



KWAME NKUMAH UNIVERSITY
OF SCIENCE AND TECHNOLOGY,
KUMASI

Research Report

2019-2021

OGR

OFFICE OF GRANTS
AND RESEARCH



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Foreword



Prof. (Mrs) Rita Akosua Dickson
Vice-Chancellor

Over the past seven decades, the Kwame Nkrumah University of Science and Technology (KNUST), has played considerable role in finding solutions to many of the complex challenges confronting the Ghanaian society and beyond through cutting-edge, evidence-based research. The University continues to advance the frontiers of knowledge by breaking new grounds in science and technology research, thereby contributing to the socioeconomic development and livelihoods of Ghanaians and the global economy.

This KNUST Research Report (2019 – 2021) is significant as it coincides with the 70th Anniversary of our existence. As we celebrate this milestone, we renew our focus in making our research visible and impactful on the global research map. The report provides the opportunity for our funders, collaborators, and benefactors to appreciate the innovations arising from their investments in our University.

At the core of our Vision 2020 – 2024 Action Plan and our long term corporate Strategic Plan is to be a world-class research-intensive university. This calls for pragmatic and innovative all-inclusive approach that will propel KNUST to greater heights. We therefore strive to create a conducive environment for research by providing the required human capital, facilities, and systems for undertaking impactful and relevant research. This, we have done by equipping and re-tooling our laboratories as well as providing capacity building opportunities for our researchers and research support staff.

To give you a flavour of the achievements of the University, in 2019, the University established three Research Centres of Excellence. Two with the support



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of the World Bank and the Association of African Universities (AAU) to research into transportation and engineering issues. The third is a Centre of Excellence in Applied Research and Innovation in Supply Chain – Africa (CARISCA), with support from USAID. Additionally, postgraduate enrollment increased from 6,711 students for the 2018/2019 academic year to 8952 students for the 2020/2021 academic year, while we expanded our research support systems and services across all our Colleges.

The various innovative and impactful research highlighted in this Report show that KNUST has advanced the attainment of the Sustainable Development Goals (SDGs). Our research cuts across all the 17 SDGs. Significantly, our scholarly output has increased from 582 in 2017 to 1301 in 2021. The increased scholarly output reflects the appreciable improvement in grantsmanship and grants portfolio for the years under review. The cumulative effect of this culminated in the University being adjudged the best destination for Quality Education in Africa in 2022, by the Times Higher Education World University Impact Ranking, on the Sustainable Development Goals (SDGs).

While the COVID-19 Pandemic affected all dimensions of our society, bringing research activities to a halt, our research outputs during this period demonstrates the exceptional resourcefulness and diligence of our researchers. Indeed, our researchers were instrumental in finding solutions to the COVID-19 pandemic in Ghana and beyond through spearheading testing across 13 out of Ghana's 16 regions. Additionally, our researchers provided timely research outputs, were involved in services including manufacture of sanitizers, and

provision of technical assistance to the government taskforce responsible for addressing the pandemic.

I believe that academia, government, and industry need to work together in finding solutions to socioeconomic challenges through research and development. We should complement each other's effort at driving societal innovations. Effective research collaborations are crucial for the advancement of knowledge in a world characterized by constant changes. In this respect, our researchers continue to engage in research collaborations with their counterparts across the globe to demonstrate their relentless efforts in finding solutions to societal challenges.

On behalf of the University Council and Management, I would like to express my profound gratitude to our researchers for such an impressive array of research innovations that firmly places KNUST as a citadel of knowledge. Finally, I commend all our external donors, business and industrial partners, and benefactors for believing in us and giving us the opportunity to finding solutions to present and future challenges, through the many bilateral and multinational grants that were provided to pursue our research agenda. The Office of Grants and Research, which initiated this Report and the KNUST Research Committee deserve special appreciation for a tremendous work done.

Prof. R.A. Dickson

Message from the Director Office of Grants and Research



Prof. Philip Antwi-Agyei

The Kwame Nkrumah University of Science and Technology (KNUST) seeks to advance knowledge in science and technology through creating an environment for undertaking relevant research pertinent to the attainment of the United Nations Sustainable Development Goals.

Since its establishment in 2013, the Office of Grants and Research (OGR) under the Vice-Chancellor's Office, has played a central role in facilitating the implementation and growth of the University's research agenda. The OGR supports the growth of the research enterprise of the University through the provision of grants and research support services to researchers.

In the 21st century, humanity is confronted with a range of complex and interconnected developmental challenges including climate change, food security, infectious diseases, globalization, environmental pollution and degradation of resources. Addressing these challenges requires concerted trans and multi-disciplinary research that provides a holistic approach in tackling these challenges, and this is where KNUST has distinguished itself by professing pragmatic evidence-based solutions to many of these developmental challenges.

At KNUST, we dwell more on how our research impacts life and all indicators of research excellence including the number of publications, number of community outreaches, number of international and national collaborations have increased remarkably since 2015.

We share, through the pages of this report, some of the innovative and impactful research conducted by staff of KNUST for the period from 2019 to 2021. The years 2020 and 2021 presented considerable challenges to research activities because of the COVID-19 pandemic and associated restrictions. Yet, KNUST researchers played a critical role in the global response to the pandemic by producing timely research outputs and innovative technologies. This is commendable and should be applauded!



It is instructive to note that KNUST continues to be a Centre of Excellence in research and this reflects the continuous confidence by Donors in our researchers. This confidence has resulted in significant inflow of grants to support research activities of the University.

The KNUST Research Report demonstrates the diverse disciplines across the research landscape of the University including medicine, engineering, pharmacy, agriculture, built environment, social sciences, natural science, to mention but a few. It is important to note that this report does not contain, and indeed, does not seek to cover all the hundreds of research activities undertaken during the period under review. The report only seeks to bring to the fore the contributions of KNUST researchers in finding solutions to societal challenges for sustainable development.

It is instructive to note that KNUST continues to be a Centre of Excellence in research and this reflects the continuous confidence by Donors in our researchers. This confidence has resulted in significant inflow of grants to support research activities of the University. Between 2019 and 2021, the University attracted over \$143 million in grants for research activities. Congratulations to our industrious researchers who brought this honour to the University.

Recognizing the role of funding in driving research, the University through the KNUST Research Fund (KReF) committed over Two Million Ghana cedis in supporting 81 researchers on various topics during the period 2019 to 2021. I am pleased to report that the Office of Grants and Research successfully administered the 4th, 5th and 6th Cycles of the KReF during the period under review.

The Office of Grants and Research has in the period under review, strengthened the policy framework governing research, enhanced grants management systems and processes, set up research and grants data management systems, and established an Intellectual Property Unit.

In the coming 2022/2023 academic year, the Office of Grants and Research has planned a number of important activities to further strengthen research activities across the Colleges. Notable amongst these will be workshops on proposal development for early career researchers, workshop on budgeting

and grant financial management, development of University-wide database for all researchers to enhance collaborative research, rebranding and resourcing of our College Research Centres, to mention but a few.

This fourth edition of the KNUST Research Report has been put together with the help of a number of staff and Units across the University. I would like to register my appreciation for the unflinching support by Management of the University particularly the Vice-Chancellor for the Office of Grants and Research in championing the research intensiveness agenda of the University.

I commend the KNUST Research Report Committee for their relentless efforts and demonstration of a high sense of professionalism and integrity through the process of getting this report published.

I applaud the commitments, tenacity and selfless dedication of the staff at the Office of Grants and Research under the Office of the Vice-Chancellor for providing exceptional research support services in pushing the research agenda of the University.

I also need to stress the significant role played by the University Relations Office, the Quality Assurance and Planning Office, the University Press, Provosts, Directors, Deans, and Heads of Department for this important exercise.

I am profoundly grateful to all our industrial and academic partners for the sustained contribution towards research at KNUST.

It is our expectation and hope that this Report will inspire private and non-governmental organizations, and civil societies in committing funds for research to address the challenges confronting us as a nation.

Please, enjoy the reading of this research report.

Prof. P. Antwi-Agyei

KNUST

Vision

To build on KNUST's leadership as the premier science and technology university in Ghana and to be among the top ten Universities in Africa.



Mission Statement

KNUST exists to advance knowledge in science and technology through creating an environment for undertaking relevant research, quality teaching, entrepreneurship training and community engagement to improve the quality of life.

Our Strategic Mandate

The Act establishing the University defines its mandate, which essentially is to provide higher education, undertake research, disseminate knowledge and foster relationships with the outside persons and bodies. The strategic mandate of the University is derived from Science and Technology in its name.

Core Values

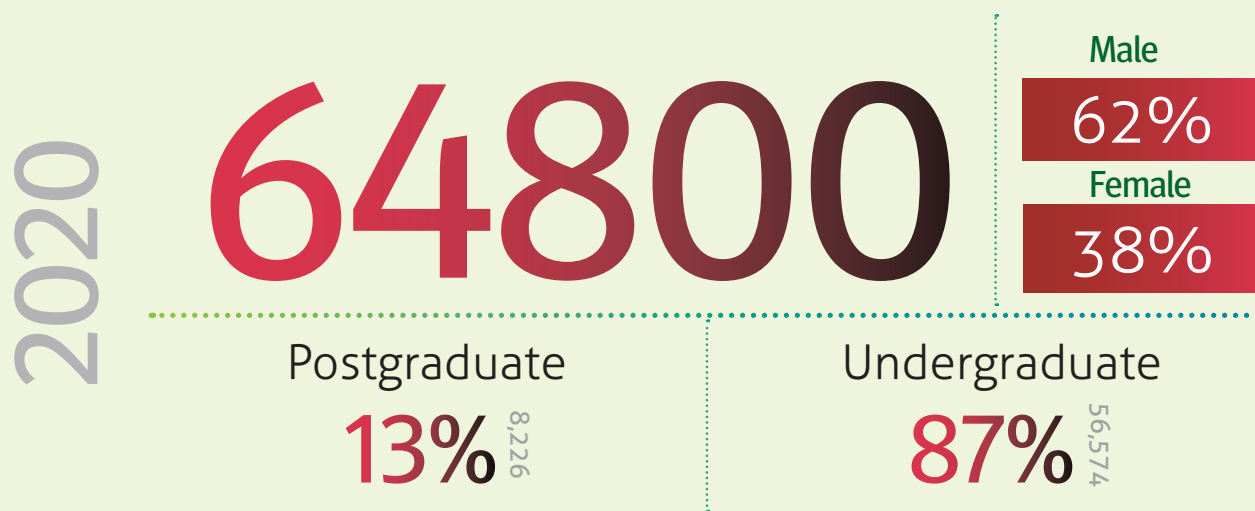
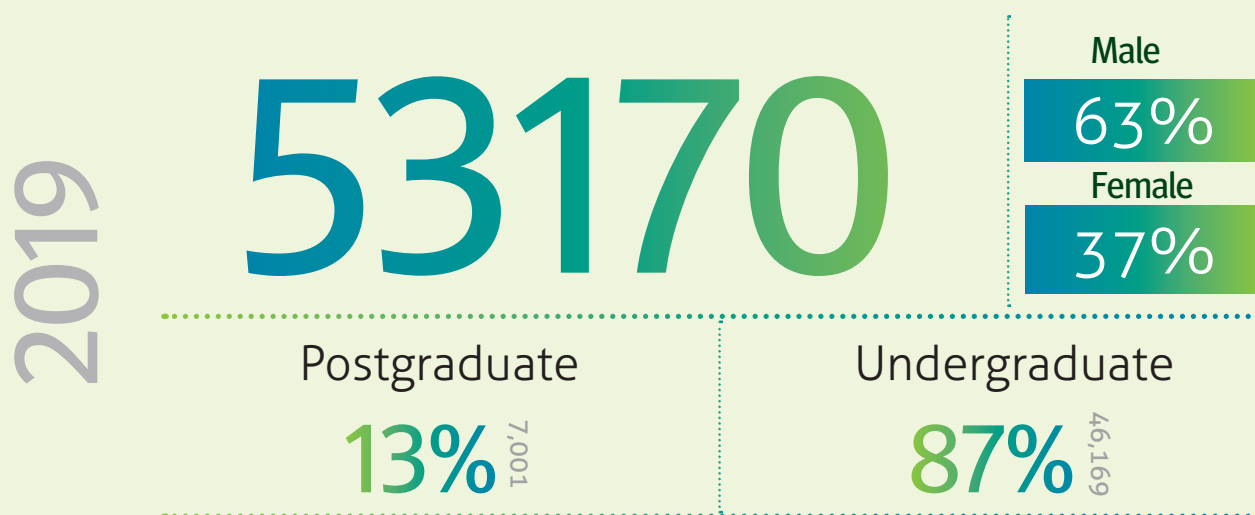
KNUST is committed to attracting and developing excellent staff and students in order to contribute towards the achievement of the goals, targets and directions that the government has set for higher education. The following cherished values characterise the work and life of the University and are ingrained in all those who pass through the University.

