under the age of forty (40) identified from the continent after a competitive and rigorous selection process.

Among affiliates were **Dr. Marian Asantewah Nkansah** of the Department of Chemistry of Kwame Nkrumah University of Science and Technology (KNUST) and **Dr. Augustina Angelina Sylverken,** a post-doctoral research scientist, at the Kumasi Centre for Collaborative Research in Tropical Medicine (KCCR). The affiliates' programme is intended to fill a gap with regard to the professional growth of young and early-to-mid career professionals in their efforts to develop into research leaders. The programme which is from 2016-2020 seeks to recognise, mentor and develop eminent young professionals into research leaders and to transform these young scientists into leading experts in their chosen fields of endeavour.

Dr. Marian A. Nkansah and Dr. Augustina A. Sylverken

Professor Richard T. Awuah, a Fellow and Council Member of the AAS, presented certificates to the affiliates from West Africa.

From Left: Dr. Sylverken, Prof. Richard T. Awauh, Prof. Esi Awauh and Dr. Marian A. Nkansah

Other Awards

KNUST School of Business received the Le Matinal Educational Excellence Award of the Africa-India Partnership 2011 for outstanding contribution to Business Education in Africa (2011).

Prof. Chrissie S. Abaidoo (SMS) was selected as an award winner for the 3rd Ghana Women of Excellence Award by the Ministry of Gender, Children and Social Protection (Aug. 2013).

The e-Learning centre of IDL was selected as the best Pan-African Regional e-Learning Centre after a very competitive selection exercise.

The Faculty of Law of KNUST took third place in the African Universities Moot Court Competition at the University of Zambia, Lusaka (5th -10th,Oct.,2015)

Miss Joaness Frimpong, a third year student of Petroleum Engineering, won the Schlumberger Award for the best intern video competition 2015. (Oct., 2015).

Dr. Kwasi Ohene Yankyera and **Dr. Robert Aidoo's** paper titled "Food-Away-From Home (FAFH) Expenditure Patterns for Ghanaian Urban Households: Effects of Income, Gender and Household Demographics" won the international award of excellence for Volume 1 of Food Studies: An Interdisciplinary Journal.

College of Engineering Awards Students and Industrial Partners

The College of Engineering organised its 2nd Students and Industrial Partners Awards ceremony on 15th October, 2015. The event was organised with the aim of recognising remarkable academic achievements of students and also to acknowledge the contribution and support of the College's industrial partners by way of collaborating with the College in improving the quality of the students.

The following categories of awards were conferred on deserving students: *Excellent Student Award, Best Student Award and Most Improved Student Award*. There were also special students awards instituted by individuals and corporate bodies for students who satisfied certain criteria. Among the College's numerous industrial partners acknowledged, the following were given awards: CONSTRUCTA NORBERTO ODEBRECHT, WOOD GROUP, TROPICAL CABLE AND CONDUCTOR LIMITED and SCHLUMBERGER.

A Special Industrial Partner award was presented to Ing. Samuel Eshun, the Corporate Affair Manager of Schlumberger for his enormous contribution in fostering good industrial relationship between the College and Schlumberger.

The Special Awards were

- Wood Group Award for tthe best students in Mechanical Engineering and the best final year theses for Civil and Mechanical Engineering Departments,
- Odebrecht Engineering Award for best students in Civil Engineering Department,
- Ghana Institution of Engineers Award for the overall most improved student, and
- College Design Award for best design group of GESA Makers Faire.

The other awards were

- ABP Civil Engineering Design Award,
- GN Electronics Award for best female third year Electrical/Electronic Engineering student,
- Prof. Nicholas Kwasi Kumapley Memorial Award for best student in Geotechnical Engineering, and
- Prof. Jonas Addae Mensah Award for best graduating Chemical Engineering student.

The rest were Prof. E. E. L. Wuddah-Martey Award and Surv. S. W. Kuranchie Award for best graduating student and best graduating project student respectively in the Geomatic Engineering Department.

The Vice Chancellor, Prof William Otoo Ellis in his opening address, congratulated the College of Engineering for their innovation in the organisation of the award ceremony which had encouraged other Colleges to hold similar events. In

order to achieve the ultimate, he stated the need for the University's stakeholders (students, staff and industrial partners) to work together. He thanked the industrial partners and tasked them to encourage their colleagues to partner the University in giving placement to students for vacation training.

Out of the 167 students who received awards, Prof S. K. Ampadu announced that 25 of them, that is 15% were female.

Prof William Otoo Ellis Presenting Award to a Student

Coker Kenneth, Best Third Year Telecommunication Engineering Student.

Sylvia Y. Edifor, Best Final Year Chemical Engineering student

Section of Staff and Student Members Present at the Ceremony

FELLOWSHIPS/EXCHANGE PROGRAMMES

EXCHANGE PROGRAMMES

Mr. Fidelis M. K. Kpodo has been awarded a fellowship from the Robert S. McNamara Fellowships (RSM) program, from the World Bank to support his research on "Characterization of Polysaccharide Extract from Different Okra Genotypes for Useful Applications in Food Systems" at the University of Huddersfield, UK from July to December 2016, with Dr. Vassilis Kontogiorogos as advisor. The value of the award is US$25,000.00

Mr. Wu Xianjiong from Harbin Finance University in China visited KNUST as a Chinese Language volunteer to the Department of Modern Languages to teach Chinese Language for the 2014/2015 academic year.

Per the agreement on the provision of Chinese Language teachers between the Confucius Institute (HANBAN) and KNUST, Mr. Hu Ding from Shanxi University was posted to the Department of Modern Languages in August, 2015. He is to replace Mr. Wu Jianxiong as a Chinese Language volunteer for a period of one year.

With the growing interest among KNUST students in the Chinese Language, Ms. Song Zhou's contract was renewed for a year to teach Chinese in the Department of Modern Languages from July, 2015 to July, 2016.

The French Embassy posted Ms. Celine Verhaeghe to the KNUST Maison Française as the new coordinator for a period of one year in the 2014/2015 academic year.

Ms. Emilie Dewitte, a Masters' student from Kuleuven, Belgium had a one semester joint research project on a thesis project on Twi and Development at the Department of Modern Languages, Faculty of Social Sciences, College of Art and Social Sciences (2014/2015 academic year).

Ms. Robin Beth Riskin, a Masters' student from the United States of America, is pursuing MFA in Painting and Sculpture, Faculty of Art, CABE for a period of two years (2014/2015 academic year).

Prof. Muriel Harris, a specialist in Health Education and Promotion from the University of Louisville in Kentucky was awarded a Fulbright Fellowship to spend a year with KNUST School of Public Health, from September 2015 to June 2016.

KNUST Hosts two Carnegie African Diaspora Fellows

The College of Engineering, KNUST, received two fellows under the Carnegie African Diaspora Fellowship (ADF) programme from June to August 2015. The Fellows are Prof. Fred Boadu of Duke University and Prof. Frank Yeboah of North Carolina Agricultural and Technical State University

Prof. Frank Yeboah .

