

2018

ANNUAL REPORT



CSIR - INSTI

Institute For Scientific and
Technological Information

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**COUNCIL FOR SCIENTIFIC AND
INDUSTRIAL RESEARCH**

**INSTITUTE FOR SCIENTIFIC AND
TECHNOLOGICAL INFORMATION**

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INDUSTRIAL RESEARCH**

**INSTITUTE FOR SCIENTIFIC AND
TECHNOLOGICAL INFORMATION (CSIR-INSTI)**

2018 ANNUAL REPORT

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List of Acronyms

AJOL	-	African Journals Online
ARI	-	Animal Research Institute
CLIMACCESS	-	Climate Accessibility
CRGS	-	Competitive Research Grant Scheme
CSIR	-	Council for Scientific and Industrial Research
ECRU	-	Electronics and Communications Research Unit
FAO	-	Food and Agriculture Organization
FRI	-	Food Research Institute
GAEC	-	Ghana Atomic Energy Commission
GES	-	Ghana Education Service
GISD	-	Geospatial and Information and Science Division
GJAS	-	Ghana Journal of Agricultural Science
GJS	-	Ghana Journal of Science
GRAF	-	Ghana Robotics Academy Foundation
GSSTI	-	Ghana Space Science and Technology Institute
INASP	-	International Network for the Availability of Scientific Publications
INSTI	-	Institute for Scientific and Technological Information
IITA	-	International Institute of Tropical Agriculture
KML	-	Keyhole Markup Language
MMDA	-	Metropolitan, Municipal & District Assemblies
NASA	-	National Aeronautics and Space Administration
NITA	-	National Information Technology Agency
OWC	-	Optical Wireless Communication
PGRRI	-	Plant Genetic Resources Research Institute
SARI	-	Soil and Agricultural Research Institute
STEM	-	Science, Technology, Engineering and Mathematics
STEPRI	-	Science, Technology and Environmental Policy Research Institute
STI	-	Science and Technology Information

S&T	-	Science and Technology
TEEAL	-	The Essential Electronic Agricultural Library
UAT	-	User Acceptance Testing
VPN	-	Virtual Private Network
WRI	-	Water Research Institute

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Dr. Joel Sam (up to June 2018)	-	(Member) Director, CSIR-INSTI, Accra
Mrs. Lucy P. Dzandu (July to November 2018)	-	(Member) Acting Director, CSIR-INSTI, Accra
Dr. Mohammed - Sani Abdulai-		(Member) Senior Lecturer and Consultant, African Centre for Development Informatics, Accra
Mr. Kobina Asmah Jr.	-	(Member) CEO, Type Company Limited, Accra

In Attendance

Mr. Joseph Anyen	-	Accountant, CSIR-INSTI, Accra
Mrs. Dorothy Awanyo	-	(Secretary) Administrative Officer, CSIR-INSTI, Accra

Membership of the Internal Management Committee
(As at 31st December 2018)

Dr. Joel Sam (up to June 2018)	-	Director/Chairman
Mrs. Lucy P. Dzandu (July to November 2018)	-	Ag. Director/Head, GIS
Mrs. Dorothy Awanyo	-	Head, Administration Division
Dr. Agnes Decardi-Nelson	-	Head, Printing and Publishing Science Division.
Dr. Paul A. Danquah	-	Head, Communication Division
Ing. Michael Wilson	-	Ag. Head, Electronics Division
Mr. Mohammed Zainudeen	-	Ag. Head, Fluid Science Division
Mrs. Ivy Koranteng	-	Representative, Senior Staff Association
Mr. D.N.D. Dodoo	-	Chairman, Trade Union Congress
Mr. Joshua Addae-Boateng	-	Public Relations Officer
Mr. Benjamin Folitse	-	Representative, Research Staff Association
Ms. Cordellia Busumtwi	-	Secretary

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Executive Summary

The list of research projects and training programmes organised below are extracted from the various Divisions and were carried out by the Institute during the period under consideration. Details of the projects are presented in this report.

Design and implementation of a LiFi Test-Bed.

A test-bed was set up to conduct experimental research into Optical Wireless Communication (OWC). LiFi signals for testing, demonstration and development of LiFi applications were generated using the test-bed. This was carried out by the Communications Division.

Simulated comparison of performance beyond inherent metrics for OSPF AND EIGRP.

Experimentation was carried out by the Communications Division to compare the protocols of network round trip times and time to live on the basis of message round trip and time to live for packets transmitted.

Impact assessment of robotics inspired science education programme on student performance and understanding in STEM subjects.

The Electronics Division in collaboration with Ghana Robotics Academy Foundation carried out the project to come up with recommendations on how the use of robotics as a wheel to foster higher understanding and performance in Science, Technology, Engineering and Mathematics (STEM) related subjects could be improved as well as inspiring STEM education in Ghana. Twenty four students have currently undergone training and an assessment of their academic performance would be made.

Poultry Incubator.

This project was performed to provide an efficient, high hatch rate and affordable incubator for Poultry Farmers leading to an increasing bird production in support of food security and sustainability. The incubating box, system control unit, sensor network and tray control motor have all

been assembled with the initial temperature and humidity tests being carried out. The design test model for the initial experiment to be carried out would be made. This was carried out by the Electronics Division.

Ubiquitous computing for location-based tourist attraction.

This research was carried out by the Electronics Division to exploit the use of web/mobile computing and Geo-Information data in unleashing a disruptive wave of new tourism experience in Ghana. The mobile version of the Ghana Portal platform is currently being tested and prepared for piloting.

Information needs and obstacles of small scale farmers in developing countries.

This project was undertaken by the Geospatial and Information Science Division (GISD) in collaboration with the Nsawam Adoagyiri Municipal Assembly Department of Agriculture. A technical report has been written on the project which focused on the information needs, awareness, sources and challenges of small scale farmers.

Exploring the constraints of accessing agricultural credit by small scale oil palm farmers.

This research, carried out by the GISD in the Kwaebibirem District investigated factors related to credit acquisition of 100 small scale oil palm farmers. Write up is in progress.

Assessing farm record-keeping behavior among small scale pineapple farmers in the Nsawam Adoagyiri Municipality, Ghana.

This project was undertaken by the GISD in collaboration with the Nsawam Adoagyiri Municipal Assembly, Department of Agriculture. The study showed that more small scale pineapple farmers in the study areas were males with formal education who kept daily farm records of sales and production through manual storage. A publication has been made from this study.

Database and map development.

The GISD created a spatial database for the distribution of forest types in Ghana. A map was produced showing the distribution of forest types in the country as observed in 1981 and 1985.

Updating the road network in the country via-Google Earth.

Thirteen and seven MMDAs in the Brong Ahafo and Upper East Regions respectively had their road networks updated. The former (Brong Ahafo Region) has been completed while the latter (Upper East Region) has four outstanding.

Robotics training programmes.

A one-week training programme was organised by the Electronics Division in collaboration with Microbot Academy and GRAF for 12 female students of the Methodist Girls Senior High School, Manfe from 9th to 13th April 2018 with age ranges from 12 to 18 years. The programme led to the award of the Microbot Academy's Megabot badge.

The second training programme took place from the 3rd to 10th of December 2018 for a different batch of 12 students from the same academic institution and within the same age range. This was in collaboration with MikroStem Academy, students were awarded Megabot certificates.

Ghana Journal of Science & Ghana Journal of Agricultural Science.

Volumes 52 (2018) and 53 (2018) of the Ghana Journal of Agricultural Science (GJS) were published on the AJOL indexing site.

Volumes 58 (2018) and 59 (2018) of the Ghana Journal of Science (GJS) were published on the AJOL indexing site.

The Printing Section also executed 15 printing jobs which included CSIR-Institutes Annual Reports, CSIR 60th Anniversary banner, CSIR-ARI flag, CSIR Annual Diaries and Calendars.

Information resources.

The information resources collected by the Scientific Information Management Section for 2018 stood at 904. These included journals/

magazines, theses, annual reports, books and newspapers which were acquired through exchanges, donations and data collection.

Number of persons who used the library.

A total of 1400 clients visited the library throughout the year. Students came to use the reading facility of the library, while researchers used the library facility for their research work.

The staff strength.

The staff strength of CSIR-INSTI stood at 65 as at 31st December 2018, comprising 20 senior members, 25 senior staff and 20 junior staff. Two staff members resigned on 25th June and 20th July 2018 respectively. The Director of the Institute, Dr. Joel Sam also proceeded on retirement from the Council on 16th June 2018. Two other staff members, a senior member and a junior staff also retired on 26th July and 22nd August 2018 respectively.

Income Generated.

The Institute generated GH¢3,752,176.37 from its services and contract research activities, while the total expenditure for the same period amounted to GH¢3,671,176.93. The surplus for the year was GH¢80,999.44 after a provision of GH¢2,639.72 was made for the consumption of non-current assets (fixed assets).

1.0 Introduction

The mandate of the Institute is to develop national capacity and capability for the efficient and effective provision of scientific and technological information on demand for the benefit of research scientists, policy decision-makers, industrialists, etc. in an appropriately packaged form for national development.