In fulfilling the Vision and Mission of the University, the following Core Values would be adhered to:

- **Leadership in Innovation and Technology**
- **Culture of Excellence**
- **Diversity and Equal Opportunity for All**
- **Integrity and Stewardship of Resources**

Basic Statistics

Students Population, Gender & Programme Distribution



2021

77883

Male

62%

Female

38%

Postgraduate

12%
9,008

Undergraduate

88%
68,875

Staff Distribution

Category	Junior Staff			Senior Staff			Senior Member (Academic)			Senior Member (Administrative)		
Gender	M	F	T	M	F	T	M	F	T	M	F	T
2019	743	179	922	734	461	1195	824	151	975	110	52	162
2020	638	160	798	748	443	1191	734	141	875	110	53	163
2021	607	158	765	849	503	1352	928	192	1120	141	66	207

RESEARCH PERFORMANCE

BEST
University
in Africa
for Quality
Education



BEST
University
in Ghana

12TH BEST
University in Africa

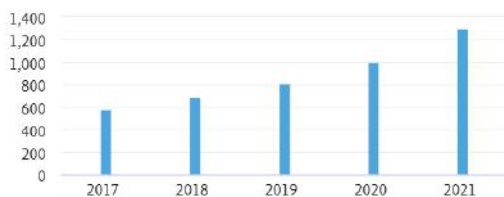
U.S. NEWS AND WORLD REPORT;
2021 BEST GLOBAL UNIVERSITIES RANKING

Research Output 2017-2021

(Data Sources: Scopus)

KNUST research output growth has been significant at 12% Compound Growth Rate over the 5-year period

Scholarly Output



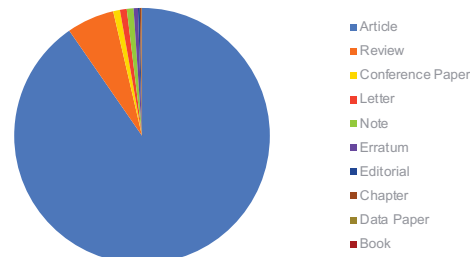
4,386

number of publications by authors at the Kwame Nkrumah University of Science and Technology

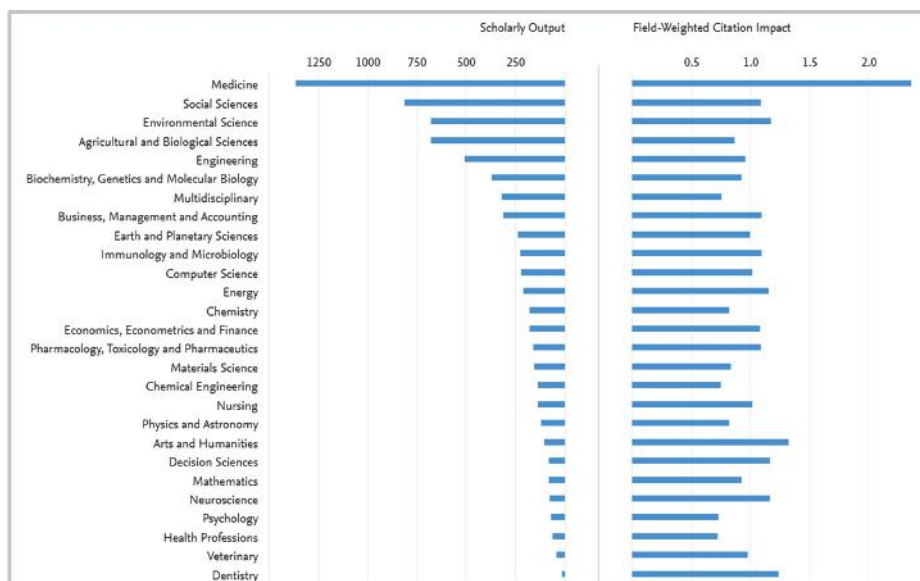
▲ +123.5%

Up 123.5% over the period 2017–2021, from 582 in 2017 to 1,301 in 2021

Publication types

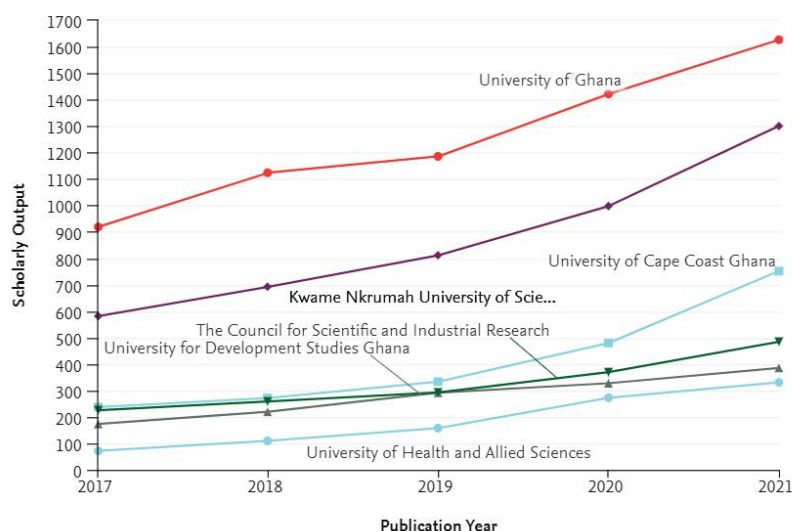


Subject Distribution (Volume vs Impact)



Medicine is the most dynamic and most impactful research area with almost 3x the world average in citations

Research Output Relative to Peers



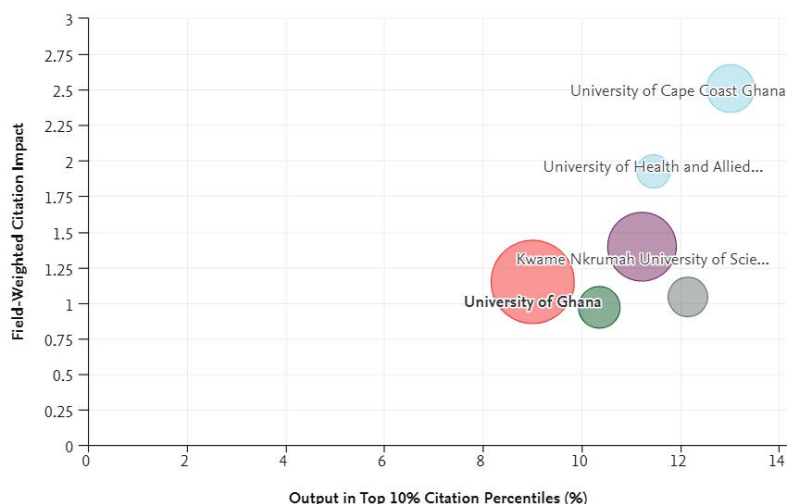
- University of Ghana
- Kwame Nkrumah University of Science and Technology
- University of Cape Coast Ghana
- The Council for Scientific and Industrial Research
- University for Development Studies Ghana
- University of Health and Allied Sciences

Hide all chart labels

View list of Scopus Sources for the selected Researchers and Groups

KNUST output growth has been consistent from 2017 - 2021

Peer Benchmarking on Impact



- University of Cape Coast Ghana
- University of Health and Allied Sciences
- Kwame Nkrumah University of Science and Technology
- University of Ghana
- University for Development Studies Ghana
- The Council for Scientific and Industrial Research

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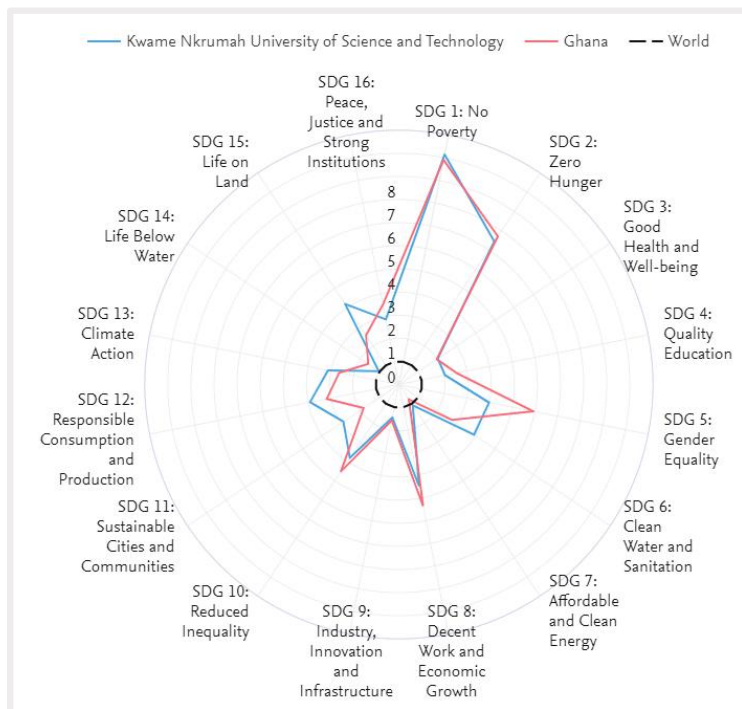
View list of Scopus Sources for the selected Researchers and Groups