Prof. Fred Boadu worked on collaborative multi-disciplinary research for tackling various societal issues, graduate supervision and mentorship, while Prof. Frank Yeboah worked on collaborative research in energy economics with The Energy Centre (TEC), KNUST and also on graduate supervision and mentorship.

Prof. Fred Boadu

Visiting Fellows of Climate Impact Research and Leadership Enhancement in Sub-Saharan Africa (CIRCLE) to KNUST for 2016

CIRCLE is a programme to develop the skills and research results for early career African researchers in the field of climate change. It aims to provide support and training to develop the institutional research capacity of participating institutions with quality assurance support on research career training from reputable advanced research institutions.

Dr. Ogheneruona Endurance Diemuodeke and Dr. Omosive Maduka both post-PhD CIRCLE visiting fellows (CVFs) from Ibadan, Nigeria were approved to be hosted at KNUST for Cohort 2 of CIRCLE visiting fellowships. They are to undertake their one-year fellowship from January 2016 to 31 December 2016.

The African Academy of Sciences (AAS) and the Association of Commonwealth Universities (ACU) is to provide a total of 100 scholarships to 40 Post-Masters' and 60 Post-Doctoral researchers in Africa to study the impact of climate change over a period of five years.

KNUST hosted two research fellows, Dr. Momodo Abiodun Suleiman from the Centre for Energy Research and Development, University of Ile-Ife, Nigeria and Dr. Olayide Emmanuel Olawale from the University of Ibadan, Nigeria under the Climate Impact Research and Leadership Enhancement in Sub-Saharan Africa programme (CIRCLE) for a period of one year (2014/2015 academic year).

Introducing the 2017 Visiting Scholar

Dr. Obiri-Yeboah is a lecturer at Kwame Nkrumah University of Science and Technology Kumasi (KNUST), Ghana, and a senior specialist in oral and maxillofacial surgery at the Komfo Anokye Teaching Hospital (KATH). He had his undergraduate training in dental surgery at the University of Ghana, Accra and residency training in oral and maxillofacial surgery at the Komfo Anokye Teaching Hospital (KATH), Kumasi, Ghana.

He holds the Fellowship of the Ghana College of Physicians and Surgeons and an International Fellowship in craniofacial surgery from the Birmingham Children's Hospital, University of Alabama at Birmingham, USA. He is an accomplished cleft and craniofacial surgeon and a member of the KATH multidisciplinary cleft palate/craniofacial clinic in Kumasi. His research interests include the genetic basis of cleft lip and palate. Solomon is married with three children and enjoys reading, music, sightseeing and soccer.

Dr. Obiri-Yeboah was sponsored by Richard Hopper, MD, MS of Seattle Children's Hospital. During his time in the US, Dr. Obiri-Yeboah plans to visit three teams including Seattle Children's Craniofacial Centre, UCSF Centre for Craniofacial Anomalies, and Los Angeles Children's Craniofacial and Cleft Centre. Obiri-Yeboah will also attend ACPA's 74th Annual Meeting in Colorado Springs, CO and will present information about his experiences.

Through the Visiting Scholar Program, ACPA selects an individual who has the potential for establishing and/or directing interdisciplinary team care for comprehensive management of individuals with craniofacial anomalies in their home country and provide the selected scholar(s) with an educational experience in the treatment of craniofacial and cleft anomalies at ACPA recognised cleft palate and craniofacial centres.

Dr. Solomon Obiri-Yeboah

UNITS SUPPORTING RESEARCH

The Green House

The Green House is one of the shared research facilities of the KNUST Central Laboratory Network. The greenhouse was built by Atig Technology from Israel in the year 2012 to support research in the university. The facility serves two main purposes: Research and Vegetable production. It is available for utilisation by Universities, research organisations and the like. It was establishmed to help with research in a controlled environment. The Department has five greenhouses: one is sophisticated and automated and the other four are not automated. The automated greenhouse comes with a weather station which is connected to the greenhouse to give weather information inside and outside the greenhouse.

The automated greenhouse is fitted with sensors in and around which are linked to a central computer to disseminate information to the user. From the computer, any activity carried out in the greenhouse can be initiated and information is sent to the spirit motherboard fitted inside the greenhouse and the mother board triggers the sensors to execute those activities. In simple terms the activities in the greenhouse can be automated, so even if the research is not present a command can be issued to the computer to carry out an activity at any point in time. The automated greenhouse runs on electricity.

Some of the activities which can be automated in the greenhouse are

- Irrigation
- Fertilisation regime
- Lightning
- Fogging/ Misting
- Thermal screen Shielding
- Roof opening and closing
- Side Windows opening and closing
- Ventilation and Circulatory fans
- Entry Fans

The computer in the control room is installed with a software called the Greenline Software. This Greenline software with the help of the mother board helps store data for any research, relating to the weather (Parameters such as temperature, humidity, intensity of sunshine (irradiation), wind speed, wind direction, rainfall,), fertigation, irrigation analysed per the researcher's interest over a period of time.

Some research work carried out in the automated greenhouses by postgraduate students are:

- most probable number (MPN) of rhizobia in the soil
- Standardisation of Organic Materials as Amendment for Soil and Soilless Media in urban Horticultural Production Systems.
- Effect of Biozyme Application on tomato planted in a soilless media
- Effect of biozyme application on the growth and shelf life of pepper.
- Effect of water stress and irrigation regime on tomato plants.

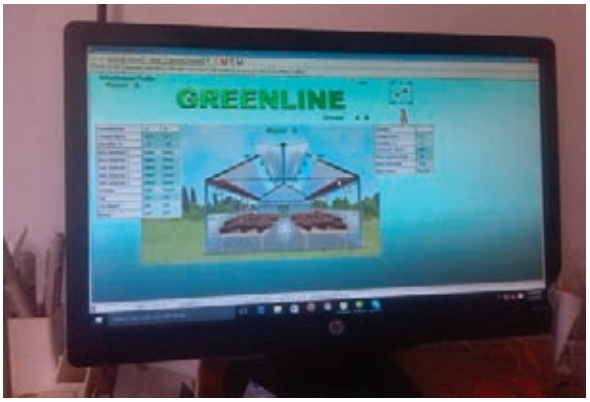
Three of the four greenhouses are used for vegetable production. For example:

- Tomato
- Sweet Pepper
- Lettuce
- Cucumber
- Carrots
- Spinach
- Cabbage

We also provide seedlings for student projects and for any other person who needs seedlings for production. **Prof. Eric Woode, HEAD**

Plants in the Green House

Plants in the Green House



Greenline Software

KNUST Central Laboratory Network

The KNUST Central Lab was established to help position KNUST as a premier centre of excellence in Africa for teaching and research in science and technology for development. The Central Lab achieves this by providing paid-for equipment run times, organising training workshops and providing training opportunities for her own staff.