The Institute's operative objectives were to:

- carry out research into the Electronics/Communication and uptake of research findings to end-users.
- utilize and develop ICT tools and communication devices for socio-economic development
- provide sustainable training programmes in the fields of ICT and consultancy services using appropriate technologies and expertise
- adopt, adapt and master known and existing technologies
- conduct research into the following areas:
 - Intelligent Transport Systems (ITS)
 - SMART agriculture for sustainable green cities
 - High-performance data networks and Cybersecurity
 - Computer-aided designs and Robotics
 - Predictive analytics and algorithm development
- distinguish itself in the field of science publishing and ultimately become a leader in the specialty in Ghana.
- collect and analyze data for the design and construction of thematic maps using digital technologies to depict Ghana's resources and development potential to aid planning, policy decision making, research and general education
- collect, process, store and repackage for disseminating science and technology information embodying the results of indigenous science and technology research activities as well as those generated elsewhere for the benefit of planners in government, production and manufacturing concerns
- support the promotion of efficient research and development

activities in the country through the provision of science and technology information services using appropriate information processing and communication technologies

- strengthen national science and technology information and infrastructure through effective networking and collaborative activities.

--In fulfillment of its mandate, INSTI continued to collect, organise, co-ordinate, manage and repackage for dissemination, STI resources on a national scale to facilitate technology transfer between the developers or producers of technologies to enhance and accelerate the adaptation and diffusion of these technologies.

The divisions at the institute were restructured with some being collapsed and new ones added with effect from 1st February 2018. Hence, the broad spectrum of activities was undertaken by the following restructured divisions:

- Communications
- Electronics
- Fluid Science
- Geospatial and Information Science
- Printing and Publishing

The supporting divisions were:

- Accounts
- Administration

2.0 On-Going Research Programmes

2.1 Design and Implementation of a LiFi Test-Bed

Research Team: Gordon V., Wilson M., Peh B., Twum-Barimah Y.

Start Date: November 2017

Duration: 22 months

Location: CSIR-INSTI

Introduction and Justification:

This research, sponsored by the CSIR – Competitive Research Grant Scheme (CRGS), set up a test-bed to conduct experimental research into Optical Wireless Communication (OWC).

Objectives:

The objectives of the project were to;

- Set up a test-bed to conduct experimental research into optical wireless communication (OWC)
- Use the test-bed platform to generate LiFi signals for testing, demonstration and development of LiFi applications.

Materials and Methods:

A hybrid research approach was employed to execute the proposal. The designing methodology of the test-bed architecture was based on three main blocks; the Main LED Unit (MLU) to which the data source was directly connected, the Agent LED nodes (AL's), LED lamps which receive optical signals from the MLU and distribute to the optical wireless-enabled end devices for optical wireless internet access. The number of ALs depends on the requirements and internal structure of the mount point or ceiling. The architecture of the study was based on three ALs namely: AL1, AL2 and AL3 to provide coverage for the end devices and a direct Field of View (FoV) of 370 ± 20 cm. Mirror technology was used to reflect the optical data signal to increase the coverage area. A constant Alternating Current (AC) would be applied to the base of the

MLU housing the ALs to trigger the emission of a constant stream of photons observed as visible light. These were then modulated, converted into a data stream, demodulated and then transmitted to suitably adapted end devices. An open-source software, DIALux EVO was used to configure the bliss ceiling mount-point for maximum illumination of the LEDs in the indoor test-bed environment.

Results:

Funding was approved by donor. Grant released by donor and disbursed. Research and experiments were successfully completed and demonstrated at CSIR-INSTITI Open Day.

Way Forward:

Documentation is ongoing.

2.2 A simulated comparison of performance beyond inherent metrics for Open Shortest Path First (OSPF) and Exterior Gateway Routing Protocol (EIGRP)

Research Team: Danquah P.A., Gordon V., Twum-Barimah Y., Peh B.

Start Date: August 2018

Duration: 3 months

Location: Accra

Introduction and Justification:

This research which was sponsored by IT Council Limited was carried out to compare the protocols of network round trip times and time to live on the basis of message round trip and time to live for packets transmitted.

Objectives:

The objectives of the project were to;

- Compare the OSPF and EIGRP routing protocols based on

results obtained from performance tests carried out beyond the inherent metrics of the respective routing protocols.

- Use network and round times and time to live to compare the protocols on the basis of message round trip and time to live for packets transmitted.

Materials and Methods:

The research was mainly experimental and the approach required computers, routers, switches, cables or a network simulator. A set of computers on two separate local area networks was interconnected via two optional paths consisting of four routers. The paths were segmented into paths one and two with bandwidths of 64Kbps and 1024000Kbps respectively. The configuration of OSPF and EIGRP were effected on all routers separately and connectivity between the two networks were tested.

Results:

Experimentation completed, paper completed and presented at research seminar. Paper has also been sent to journal for publication.

Way Forward:

Completed and awaiting publication.

2.3 Usage of anti-malware, implementation of business continuity and disaster recovery plans, vulnerability assessment and penetration tests

Research Team: Danquah P.A., Gordon V., Twum-Barimah Y., Wilson M., Bekoe S.

Start Date: December 2018

Duration: 4 months

Location: Accra

Introduction and Justification:

This research which was sponsored by the CITSYS sought to gain insight into the usage and deployment of anti-malware.

Objectives:

The objective of the project was to know what was happening, how it was happening and why it was happening in the specific thematic information security areas of usage and deployment of anti-malware, business continuity and disaster recovery, vulnerability and penetration tests.

Materials and Methods:

The research approach would use predominantly survey, interview and observation. The analysis of data would involve a combination of quantitative and qualitative approach. Specific logistics required would include transportation, telephone communication, development of and hosting of online questionnaire and observation of subjects of the research. The analysis process would require the use of various computerised analytical tools with statistical and qualitative capability.

Results:

50% funding by donor to INSTI.

Way Forward:

Data collection to commence.

2.4 Impact Assessment of a Robotics Inspired Science Education Program on Student Performance and Understanding in STEM Subjects

Research Team: Wilson M., Okraku-Yirenkyi Y., Twum-Barimah Y.

Start Date: August 2018

Duration: 12 months

Location: 10 Regions of Ghana

Introduction and Justification:

The CSIR in collaboration with the Ghana Robotics Academy Foundation (GRAF) intends to carry out this study leading to recommendations on how GRAF and CSIR can jointly collaborate to improve the use of

robotics as a wheel in fostering higher understanding and performance in STEM-related subjects as well as inspiring STEM education in Ghana.

Objectives:

The objectives of the project are to;

- Develop recommendations on improving the use of robotics for better understanding of STEM subjects.
- Inspire STEM education in Ghana.

Materials and Methods:

The research work seeks to introduce a more tacit – “knowledge in action” method of learning to augment the traditional declarative and propositional knowledge acquisition methodology in Ghana schools. The academic and skill index performance of 500 students in the Robotics Inspired STEM Education Project would be compared to the performance of students who only go through the traditional GES curriculum after a year duration of running this project to determine the efficiency of the augmented curriculum.

Results:

Course content for the first module is completed and training sessions using this content has been commercialised. Twenty four students have received 20 hours of intensive training at a course fee of GH¢ 100. This training introduced students to a hands-on, minds-on approach curriculum – the core of which would be enduringly engaging tasks using the versatile LEGO Mindstorm Robot – designed to help students take ownership of the learning process, enabling them to actively develop their thinking, problem-solving skills and collaborative outlook necessary to become creators, not just consumers of knowledge. The duration of the actual training was 24 hours which was followed by an examination. All candidates passed their examinations with the highest score being 49 points out of 50 and the least score being 25 points out of 50 achievable points. A total of **GH¢ 2, 400** has been generated from the project’s training as of December 2018.

Way Forward:

Subsequent training would be carried out till June 2019 after which assessment of participants academic performance would be carried out to measure the impact of the robotics inspired STEM education on student's performance in STEM-related subjects. A journal paper will be published from this assessment and study.

Expected Beneficiaries:

- Ghana Education Service
- Educational Institutions (JHS, SHS, Local and Global Universities, etc.

2.5 Poultry Incubator

Research Team: Twum-Barimah Y., Wilson M., Peh B., Gordon V.

Start Date: May 2017

Duration: 4 years

Location: CSIR-INSTI

Introduction:

This project seeks to provide efficient, a high hatch rate and affordable incubator for poultry farmers leading to an increasing bird production in support of food security and sustainability.

Objectives:

The objectives of the project were to;

- Develop an efficient, high hatch rate and affordable poultry incubator.
- Increase bird production in support of food security and sustainability.

Materials and Methods:

To have the design structure model such that the top lid has the possibility to receive and heat the inner chamber of the system. Also, the power

interface is designed to have Solar Power as the main Power Input. To arrive at the right parameter settings for excellent hatchery, a data logger results simulation is employed. For early warning and quick response action, a channel is developed for real-time communication.

Results:

The incubating box, system control unit, sensor network and tray control motor have been assembled. The initial temperature and humidity tests are being carried out. The temperature setting seems fairly good, however, an unpractical system is used to control the internal humidity. Different setups are being tested to arrive at good levels of humidity generation and control. The system runs on normal electrical power since the Solar Unit is not yet in.