Scholarly Output

Field Weighted Citation Impact (FWCI) indicates how the number of citations received by an article compares to the average or expected number of citations received by other similar publications. Similar publications are determined by year, type, and discipline

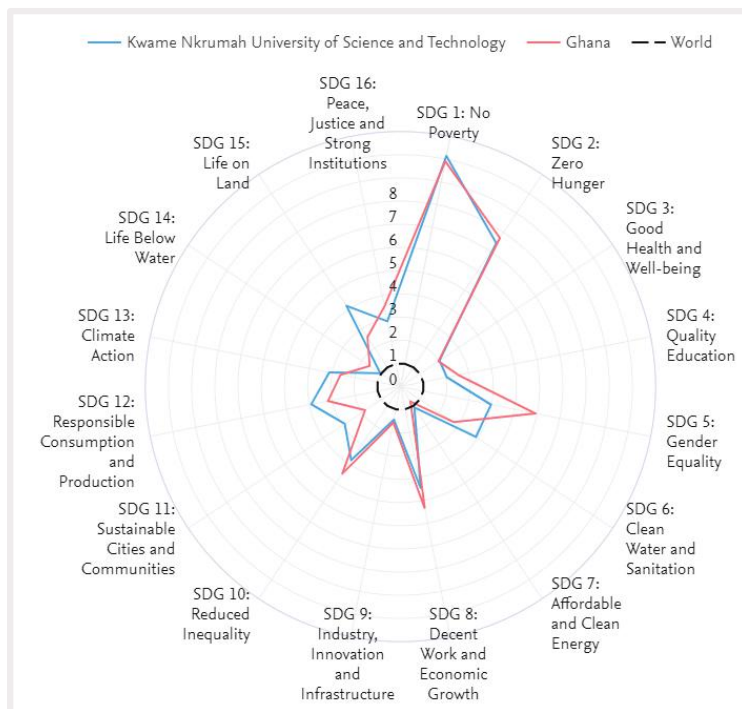
Research Outputs towards Sustainable Development Goals (SDGs)



Relative to Ghana and the World, KNUST contributes more towards SDGs 11, 12, 13, and 15

Relative to World & Country

Mapping towards SDGs is based on keyword-based searches in Scopus.

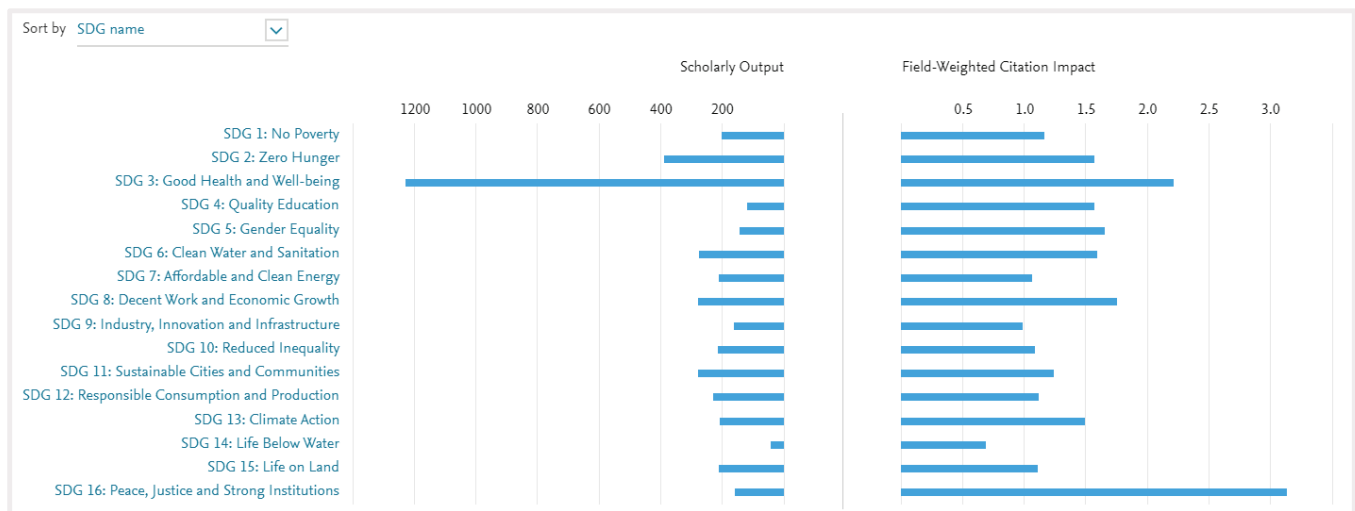


Relative to World

RAI is calculated by looking at the total publications an entity has for an SDG, divided by the total publications for the same entity, to create a percentage.

Research Contribution towards the SDGs

Significant research contribution towards SDG 3 and higher citation impact towards SDG 16



Research Output Relative to Peers

Top collaborating institutions are dominated by country peers followed by Nigeria, UK and South Africa



Institutions collaborating with the Kwame Nkrumah University of Science and Technology

Worldwide All countries/regions All sectors All authors

2,759 collaborating institutions 3,165 co-authored publications

Institution	Co-authored publications	Co-authors at the Kwame Nkrumah University of Science and Technology	Co-authors at the other institution	Field-Weighted Citation Impact	Field-Weighted Views Impact
University of Ghana	415	430	482	1.48	2.53
The Council for Scientific and Industrial Research	269	323	269	0.97	1.14
University of Cape Coast Ghana	237	257	244	3.41	8.20
University of Health and Allied Sciences	207	245	164	4.24	8.75
Kumasi Centre for Collaborative Research in Tropical Medicine	154	197	108	1.03	0.93
University of Ibadan	154	118	174	11.90	20.04
London School of Hygiene and Tropical Medicine	125	78	144	13.93	24.03
University for Development Studies Ghana	125	181	120	0.88	0.96
University of Cape Town	106	63	126	18.06	29.90
University of Oxford	101	79	167	17.39	29.73

A photograph of a group of people at an outdoor event. In the foreground, a woman on the left wears a vibrant, multi-colored patterned headwrap and glasses. Next to her is a woman in a blue dress with a ruffled collar. To the right, a man in a patterned shirt and a woman in a red and yellow patterned top are looking down at a table. The table is covered with various traditional dishes, including what appears to be injera (flatbread) and other food items. The background shows a white lattice fence and greenery.

Research Overview Colleges

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES



The College of Agriculture and Natural Resources (CANR) remains one of the most active, innovative and research-intensive colleges of KNUST. The College's research focuses on food production; rural livelihoods and development; climate change vulnerability, impacts, adaptation and mitigation; entrepreneurship, and natural resources governance and management. Researchers from CANR contribute significantly to national and global development through extensive publications of their outputs and engagement with policy makers, practitioners and communities at both national and international levels. The College's research is undertaken by two Academic Faculties (Faculty of Agriculture and Faculty of Renewable Natural Resources) and three Research Centres (Bureau of Integrated Rural Development (BIRD), Dairy/Beef Cattle Research Station, and Agricultural Research Station, Anwomaso). Between 2019 and 2021, the College attracted over 20 major research grants which are actively being undertaken by faculty and students in collaboration with national and international partners. These include collaborations with USAID, DANIDA, Royal Society, UK-DFID, United Nations World Food programme, Alliance for Green Revolution in Africa (AGRA), World Vegetable Centre, Education for Sustainable Development in Africa (ESDA) and International Union for the Conservation of Nature (IUCN). The College provides research support to many governmental interventions in food production, rural development and natural resources management. Large acres of maize and other food crops have been cultivated under the "Planting for Food and Jobs" programmes. There are also large tree plantations and fish farms that are used for both research and entrepreneurial training. Research from the College contributes directly to Sustainable Development Goals (SDGs) 1 (No Poverty), 2 (Zero Hunger), 3 (Good Health and Well-being), 6 (Clean Water and Sanitation), 13 (Climate Action), 14 (Life Below Water), and 15 (Life on Land).

COLLEGE OF ART AND BUILT ENVIRONMENT



The College of Art and Built Environment (CABE) is Ghana's foremost institution in the training of professionals of the built environment, design and art industry in Ghana. It is made up of three faculties (Art, Built Environment and Educational Studies) and offers an array of teaching, research and outreach programmes in the key disciplines of Architecture, Building Technology, Planning, Land Economy, Communication Design, Painting and Sculpture, Rural and Industrial Art and Publishing studies. The College exists to advance knowledge promotion towards addressing global interventions as outlined in the SDGs and AU agenda 2063. Through its research department the Centre for Settlement Studies (CSS), the College is engaged in developing innovative and appropriate technology for addressing rural and urban housing solutions. For instance, the Centre developed the KNUST fire escape burglar proof window which protects against burglary and also provides safe exit during emergencies such as fire outbreaks. The fire escape burglar proof window has been endorsed by the Ghana National Fire Service who are in talks with the College to publicize it for use in the housing sector. The Department of Painting and Sculptor also recently outdoored a locally fabricated pulp and paper making machine, whilst the Department of Industrial Art is also developing high-quality local crucibles from local materials that has potential for use in the mining sector for gold refinery. The College has many international collaborations and currently hosts the Network of Excellence in Land Governance in Africa (NELGA) project in Ghana. As part of its project's activities, sixty thousand (60,000) Euros has been awarded as research support from the GIZ for the West Africa Flood Land Research Project led by the Centre for Settlements Studies.



COLLEGE OF ENGINEERING

Since its establishment in October 1952, the KNUST College of Engineering (COE) has maintained its reputation for quality education in preparing intellectuals to promote the engineering and technological advancement of Ghana and Africa. The College has been training skilled individuals to meet Ghana's engineering needs; with a number of renowned academics and professionals both in and outside Ghana to its credit.

To achieve its strategic vision of becoming an internationally renowned centre of excellence in Engineering education

and Technology advancement, our staff are committed to providing a safe and secure learning environment to enable our students to grow intellectually, emotionally and socially, while at the same time offering a wide array of exciting and challenging academic programmes.

The College consists of three faculties – namely Civil & Geo-Engineering, Electrical & Computer Engineering and Mechanical & Chemical Engineering. CoE has 11 departments and runs 18 programmes in varied fields of engineering. The College also offers a number of specialized postgraduate programmes in Renewable Energy, Transportation, Water Resources Engineering and Management, Water Supply and Environmental Sanitation, Electrical Power Systems, Agro-Environmental Engineering, Bioengineering, and Food and Post-Harvest Engineering.

In addition to the research conducted at the various departments, the College also hosts three Research Centres; The West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL), The Brew-Hammond Energy Center (TBHEC) and the Technology Consultancy Center (TCC). It also hosts two World Bank sponsored Africa Centres of Excellence – the Regional Transport Research and Education Centre, Kumasi (TRECK) and the Regional Water, Environment, Sanitation Center Kumasi (RWESCK) as well as the KNUST Engineering Education Programme (KEEP).