The Central Lab has supported research efforts of scientists at KNUST, and other sister institutions in Ghana and Nigeria. We have also undertaken projects for industries in Ghana. The services provided are paid for by our clients and we through this some revenue has accrued to support our activities. We have undertaken up to 300 individual requests for research support. Our requests have come from researchers in the Colleges of Health Science, Science, Engineering and Agricultural and Natural Resources at KNUST. We have also had occasion to work for scientists from sister institutions and research facilities - University of Cape Coast, University of Development Studies, University of Mines and Technology, University of Education, Kumasi Polytechnic and University of Port Harcourt. The Centre for Scientific and Industrial Research (CSIR) and Goldfields Ghana have been very good clients as well.

To get the requests coming in the thousands, we have also conducted equipment specific application and methodologies training workshops. Our focus for these training events are to help our clients better understand the technologies we have and how they can use them to better answer their research questions. These we have achieved through collaborations with institutions in Ghana and abroad. Notable of mention are the following;

1. Nuclear Magnetic Resonance (NMR) Structure Elucidation training workshop (31 August – 02 September, 2015) held in partnership with Novartis Institutes of Biomedical Research, Switzerland and Bruker, Switzerland.
2. We joined hands with the Department of Chemistry, KNUST and the Pan African Chemistry Network of the Royal Society of Chemistry to organize the Gas Chromatography – Mass Spectrometry training workshop for West Africa (16 – 20 March, 2015).
3. From 25-29 July 2016, we partnered with the Borlaug Higher Education for Agricultural Research and Development (BHEARD) and the United States Agency for International Development (USAID). We offered demonstration on the UV-Vis, Atomic Absorption Spectrophotometer and Infrared Spectroscopy on their "Skill Building and Professional Development Workshop for Research Technicians".
4. And quite recently between 18 – 20th October 2016, the Central Lab with funding from the BSU II project organized a theoretical and practical exposure of the Atomic Absorption Spectroscopy to lecturers and technicians and national service persons here at KNUST.

In the past year, the KNUST Central Laboratory has sought to support research and teaching efforts of its members by providing access to state-of-the-art equipment. The initiative of a shared lab facility has been important for the following reasons:

- Enhancement of analytical skills
- Generating revenue and becoming potentially self-sustaining
- High impact on science and technology research

Word has travelled quickly about the existence of such a facility at KNUST and the scientific community in Ghana and West Africa are beginning to see what is possible in research. We believe we are at the brink of something wonderful and are better positioned to be an institution of excellence in science and technology. We hope to get better in the coming years and reach our fullest potential.

Finance Office

KNUST Finance Office is responsible for the financial administration of the University. The Office in consultation with other related units in the University, formulates financial policies to guide the conduct of research.

The Office also ensures that clear and transparent procedures are followed in project accounting to ensure that funds are not used for purposes or activities that are not approved in the project budget. At the College level, Finance Officers work with Principal Investigators to submit periodic financial reports to funders and ensures that funders as well as institutional financial requirements are adhered to.

In a bid to ensure the smooth running of research projects in the university, the Finance Office has produced a manual on accounting policies and procedures which is accessible to Staff. This manual seeks to highlight the internal control processes and procedures that will ensure accountability and transparency in the management of donor funds. **Mr. Yaw Nimo-Baffour, FINANCE OFFICER**

International Programmes Office (IPO)

The International Programmes Office (IPO) was established to help bring under a common umbrella all exchange programmes and external relations that the Departments/Faculties/Colleges had with other institutions in and outside the country. The major objective was to help in the effective organisation, management and recording of the inflow of benefactor and collaborator institutions and individuals as spelt out in the statutes of the University.

In order to achieve this goal, the IPO carries out the following duties:

- it establishes links with international institutions in collaboration with the Provosts of Colleges, Deans of Faculties and Heads of Department.
- regularly updates the database on the University's collaborators or partners in respect of international academic programmes.
- handles matters involving both staff and student visits and exchange programmes.
- handles all agreements involving the University and its collaborators or partners in respect of external academic programmes in conjunction with the Registrar's Office.
- facilitates Scholarships for KNUST staff and students.
- facilitates the Chinese Government and Chinese Universities Scholarships for staff and teaching assistants of the University.
- facilitates career fairs for KNUST students.
- hosts of research projects within and outside the University.
- facilitates resident permits, visas and work permits for foreign and KNUST students and visiting scholars in close collaboration with the Human Resource Development Division of the Registrar's Office.

The IPO solicits research linkages with African and non-African Institutions as well as other Ghanaian Institutions for staff and students. **Prof. Opoku Amankwah, HEAD, IPO**

Legal and Welfare Office

The Legal and Welfare Office of the University is a division of the Registrar's Office which was set up to perform legal support functions for the University including the following:

i. Advising the University on legal matters affecting and/or involving the University;

ii. Preparing, for and on behalf of the University, all conveyances including contract agreements, memorandum of understanding etc.

iii. Training staff on Acts of Parliament such as the Labour Act, 2003 (Act 651), Intestate Succession Law, 1985 (PNDCL 111); Public Procurement Act, 2003 (663) etc. for the benefit of Staff;

iv. Settling disputes involving the University and Staff using Alternative Dispute Resolution mechanisms

Since its inception in 2000, the office has played an important role in the research enterprise of the University. The Office aids research capabilities of the University by preparing or reviewing agreements between the University and sponsors as well as other collaborative institutions. These agreements are usually for the purposes of research, capacity building, and staff and student exchanges among others. The Legal Office ensures that the University's interests are protected in contractual relationships as well as grant applications and awards. The office also ensures that any contractual agreements entered while implementing research projects such as employment, consultancies, supply, etc. adhere to university, sponsor and national requirements. **Ms. Eudora Oppong, HEAD, LEGAL AND WELFARE OFFICE**

Prempeh II University Library

Introduction

Kwame Nkrumah University of Science and Technology (KNUST) recognises the transformative value of scientific research as the surest route to global development. Hence, the University strives to consolidate its status as an intensive research University. To this end, the University has invested in the development of its research infrastructure and systems. One area where this development is evident, is the research information systems landscape, managed from the University Library to directly support research activities. For the 2015/2016 academic year, the Prempeh II Library and its six affiliate College Libraries have contributed to the development of research activities through the provision of research information services and training programmes, targeted at faculty and graduate researchers in the following key areas.

Prempeh II Library Building

Institutional repository

Our online institutional repository – KNUSTSpace – collects, preserves and disseminates digital copies of the intellectual output of the University. This is part of the wider vision of the Prempeh II Library to promote open access to resources and also raise the visibility of KNUST as a research university. The Library has uploaded over 8,500 theses and research publications emanating from researchers unto its repository for easy access. In the latest webometric ranking of repositories, KNUSTSpace was ranked 14th in Africa and 1st in Ghana, a very remarkable achievement. Usage statistics from Google Analytics indicate that on the average, three hundred and fifteen (315) users visit the repository a day from countries such as Kenya, Sudan, India, USA, Netherlands, UK, Nigeria and South Africa. Over 4,200 new visitors per month visit KNUSTSpace.