Way Forward:

Potential Technologies to be generated are geared towards the integration of Power System (Solar), Portable Data Logger and an Efficient Communication Channel (mobile App) and efficient control Unit for high volume incubator system. A successful accomplishment of the project design is hoped to be commercialized as an efficient and affordable incubator with an integrated channel to send real-time data parameters to farmers for important corrections. Setting out the design test model for the initial experiment is to be carried out. Sponsors are also being sought after to assist with the financial constraint of the research work.

2.6 Ubiquitous Computing for Location Based Tourist Attraction

Research Team: Wilson M., Peh B., Gordon V., Twum-Barimah Y.

Start Date: September 2017

Duration: 28 months

Location: 10 Regions of Ghana

Introduction:

CSIR-INSTI in collaboration with MIPH consult seeks to exploit the use of technology in unleashing a disruptive wave of new tourism experience in Ghana. This project envisages the creation of local content on tourism from the people of Ghana.

Objectives:

The objectives of the project were to;

- Gather documentation on both documented and undocumented tourist towns, festivals, heroes, etc from indigenous people and other authentic sources.
- Investigate the authenticity of information and associate them digitally with generated QR Codes.
- Replicate QR Codes and tag them on all artifacts and places connected to the documentation.

Materials and Methods:

Gathered information is investigated for authenticity and is digitally associated with a QR code. The generated codes would be replicated and tagged on all artifacts and places connected to the documentation. Drones would be used where applicable to capture a virtual tour of popular tourist sites and linked up to a web portal where tourists could have a feel of these places before a planned visit.

3D printing technologies would be used to print artifacts related to various tourist sites, they would bear tagged QR Codes that link to documented information about the artifacts. Location-based services are being used to advertise nearby tourist towns and sites through a custom mobile application. The application has a “birdeye search” feature which prompts users via a notification service anytime they get into a 50km radius where a documented tourist site is located. The App also includes a navigation feature to direct interested users to visit these sites or artifacts where they could also use the App to scan tagged QR codes to know more about these sites or artifacts in the absence of a tour guide.

Results:

The projects domain has been registered. The official website available at www.ghanaportals.com has been successfully developed and hosted and is currently being managed by a team at CSIR-INSTI, the cost of which was borne by MIPH. A Mobile version application of the Ghana Portal platform is currently being tested and prepared for piloting. The project was demonstrated on the CSIR-INSTI open day celebration. A journal paper is also being put together for publication.

Way Forward:

A third party is being sought after to support the project financially. QR Codes for documented sites so far would be printed and a proposed launch date for the commercialised version of the portal scheduled with the commercial partner. Discussions have commenced with a consultant to the Ghana Tourism Authority. A general invitation has also been given to corporate bodies in Ghana to come for discussions towards commercialising the research output. Research findings are intended to be published by the end of the year. The product would be operationalised with appropriate investors.

2.7 Production and Development of Fuel Cell/ Biogas

Research Team: Zainudeen M.N.,
Nyamful A.

Start Date: December 2018

Duration: 3 months

Location: CSIR-INSTI

Introduction and Justification:

This project seeks to provide clean energy usage and protection of our environment against green gas emissions which will positively affect job creation and the economy at both the local and national level. This would, in turn, reduce dependence on the national grid which is becoming too extensive and expensive for Small and Medium Scale Enterprises.

Objectives:

The objectives of the project are to;

- Develop the fuel cell for electricity and heat generation.
- Develop Biogas as household fuel for heating instead of trees or charcoal.

Expected Beneficiaries:

Citizens who live in the remote settlements/ communities and some Small and Medium Scale Enterprises (SME's).

Way Forward:

Potential Technologies to be generated are geared towards building of customized fuel cell and Biogas production unit for the rural folks, SME's and other agriculture-based industries.

2.8 Assessing Farm Record Keeping Behaviour Among Small Scale Pineapple Farmers In The Nsawam Adoagyiri Municipality, Ghana

Research Team: Folitse B.Y., Akpotosu B.W., Manteaw S.A., Koranteng I.M.

Start Date: December 2018

Duration: 18 months

Location: CSIR-INSTI

Introduction:

Research was conducted amongst small scale pineapple farmers of 12 communities in the Akwapim South District; Ankwa Dobro, Panpanso, Sakyikrom, Krokese, Akraman, Bowkrom, Daaman, Oparekrom, Nkyenenkyene, Fotobi, Djankrom and Akuffokrom farming communities, to assess their record-keeping culture.

Objectives:

The objectives of the project were to;

- Describe the demographic characteristics of pineapple farmers
- Determine the various types of farm records kept by pineapple farmers
- Define the benefits derived by pineapple farmers in keeping farm records
- Examine the challenges pineapple farmers faced keeping farm records

Materials and Methods:

Sampling procedure was carried out through a multi-stage random selection procedure to select 12 community respondents for the study. Similarly, 10 farmers were purposively selected from each community and interviewed for data gathering. The population for the study was 120 pineapple farmers.

A quantitative approach through the use of personal interview schedules was employed to collect data from key pineapple farmers. Data on demographic characteristics, various types of farm records kept by pineapple farmers, benefits of keeping farm records and challenges faced by pineapple farmers in keeping farm records were collected. The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 21. Data was presented in the form of tables, graphs and Chi-square analyses which gave a condensed picture of record-keeping behaviour of the pineapple farmers in the study area.

Results:

Data have been analyzed and the write up is in progress.

Way Forward:

A technical report would be sent to CSIR-INSTI Administration and a suitable journal selected for publication.

2.9 Exploring The Constraints Of Accessing Agricultural Credit By Small Scale Oil Palm Farmers: The Case of Kwaebibirem District, Eastern Region, Ghana

Research Team: Folitse B.Y., Manteaw S.A., Koranteng I.M. and Ampofo-Addo A.S.

Start Date: July 2018

Duration: 18 months

Location: CSIR-INSTI

Introduction:

Factors related to credit acquisition of 100 small scale oil palm farmers in the Kwaebibirem District were investigated.

Objectives:

The objectives of the project were to;

- Identify the socio-economic characteristics of small scale oil palm farmers
- Examine the factors affecting access to credit by small scale oil palm farmers
- Determine the factors that influence access to credit by small scale oil palm farmers
- Define how small scale oil palm farmers choose their source of credit
- Ascertain constraints faced by small scale oil palm farmers in credit acquisition.

Materials and Methods:

Data for the study were collected using interview schedules to elicit information from the 100 selected farmers. The interview schedules were administered by the researchers in Akan (Twi) language and the responses translated into English Language. The data collected were analyzed using descriptive statistics such as frequencies, percentages and inferential statistics such as Pearson chi-square. Continuity correction and Fisher's Exact Probability Test were also used to analyse data collected.

Beneficiaries:

Expected beneficiaries of the programme include small scale oil palm farmers, agricultural extension agents and financial institutions.

2.10 Information Needs and Obstacles of Small Scale Farmers In Developing Countries: A Case Study Of Small Scale Farmers In The Volta Region, Ghana Research

Team: Folitse B.Y., Asante I.K., Akpotosu B.W., Manteaw S.A.

Start Date: June 2018

Duration: 18 months

Location: CSIR-INSTI

Introduction:

CSIR-INSTI in collaboration with the Department of Agriculture, Nsawam Adoagyiri Municipal Assembly, Nsawam carried out this research to address the information transfer gaps amongst small scale farmers in the Volta Region, Ghana.

Objectives:

The objectives of the project were to;

- Find out the information needs of small scale farmers
- Examine the awareness of information sources of small scale farmers
- Determine the information sources consulted by small scale farmers
- Establish the challenges faced by small scale farmers in accessing and using information sources

Materials and Methods:

A survey design comprising an interview schedule was used to collect data for the study. The survey design was chosen because it allowed the researchers to systematically ask many small scale farmers the same questions about the situation according to Newman (2003). The population

for the study was small scale farmers in the Volta Region of Ghana. A multistage sampling technique was used to select the respondents from the 25 districts and municipalities in the Volta Region. A simple random technique was used to select 50% of the 25 municipalities and districts in the first stage. In the second stage, a list of communities was obtained from the Ministry of Food and Agriculture (MOFA) offices. A third of the number of communities was randomly selected. At the third stage, the list of registered small scale farmers collected from MOFA offices in each of the districts and municipalities and 5 small scale farmers were purposively selected from each community and interviewed.

Beneficiaries:

Expected beneficiaries of the programme include small scale farmers, agricultural extension agents, information professionals, government and policy makers, agricultural organisations and research institutions.

Results:

Data have been analyzed and a report has been written.

Way Forward:

A technical report is being edited. A journal article would then be produced for publication.

2.11 Urban Vegetable Farmers' Appreciation of Insurance in the Greater Accra Region of Ghana

Research Team: Folitse B.Y., Manteaw S.A., Akpotosu B.W. Bekoe S., Martey F.

Start Date: July 2017

Duration: 18 months

Location: CSIR-INSTI

Introduction:

Perceptions of Insurance amongst urban vegetable farmers were assessed.