COLLEGE OF HEALTH SCIENCES



With the goal to make the College of Health Sciences a primary hub for health-related research, areas of research focus on nearly every aspect of patient care, including disease prevention, management, rehabilitation, and health monitoring. Faculty members across the forty-two academic departments collaborate on research programmes that address infectious diseases, neglected tropical diseases, cardiovascular health, neurological diseases and mental health, child health, drug development and safety, traditional medical practice, healthcare diagnostics, physiotherapy and many more. Research collaboration is not limited to only within the College but spans across the entire University, external partners as well as industry. Due to the diversity of research disciplines within the College, several laboratories exist which provide resources to faculty, research fellows and students to embark on impactful research projects. Facilities available support among others, cell culture studies, pre-clinical animal investigations (including fish, rodent and rabbit models), and clinical trials. Research is funded through several sources, with faculty members collectively securing millions of dollars annually to support donor-funded research work. Additionally, the College provides funding through the College Research Fund. The Biennial College Conference and Exhibition provides the opportunity for dissemination of research findings and public engagement. Importantly, our faculty serve as a link between African health systems and global academic communities. In light of the Coronavirus disease (COVID-19) pandemic, the College of Health Sciences has made considerable contributions in the generation and translation of valuable knowledge, by contributing to the enhancement of prevention, testing and management strategies for COVID-19. This was an important step in furtherance of the strategic objective of enhancing entrepreneurship.

COLLEGE OF HUMANITIES AND SOCIAL SCIENCES

The College of Humanities and Social Sciences is the largest among the six Colleges of the Kwame Nkrumah University of Science and Technology (KNUST). The College is made up of two Faculties (Faculty of Social Sciences and Faculty of Law), one School (KNUST School of Business) and two Research Centres (Centre for Cultural and African Studies and West African Institute for Supply Chain Leadership). Being the largest College of KNUST, it boasts of about 196 full time academic staff and a student population of approximately 21,000.

The College of Humanities and Social Sciences has 17 undergraduate and 77 postgraduate programmes hosted in 14 Departments. The diverse nature of programmes offered enable the College attract significant number of international students. In line with the University's mission of providing an environment for teaching, research and entrepreneurship training in Science and Technology through creating a conducive environment for undertaking quality teaching and conducting policy

relevant research for the industrial and socioeconomic development of Ghana, Africa, and the world, the College has over the years created an enabling environment for teaching, research, entrepreneurship and community engagement, as per its mission to promote collaborative research, innovative teaching and learning, and entrepreneurial attitudes in our community engagement for sustainable development of Ghana and the world at large. With the vision to become an indispensable partner in the University's quest to advance relevant knowledge for sustainable development of Ghana and the world, the College has produced several graduates in the Humanities and Social Sciences who have been employed in many sectors of the Ghanaian economy and the international community.



COLLEGE OF SCIENCE

The College of Science is one of six Colleges of the Kwame Nkrumah University of Science and Technology (KNUST). The College is made up of two main Faculties and a Research Centre. It has approximately 200 academic staff and a student population of 10,366. The College appreciates the need for diversity in education and research, increasing the intake of international students and collaborators/partners. The College has a huge collection of alumni, many of whom are engaged in various sectors of the national economy and around the globe. It has, over the years, built a high reputation as a centre of excellence for training basic and applied scientists and has produced many graduates for various sectors of the national economy and internationally.

College of Science has 12 undergraduate and 42 postgraduate programmes in 11 Departments, poised to enable our students discover and fulfil their potential in various fields of basic and applied sciences and prepare them for careers in an ever-changing global village. Therefore, the mission of the College is to provide high-

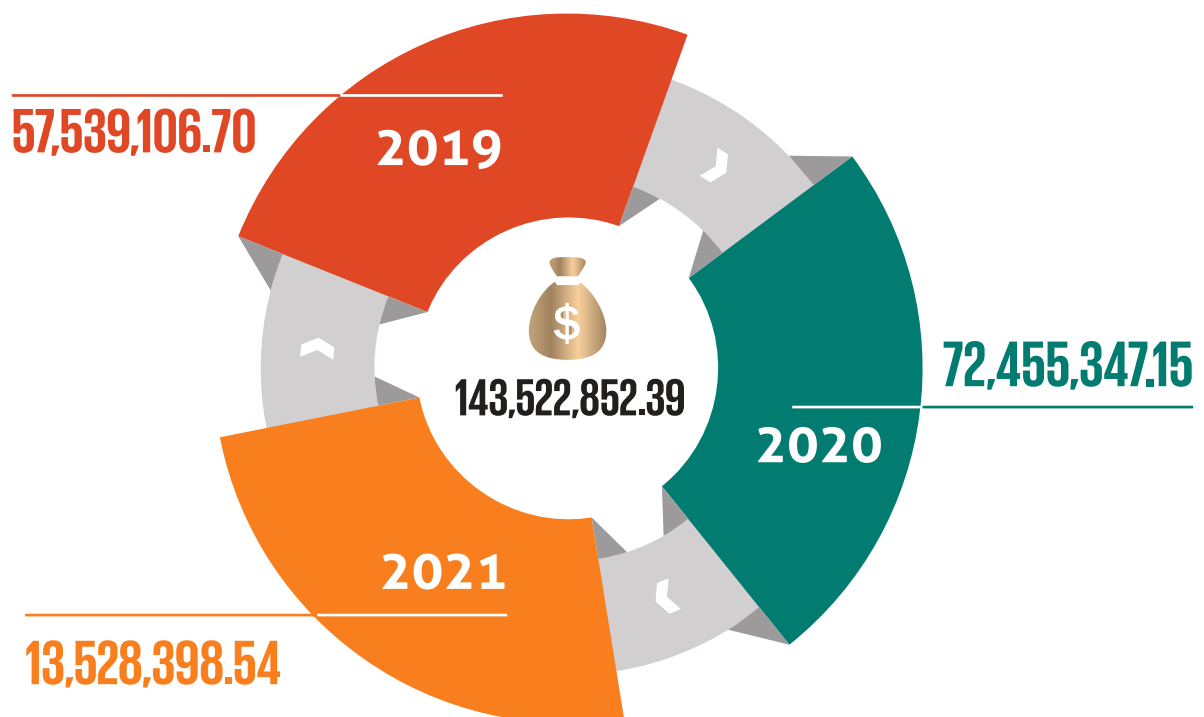
quality teaching, research, entrepreneurship training and service in the pure and applied sciences for sustainable industrial and socio-economic development of Ghana and Africa and beyond. The Vision is to produce high calibre graduates to support and sustain the industrial and socio-economic development of Ghana and Africa. The ultimate goal is to become a centre of excellence in the training of high calibre science graduates critical to Ghana and Africa's industrial and economic development.



Research Grant Awards

2019-2021

Total Amount of Grants Received (USD)



Institutional Grants

As a university, KNUST supports various research activities through its own internally Generated Funds (IGF) through the KNUST Research Fund (KReF), College Research Fund and Conference Travel Support.

KNUST Research Funds (KReF)

The University established the KNUST Research Fund (KReF) to provide an internal source of funding for the staff of KNUST to conduct innovative research projects that address specific developmental challenges in Ghana and beyond. The Fund has two key objectives;

- To promote innovative and impactful research by KNUST staff through inter/multi/transdisciplinary research collaborations.
- To provide a platform for building staff capacity in sourcing and managing external research grants

KReF plays a crucial role in championing the University's quest to be research intensive. Since its establishment in 2015, KReF has supported researchers across the six Colleges of the University with over Gh¢ 2.7 million.

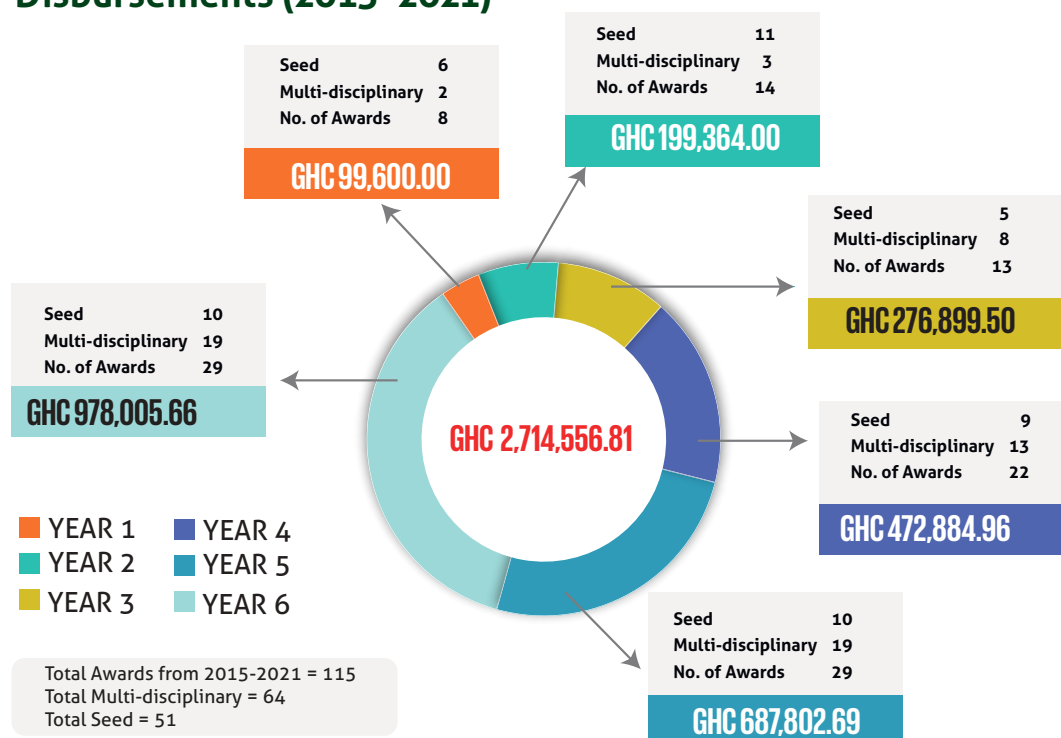
College Research Fund

The College of Agriculture and Natural Resources, College of Art and Built Environment and College of Health Sciences have special research funds for its staff to undertake cutting edge research.

Research and Conference Support

Each College is allocated funds by the University to facilitate attendance at conferences by staff.