Electronic Resources

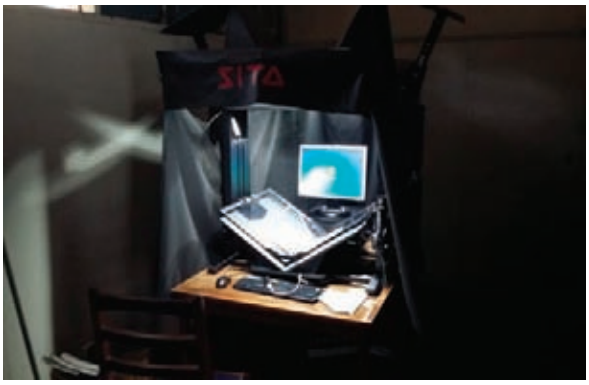
The Prempeh II Library, subscribes to over fifty (50) online databases to support the research activities of the University. Notable databases among these are EBSCO, Emerald, Sage and Wiley. The library has also increased its subscription of subject-specific databases e.g. IEEE, IOP to support research activities in the area of Electrical and Electronic Engineering. Majority of these databases were acquired through membership of the Consortium of Academic and Research Libraries (CARLIGH). The various databases can be accessed both within and outside the University by students and faculty using the University's email address. The Library also offers virtual reference services to support research via social media.

Digitisation Programme

The Prempeh II Library provides digitisation services of the intellectual property of the University. The objectives of this programme are to:

- preserve the intellectual heritage of the University
- provide global access to works emanating from this University
- make searching of these resources much easier
- for easy retrieval in the event of a disaster
- promote the research brand heritage of KNUST

To date over 654 materials have been digitised. The plan for the future is to make sure that all PhD theses are available online.



Digitisation Machine- Book Drive

The New Faculty and Graduate Research Commons

The Research Commons was set up two years ago as a dedicated hub within the KNUST University library system to directly support the research mandate of the University and enhance the University's reputation as a global centre of research excellence. It provides the intellectual space where academics and postgraduate researchers can connect, collaborate, co-create, build and share understanding of the global research landscape. The Research Commons was given a major face-lift recently, with support from the Building Stronger University (BSU) project, supported by the Danish government.

Faculty Area

Video Conferencing Room

Graduate Area

The Research Commons which can accommodate over one hundred and twenty (120) users, provides access to research information services, expert help and seamless access to scientific resources. It also makes available a wide range of technological tools, facilities and services, including video conferencing, computer assisted technologies, seminar rooms for training workshops, as well as highly reputable academic and scholarly databases. These services and facilities allow postgraduate students and academic staff to carry out their research in a supportive environment. The centre has seen a dramatic increase in the number of users.

Training Area

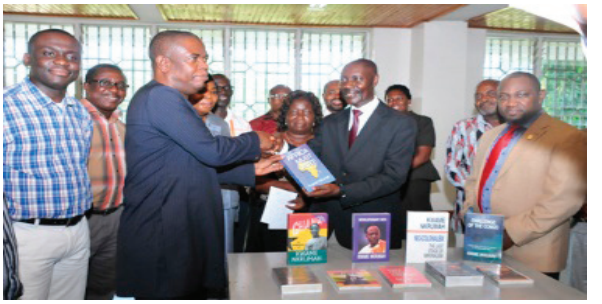
Training and Capacity Building

The KNUST Library has run training programmes and workshops attended by both library staff and researchers to update their knowledge and build their capacity. These training programmes have created synergy between library staff and their research counterparts in various Colleges and stimulated dialogue among the scientific community of KNUST on current developments in the field of science and technology. Library research staff have also carried out bibliometric analysis for members of the research community to assess the impact of their research in their chosen fields. On average, 40 users visit the Library daily for research support and also make use of the online research support services available.

Library System Upgrade

The KNUST Library is in the process of migrating from the Alexandria Library Management System (LMS) to KOHA for the 2016/2017 academic year. KOHA is an integrated open access Library Management System with comprehensive library application programming interface (APIs) for third-party. KOHA has inbuilt tools that facilitate interaction with web properties and social networking sites. The introduction of KOHA, which also features open source tools like PostgreSQL database and Lucene keyword engine will help improve library workflow and data management and also give users a more interactive search interface.

Book Donations



Mr. Kwesi Pratt Jnr. Making Book Donations to the University Librarian Dr. Sam Nikoi

The 8th Pan Africa Congress Legacy Project, donated assorted books by various authors (including the first President of Ghana, Dr Kwame Nkrumah) to the KNUST Library. The goal of the Legacy Project is to promote the ideals of great Pan Africanists like Osagyefo Dr. Kwame Nkrumah, Frantz Fanon and Walter Rodney through books. The donation was a valuable addition to the Ghana Collection of the Library, which is made up of rare books on economic and socio-cultural developments in Ghana. The donation is a valuable intellectual and historical resource for the promotion of academic scholarship and research on development issues facing Africa. **Dr. Samuel Kotei Nikoi, UNIVERSITY LIBRARIAN**

Quality Assurance and Planning Unit (QAPU)

The Quality Assurance and Planning Unit (QAPU) is "responsible for the strategic planning, management of quality assurance, and the management of information systems of the University" (2004 KNUST Statutes).

QAPU has over the years compiled academic staff research information and published them annually in the Quality Assurance Bulletin. The reports include peer-reviewed journal publications, articles published in conference proceedings, as well as books and book chapters authored by staff.

To support research activities at KNUST, QAPU organises capacity building workshops on research and its related topics for members of staff. The 3rd Summer School, for instance, was organised under the theme: "Repositioning KNUST as a Global Institution: Effective Research Management as a Tool". Interesting sub-topics treated included: Research Management, The role of Research in Positioning a University as a Global Institution, A University Research Enterprise: The University of Michigan's Example, Why an Office of Grant and Research?, The role of Research Administration Management in Boosting Research, Pre-Award Research Administration and Management, Cost Categories and Budgeting; How to Develop a Winning Proposal among others.

QAPU is committed to ensuring the highest level of quality of KNUST in executing its core mandate including teaching, research and service to community and is ready to support and position KNUST as a global Centre of Excellence. **Dr. Christian Agyare, HEAD, QAPU**

University Health Services

The University Hospital has a mission to lead in the provision of general and emergency medical care through efficient and compassionate delivery of quality health care to improve the health status of the University community and the general public. It also serves as a centre for training for healthcare professionals. Research is important in accomplishing this mission.

For years now the hospital has, therefore, been a study site for a lot of research activities by undergraduate and postgraduate students, staff of the university, individuals and organisations.

Our staff have undertaken various projects aimed at building the capacity of other staff in research, improved clinical practices and positive impact on the people within our community. The research areas have been on infectious diseases, renal diseases, community dentistry, non-communicable diseases and health problems of public health importance.