Objectives:

The objectives of the project were to;

- Determine the demographic characteristics of urban vegetable farmers the Greater Accra Region
- Measure the appreciation of insurance by urban vegetable farmers' in the Greater Accra region
- Determine reasons of insurance coverage for vegetable farmers
- Examine the willingness on the part of vegetable farmers to pay for insurance premium

Materials and Methods:

Primary data were obtained from the urban vegetable farmers using a questionnaire during the 2017 farming season. Two-stage sampling procedures were employed. The first stage involved the random selection of four urban areas viz: Maamobi, Dzorwulu, Atomic Energy and Korle Bu. The second stage involved the selection of 150 farmers from a database of vegetable farmers provided by the Vegetable Farmers Association. These associations are sometimes based on the area where farming is taking place. One-third of the population of vegetable farmers in each of the four areas was selected. From Maamobi, 45 vegetable farmers were selected out of 135; Dzorwulu, 35 were selected out of 105; Atomic Energy, 50 were selected out of 151 and Korle Bu. 20 out of 60. Data analysis was univariate using descriptive statistics of frequencies and percentages.

Results:

Data have been analyzed and the write up is in progress.

Way Forward:

A technical report will be sent to CSIR-INSTITI Administration and a suitable journal will be selected for publication.

2.12 Climate Change Resilience in Urban Mobility

Research Team: Kofie R.Y. and Allotey A.N.M.

Start Date: June 2018

Duration: 5 years

Location: Accra

Introduction:

CSIR-INSTI in collaboration with the Department of Geoscience, University of Copenhagen, Denmark, and the Department of Geography & Resource Development, University of Ghana, Legon are undertaking this research to enhance research capacity in the field, introduce new methods for mobility analysis, new methods for predicting urban floods and devise policy and planning measures to advance the sustainable urban development agenda.

Objectives:

The objectives of the project were to;

- Identify strategies for increasing climate change resilience within urban mobility, accessibility and transport in Accra
- Investigate how these strategies may be integrated into the urban planning and decision-making process

Materials and Methods:

This interdisciplinary research effort will draw upon the combined competences of the involved North and South partner teams within climate change scenarios, flood modeling, urban planning, socio-economic analysis and GIS-based spatial analysis. This project will apply a combination of quantitative and qualitative methods to address the objectives of the different work packages. The quantitative methods include questionnaire surveys, computerized analysis of local and city-wide elevation models, satellite images as well as GIS-based analysis of the urban transport networks in terms of risk of flooding, connectivity and level of redundancy. A small UAV drone will be applied to collect local elevation data for eval-

uation purposes. A city-wide elevation model based on satellite images will be obtained for the project. The qualitative methods include focus groups, key informant interviews, field observations, in-depth qualitative interviews and participatory community workshops.

Results:

An inception workshop was successfully organised on 27th June 2018 at Alisa Swiss Hotel, North Ridge, Accra. Reconnaissance survey was undertaken with all collaborating researchers. Team members travelled to Copenhagen, Denmark for a project meeting from 18th to 27th August 2018. A shapefile of Enumeration Areas of Greater Accra Region to assist in organising population data for the selected study area was organized.

Way Forward:

Work package-1 which involves literature review, data identification, sources and acquisition, profiling of possible study areas, discussion of theory, methodology and work process is still being worked on. Newspaper reports on floods in the Greater Accra region since 1990 are being compiled. Meteorological data with emphasis on daily rainfall would be acquired from Ghana Meteorological Agency.

2.13 Evaluation of the impact of reintroducing the CSIR newsletter to the Council and clients

Research Team: Sawyerr A., Zainudeen M.N., Decardi-Nelson A., Adotevi E.J.

Start Date: September 2018

Duration: 8 months

Location: CSIR Institutes and Donor Organisations in the Greater Accra Region

Introduction and Justification:

This, in collaboration with donor organizations, is meant to determine what accounted for the demise of CSIR newsletter and to conduct a needs

assessment of the newsletter's purpose to the information and education needs of CSIR's target audience.

Objectives:

The objectives of the project are to;

- Determine if the newsletter is a useful resource for your target audience (CSIR staff and clients).
- Determine whether the defunct newsletter increased reader knowledge of key issues and organisation practices.
- Quantify the acceptance rate of the newsletter among staff and client if it is reintroduced.
- Determine what readers did learn as a result of the newsletter.

Materials and Methods:

A questionnaire-based survey would be used to collect data. The population for the study comprised staff within CSIR and 5 selected donor agencies. The MS Excel and SPSS software would be used to analyze results.

Results:

Questionnaires have been developed and distribution to study population has begun. Circulation of grant proposals is still ongoing.

Way Forward:

Distribution of questionnaires both physically and digitally to collate the responses from the study population.

2.14 Assessing the likelihood of a scientific research to attract funding in Ghana

Research Team: Sawyerr A., Zainudeen M.N., Decardi-Nelson A., Adotevi E.J.

Start Date: September 2018

Duration: 12 months

Location: CSIR Institutes and Donor Organizations in the Greater Accra Region

Introduction and Justification:

This research in collaboration with donor organizations is meant to quantify the factors donors or sponsors look out for in funding scientific researches.

Objectives:

The objectives of the project are to;

- Investigate what funded researchers did right.
- Investigate what non-funded researchers did wrong.

Materials and Methods:

Questionnaires on the mode of their work and research history will be administered to the donors and researchers respectively. Analysis would be done with the SPSS and MS Excel software.

Results:

Questionnaires are being developed.

Way Forward:

Completion of questionnaires so they can be vetted by experts in the field.

2.15 Investigating the perception of research scientists and chief technologists on the Ghana Journal of Science and Ghana Journal of Agricultural Science

Research Team: Zainudeen M.N., Sawyerr A., Decardi-Nelson A., Adotevi E.J.

Start Date: July 2018

Duration: 12 months

Location: CSIR Institutes and Donor Organizations in the Greater Accra Region

Introduction and Justification:

The research was carried out to understand how research scientists and chief technologies view the GJS and GJAS.

Objectives:

The objectives of the project are to;

- Find out why the Ghana Journal of Science and Ghana Journal of Agricultural Science do not receive enough articles for publications when most of the scientists get their promotion based mainly on articles they publish.
- Identify factors which influence the perception of the scientist.
- Find out if charging authors per their articles to be published can shift scientist's perception of GJS and GJAS.

Materials and Methods:

The field work will include the researchers engaging scientists responding to questionnaires. Inventories will be developed as a measure of the perception to which the scientist will have to tick. The method is chosen because it is economical and fast for the purpose of data collection. The study is also delimited to scientists pursuing their PhD programmes or those who have completed.

Results:

Questionnaires have been developed.

Way Forward:

Questionnaires will be distributed to PhD holders and students as well as lecturers in University of Ghana and the CSIR institutes in Accra.

3.0 Programmes and Activities

3.1 Communications

This Division has the mandate to research and develop communication systems aimed at solving communication problems for community development. The objectives for the period were to:

- Carry out research into communication and uptake of research findings to end-users.
- Utilise and develop ICT tools and communication devices for socio-economic development.
- Provide sustainable training programs in the fields of ICT and consultancy services using appropriate technologies and expertise.
- Improve the weak institutional infrastructure of CSIR for information and communications technology.
- Publish research findings and articles in scientific journals.

3.1.1 Electronics and Communications Research Unit

The Communication Division developed a draft of the strategic plan for the Electronics and Communications Research Unit (ECRU) as well as a strategic document for the human and non-human resource development for the smooth take-off of the unit. An IT policy document was also designed for the Institute.

3.1.2 Websites

The Division served as a developer for the website of CSIR-INSTI and as a technical advisor for the website domain. It also developed the CSIR-SARI website in addition to offering website management training for CSIR-SARI staff in collaboration with the Electronics Division, provided technical contribution to the User Acceptance Testing (UAT) of CSIR-PGGRI website and

contributed to the provision of Technical support for all CSIR institutes in joining the NITA Govnet and E-work-space Platform.

3.2 Electronics

This Division has the mandate to research and develop the next generation computing and electronic solutions and tools for the social-economic development of local communities and Small to Medium Scale Enterprises. The objectives for the period were to:

- Adopt, adapt and master known and existing technologies by conducting research into the areas of Intelligent Transport Systems (ITS), SMART agriculture for sustainable eco-friendly applications and high-performance data networks and Cyber security.
- Computer-aided designs and Robotics.
- Predictive analytics and algorithm development.

3.2.1 Consultancy & Seminars

The Electronics Division played the lead role in the design and implementation of the CSIR-SARI website. It also served as the technical assessor for the UAT of the CSIR-PGGRI website. The Division was the main leader in the development of the Canovalator App for IITA. Technical assessment and recommendation of internet solution and VPN connectivity for CSIR-SARI was also provided.

The maiden edition of the Electronics and Communications seminar with Dr. Ashitey Trebi Ollennu from NASA was organised.

3.2.2 Robotics Training Programmes

The Electronic Division in collaboration with Microbot Academy and GRAF arranged a maiden one-week

robotics training programme for 12 female students of the Methodist Girls Senior High School (Fig 3.1 and Fig 3.2) The girls were from 12 to 18 years old with 92% of them being general science students and the remaining 8% offering general arts. The programme was held from 9th to 13th April 2018 at the conference room of CSIR-INSTI. The training introduced students to a hands-on, minds-on approach curriculum by engaging them in tasks using the versatile LEGO Mindstorm Robot designed to help students take ownership of the learning process, enabling them to actively develop their thinking, problem-solving skills and collaborative outlook necessary to become creators. The programme led to the award of the Microbot Academy's Megabot badge.