KReF Disbursements (2015 -2021)





Funding Agencies and Collaborators of the University

MAJOR FUNDERS



THE WORLD BANK



Danida Fellowship Centre
Sustaining development through research and learning



**mastercard
foundation**



European Union



**National Institutes
of Health**



GOVERNMENT OF GHANA

**BILL & MELINDA
GATES foundation**



**The African
Academy of Sciences**



GCRF
Global Challenges
Research Fund

wellcometrust



IDRC · CRDI

International Development Research Centre
Centre de recherches pour le développement international

Canada



**UK Research
and Innovation**



**World Health
Organization**



OTHER FUNDERS

- | | |
|---|--|
| • ACADEMY OF FINLAND | • INNOWWIDE CONSORTIUM |
| • ADELAIDE AND OLIVER FOUNDATION - SA | • INTERNATIONAL COCOA INITIATIVE |
| • AFRICA INSTITUTE FOR MATHEMATICAL SCIENCES | • INTERNATIONAL FERTILIZER DEVELOPMENT CENTER |
| • AGSENZE COMPANY LTD - UK | • INTERNATIONAL FOUNDATION FOR SCIENCE |
| • ASSOCIATION OF AFRICAN UNIVERSITIES | • INTERNATIONAL SOCIETY OF NEUROCHEMISTRY |
| • ATLAS - WASCAL | • INTERNATIONAL VACCINE INSTITUTE |
| • BMBF - GERMANY | • JOHNS HOPKINS ALLIANCE FOR
A HEALTHIER WORLD |
| • CDC FOUNDATION | • NATIONAL ACADEMY OF SCIENCE,
ENGINEERING & MEDICINE, US |
| • COMMONWEALTH PARTNERSHIP FOR
ANTIMICROBIAL STEWARDSHIP - UK | • NATIONAL INSURANCE COMMISSION, GHANA |
| • COMMUNITY WATER AND SANITATION AGENCY | • NESTLÉ FOUNDATION |
| • COMPOST AND RECYCLING PLANT LTD | • NETWORK OF AFRICAN SCIENCE ACADEMICS |
| • COUNCIL FOR SCIENTIFIC AND
INDUSTRIAL RESEARCH | • ORGANISATION FOR WOMEN IN SCIENCE
IN THE DEVELOPING WORLD |
| • DFID | • ROYAL ACADEMY OF ENGINEERING |
| • ENI GHANA EXPLORATION | • ROYAL SOCIETY OF CHEMISTRY |
| • EUROPEAN AND DEVELOPING COUNTRIES
CLINICAL TRIALS PARTNERSHIPS (EDCTP) | • RURAL ENTERPRISES PROGRAMME, GHANA |
| • FRENCH DEVELOPMENT AGENCY | • SCLAVO VACCINES ASSOCIATION |
| • GERMAN ACADEMIC EXCHANGE
SERVICE (DAAD) - GERMANY | • SKILLS DEVELOPMENT FUND |
| • GERMAN FEDERAL MINISTRY FOR ECONOMIC
CORPORATION AND DEVELOPMENT | • THE NETWORK OF EXCELLENCE ON
LAND GOVERNANCE IN AFRICA |
| • GHACEM COMPANY LTD. | • UNICEF |
| • GHANA WILDLIFE SOCIETY | • UNIDO |
| • GUINNESS GHANA BREWERIES | • USAID |



Innovative & Impactful Research

Featured Research Projects

01

KNUST develops Ventilator to Support COVID-19 Care and Management

02

myTroski Mobile App: An integrated local digital map providing route guidance in Twi and English

03

Diagnostics for COVID-19: Field-deployable, rapid molecular tests for community surveillance

04

Transmission of SARS-CoV-2 in Northern Ghana: Insights from whole-genome sequencing

05

K-Switch: The automated switching device

06

KNUST participates in the clinical trial of the RTS,S/ASo1 E candidate malaria vaccine

07

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Seroprevalence of COVID-19 across different regions in Ghana and three other African countries

01

KNUST develops ventilator to support COVID-19 care and management

A team of researchers from the Department of Computer Engineering of KNUST and Michigan Technological University (Michigan Tech) has developed a Ventilator dubbed the 'KNUST Ventilator'. The team jointly started the project to design and implement inexpensive but effective ventilators for patients with breathing deficiencies and disorders. This cooperative effort was led by Professor Kwame Osei Boateng and Dr. Yacub Ahmed, together with six students of the Department, Akwasi Darkwah Akwaboah, Josephine Owusu- Akyaw, Ayesha Tiwaa Ahmad, Isaac Kumi-Koduah, Stephen Kwabena Asante and Afua Boakyewaa Appiah. The 'KNUST Ventilator' is an enhancement from an earlier prototype, the 'IBV Ventilator'. The improved prototype significantly reduces heat generation when the ventilator is used over long periods. To further enhance the ventilator, the team is considering the use of external signals from the muscles of a conscious patient as a feedback signal to trigger the ventilator into operation.



02



myTroski Mobile App: An integrated local digital map providing route guidance in Twi and English

Three KNUST researchers, Dr. Gift Dumedah, Prof. Charles Marfo, and Dr. Samuel Ato Andam-Akorful, have developed a Mobile App which can give detailed route guidance and location identity for travel planning in Twi and English. It also has a Twi travel dictionary, local business database, cultural and social information, and uses known local place names to provide location information. The innovation is a result of interdisciplinary research collaboration between departments in the Colleges of Humanities and Social Sciences and Engineering under the auspices of the Africa Centre of Excellence – Regional Transport Research and Education Centre, Kumasi (TRECK). The first phase of the study used data from the Oforikrom Municipality of the Ashanti Region. The app, which was launched in February 2022, provides location and travel planning services and can be used to search, find, visualize, and explore information about places of interest in any local area. When travelling, myTroski provides a guide with a digital map, a real-time location indicator (GPS), together with a message in writing or audio (voice) using Twi or English. Upon further development, the app is expected to be scaled to other Municipalities in Kumasi, Accra Metropolitan Areas and beyond. As part of the study, the team developed an English-Twi translation document and its corresponding audio titled 'Map Basics & Digital Map'.

03

Diagnostics for COVID-19: Field-deployable, rapid molecular tests for community surveillance

A team from the Kumasi Collaborative Centre for Research in Tropical Medicine (KCCR) led by Dr. Michael Frimpong validated, evaluated and deployed an innovative diagnostic tool on a mobile laboratory platform to accelerate COVID-19 testing. At the start of the pandemic, Ghana had a centralized testing approach, that took 4-5 days for samples to be shipped and tested at central reference laboratories with results communicated to the district, regional and national stakeholders. This delay in diagnosis increased the risk of ongoing transmission in communities and vulnerable institutions. With the introduction of the field testing, results from suspected COVID-19 cases showed a turn-around time of less than 3 hours from sample taking to reporting of results. This significantly reduced the waiting time from days to hours, enabling expedient response by the health system for contact tracing to reduce transmission and improving case management.

04

Transmission of SARS-CoV-2 in Northern Ghana: Insights from whole-genome sequencing

Following the detection of the first imported case of COVID-19 in the northern sector of Ghana, Dr. Augustina Sylverken and a team from the Kumasi Collaborative Centre for Research in Tropical Medicine (KCCR) molecularly characterized and phylogenetically analyzed genome sequences of SARS-CoV-2 obtained from nine patients in Ghana. Previous studies on COVID-19 have concentrated on testing without whole-genome sequencing. A high-throughput sequencing on the nine samples showed high concentrations of the viral RNA. After the analysis, three complete genome sequences and another nearly complete genome sequence with 95.6% coverage were obtained. The sequences were found to belong to three lineages and two different clades. The majority fell within a clade composed of sequences from sub-Saharan Africa, which indicated that there is a sub-regional circulation of the viruses, and there may be a need to centralize testing sites and build more capacity across Africa to boost the sequencing output. Long-distance transportation of the samples to testing centres affected sequencing results. A sample KATH23, collected 9 km from the testing



site, was found to have minimal RNA fragmentation compared to sample TTH6, which was collected and transported over 400 km to the testing site. This was an important study as it enables the detection of circulating variants and hosting and reporting sequences generated in Ghana on a worldwide genomic data submission repository.

05 K-Switch: The automated switching device



A collaborative study conducted by researchers from various disciplines, including planning, chemistry, physics and engineering, has revealed that rivers Wiwi, Subin, and Suntre have a high concentration of contaminants, including heavy metals, polycyclic aromatic hydrocarbons, pesticide residues, and microbials. The study revealed that weak enforcement of land use planning regulations along these river bodies has resulted in increasing human activities that have compromised the quality of these rivers. Samples collected from these rivers were subjected to chemical and biological tests to establish the relationship between the various categories of human activities and surface water quality. River Subin, the most polluted among the three rivers, recorded benzo[e]pyrene concentrations up to 47,169 µg/kg which was linked to the development of squatter settlements and commercial activities within its 100m buffer zone. Also, the geo-accumulation index and concentration factors showed that the rivers are highly polluted with metals such as cadmium, chromium, mercury, and arsenic related to human activities. The microbial quality of the rivers was found to be poor, recording specific microbial loads of 6.8, 4.1, and 1.5×10^7 counts/100 mL, respectively for Wiwi, Subin, and the Suntre Rivers. Based on these findings, the study concluded that the three water bodies are unsuitable for human consumption, recreational activities or irrigational purposes.

06 KNUST participates in the clinical trial of the RTS,S/AS01 E candidate malaria vaccine

Researchers from KNUST led by Prof. Tsiri Agbenyega and Prof. Daniel Ansong played a key role in the clinical trials which led to the roll out of the RTS,S malaria vaccine. The vaccine is currently undergoing implementation studies in some countries in sub-Saharan Africa, including Ghana targeting children 5-17 months of age. The team is currently evaluating different vaccine schedules through a Phase IIb randomized, open-label, controlled, multicentre study. The study is investigating the efficacy, safety and immunogenicity of GSK Biologicals' candidate malaria vaccine RTS,S/AS01 E with or without fractional doses, early Dose 4 and yearly doses. The Malaria Vaccine Project is a commitment to develop an effective malaria vaccine for the reduction of malaria disease burden in children and contribution to the malaria elimination goal.



College of Engineering invents cocoa pod breaker and separation machine

The ingenuity of the Department of Mechanical Engineering led by Prof. Francis Davis resulted in the invention of a solar-powered cocoa pod breaker and separation machine. This contraption reforms the conventional way of breaking and separating the cocoa beans which leads to significant post-harvest losses. The machine averts fatigue, the risk of injury among workers, damage to the beans, and low productivity which are peculiar to the manual process. This technology significantly increases efficiency as the machine processes 60 pods per minute with a 97% rate of efficiency in separating the beans from the pod. Mass production and usage of the machine will critically enhance the sustainability of the cocoa value chain both locally and globally.



08

The first implantation of the novel biological heart valve in Africa

A novel permanent bioprosthesis, the Inspiris Resilia Aortic Valve, has been developed and implanted by a team led by Dr Isaac Okyere from the Department of Surgery. This is the first implanted special artificial heart valve in Africa. The Inspiris Resilia Aortic Valve is a stented tri-leaflet valve made from bovine pericardial tissue which demonstrates excellent hemodynamic performance and safety outcomes in the first year of implantation. The valve has generated intense interest in other cardiothoracic surgery centers in Africa. In preclinical studies, it has shown reduced calcification, thus improving its durability. The tissue is created by treating bovine pericardial tissue with Edwards

Integrity Preservation. The valve is stored under dry packaging conditions. The novel tissue preservation technology significantly improves hemodynamic and anticalcification properties compared with the standard artificial bioprosthesis aortic valve and the Perimount tissue valve. The valve was implanted in a 57-year-old patient who followed up for a year. He presents well-healed wounds and transthoracic echocardiography revealing a well-seated valve with no regurgitant flow or paravalvular leak. This may well be the first report describing the use of the new Inspiris Resilia Aortic valve that has increased durability without requiring anticoagulation in Africa.