As Director of University Health Services, I encourage a lot more of our health workers to identify important research areas, seek funding and publish their findings to enhance knowledge. I also welcome partnerships from University staff and other organisations to assist us in our efforts. **Dr. Osei Kwaku Wusu-Ansah, DIRECTOR, UNIVERSITY HEALTH SERVICES**

University Information Technology and Systems (UITS) Unit

The University Information Technology Services (UITS) operating under the office of the Vice Chancellor provides key IT infrastructure to support academic work across the University in planning, delivering and disseminating research.

The UITS continues to offer high-quality services that meet the requirements of users in the most cost-effective way, and identify new services while improving upon existing services.

There are four major units for the provision of technical support for learning, teaching and research.

These are:

- IT training and helpdesk
- Software development services
- Website and e-platform services
- Network operations and infrastructure department

The UITS's core objectives stem from the university's objectives on ICT policy. They are:

- To extend ICT services to all units of the university
- To ensure the availability of user-level communication services.
- To develop schemes for the growth and financial sustainability of ICT resources through appropriate funding and operational mechanism
- To ensure sustainable management of the university's ICT resources through the creation of appropriate institutional framework.
- To develop content management and information systems for the university.
- To regularly train staff and students in order to equip them with the requisite skills to fully exploit the ICT environment in their different functions

Responsibilities include;

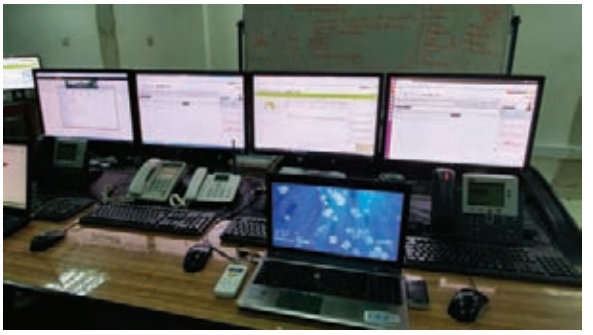
- Provision of Internet services and security to the University
- Regulation and maintenance of networks on campus

- Management of staff and student data
- Development and maintenance of software and web applications for the university
- Provide IT help and training services for the entire university

IT Training and Helpdesk

The centre has a **number of computer laboratories that are made available to the university community for teaching and research.** Additionally**,** regular training programmes are organised for students and staff in order to equip them with the requisite ICT skills.

The helpdesk has a centralised ticketing system where all helpdesk and support functions are logged and forwarded to the appropriate section/department to handle. Plans are far advanced to decentralise the helpdesk system to the collegiate level.



Helpdesk Systems

Software Development Services

The Application Development Unit is responsible for the development and maintenance of all information systems and applications required by the University. KNUST by its ICT Policy document is to provide and maintain enterprise systems to cover a wide range of the University administrative and management processes.

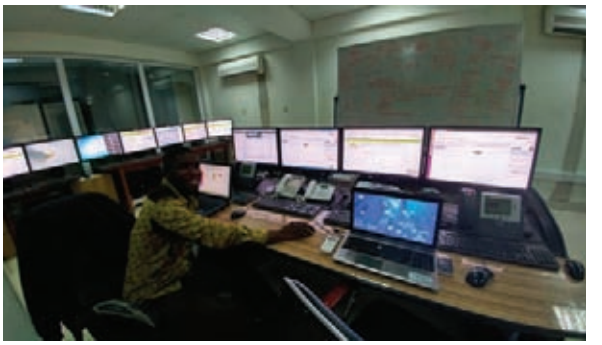
Website and E-Platform Services

The Website and E-Platform section (WES) is in charge of designing and building websites as well as mobile applications for the University community. Additionally, services ranging from user-centred design to process analysis and systems architecture are provided.

The WES provides professional, standards-compliant development, support, consultation and hosting of sites and applications that serve the broad needs of the University community. This includes custom application development; extending pre-packaged functionality of core systems; leveraged/instanced applications, custom web design for departments, laboratories, administrative units and affiliates; strategic business process redesign and integration between technical and administrative units and Intra-IT services as required by the situation.

Network Operations and Infrastructure Department

The mission of Network Operations and Infrastructure Department at KNUST is to facilitate Internet and Intranet access on campus and to promote the use of online access in teaching, learning and research. Among other responsibilities are the administration, regulation and promotion of the use of the University's fibre optic and Wireless backbone network.



KNUST-Net

It also manages the University's IT infrastructure, IT security and provides core services including central servers as well as training and support for the entire network. **Mr. Francis Osae Agyei, DIRECTOR, UITS**

University Relations Office

The University Relations Office, with its affiliate units - Public Relations, Protocol, Publication and Documentation, Reprographic, Alumni Office and Focus FM (a campus-based radio station) all work together to push the agenda of "Advancing Knowledge in Science and Technology for Sustainable Development of Africa".

The University Relations Office (URO) has supported and promoted research over the past year by covering events such as research conferences, PhD viva and theses defence, outdooring of technological innovations and other research activities undertaken by the Colleges. The office places more premium on research which has the potential for uptake and utilisation and relays such to our stakeholders. We have been able to effectively enhance the engagement of the University with the public and have generally informed the University community and our stakeholders.

The Reprographic Unit takes care of all the photography needs of the University and currently holds a good repository of photographs covering research activities of the University.

The URO has hosted and provided professional support for events, conferences, press briefings, inaugural and professorial lectures, exhibitions and all official university functions aimed at enhancing our vision.

As the official mouthpiece of the University, we have communicated in various ways the University's research activities and projected the University to maintain its favourable image. This we have achieved through the print and electronic media and our strategic communication and crisis management efforts. With our good media relations, we are able to use the mass media effectively to our advantage to reach our internal and external audiences.

The URO continues to promote research by managing and constantly updating the content of the University website. The website profiles active researchers of the University and showcases their research. This includes the coverage of PhD vivas, which are placed in the spotlight of the University website. Besides these the university website has a permanent page dedicated to research uptake.

Our Publications and Documentation Unit also handles all publications of the University and assists in disseminating our research. Through publications like the *Journal of Science and Technology (JUST)* and *Technocrat* Magazine, the University is able to link up with industry by updating them on current happenings and research in the University.

Our Alumni Office continues with efforts to link up with alumni for the needed support to the University. The office has been at the forefront of organising congresses and other activities, which promote national development.