Fig 3.1



Fig 3.2

The second training programme in collaboration with MikroStem Academy took place from the 3rd to 10th of December 2018 for a different batch of 12 form-one students from the same academic institution and within the same age range. Students were awarded Megabot certificates.

3.2.3 Council Support

The Electronic Division supported the council by developing a training manual and coordinating the registration of all CSIR Research Scientists on Google Scholar,

draping the proposed CSIR-INTRANET connectivity through GovNet and coordinating and executing a consultancy agreement with FAO-COMDEV.

3.2.4 Meet the Press Series at Ministry of Information

The Ministry of Environment, Science, Technology and Innovation (MESTI) organised its turn of the Ministry of Information's (MOI) met the press series on 10th April 2018. The ECRU unit of INSTI exhibited a Lego Brand EV3 Robot navigating an autonomous path and 3D printer scan machine with few sample 3D product prints displays.

3.2.5 Participation of CSIR-WRI Open Day

In accordance with the 60th CSIR anniversary celebrations, the WRI held its open day on the 19th of June, 2018. INSTI was represented at the programme by the Electronics Division.

3.2.6 Participation of Africa Scientific Renaissance Day

The CSIR-CRI organized the 60th anniversary programme of Council on 29th June 2018 which coincided with the Africa Scientific Renaissance Day. The Communications and Electronics Divisions of INSTI jointly exhibited a Lego Brand EV3 Robot navigating an autonomous path and 3D printer scan machine with few sample 3D product prints displays. Participants who visited the stand were schooled on the diverse application areas of 3D printers and the importance of the self-navigated robot.

3.3 Fluid Science

The Fluid Science Division has the mandate to design and produce fuel cell for the production of Bio gas for energy generation, to introduce water in the Ghanaian fuel mix through the

use of fuel cell and an ability to design and conduct experiments on fluids, as well as to analyze and interpret data. The specific objectives of the Division were to:

- Utilise water which is readily available and cheaper relative to fossil fuel for energy generation.
- Produce fuel through the use of fuel cell for energy generation without adverse effect on the environment.
- Be equipped with the state of the art fluid testing equipment for accurate measurement of the properties of fluids.

The vision is to design and produce a fuel cell whose efficiency with respect to energy generation far outweighs that of other energy generating sources and to be counted as one of the most reliable fluid testing laboratories in the country.

3.4 Geospatial and Information Science

This Division consists of two sections; the Scientific Information Management Section and the Geographic and Information Systems Section.

3.4.1 Scientific Information Management Section

This Section provides library and documentation services for the CSIR and analogous institutions, learned and professional associations and societies, industrial sector, students and the general public under the collection development, cataloguing and classification and user services technical sub-sections.

The collection development sub-section is responsible for providing specific and general guidelines for the selection and acquisition of new materials through purchases, exchanges, soliciting or donation, legal deposit or through subscription and collaboration. It is also responsible for data collection to feed all the databases.

Table 1: Summary of statistics of materials received in 2018

Type of Material	Number of Copies Received	Percentage
Theses	38	4.2
Journals/ Magazines	50	5.5
Books	4	0.4
Newspapers: Daily Graphic	335	37.1
Ghanaian Times	335	37.1
Spectator	60	6.6
Mirror	60	6.6
Annual Reports	22	2.4
Total	904	100

Cataloguing and classification sub-section is responsible for the processing of the materials acquired for the section and making them ready for use by clients. This is done by physical description of the materials as well as content description.

The user services sub-section is in charge of the retrieval of information to satisfy the needs of clients. These services are provided through books, periodicals, abstracts, theses, newspapers and reference materials. Services are both digital and manual involving the use of card catalogues tool. A total of 1400 clients visited the library.

3.4.2 Geographic Information System Section

This Section has the mandate to collect data for the design and construction of Thematic Maps that depict contemporary geographic knowledge on Ghana at the national, regional and district levels. It is also to answer to the need of clients for special or customized maps and to use its existing capabilities to train individuals and institutions on techniques of spatial data documentations using Geographical Information Systems.

3.4.2.1 Updating road network in the country via-Google Earth.

13 and 7 MMDAs in the Brong Ahafo and Upper East Regions respectively had their road networks completed. That for the 27 MMDAs in the Brong Ahafo Region is hence complete while the Upper East Region has 4 outstanding. KML files have been saved according to MMDA name and would be converted into shapefiles so they can be used in ArcMap to update the road network.

3.4.2.2 Database and map development.

The GISD created a spatial database for the distribution of forest types in Ghana and produced a map showing the distribution of forest types in the country as observed in 1981 and 1985.

3.5 Printing and Publishing

The Printing and Publishing Division is mandated to publish Ghana Journal of Agricultural Science and Ghana Journal of Science as well as other S & T literature emanating from the national and international scientific community. For the year under review, the Division undertook the following activities:

3.5.1 Printing Section

This Section provides printing and reprographic services for the production of scientific, technical literature and other printing services and products to support the socio-economic development of the country.

The section executed 15 jobs which included CSIR-Institutes Annual Reports, banners, annual diaries and calendars, letterheads, etc.

Table 2: List of projects implemented by printing division

No	Organization	Description of Job
1	CSIR – FRI	2016 Annual Report
2	CSIR – Head Office	2018 Annual Diaries and Calendars
3	CSIR – Head Office	Letterheads and envelopes
4	CSIR – SARI	2016 Annual Report
5	CSIR – SARI	2017 Annual Report
6	CSIR – Head Office	60 th Anniversary Logo
7	CSIR – ARI	Flag
8	CSIR – Head Office	60 th Anniversary Banners
9	CSIR – INSTI	INSTI Open Day Banners, pull-up banners, flyers, brochures.
10	CSIR – INSTI	Flag
11	CSIR – CC	Call Card
12	CSIR – DG	Call Card
13	CSIR – WRI	Annual Report
14	CSIR – Head Office	Fundraising & Dinner; Programme and card
15	CSIR – Head Office	2019 Annual Diaries and Calendars

3.5.2 Science Publishing Section

This Section is mandated to publish the flagship journals, GJAS and GJS Science and Technology literature emanating from the national and international scientific community. The journals have performed creditably well both locally and internationally as outlets for scientists to disseminate their research findings and invariably assisted in their promotions. GJS and GJAS are Open Access Journals, distributed under the terms of the Creative Commons (CC) License [CC BY 4.0].

3.5.2.1 Ghana Journal of Agricultural Science

The Ghana Journal of Agricultural Science published two issues under the year of review, Vol. 52 (2018) [*Ghana Jnl agric. Sci.* 52 (2018)], comprising of 15 articles and Vol. 53 (2018) [*Ghana Jnl agric. Sci.* 53 (2018)], comprising of 6 articles. These articles are openly accessible online on the AJOL indexing site.

3.5.2.2 Ghana Journal of Science

The Ghana Journal of Science, also, published two issues under the year of review, Vol. 58 (2018) [*Ghana Jnl. Sci.* 58 (2018)], comprising of 7 articles and Vol. 59 (2018) [*Ghana Jnl. Sci.* 59 (2018)], comprising of 8 articles. These articles are openly accessible online on the AJOL indexing site.

3.6 CSIR-INSTI Open Day – CSIR 60 Years of Research with Impact for Sustainable Development

As part of the Council's 60th Anniversary Celebrations, the Institute held its open day chaired by the Council Chairman, Prof. Robert Kingsford Adaboh on Thursday the 20th of September 2018 at its conference room. The sub-theme for the programme was “*Leveraging on Information Technology for Effective Scientific Research*”. A presentation was made on “An Overview of CSIR-INSTI and the Future Outlook” by Ing. Michael Wilson after the open address by the Acting Director, Mrs. Lucy Payne Dzandu. Prof. Robert Kingsford Adaboh as well as Dr. Paul Effah, the Chairman for the CSIR-INSTI Management Board gave speeches during the occasion. There were about 100 people in attendance made up of the former Director of the Institute, Mr. Clement Entsua-Mensah, and the immediate past Director of the Institute, Dr. Joel Sam, INSTI Board Members, representatives of sister CSIR Institutes and the press. Media houses present included; Ghana Broadcasting Corporation, Ghanaian Times and Ghana News Agency.

Visitors were sent on a tour of the Institute’s facilities led by Dr. Paul Danquah. Various exhibitions made by the divisions of the institute showing the rich diversity of research and activities on-going included:

- LiFi Testbed Project - Communication Division
- Newly Developed INSTI Website - Communication Division
- Ghana Portals and Carnovalator - Communication and Electronics Divisions
- HPC Concept - Communication and Electronics Divisions
- Online Research Scientists Directory- Communication and Electronics Divisions
- Poultry Incubator Project - Electronics Division
- Robotics - Electronics Division
- 3D Printing - Electronics Division
- Climate Change Resilience Project - Geospatial Information Service Division
- Printing Division Exhibits - Printing and Publishing Division

4.0 Administration and Financial Issues

4.1 Administration

The Administration Division provided administrative support services and created the enabling environment for staff of the institute to perform efficiently and effectively. The Division ensured the implementations of directives, policies, rules and regulations of the Council.