09

KNUST Scientists operationalise real-time weather forecasting in Ghana, one of the first in Africa

NWC GEO RDT-CW

Triggering Triggering from Split Growing Maturity Decaying



Providing an efficient and effective early warning weather system is a nationwide challenge. A Nowcasting Satellite Facility (NWC-SAF), an improved early warning system that enables nowcasting and provides real-time weather updates has been installed at KNUST. This was made possible through the Global Challenges Research Fund – African Science for Weather Information and Forecasting Techniques (GCRF African SWIFT) project. The SWIFT project is a collaboration between KNUST and Ghana Meteorological Agency (GMet) and is led by Prof Leonard Amekudzi, Prof Sylvester Danour and Prof Philip Antwi-Agyei. The project aimed at improving the state of nowcasting in sub-Saharan Africa and addressing the challenges of predicting high-impact weather on timescales of 0 to 24 hours. The benefits of NWC-SAF in the sub-region include advancing the adaptive and responsive capacities of stakeholders to severe weather events. With the operational run of the system on KNUST campus, the university and its surrounding communities benefit from real-time weather updates and forecast. KNUST liaises with GMet to disseminate the forecast products in communities in the Ashanti Region. The fruitful installation and functioning of the NWC-SAF will advance research collaborations and knowledge-sharing to improve on forecast provision to the country. This is geared towards improving general livelihood and increasing citizen trust in issued forecasts and will serve as a solution to the challenges of predicting high-impact weather on short timescales.

Site-Specific fertilizer recommendations for efficient nutrient use and yield prediction

10

A team of researchers from KNUST, Wageningen University, Mohammed VI Polytechnic University and the International Fertilizer Development Centre (through the FERARI project) has explored site-specific fertilizer recommendation for efficient nutrient use and yield prediction and its relevance to the agricultural value chain in Ghana. Prof. Vincent Logah, the country Principal Investigator, explained that conventional methods such as soil-crop simulation models and descriptive empirical models to generate fertilizer recommendation are overpriced and laborious. Thus, such methods are unable to cover large areas, limiting their usefulness for accurate site and crop-specific recommendations. This innovative research sought to develop a novel approach to address these challenges. In this regard, a machine-learning model (Random Forest Model) will be developed and tested for maize to derive fertilizer recommendations to improve maize yields in Ghana to ensure efficient nutrient use. The outcome of this unparalleled study will be highly relevant to actors in the fertilizer value chain for decision making to boost maize production in Ghana and beyond.

11

Improving indigenous craft for the global market: the Asante lost wax casting

Dr. Samuel Baah Kissi Asante of the Department of Industrial Art has examined adaptation strategies for preservation and sustainability of the Krofofrom village traditional brass casting technology in the Ashanti Region. Lost wax casting is a process of creating a duplicate of a metal statue in which a wax sculpture of an image is covered in clay and baked. The study discovered that adding charcoal, Plaster of Paris (POP), sawdust and aluminous clay to the original composition of charcoal, cow dung and clay enhanced its quality and sustainability. The addition of the P.O.P prevented shrinkage and fracture, while the presence of sawdust provided microscopic holes in the core structure to

facilitate easy core disintegration after casting. High content aluminous clay components also improved the refractory properties of the core. Although the original composition results in a very stable core that disintegrates quickly after casting, it suffers defects in the form of pin holes on the inner walls of the cast artefacts, thereby ruining the finish. In many instances, these pinholes are difficult if not impossible, to remove or seal. The new composition yields efficient cores that disintegrate easily after casting and imparts a smoother inner wall surface devoid of pinholes. The discovery is expected to enhance the opportunity for exporting these indigenous crafts to the global market and job creation for the local people.

12

Investigating the antiviral and anticancer effects of Nibima



In sub-Saharan Africa, first-line agents in treating chronic HBV infection such as pegylated IFN- α and tenofovir disoproxil fumarate are inaccessible due to their high cost. A study led by Prof. Mohamed Mutocheluh of the Department of Clinical Microbiology investigated the anti-HBV activity of cryptolepis sanguinolenta, locally called Nibima. The anti-HBV activity of cryptolepine was established in human hepatoma cells (HepG2 cells) transfected HBV. To translate the in vitro findings into clinical care, a 49-year-old male patient with a history of chronic HBV infection was administered with Nibima for six months in a case study. His HBV load, as well as haematological, kidney, and liver function indices, were assessed. Cryptolepine reduced HBV-DNA in a dose-dependent manner in vitro, and the magnitude of the reduction was enhanced by the presence of a low concentration of IFN- α . The levels of HBV core protein, HBsAg, and HBeAg were similarly reduced. After six months of Nibima therapy, the HBV load of the patient reduced from 10.4×10^4 IU/mL to 8.6×10^2 IU/mL (about 99% reduction). More so, there were no reported abnormalities in the haematological, liver, and kidney function indices within the six months of the Nibima therapy. A cheap local herbal medicinal product has been shown to potentially cure chronic hepatitis B virus infection.



Researchers identify new techniques for delineating groundwater potential zones

Researchers in KNUST have employed cokriging and weighted overlay techniques using GIS to delineate groundwater potential zones from hydrogeological parameters in the Assin Municipalities where underground water is the main source of portable water. The study, led by Dr. Dennis Asante, resulted in the generation of maps indicating groundwater potential which were categorized into very low, low, moderate, and high groundwater potential zones. The researchers used numerous hydrogeological parameters from data and deployed the cokriging and weighted overlay techniques in ArcGIS to create parameters using spatial maps. The results revealed that cokriging techniques were exceptional in delineating the groundwater potential zones of the study area with a prediction accuracy of 67% while the weighted overlay approach had an accuracy of 44%. However, the delineated moderate and high groundwater potential zones in the area for both approaches were largely the same and underlined by granitic rocks. The improved techniques for groundwater potential zones delineation will significantly enhance the exploration and development of groundwater resources.

14

KNUST develops a touchless solar-powered Hand Washing Station

Students affiliated with the Innovation Centre of the College of Engineering have manufactured a Solar-Powered Automated Handwashing Station. The Project began in 2020 with support from the Strengthening Engineering Ecosystem in Sub Saharan Africa (SEESA) initiative which is aimed at turning innovative ideas into business ventures. The project team comprised Miss Elizabeth Oduro-Koranteng, an Electrical/Electronic Engineering student, and Mr. Max Otuteye and Mr. Obeng Okofo Dartey, both Computer Engineering students. The team developed the Hand Washing Station, under the supervision of Dr. Selorm Klogo, towards the implementation and strengthening of the World Health Organization's COVID protocols. The College of Engineering's Innovation Centre has about 800 student members who constantly come up with innovative ideas to solve societal problems.



15

The “Portable” Container-kiosk

Metal container-kiosks are temporal structures popularly used in Ghana mainly for commercial and sometimes residential activities, and often transported from one location to another. The materials used to fabricate these containers are unsuitable for transportability. These containers are defaced or partially destroyed during movement, compromising their aesthetic quality and the environmental outlook of our cities and towns. Research led by Dr. Samuel Baah Kissi of the Department of Industrial Art, employed several methods, including descriptive and studio-based research design, to analyse the materials used for fabricating these container-kiosks. The team discovered that these containers rusted at a fast rate due to the use of mild steel instead of galvanized steel to manufacture them. Mild steel appeared less resistant to atmospheric conditions and rusted even faster because they were placed on concrete. To address these problems, the study developed an

alternative design that is easily dismountable for transportation and easy to assemble without damaging its quality and physical outlook. The new design also addresses the problem of rust by creating pedestals that are not made of cement.



16

Mobile electronic health information system as a tool for reducing child mortality in Ghana

A multi-purpose mobile phone-based Health Information System (MHIS) has been developed aimed at enhancing timely access to health care for children through the MobChild programme. The MHIS was designed with an Interactive Voice Response (IVR) technology to empower caregivers to identify health problems of their children for early intervention. The MobChild research project was led by Prof Ellis Owusu-Dabo and involved a team of experts from KNUST, Ghana Health Service and stakeholders from the Asante Akim North district of Ashanti. The study sought to address gaps in health seeking behaviour of

caregivers. Of the 2,045 calls recorded by the system, there was an overall uptake of 66% (580/880). Over 1400 of the calls were unregistered, which means that without prior registration in the system, caregivers are still able to make calls for help. The study highlights the need for policy makers to adopt a mobile phone-based IVR system to complement and strengthen existing health information system for early detection of childhood illnesses. This system has the potential to improve child survival in line with Sustainable Development Goal 3, particularly if integrated into the national health system.



17 Modern and innovative approaches to fighting malaria

To augment international efforts towards malaria elimination, an ideal tool for tracking malaria transmission intensity which reflects both exposure to the vector, parasite infection and human immunity has been developed by Dr Kingsley Badu and his research team. They have identified markers (sporozoite and ookinete peptides/proteins) which human immune response correlates with for seasonal vector and parasite exposure and thus serves as a promising ideal marker for infectious bites. The method employed measures the number of infected bites an individual can receive within a given period of time, providing accurate data of transmission intensity needed for directing control efforts, developing, and testing new interventions. Using longitudinal community cohorts in the Ashanti and Greater Accra Regions, under varying levels of malaria transmission, kinetic studies were conducted to evaluate the dynamics of antibody response to candidate biomarkers. These were compared to other salivary proteins to validate infectious-bite markers. These biomarkers proved to be sensitive tools for the identification of micro geographical hotspots, vulnerable populations and thus inform focused interventions to speed up malaria elimination.



18

KNUST develops a multi-purpose dryer

A multi-purpose dryer has been developed at the Regional Water and Environmental Sanitation Centre (RWESCK) at KNUST. This innovation was led by Mr. Joseph Kwako-Kyei, during his Masters training. The dryer, which can be used for multiple industrial applications, has the ability to produce organic fertilizers by collecting organic waste, drying and milling it into powder to feed animals. It can also be used by cement factories. Such dryers are often imported for industrial use, and this innovation is expected to increase access to such machinery locally. It is expected that the use of this locally produced dryer will reduce the importation of chemical and other fertilizers burden on local industries and promote innovation in Ghana.



19

A novel approach to vocational training for children with special needs

A Participatory Action Research (PAR), led by Dr. John Boulard Forkuor has revealed that, providing tailor-made vocational training to Persons with Learning Disabilities (PwLDs) in an integrated community setting yields better opportunities for social inclusion and economic empowerment. According to the study, the traditional approach to vocational training that occurs in segregated environments like Special Schools denies PwLDs the opportunity for to learn various social and employable skills within the community. This situation does not only fuel societal exclusion but also increases the economic burden of PwLDs. The project revealed that PwLDs possess unique abilities and can make meaningful contributions to society when given the opportunity. As part of the research process, the team explored the vocational training needs of both teachers and children with different forms of learning disabilities as well as the willingness of about 400 community-based

entrepreneurs to provide supervised apprenticeship training for PwLDs. The researchers, from the Department of Sociology and Social Work, collaborated with the Department of Integrated and Rural Arts and Industry to provide training on emerging trends in leather and beadwork to the teachers of these Special Schools. The trained teachers then transferred the knowledge and skills acquired to the students with support from the KNUST Center for Disability Studies. The students were later assigned to community entrepreneurs under a supervised apprenticeship arrangement as part of the research project. The project has established an important network of relationships among experts in academia (KNUST), the vocational training school for PwLDs, and some community-based entrepreneurs. This network ensures that products from the Special Schools, which previously could not be sold because of stigma, now have a willing and ready market from the community.