Focus FM, the official campus radio station has in recent times been airing quality programmes to entertain, educate and inform its wide audience. The station spearheads our flagship research dissemination and outreach efforts through its programme "Nyansapɔ". **Mr. Kwame Yeboah Jr, UNIVERSITY RELATIONS OFFICER**

RESEARCH OUTPUT

Summary of Research Output for 2013/2014 and 2014/2015/2016

College of Agriculture and Natural Resources												
	Refereed Journals		Published Conference Papers		Unpublished Conference Papers		Books Published		Book Chapters		Total Publications	
	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16
Department of Agroforestry	-	11	-	4	-	-	-		-	-	-	**15**
Department of Animal Science	42	41	5	11	8	-	-	1	-	-	**55**	**53**
Department of Ecotourism and Forest Recreation	-	3	-	-	3	-	-	-	-	-	**3**	**3**
Department of Crop and Soil Sciences	18	22	-	6	5	-	-	-	-	-	**23**	**28**
Department of Fisheries and Watershed Management	26	32	-	-	-	-	1	-	-	-	**27**	**32**
Department of Horticulture	8	10	1	2	6	-	-	-	-	-	**15**	**12**
Department of Land Reclamation and Rehabilitation	1	3	-	-	-	-	-	-	-	-	**1**	**3**
Department of Silviculture and Forest Management	2	11	-	5	3	-	-	3	-	-	**5**	**19**
Wildlife and Range Management	-	25	-	-	-	-	-	-	-	-	-	**25**
Department of Wood Science and Technology	8	10	2	-	-	-	-	-	-	-	**10**	**10**
Bureau of Integrated Rural Development	-	10	-	2	-	-	-	2	-	2	-	**15**
Department of Wood Processing and Marketing	5	4	5	2	2	-	-	-	-	-	**12**	**6**
Department of Social Forestry	3	-	1	-	-	-	-	-	-	-	**4**	-
Department of Agricultural Economics, Agribusiness and Extension	31	-	-	-	12	-	2	-	1	-	**46**	-
College Total	**144**	**182**	**14**	**32**	**39**	-	**3**	**6**	**1**	**2**	**201**	**221**

Source: Quality Assurance and Publication Unit

College of Art and Built Environment												
	Refereed Journals		Published Conference Papers		Unpublished Conference Papers		Books Published		Book Chapters		Total Publications	
	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16
Centre for Settlement Studies	8	12	6	8	-	-	-	-	-	-	**14**	**20**
Department of Land Economy	11	7	1	17	6	-	-	-	-	1	**17**	**24**
Department of Planning	22	18	3	3	-	-	3	-	15	14	**43**	**35**
Department of Architecture	13	17	12	16	-	-	-	-	-	2	**25**	**35**
Department of Building Technology	17	-	19	-	1	-	-	-	-	-	**37**	**-**
Institute of Land Administration (ILMAD)	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Department of General Art Studies	21	14	-	2	6	-	-	-	-	-	**27**	**16**
Department of Communication Design	3	3	13	6	-	-	-	-	-	-	**16**	**9**
Department of Integrated Rural Art and Industry	27	36	6	10	-	-	-	2	-	-	**33**	**48**
Department of Painting and Sculpture	6	2	2	5	6	5	-	-	-	-	**14**	**7**
Department of Industrial Art	11	-	-	-	-	-	-	-	-	-	**11**	**-**
Department of Publishing	3	-	-	-	-	-	-	-	-	-	**3**	**-**
Total	**142**	**109**	**62**	**67**	**19**	**5**	**3**	**2**	**15**	**17**	**240**	**194**

Source: Quality Assurance and Publication Unit

College of Humanities and Social Sciences												
	Refereed Journals		Published Conference Papers		Unpublished Conference Papers		Books Published		Book Chapters		Total Publications	
	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16
Department of Accounting and Finance	24	28	1	-	-	-	-	-	-	-	**25**	**28**
Department of Information Systems and Decision Sciences	17	6	5	1	-	-	1	2	-	-	**23**	**9**
Department of Economics	21	35	-	-	-	-	-	-	-	1	**21**	**36**
Department of Geography and Rural Development	22	63	3	-	-	-	-	-	-	-	**25**	**63**
Department of Human Resource and Organisational Development	-	3	-	2	-	-	-	-	-	-	-	**5**
Department of Sociology and Social Work	1	20	-	-	1	-	-	-	2	-	**4**	**10**
Department of English	-	3	4	-	-	-	-	-	-	-	**4**	**3**
Department of Modern Languages	3	8	-	-	9	7	-	-	-	-	**12**	**15**
Department of Marketing and Corporate Strategy	8	-	-	-	-	-	-	-	-	-	**8**	-
Department of History and Political Studies	19	-	-		-		4		-	-	**23**	-
Department of Religious Studies	23	50	1	1	14	18	7	14	7	3	**52**	**46**
Centre for Cultural and African Studies	5	10	9	6	-	6	4	4	-	1	**18**	**22**
Department of Managerial Science	2	-	-	-	-	-	-	-	1	-	**3**	-
Department of Commercial Law	2	-	-	-	3	-	-	-	-	-	**5**	-
Department of Private Law	1	-	-	-	-		-		1	-	**2**	-
Department of Public Law	1	-	-		-		3		-	-	**4**	-
Total	**149**	**226**	**23**	**10**	**27**	**31**	**19**	**20**	**11**	**5**	**229**	**237**

Source: Quality Assurance and Publication Unit

College of Engineering												
	Refereed Journals		Published Conference Papers		Unpublished Conference Papers		Books Published		Book Chapters		Total Publications	
	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16
Department of Chemical Engineering	-	32	-	-		1	-	-	-	1	-	**34**
Department of Electrical and Electronic Engineering	14	11	-	15	1	-	1	-	-	-	**16**	**26**
Department of Geological Engineering	13	9	-	1	-	-	-	-	-	-	**13**	**10**
Technology Consultancy Centre	4	3	-	5	4	-	-	-	1	-	**9**	**8**
Department of Materials and Metallurgical Engineering	-	16	-	-	-	-	-	-	-	-	-	**16**
Department of Civil Engineering	35	20	5	-	5	-	-	-	-	-	**40**	**20**
Department of Computer & Biomedical Engineering	-	7	-	-	-	-	-	-	-	-	-	**7**
Department of Geomatic Engineering	-	14	-	2	-	-	-	-	-	-	-	**16**
Department of Petroleum Engineering	-	3	-	-	-	-	-	-	-	-	-	**3**
Department of Mechanical Engineering	-	21	-	-	-	-	-	-	-	-	-	**21**
Department of Agricultural Engineering	19	-	-		-	-	-		-	-	**19**	-
The Energy Center	-	-	-	-	-	-	-	-	-	-	-	-
Total	**85**	**136**	**5**	**23**	**10**	**1**	**1**	**-**	**1**	**1**	**97**	**161**