4.1.1 Management of INSTI

A seven-member Management Board with Dr. Paul Effah as the Chairman and a twelve-member Internal Management Committee with Dr. Joel Sam as Chairman managed the Institute for the period.

4.1.2 Staff Strength

The staff strength of the Institute stood at 65. This is made up of 18 Core and 2 Non-core Senior Members totaling 20, 25 Senior Staff and 20 Junior Staff. The staff strength and gender distribution are shown below. The list of staff is shown in Appendix III.

Table 3: Staff Strength: Gender Distribution

Gender	Senior Members	Senior Staff	Junior Staff	Total
Males	16	15	16	47
Females	4	10	4	18
Total	20	25	20	65

4.1.3 Staff Transfer

During the reporting year, Ms. Faizatu Yakubu, a Principal Auditing Assistant was transferred from CSIR Head office to CSIR-INSTI.

4.1.4 Study Leave Issues

As part of the Institute's policy on training, the following members of staff were granted study leave to continue their education at various Institutions.

Table 4: Staff on fulltime/ partial study leave with pay.

№	Name	Institution	Programme	Duration	Date of Start/ Expected Completion	Remarks
1	M.A. Mahamadu	SouthWest Jiatong University, China	PhD Communication Engineering	2years full-time study leave with pay	Sep 2012 – Aug 2014	Extended to 2018
2	F.T. Kabutey	Harbin Institute of Technology, China	PhD Environmental Science and Engineering	3years full-time study leave with pay	Sep 2015 – July 2018	
3	E. Opoku	Central University College	Master of Business Administration	2years partial study leave with pay	Sep 2017 – Sep 2019	
4	Atta. Ampofo-Addo	Ghana Institute of Management in Public Administration	MSc Information Management Systems	2years partial study leave with pay	Aug 2016 – Aug 2018	
5	D. Kumiwa	University of Cape Coast Tema Campus	Diploma in Business Studies	3years partial study leave with pay	Aug 2015 – July 2018	
6	Y.D. Azuma	University of Ghana	Diploma in Public Administration	2years partial study leave with pay	Sep 2017 – Sep 2019	

4.1.5 Junior and Senior Staff and Senior Members Promotions

The promotion of the following officers took effect from the 1st of January 2018.

Table 5: List of Staff Promotions

№	Name	Division	Previous Grade	Promotion Grade
1	Lucy Payne Dzandu	Geospatial and Information Science	Senior Librarian	Principal Librarian
2	Grace Obeng-Koranteng	Geospatial and Information Science	Librarian	Senior Librarian
3	Benjamin Folitse	Geospatial and Information Science	Librarian	Senior Librarian
4	Linda Agbefi	Accounts	Principal Audit Assistant	Chief Auditing Assistant
5	Esther Opoku	Geospatial and Information Science	Principal Library Assistant	Chief Library Assistant
6	Atta Ampofo Addo (Snr)	Geospatial and Information Science	Principal Library Assistant	Chief Library Assistant
7	Risikatu Lawal	Accounts	Senior Accounting Assistant	Principal Accounting Assistant
8	Robert Abomoi	Administration	Security Officer	Senior Security Officer
9	Salamatu Abdul Mumuni	Administration	Clerk Grade I	Senior Clerk
10	Yvonne D. Azuma	Administration	Clerk Grade I	Senior Clerk
11	Simon Angabe	Administration	Security Assistant Grade I	Senior Security Assistant
12	Nathan Aborgeh	Administration	Security Assistant Grade I	Senior Security Assistant

4.1.6 Resignation

Belinda Bella Nkansah, Principal Administrative Assistant resigned from the service of the Council with effect from 20th July 2018.

4.1.7 Retirement

- Dr. Joel Sam, the Director of the Institute retired from the service during the period under review. He served the Council for 28 years. Dr. Joel Sam started his employment career with the Council as Assistant Librarian and rose to the position of Director of CSIR-INSTI before his retirement on 16th June 2018.
- Mr. Simon Osei who served the Council for 23 years, rose from Assistant Librarian to Senior Librarian and retired on 26th July 2018.
- Mr. Alex Mireku-Bamfo retired on 22nd August 2018 after 26 years of service rising from Labourer to Works Superintendent.
- Ms. Linda Agbefe, Chief Auditing Assistant retired from the Council on October 2018 after serving for 38 years, she began as an Audit Clerk Grade III.

4.1.8 Interim Director

With the retirement of Dr. Joel Sam, Mrs. Lucy Payne Dzandu was appointed as the Acting Director of the Institute. She acted until a substantive Director was appointed.

4.1.9 New Employment

The Institute had a new Director in the person of Dr. Seth Awuku Manteaw effective 1st December 2018. The following officers were also employed to fill the various vacant positions as a result of retirements and resignations in the Institute.

Table 6: Newly employed staff for 2018

№	Name	Grade	Division
1	Agnes Decardi-Nelson (Dr)	Research Scientist	Printing and Publishing
2	Paul Asante Danquah (Dr)	Research Scientist	Communications
3	Akilakpa Sawyerr	Chief Technologist	Printing and Publishing
4	Mohammed Zainudeen	Chief Technologist	Fluid Science

4.1.10 National Service Persons

The following National Service personnel which arrived in two batches, January and September, had the opportunity to do their national service at the Institute. They were assigned to the various divisions of the Institute as depicted in the table below.

Table 7: National service personnel

№	Name	Institution	Division Attached To
1	Amanda Assan	University of Professional Studies	Accounts
2	Hannah Boakye	University of Cape Coast	Accounts
3	Graham Juliana	Wisconsin International Uni. Coll.	Administration
4	Edward Acheampong	University of Professional Studies	Administration
5	Michael Nartey	Accra Technical University	Electronics & Comm.
6	Albert Bakpa	Accra Technical University	Electronics & Comm.
7	Moro Nasir	Ghana Technology University Coll.	Electronics & Comm.

8	Joseph Nsowah	Takoradi Technical University	Estate
9	Robert Fiati	KNUST	Information Technology
10	Ediimata Zabiesu	KNUST	Information Technology
11	Nura Salga	All Nations University College	Information Technology
12	Emmanuel Asiedu	Ghana Technology University Coll.	Information Technology
13	Philomena Amevuvor	Ghana Technology University Coll.	Information Technology
14	Emmanuel Enin-Adjei	KNUST	Science Publishing
15	Priscilla Lekey	University of Ghana	Science Publishing
16	Khadija Aliyu	Accra Technical University	Administration
17	Gabriel Mensah	University of Education	Commercialization and Info.
18	Jonathan Aidoo-Facosh	Accra Technical University	Commercialization and Info.
19	Michael Nadutey	University of Ghana	Commercialization and Info.
20	Stephen Darko	GIMPA	Commercialization and Info.
21	Andrew Somuah-Asamoah	University of Ghana	Commercialization and Info.
22	Angela Opoku	Methodist University College	SIMS
23	Kabuki Aidoo	Wisconsin Int. University	Administration
24	Vivian Annor Pobee	Cambridge University College	Administration
25	Irvyne Jojo Blisset	BlueCrest College	Communication
26	Nathaniel Nartey	Accra Technical University	Communication

27	Yaw D. Mandla	KNUST	Electronics
28	Prince Kissi Owusu	KNUST	Electronics
29	Godwin K.I. Fordjor	Accra Technical University	Electronics
30	Benjamin Dadzie	Cape Coast Tech. University	Electronics
31	Stephen Boakye Frimpong	Kumasi Technical University	Fluid Science
32	Nadia Yaa A. Lartey	Accra Technical University	Printing & Publishing
33	Harry Tettey Tetteh	University of Education	Printing & Publishing
34	Thomas Koomson	Takoradi Technical University	Printing & Publishing
35	Benjamin Ackumey	Takoradi Technical University	Printing & Publishing
36	Prince Holyfa	University of Ghana	SIMS
37	Munir A. Sudais	University of Cape Coast	SIMS

4.1.11 Obituary

Mr. Daniel Darke, Chief Accounting Assistant passed on, on 13th March 2018 at the Korle-Bu Teaching Hospital. He was laid to rest at Peki Blengo, Volta Region on 29th April 2018. Mr. Stephen Ayim, Foreman of the Printing Division passed on, on 5th June 2018 at. He was laid to rest at Akim Akropong near Kwabeng on 23rd June 2018.

4.2 Accounts Division

The objectives of the Division among other things were to:

- Capture financial transactions and prepare timely, accurate and transparent financial reports

- Ensure payroll duties are fulfilled
- Ensure adequate internal control procedures are put in place to safeguard the assets of the Institute
- Actively assist, support and guide management in making sound management decisions
- Take active role in setting the annual budget, monitor the budget and do variance analysis.

The table below shows the summary and 2018 budget.

Financial Statement for 2018

Total receipts from Internally Generated Fund activities including Printing, Hiring of facilities and Production of Maps for the year amounted to GH¢223,949.65 and payment of GH¢177,094.02 with net receipts of GH¢46,855.63.