20

Harmful chemicals identified in major river bodies in the Kumasi Metropolis, Ghana

A collaborative study conducted by researchers from various disciplines, including planning, chemistry, physics and engineering, has revealed that rivers Wiwi, Subin, and Suntre have a high concentration of contaminants, including heavy metals, polycyclic aromatic hydrocarbons, pesticide residues, and microbials. The study, led by Dr. Stephen Appiah Takyi, revealed that weak enforcement of land use planning regulations along these river bodies has resulted in increasing human activities that have compromised the quality of these rivers. Samples collected from these rivers were subjected to chemical and biological tests to establish the relationship between the various categories of human activities and surface water quality. River Subin,



the most polluted among the three rivers, recorded benzo[e]pyrene concentrations up to 47,169 µg/kg which was linked to the development of squatter settlements and commercial activities within its 100m buffer zone. Also, the geo-accumulation index and concentration factors showed that the rivers are highly polluted with metals such as cadmium, chromium, mercury, and arsenic related to human activities. The microbial quality of the rivers was found to be poor, recording specific microbial loads of 6.8, 4.1, and 1.5 × 10⁷ counts/100 mL, respectively for Wiwi, Subin and the Suntre Rivers. Based on these findings, the study concluded that the three water bodies are unsuitable for human consumption, recreational activities or irrigational purposes.

21

The relationship between urban sprawl, flooding, and green space depletion in Kumasi, Ghana

Flooding has become a perennial occurrence in urban Ghana. To understand this issue, a team of researchers led by Dr Kabila Abass sought to examine the extent to which urban sprawl and the attendant green space depletion underlies flood incidence in Ghana. The study found that the most significant factor underlying the worsening flooding situation in Kumasi is the high proportion of impermeable surface caused by urban expansion. According to the findings, impermeable areas have expanded by 54% from 1986 to 2016 while permeable space correspondingly declined by the same rate within the period due to unplanned and unregulated urban expansion. Globally, urban area expansion is often

considered a flood inducing factor. The study used geospatial techniques, key informant interviews and direct observations to explain the relationships between urban sprawl and flood occurrence. The study also highlighted additional factors which increase the intensity and severity of the floods including poor spatial planning, inadequate storm drain infrastructure, poor waste management practices, and lax law enforcement. Addressing the uncontrolled urban expansion through the adoption and enforcement of smart growth policies, land use control through legislative enforcement, and prioritizing greening by city authorities and other key stakeholders are essential for effective flood control and mitigation in Kumasi.

22

Factors influencing trust in political parties in Ghana

A study led by Prof George M. Bob-Milliar, of the Department of History and Political Studies has indicated that despite an established tradition of democratic elections and peaceful transfers of power, Ghanaians widely trust political parties they are affiliated to and distrust opposition political parties and public institutions. Together with Prof Karen Lauterbach of the Centre of African Studies, University of Copenhagen, Prof Bob-Milliar took a mixed methods approach using both ethnographic and survey data in exploring how political trust is generated in Ghana. Ghana is a newly democratized state with a vibrant multiparty system and requires political trust to consolidate its democratic gains. However, Ghanaians trust religious organizations and traditional authorities more than political parties and state institutions although it is political parties that govern and implement public policy. The study showed that political trust in Ghana largely reflects party loyalty although influenced by government performance. Trust or distrust for political parties is influenced by their management of the economy, the impact of public

programmes, and internal handling of party affairs. Political trust in the two dominant parties in Ghana reflects the strength of party affiliation. Unlike in other democracies, where distrust could imply breakthrough success for third parties, distrust in Ghana does not benefit third parties but commonly results in low voter turnout. Thus, understanding political trust in Ghana must not only focus on government performance but consider the histories of political parties and their relationship to power and control of public institutions.





23

Empowering women through artisanal and small-scale mining

A study conducted by Prof. Daniel Buor of the Department of Geography and Rural Development has confirmed that women's involvement in small-scale mining (SSM) is a tool of empowerment as it improves income which enables access to assets and education, increases participation in household and community decision-making, and enhances self-assertiveness. Researchers in the social sciences have done very little on women empowerment through involvement in energy sapping and hazardous occupations such as small-scale mining (SSM). Thus, this study adopted the CARE International Sustainable Livelihood model to explore how the participation of women in SSM in the Adansi North District of Ghana influences empowerment. A mixed method approach using questionnaires and interviews were adopted to explore these issues with 109 participants. Notwithstanding the challenges associated with SSM, women preferred it over other rural economic activities due to the resulting relief it gave them from hardships and deprivation. The study has strengthened the foundations of geography of gender and feminist geography. It highlights the capability of women to engage in occupations hitherto perceived to be the preserve of men to contribute to poverty reduction, and the need for policies that remove bottlenecks and enable women's participation in SSM as a means of poverty reduction.

24

Eye infections and their antimicrobial treatment patterns in Ghana

Dr. Isaiah Osei Duah of the Optometry Department has presented a pioneering report on bacterial pathogens implicated in eye infections presented by patients in eye clinics in Ghana. This finding is essential for clinical practice as it could inform clinicians on the appropriate choice of antibiotic therapy in the routine clinical management of bacterial eye infections. This study is timely because accurate treatment of external ocular and periocular infections involves identifying the exact bacteria aetiology either by culture or sensitivity before administering target-specific antibiotic therapy. However due to resource constraints, clinicians in Ghana manage eye infections using empirical data and broad-spectrum antibiotics. This approach by clinicians jeopardizes the efforts to tackle antibiotic resistance. Therefore to improve the current understanding of the management of eye infections, biographic and clinical data and ocular specimens were obtained from a Ghanaian ophthalmic population and subjected to microbial analysis. Statistical analysis showed Gram-negative bacteria *Pseudomonas aeruginosa* and *Staphylococcus aureus* as the commonest implicated class of bacteria in eye infections. This finding will provide guidance on the implementation of bacterial surveillance and control programmes to prevent the emergence of resistant strains.



25 Mitigating the devastating effects of greenhouse gas emissions in Ghana and Burkina Faso

Since August 2021, significant efforts have been made by KNUST, University of Augsburg and other German and African partners to measure atmospheric greenhouse gases (GHG) including CO₂, CH₄, N₂O, and other biophysical meteorological parameters in Ghana and Burkina Faso. This has been done through upgrading of three existing eddy covariance stations and installation of two new state-of-the-art eddy covariance stations. Data measurement is important to validate model activities for the emission of greenhouse gas since these gases trap long waves radiation (heat) which cause global warming and have devastating effects on sustainable agriculture and food security, biodiversity preservation and carbon sequestration, and land rehabilitation. The population of Sub-Saharan Africa is growing quickly, and this is also accompanied by

a major intensification of agriculture. As temperatures rise, the rainy season begins and ends differently, and drought and heavy precipitation warnings are changed, people become more vulnerable to climate change. The project is led by Prof Leonard Amekudzi and Dr. Emmanuel Quansah. The data being generated will validate atmospheric models' outputs, used in forecasting climate changes for the region, and help develop mitigation plans to reduce GHG emission.

These are policy-relevant information, which support decision-making for tackling climate change and for planning socio-ecological landscapes. Accordingly, sustainable agriculture and food production under climate and land use (LU) change can be well planned as they are crucial factors in improving people's livelihoods and maintaining peace in the region.



26 Using energy audit findings to reduce electricity consumption



As part of activities to strengthen academia-industry relationship and make academic research more relevant for the development of industries, KNUST Engineering Education Project (KEEP) facilitated the conduct of an energy audit at Vestor Oil Mills Limited, a food processing company located in Kumasi, in the Ashanti Region. The College of Engineering, through its KEEP programme has undertaken this community service of energy auditing, with the target of helping industries to optimize their electricity usage. The energy audit, which was conducted over a three-day period, took inventory of energy supply and consumption in the company, and the operational mechanisms of major equipment such as pumps, motors, boiler, lighting system, heat exchangers, and cooling towers. The equipment was monitored to evaluate how their rate of electricity usage could be optimized. The leader of the energy audit team, Dr. Richard Opoku, indicated that initial analysis of the data has revealed potential savings in electricity consumption by about 15-20%, by incorporating energy-efficient motors together with energy management techniques for other equipment in the facility.

27

Research for Development and Innovation Agriculture and Learning (ReDIAL) project

The Research for Development and Innovation Agriculture and Learning (ReDIAL) led by Prof. Emmanuel Acheampong and Prof. Boateng Kyereh in the College of Agriculture and Natural Resources have explored innovative technology to enhance productivity through improvement in soil fertility, harvesting and processing. This four-year project is a collaboration between the Department of Silviculture and Forest Management and two NGOs - Friends of the Nation (FoN) and Tropenbos Ghana (TBG) is funded by the European Union. According to the study 50 percent of the Ghanaian populace is engaged in the agriculture value chain as agriculture continues to be the mainstay of Ghana's economy. Despite agriculture, particularly,

farming providing livelihoods for millions of people by offering work and food; the sector continues to suffer countless challenges such as: inadequate levels of innovative technology to enhance productivity and soil fertility, thin extension services and weak market linkages which affect farm productivity. Thus, the study sought to promote innovations for improving landscape productivity in five districts across the country by contributing to transformation and innovation in agriculture and food systems in Ghana through action research and application of innovative technologies. REDIAL aims to foster innovation for improving soil fertility in Ghana by generating scientific knowledge and data while applying innovative technology to improve threshing of grains and cereals.

Development of a national agricultural insurance policy to facilitate the provision of agricultural insurance

28

A team of researchers from the Bureau of Integrated Rural Development (BIRD), led by Dr. Monica Addison has developed a framework for all key stakeholders in the sector to coordinate and distribute agricultural insurance products to mitigate risk, shocks and losses in the agricultural sector. The vision of this policy is to establish a vibrant agricultural insurance sector that draws upon public-private expertise to design and distribute; acceptable, accessible and affordable products that makes agricultural value chain actors resilient to climate change and other shocks to protect incomes/investments. This unprecedented policy has been formulated pending the approval from policy makers to revamp the agricultural landscape in Ghana. The policy development process benefitted from the

experiences of other countries and nationwide consultations with over 800 actors in the agricultural and insurance value chain. The main objectives of the agricultural insurance policy includes: integrate agricultural insurance into the risk management tools in the agri-business landscape; increase stakeholders sensitization on agricultural insurance; enhance affordability of agricultural insurance products; provide incentive for private sector participation in the development and distribution of agricultural insurance products; increase and strengthen the level of participation and coordination among collaborating institutions in the agricultural insurance landscape and provide a framework for sustainable funding of agricultural insurance development and promotion in Ghana.