Source: Quality Assurance and Publication Unit

College of Health Sciences												
	Refereed Journals		Published Conference Papers		Unpublished Conference Papers		Books Published		Book Chapters		Total Publications	
	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16
Department of Dentistry	-	5	-	-	-	-	-	-	-	--	-	**5**
Department of Herbal Medicine	10	12	-	-	1	-	-	-	-	-	**11**	**12**
Department of Pharmaceutics	17	48	-	18	-	-	-	-	-	2	**17**	**68**
Department of Pharmacognosy	10	17	-	-	-	-	-	-	-	-	**10**	**17**
Department of Pharmacology	32	20	-	-	-	-	-	-	-	-	**32**	**20**
Department of Pharmaceutical Chemistry	-	19	-	-	-	-	-	-	-	1	-	**20**
Department of Physiology	10	21	-	-	-	-	-	-	-	-	**10**	**21**
School of Verterinary Medicine	11	18	4	10	-	-	-	-	-	-	**15**	**28**
Department of Surgery	19	70	5	19	3	-	-	-	2	-	**29**	**89**
Department of Nursing	1	3	-	1	-	-	-	-	-	-	**1**	**4**
Department of Molecular Medicine	26	22	-	7	-	4	-	-	6	-	**32**	**33**
Department of Obstetrics and Gynaecology	17	30	1	6	16	-	1	-	9	-	**44**	**36**
Department of Medicine	3	34	-	3	-	-	-	-	-	-	**3**	**37**
Department of Clinical and Social Pharmacy	9	14	-	10	4	5	-	-	-	-	**13**	**29**
Department of Child Health	12	3	4	18	-	-	-	-	-	-	**16**	**21**
Department of Eye, Ear, Nose and Throat	13	2	-	-	-	-	-	-	-	-	**13**	**2**
Department of Community Health	-	42	-	-	-	-	-	-	-	-	-	**42**
Kumasi Centre for Collaborative Research	48	64	-	-	-	-	-	-	-	-	**48**	**64**
Department of Medical Laboratory Technology	10	5	3	2	3	-	-	-	-	2	**16**	**9**
Department of Pathology	-	6	-	2	-	-	-	-	-	-	-	**8**
Department of Adult Oral Health	-	-	-	-	-	-	-	-	-	-	-	-

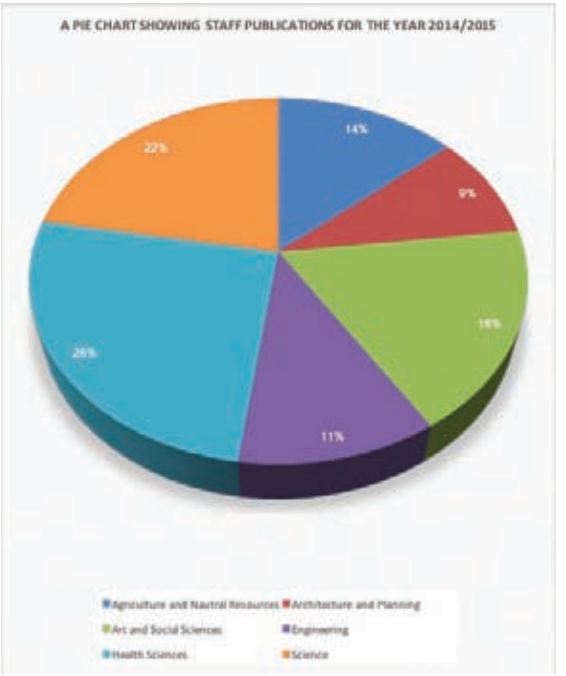
Department of Basic and Diagnostic Oral Sciences	-	9	-	-	-	-	-	-	-	-	**9**	-
Department of Child Oral Health and Orthodontics												
Department of Community Dentistry	1	12	-	-	1	-	-	1	-	-	**2**	**13**
Oral and Maxillofacial Sciences												
Department of Medical Laboratory Technology	10	5	3	2	3	-	-	-	-	2	**16**	**9**
Department of Sonography	-	-	-	-	-	-	-	-	-	-	-	-
Department of Sports and Exercise Science	-	-	-	-	-	-	-	-	-	-	-	-
Anesthesiology and Intensive Care												
Department of Anatomy	-	20	-		-		-		-		**20**	
Department of Behavioural Sciences												
Department of Clinical Microbiology	17	-	-	-	-	-	-	-	-	-	**17**	-
Department of Physiology	-	21	-	-	-	-	-	-	-	-	-	**21**
Total	**276**	**564**	**20**	**98**	**31**	**9**	**1**	**1**	**17**	**7**	**374**	**650**

Source: Quality Assurance and Publication Unit

College of Science												
	Refereed Journals		Published Conference Papers		Unpublished Conference Papers		Books Published		Book Chapters		Total Publications	
	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16
Department of Computer Science	7	16	3	2	2	-	-	-	-	-	**12**	**18**
Department of Optometry and Visual Science	9	17	-	9	-	-	-	-	-	-	**9**	**26**
Department of Physics	40	31	14	-	-	5	-	-	-	-	**54**	**36**
Department of Mathematics	41	12	-	-	-	-	2	-	-	-	**43**	**12**
Department of Biochemistry and Biotechnology	13	46	3	6	-	-	1	-	-	1	**17**	**53**
Department of Chemistry	27	48	5	5	-	-	-	-	-	-	**32**	**53**
Department of Food Science and Technology	13	39	-	51	12	33	-	-	-	-	**25**	**90**
Department of Theoretical and Applied Biology and Environmental Science	31	27	1	-	1	-	-	-	-	-	**34**	**27**
Total	**181**	**236**	**26**	**73**	**15**	**38**	**3**	**-**	**-**	**1**	**226**	**315**
Aggregate Totals	**977**	**1453**	**150**	**303**	**141**	**84**	**30**	**29**	**45**	**33**	**1367**	**1778**

Source: Quality Assurance and Publication Unit

OTHER INSTITUTIONS												
	Refereed Journals		Published Conference Papers		Unpublished Conference Papers		Books Published		Book Chapters		Total Publications	
	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16	13/14	14/15/16
Institute of Distance Learning	**5**	**-**	**-**		**15**	**-**	**1**	**-**	**9**	**-**	**30**	**-**
Quality Assurance and Planning Unit	**7**	**1**	**4**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**11**	**4**
University Library	-	2	-	2	-	1	-	-	-	-	-	**4**
Overall Aggregate	**1012**	**1456**	**155**	**308**	**153**	**87**	**31**	**29**	**54**	**35**	**1387**	**1786**



Source: Quality Assurance and Publication Unit

Staff Publication Ratio for Colleges (2014/2015)

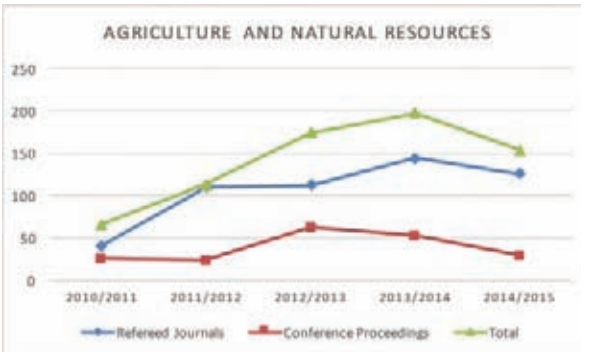
COLLEGE	Total Number of Publications	Total Number of Lecturers	Staff Publication Ratio
Agriculture and Natural Resources	173	80	2.1625
Art and Social Sciences	224	215	1.04186
Architecture and Planning	116	63	1.84127
Engineering	140	125	1.12
Health Sciences	320	175	1.828571
Science	278	135	2.059259
Total	**1251**	**793**	**1.682219**

University Average: 1.682219

(Source: Publication Output from QAPU; Total Number of Academic staff from 2015 KNUST Budget)

Staff Publication Ratio (SPR): Total Number of Publications / Total Number of Lecturers