Total receipts for Donor and Collaborative Projects, including INASP amounted to GH¢52,712.50 and a total payment of GH¢36,409.17 leaving a net receipt of GH¢16,303.33.

The total IGF and Donor Projects receipts, therefore, amounted to GH¢276,662.15 and the total net receipts amounted to GH¢63,158.96. Total CIGF payments to the CSIR Head Office totaled GH¢8,215.27. This includes 15% administrative charges on the INASP Project.

The Institute projected to earn GH¢108,153.89 for the year 2018. There was a shortfall of GH¢44,994.93. This was mainly due to shortfall in the revenue from the press, production of maps and low level of corroborative projects in the Institute.

GOG subvention for Personnel Emoluments (PE) amounted to GH¢3,305,744.66. However, no GOG subvention was received for Goods and Services.

Table 8: INSTI Statement of Revenue and Expenditure for the year ended December 31, 2018

REVENUE	BUDGET	ACTUAL CURRENT	ACTUAL 2017
	GH¢	GH¢	GH¢
GOG Subvention	4,304,155.00	3,305,744.66	2,945,223.52
Internally Generated Fund	244,140.13	244,140.13	293,670.38
Donor	202,291.58	202,291.58	38,417.16
Other Revenue	-	-	-
TOTAL REVENUE	4,750,586.71	3,752,176.37	3,277,311.06
EXPENDITURE			
Compensation of Employees	4,304,155.00	3,356,972.78	2,945,223.52
Goods & Services	338,440.00	311,564.43	242,970.76
Consumption of Fixed Assets		2,639.72	9,434.10
Other Expenses			95,620.64
TOTAL EXPENDITURE	4,642,595.00	3,671,176.93	3,293,249.02
SURPLUS/(DEFICIT)	107,991.71	80,999.44	(15,937.96)

Table 9: Balance sheet as of December 31, 2018

ASSETS	2018	2017
CURRENT ASSETS		
Cash & Cash Equivalents	90,593.67	26,620.00
Receivables	56,297.52	51,986.94
Inventories	83,894.38	34,990.27
TOTAL	230,785.57	113,597.21
NON-CURRENT ASSETS		
Investments	-	-
Property, Plant & Equipment	35,052.76	23,683.26
Work-In-Progress		
NON-CURRENT ASSETS	265,838.33	137,280.47
LIABILITIES		
CURRENT LIABILITIES		
Accounts Payable	183,488.98	135,930.56
TOTAL	183,488.98	135,930.56
NON CURRENT LIABILITIES		
TOTAL LIABILITIES	183488.98	135930.56
NET ASSETS/ (LIABILITIES)	82,349.35	1349.91

FINANCED BY:		
Accumulated Fund b/f	1,349.91	17287.89
Surplus/(Deficit) for the year	80,999.44	-15937.96
NET WORTH	82,349.35	1349.93

APPENDIX I Publications

Refereed Journal Papers

Bekoe, S., Atiso, K., Ayoung, D. A., Dzandu, L. & Kumangkem, K. K. (2018) “Examining Internet Usage Patterns on Socio-Economic Benefits of Marginalised Communities: The Case of Community Information Centres in Ghana” *Library Philosophy and Practice* (e-journal) 1-26 (<http://digitalcommons.unl.edu/libphilprac/1870>)

Folitse, B. Y., Manteaw, S. A., Dzandu, P. L., Obeng-Koranteng, G. & Bekoe, S. (2018) The determinants of mobile-phone usage among small scale poultry farmers in Ghana. *Information Development* 1-11. DOI:10.1177/0266666918772005

Boadu, P., Aidoo, R., Ohene-Yankyera, K., Kleih, U., Abdoulaye, T., Mayora, N., Orchard, J. & Bekoe, S. (2018) Farmers’ perception about quality of planted seed yam on their preferences for certified seed yam in Ghana. *International Journal of Food and Agricultural Economics*. 6(3) PP. 71—83

Osei-Kofi, P. S., Aboagye, L. M. Bekoe, S. Dzandu, L. (2018). Investigating major subject research areas of Council for Scientific and Industrial Research Journals in Ghana. *Ghana Journal of Agricultural Science* Vol. 52, pp. 77-82

Danquah, P., Gordon, V. & Peh B. (2018), A simulated comparison of performance beyond inherent metrics for Open Shortest Path First (OSPF) and Exterior Gateway Routing Protocol (EIGRP), *Digital Innovations and Contemporary Research in Science, Engineering and Technology*, Vol 6 No. 4, pp.35 -48

Danquah, P., Lartey J. D. & Kani J.A (2018), Beyond Inherent Routing Metrics: A Simulated Comparison of Routing Information Protocol (RIP) and Enhanced Interior Gateway Routing Protocols (EIGRP), *Advances*

in Multidisciplinary & Scientific (AIMS) Research Journal, Vol 4 No. 2, pp. 35-46

Fold, N., **Allotey, A.N.M.**, Kalvig, P. & Moeller-Jensen, L. (2017) Grounding Institutions Through Informal Practice: Credibility in Artisanal Mining of Aggregates, Ghana. *Land Use Policy*, (May), 0-1, <https://doi.org/10.1016/j.landusepol.2017.06.022>

Kavi, R.K., Bugyei, K.A., **Obeng-Koranteng, G.**, **Folitse, B.Y.** (2018) Assessing Sources of Information for Urban Mushroom Growers in Accra, Ghana. *Journal of Agricultural and Food Information* 19(2), pp. 176-191

Folitse, B.Y., **Sam, J.**, **Dzandue, L.**, **Osei, S.K.** (2018) Poultry Farmers' Information Needs and Sources in Selected Rural Communities in the Greater Accra Region, Ghana. *International Information and Library Review* 50(1), pp. 1-12

Technical Report

Allotey, A.N.M. (2018): Identification and mapping of Onchocerciasis vulnerable areas in Asunafo North Municipality and Dormaa West District in the Brong-Ahafo Region of Ghana.

Flyers

Bekoe, S. & Osei-Kofi, P.S. (2018). Strategies for User's Searches in Digital Environments
(CSIR-INSTITI/GISD/SB/2018/01)

APPENDIX II

Training Workshop/ Conference/ Seminar

Allotey, A.N.M. attended and facilitated these workshops;

- A two-week planning meeting for Project Inception Workshop from 11th March to 25th March 2018, Accra.
- A training workshop on Technical Report Writing on 9th May 2018 at CSIR-INSTITI, Accra.
- An inception workshop on Future Dams on 12th June 2018 at CSIR-STEPRI, Accra.
- Undertook a 2-day reconnaissance survey in Greater Accra and parts of Eastern Region on 26th and 28th June.
- Organized a day's inception workshop on Climate Change Resilience in Urban Mobility on 27th June 2018 at Alisa Swiss Spirit Hotel, North Ridge, Accra.
- A meeting of members of UNESCO MAN and the Biosphere (MAB) National Editorial Board Sub-committee on 31st July 2018 on behalf of DDG, CSIR at Environmental Protection Agency (EPA), Millennium Room, Accra.
- A CLIMACCESS project meeting with collaborators from 18th to 27th August 2018 at Copenhagen, Denmark.
- A UNESCO MAN and the Biosphere (MAB) National Editorial Board Sub-committee on 29th August 2018 at Environmental Protection Agency (EPA), Millennium Room, Accra.
- A National Conference on Environmental Management and Livelihoods Nexus: Towards the Attainment of Sustainable

Development Goals from 5th to 7th September 2018 at the Presbyterian University College, Akropong-Akuapem.

- Organized a 4-day CSIR-RSA Scientific Conference (Maiden Edition) on Catalyzing Economic Development Through Scientific Innovations from 16th to 19th October 2018 at GNAT village, Ejisu-Abankro.

Barimah Y.T, A.N.M. participated in a 5-day HPC training programme from 28th May to 1st June 2018 at the Ghana Space Science and Technology Institute (GSSTI) of the Ghana Atomic Energy Commission (GAEC)

Bekoe S. attended these workshops;

- A day's Elsevier Research Intelligence workshop on Scopus; A Global perspective on Research on 9th August 2018 at CSIR-IN-
STI.
- A day's validation workshop on Agricultural Innovation Sys-
tem Policy Practice Index (AIS-PPI) on 18th September 2018 at
CSIR-STEPRI.
- A 3-day workshop on Writing a Research Paper for Publication
from 9th to 11th October 2018 at CSIR-IN-
STI.
- A 4-day CSIR-RSA Scientific Conference (Maiden Edition) on
Catalyzing Economic Development Through Scientific Inno-
vations from 16th to 19th October 2018 at GNAT village, Eji-
su-Abankro.
- A day's TEEAL/ AGRICNOWLEDGE/ RESEARCH4LIFE Na-
tional Training Workshop for Ghana on Improving Agricultural
Research Through Access to Library e-resources in Ghana on
13th November 2018 at Balm Library, University of Ghana.