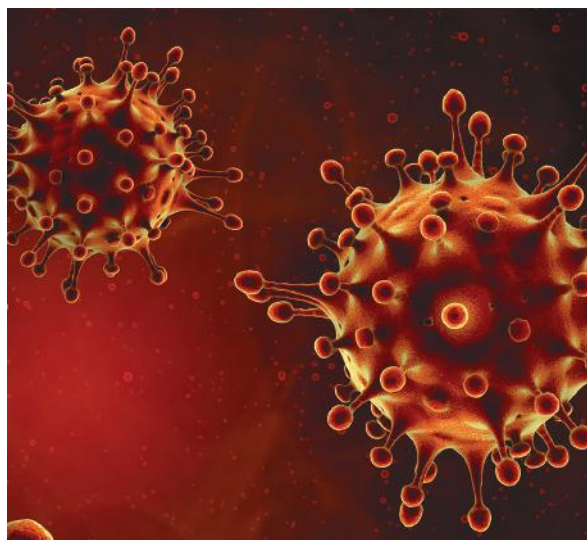
29 Modeling for COVID-19: Does the data tell the true story?

At the onset of the COVID-19 pandemic, a study led by Dr. John Amuasi employed modelling to assess pandemic suppression and mitigation strategies in Ghana. The research was a collaboration between the Ministry of Health, the Ghana Health Service, and the Ghana COVID-19 Taskforce. The study revealed that COVID-19 transmission reduced consistently in Ghana after the imposition of public health interventions—such as border restrictions, intra-city movement, quarantine and isolation—during the first phase of the pandemic from March to May 2020. However, beyond mid-May 2020, the time-dependent reproduction number (R_t) did not represent the true situation, given that a consistent testing regime was not in place. This was also confirmed by the team's Jack-knife bootstrap estimates which show that the positivity rate overestimated the true incidence rate from mid-May 2020. Using modelling, the study sought to estimate Ghana's reproductive number (R_0) for COVID-19 and developing predictive models for number of people exposed, the number

who might fall ill (asymptomatic, mild and severe), and the number who might die. This model took into consideration various control measures introduced and their duration and was critical for decision-making around introducing or lifting social-distancing measures and their socio-economic implications.



30 Seroprevalence of COVID-19 across different regions in Ghana and three other African countries



To determine the burden of SARS-CoV-2 infection in Ghana during the COVID-19 pandemic, a seroprevalence study was conducted by a team led by Dr. John Amuasi. The study discovered that SARS-CoV-2 seroprevalence was approximately 5 times, 6 times, and 11 times higher in Kumasi, Accra, and Tamale, respectively, than the reported SARS-CoV-2 positive rates inferred by PCR-confirmed COVID-19 cases 21 days before the study started. This was done by estimating the SARS-CoV-2 seroprevalence within two districts to determine the SARS-CoV-2 seroprevalence across different regions (i.e. rural and urban/semi-urban) in Ghana. The study, which was funded by the German Government and the Ghana COVID-19 Trust Fund, was also replicated in three other African countries by the team. The findings across the study countries reiterate the need to ensure fair resource intervention distribution across the country in the face of an epidemic.

Research Centres



Bureau of Integrated Rural Development (BIRD)

- Innovation for rural development
- Entrepreneurial development of small and medium scale industries
- Promotion of tourism



Centre for Settlement Studies (CSS)

- Human settlements development
- Rural/ urban research and planning
- Urbanisation and national development



KNUST Dairy/Beef Cattle Research Station

- Dairy and beef product development
- Sustainable cattle farming
- Production management



Centre for Cultural and African Studies (CeCAST)

- Cultural development
- Arts and practices of traditional society
- Cultural recreation and entertainment



KNUST Agriculture Research Station, Kumasi

- Plantation development
- Extension and community services
- Sustainable crop production practices

CARISCA

Center for Applied Research and Innovation in Supply Chain-Africa (CARISCA)

- Sustainable and resilient Supply chain systems
- Supply chain technology and innovation
- Supply chain access and inclusion



The Brew-Hammond Energy Centre

- Renewable and conventional energy
- Energy economics and policy
- Innovation in sustainable energy technology



Kumasi Centre for Collaborative Research in Tropical Medicine (KCCR)

- Basic and applied biomedical research
- Tropical and related disease control and prevention
- Clinical trials and vaccine development



Technology Consultancy Centre (TCC)

- Technology transfer
- Manufacturing technology
- Rural/urban enterprises



Laboratory for Interdisciplinary Analysis

- Statistical literacy
- Data science and analytics
- Interdisciplinary research and collaborations



Regional Water and Environmental Sanitation Centre, Kumasi (RWESCK)

- Water resources management
- Water and sanitation development
- Water and sanitation technology



Regional Transport Research and Education Centre, Kumasi (TRECK)

- Urban transport and mobility technology
- Sustainable public transport systems
- Transport economics and management



West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL)

- Climate change adaptation
- Climate and land use policy
- Water, energy and climate change capacity building



Research Support Units

Office of Grants and Research

The Office of Grants and Research (OGR) is responsible for facilitating the implementation and growth of the University's research agenda. The Office provides the framework and support services to ensure that the University's strategic research goals are achieved and the University's interests are protected. The OGR provides services through its Central and College Offices. Staff who are specialised in grants and research management support researchers throughout the research and grant cycle.

OGR Services

Pre-award Services

- Funding Opportunities
- Funder Systems and Processes
- Proposal Development and Submission
- Guidelines and Templates
- Due Diligence Processes

Grant Financial Management

- Budgeting
- Funder Assessments of Financial Processes
- Troubleshooting
- Financial Reports

Research Data Management

- Research Management Information System (ReMIS)
- Grant Accounting Management System (GAMS)

Research Dissemination and Visibility

- KNUST Research Report
- Research News Briefs
- Spotlight on Researchers

Intellectual Property (IP) and Knowledge Transfer

- Patent Search
- IP Valuation
- Patent Filing and Application
- IP Protection
- IP Audit and Asset Management

Post-award Services

- Award Negotiation and Agreements
- Contract Development and Review
- Award Set-Up
- Grant Management Support
- Grant Close-out

Research Capacity Development

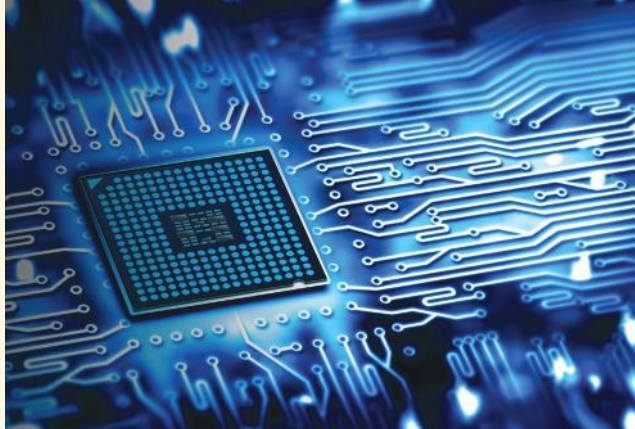
- KNUST Research Fund (KREF) Awards
- Capacity Building
- Promoting Collaborations and Mentoring
- Promoting Research Culture
- Young Researchers Forum

Research Ethics

- Oversight by University Research Ethics Board
- Coordination and support for three (3) Ethics Review Committees
- Training on Ethics
- International Assurances and Certifications

Research Compliance

- Policies and Guidelines
- Grant Accountability
- Funder Assurances and Certifications



UNIVERSITY INFORMATION TECHNOLOGY SERVICES (UITS)

Provides a connected environment and innovative sustainable technology solutions to enhance research activities through:

- **Software Development**
 - Mobile, web and desktop applications
 - Data collection, visualization and analytics platforms
 - Research related websites
 - Provision of demographic statistics on staff and students
- **Network Operations and Infrastructure**
 - Setup and management of servers for research activities
 - Provision of internet for research, remote engagements, and collaborations
- **User Support Services**
 - Provision of IT-related training
 - Provision of data recovery and data-restore services
 - Assistance with collaborative cloud-based platforms like Google Drive and One Drive applications
 - Setup and management of central computer labs
 - Laptop computers and biometric devices available for research work
 - Provision and installation of research-related software like ArcGIS
- **Systems and Data Management**
 - Corporate information dissemination e-mail platform
 - Briefcase feature for storing research documents and collaborative research

UNIVERSITY LIBRARY

Provides adequate scholarly resources to support research and dissemination of knowledge through:

- Journal and Database Subscription
- Electronic Resources
- The Research Commons for Faculty and Postgraduate Students
- Turnitin plagiarism software
- Institutional Repository (KNUSTSpace) for publication visibility
- Institutional Visibility through generation of research performance data
- Academic Skill and Research Training
- Verification of Research Publication Sources
- Promotion of Open Access



UNIVERSITY RELATIONS OFFICE

Supports and promotes research dissemination and visibility using print and electronic media through:

- Coverage of research events and activities
- Focus FM radio station programmes
- Promotion of research with potential for uptake and utilization
- Research content on website
- Engagement of the University with the public

FINANCE OFFICE

Provides the financial framework and services for the implementation of research projects through:

- Support for budgeting
- Financial management of grants
- Internal control processes
- Ensuring adherence to funder and institutional regulations
- Financial reporting for grants

JOURNAL OF UNIVERSITY OF SCIENCE AND TECHNOLOGY

The official journal of KNUST, the Journal of University of Science and Technology (JUST) publishes articles resulting from original research in Science, Humanities, and Technology.

SCHOOL OF GRADUATE STUDIES

Enhances research activities in the University through

- Coordinating postgraduate studies including research degrees
- Enhancing the quality of research in the University through appropriate policies and procedures
- Facilitating the development of research skills of students through courses and seminars
- Strengthening research supervision and enhancing student-supervisor relationships in the university through training, defining student and supervisor roles and responsibilities, and supervision monitoring



CENTRAL LABORATORY

The Central Laboratory is a shared facility providing access to state-of-the-art equipment for research and training in equipment-specific application and methodologies. Notable among the available equipment are:

Chromatography Facility	<ul style="list-style-type: none"> • Gas Chromatograph – Electron Ionization -Mass Spectrometer (GC-EI-MS) • Gas Chromatograph – Flame Ionization Detector (GC-FID) • Analytical High Performance Liquid Chromatograph (HPLC) • Ultra-High-Performance Liquid Chromatograph – Electrospray Ionization – Time of Flight Mass Spectrometer (UHPLC-ESI-ToF-MS)
Spectroscopy Facility	<ul style="list-style-type: none"> • 500 MHz AVANCE III HD Nuclear Magnetic Resonance • Atomic Absorption Spectroscopy - Flame and Graphite Furnace • Attenuated Total Reflectance – Fourier Transform Infrared Spectroscopy • Double Beam UV/VIS Absorption Spectrophotometry • Multi-Mode Microplate Reader (Fluorescence, Absorbance and Luminescence.)
Automated Greenhouse with Greenline Technology	<p>The twin-cabin automated greenhouse can accommodate about 1768 plants at a time, and can monitor and control relative humidity, temperature, fertigation program, and artificial lighting. With the aid of a modern weather station linked to the Greenline software, extensive data on internal and external conditions are recorded.</p>

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