Time Series Plot for Research Output (2010/2011 To 2014/2015)



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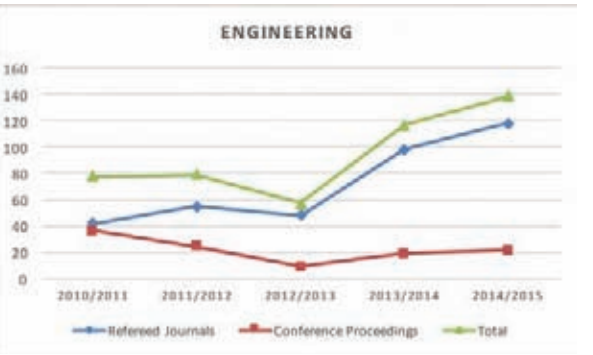

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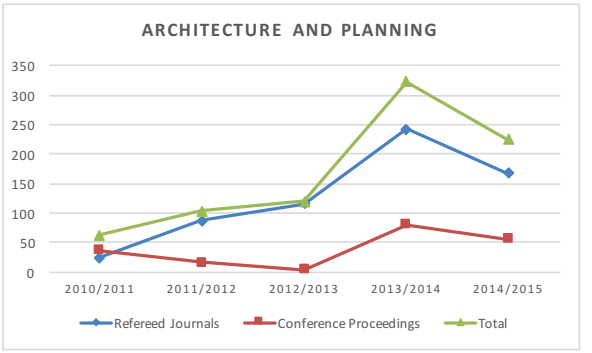

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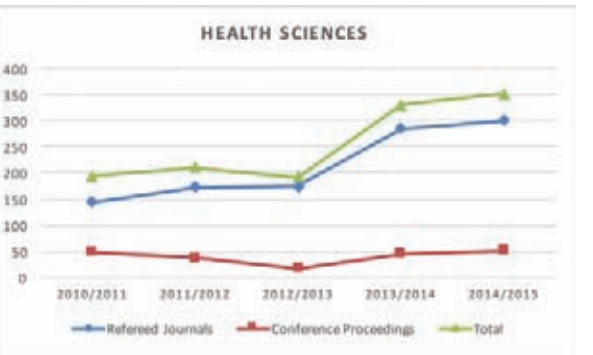

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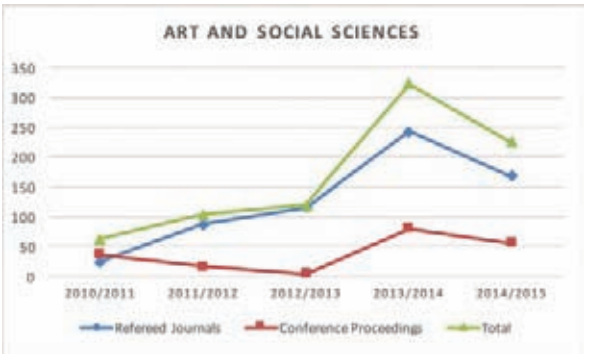

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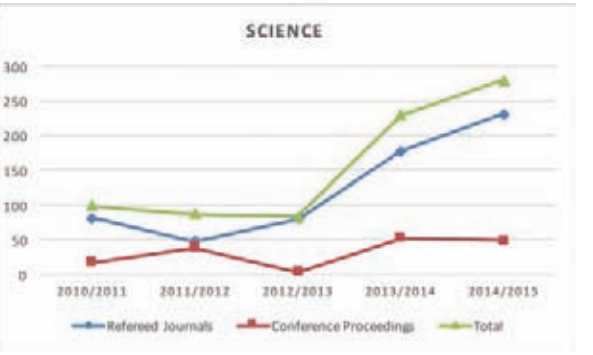

Source: Quality Assurance and Publication Unit

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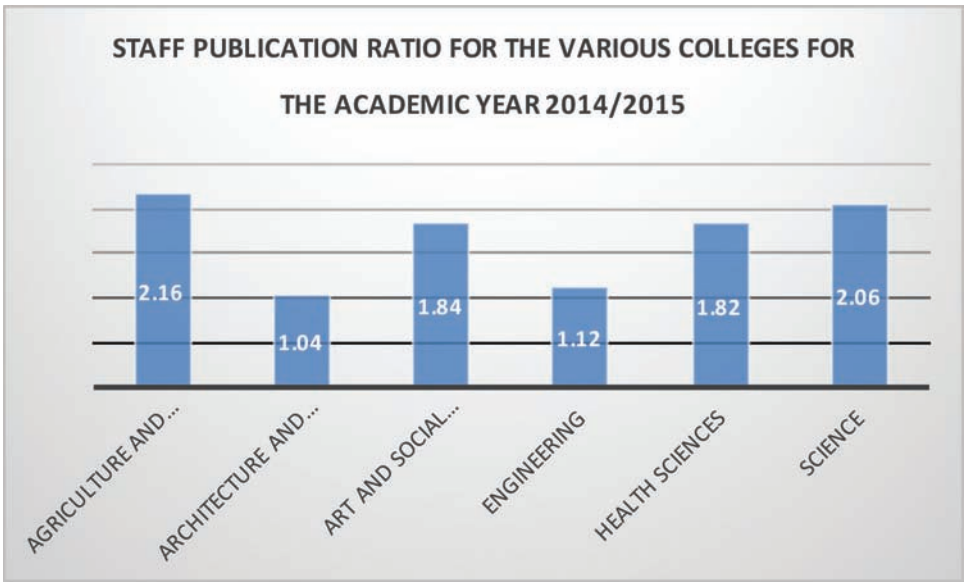

Source: Quality Assurance and Publication Unit

Five Year Trend Analysis of Research Output (2010/2011 To 2014/2015)

	2010/2011			2011/2012			2012/2013			2013/2014			2014/2015		
	R	C	T	R	C	T	R	C	T	R	C	T	R	C	T
Agriculture and Natural Resources	41	25	**66**	110	23	**133**	112	62	**174**	144	53	**197**	125	29	**154**
Architecture and Planning	28	40	**68**	60	39	**99**	33	35	**68**	89	48	**137**	72	44	**116**
Art and Social Sciences	25	37	**62**	87	16	**103**	116	4	**120**	242	81	**323**	168	56	**224**
Engineering	42	36	**78**	55	24	**79**	48	9	**57**	98	19	**117**	118	21	**139**
Health Sciences	144	49	**193**	173	37	**210**	174	17	**191**	285	45	**330**	300	52	**352**
Science	82	17	**99**	48	39	**87**	80	4	**84**	177	53	**230**	231	49	**280**
Total	**362**	**204**	566	**538**	**184**	**722**	**566**	**134**	**700**	**995**	**146**	**1334**	**1014**	**251**	**1265**

Source: Quality Assurance and Publication Unit

R: Refereed Journals, Books Published and Book chapters

C: Published and Unpublished Conference Papers

T: Total

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Production
University Printing Press
KNUST–Kumasi (03220 60150)