Dzandu L.P. attended these workshops;

- A day's inception workshop on Climate Change Resilience in Urban Mobility on 27th June 2018 at Alisa Swiss Spirit Hotel, North Ridge Accra.
- A one-week workshop on ICT Knowledge Sharing Programme from 7th to 13th July 2018 in Daejeon, South Korea.
- A 3-day workshop on Writing a Research Paper for Publication from 9th to 11th October 2018 at CSIR-INSTI.
- Organized a 4-day CSIR-RSA Scientific Conference (Maiden Edition) on Catalyzing Economic Development Through Scientific Innovations from 16th to 19th October 2018 at GNAT village, Ejisu-Abankro.

Wilson M. attended these workshops;

- Presented on the Availability of Data Holdings for Effective Compliance Monitoring at the 2018 European Union's Accountability, Rule of Law and Anti-Corruption Conference on 25th & 26th January 2018 at Koforidua.
- A 10-week workshop on ICT Knowledge Sharing Programme from 8th May to 13th July 2018 in Daejeon, South Korea.

APPENDIX III

List of Staff as at 31st December 2018

SENIOR MEMBERS

№	NAME	PRESENT DESIGNATION	QUALIFICATION
1	Mrs. Lucy Payne Dzandu	Acting Director (June-Nov 2018) Deputy Director/ Principal Librarian	MPhil (Library Studies); M.A. (Library Studies); PGDip (Education); BA (Hons) Sociology & Political Science
2	Mr. Joseph A. Anyen	Senior Accountant	MBA (Finance); I.C.A.; BSc. (Admin) Accounting Option
3	Dr. Albert N. M. Allotey	Senior Research Scientist	PhD (Geography & Resource Development); MPhil (Geography & Resource Development) BA (Hons) Geography & Resource Dev't
4	Mr. Joshua Addae-Boateng	Senior Public Relations Officer	M.A. (Adult Education); BA (Hons) Psychology/Religion
5	Mr. Benjamin Yao Folitse	Senior Librarian	MPhil (Agricultural Extension); M.A. (Library Studies); B.Ed. (Agric); Dip (Agric Ed.)
6	Mrs. Grace Obeng-Koranteng	Senior Librarian	M.A. (Library Studies); BA (Hons) Information Studies with History; Dip (Librarianship)
7	Mrs. Dorothy Awanyo	Administrative Officer	MBA (Admin.); BA (Public Admin.); Dip. (Librarianship)
8	Dr. Paul Asante Danquah	Research Scientist	PhD (Info. Technology); MSc. (Info. Security); BSc.(Hons) Computing
9	Dr. Agnes Decardi-Nelson	Research Scientist	PhD (African Art & Culture); BFA(Graphic Design)

10	Dr. Stephen Bekoe	Scientific Information Officer	PhD (Informatics); MSc. (Information Studies); BA (Hons) Publishing Studies
11	Mr. Mahamuda A. Mahamadu	Scientific Information Officer	M.Sc. (Electrical Engineering); BSc.(Hons) Computer Science / Statistics)
12	Mr. Felix Tetteh Kabutey	Scientific Information Officer	MPhil (Botany); BSc.(Applied Biology with Environmental Sci.); Teacher's cert "A"; SSSCE; B.E.C.E.
13	Mr. Yaw Twum Barimah	Chief Technologist	MSc. (Telecom); BSc. Elec. & Computer Engineering
14	Mr. Victor D. Gordon	Chief Technologist	MSc. (Telecom & Internet Telecom.)
15	Mr. Michael Wilson	Chief Technologist	MPhil. (Computer Engineering); PostGrad. (Wireless & Mobile Computing); CDAC; BSc. Computer Eng.
16	Mr. Mohammed N. Zainudeen	Chief Technologist	MSc. (Chemical Eng.); BSc.(Hons) Chemical Eng.
17	Mr. Akilakpa Sawyerr	Chief Technologist	MPhil (Radiation Protection); BSc.(Physics)
18	Mr. Christian K. Lettu	Chief Technologist	MPhil (Dev. Geography); BA (Hons) Geography & Resource Development
19	Mr. Jeffrey Yeboah	Principal Technologist	M.A. (Comm. Studies); BA (Info. Studies Archaeology)
20	Mr. Peh Benjamin Yaw	Principal Technologist	MSc. (MIS); BSc. (Computer Eng.)

SENIOR STAFF

№	NAME	PRESENT DESIG- NATION	QUALIFICATION
1	Mr. Edwin Adotevi	Senior Technologist	BA (Comm. Studies)
2	Mrs. Janet Otoo-Abedi	Chief Accounting Assistant	Diploma (Public Finance and Account- tancy)
3	Ms. Bernice Acorlor	Chief Administrative Assistant	HND (Secretariaship & Mgt)
4	Ms. Cordellia Akua Busumtwi	Chief Administrative Assistant	Cert. (Private Secretary)
5	Mrs. Linda Agbefi	Chief Auditing Assistant	BSc. (Commerce)
6	Mrs. Margaret Ivy Koranteng	Chief Library Assistant	Diploma (Librarian- ship)
7	Ms. Doreen Appiah	Chief Library Assistant	BA (Info. Studies with Political Sci.); HND (Info. Systems)
8	Miss. Esther Opoku	Chief Library Assistant	BA (Information Studies and Sociolo- gy); Diploma (Librari- anship)
9	Mr. Atta Ampofo Addo Snr.	Chief Library Assis- tant	CIM (Level 1); BA (Info. Studies & Sociology)
10	Rev. Dennis N.D. Dodoo	Chief Purchasing Assistant	HND (Purchasing)
11	Mr. Emmanuel E. Davidson	Chief Technical Officer	Cert. Basic Cartography
12	Ms. Sarah Mensah	Principal Accounting Assistant	Dip. (Public Finance and Accountancy)
13	Ms. Risikatu Lawal	Principal Accounting Assistant	BSc. (Accounting); DBS (Accounting); CIPS Cert. (Purch.&- Supply)

14	Ms. Faizatu Yakubu	Principal Auditing Assistant	ICA (Gh) Part III (Commerce)
15	Mr. Alex K. I. Ocansey	Principal Technical Officer	Cert. (ITS) Snr.Sup/Mgt; N.V.T.I. Grade I Cert.
16	Mr. William K. Akpakli	Principal Security Officer	BA (Social Work with Psychology); SSSCE; B.E.C.E.
17	Mr. James W.K. Sam	Senior Accounting Assistant	H.N.D. (Marketing); D.B.S. (Accounting)
18	Mr. Samuel Ankrah	Senior Accounting Assistant	Bachelor of Commerce; HND (Accountancy); SSSCE; B.E.C.E.
19	Mr. Eric Sam	Senior Technical Officer	HND (Graphic Designing)
20	Mr. Robert Abomoi	Senior Security Officer	Security Trg. Module 3; M.S.L.C.
21	Mr. Roland A. Pappoe	Technical Officer	Cert (Linux Network Admin.); City & Guilds Grad. Dip.(Microtech) I & II
22	Mr. Eric K. Acquaye	Technical Officer	Advanced Certificate in Microsoft Certified Systems Eng. (GIM-PA); SSSCE
23	Mr. Cephas Awusie	Security Officer	Security Training Module I; G .C. E. 'O' Level
24	Mr. Abdul Rahaman Iddrisu	Security Officer	Security Training Module I; M.S.L.C.
25	Mr. Timothy Kwamena	Assistant Transport Officer	Cert. (Trans Mgt); Intercity STC Coaches Ltd.; M.S.L.C.

JUNIOR STAFF

№	NAME	PRESENT DESIGNATION	QUALIFICATION
1	Mrs. Salamatul Abdul Mumuni	Senior Clerk	NACVET Cert. (STENOGRAPHER)
2	Ms. Yvonne D. Azuma	Senior Clerk	SSSCE
3	Ms. Doris Kumiwa	Senior Clerk	DBS (Secretariaship); Nat. Banking Coll. (Cert Cashier & Front-line Exec); SSSCE; B.E.C.E.
4	Ms. Lucy Akyempon	Senior Clerk	“O” level, DBS
5	Mr. Simon Angabe	Senior Security Assistant	Security Training Module I; M.S.L.C.
6	Mr. Nathan K. Aborgeh	Senior Security Assistant	Security Training Module I; M.S.L.C.
7	Mr. Fuseini Inusah	Senior Security Assistant	SSSCE
8	Mr. Charles Kulley	Junior Library Assistant	SSSCE
9	Mr. Bantie Habila Hussein	Junior Library Assistant	SSSCE
10	Mr. Enos Awusie	Traffic Supervisor	Intercity STC (Def. Driving Course); MSLC
11	Mr. Joseph Lamptey	Traffic Supervisor	Intercity STC (Def. Driving Course); B.E.C.E.
12	Mr. Seth Asare	Artisan	Special Junior Tech. Super. Mgt Course, ITS- Accra; MSLC
13	Mr. Jonathan Sotie	Driver Grade I	NVTI (Motor Vehicle Mechanic I); B.E.C.E.
14	Mr. Mathew Narteh Amoatey	Driver Grade I	City & Guild (Mech. Eng. Craft Practice); B.E.C.E.; Driv. Lic “C”

15	Mr. Razak Ayidana Akambase	Supervisor Grade I	B.E.C.E.
16	Mr. Kojo Asanaab	Supervisor Grade I	B.E.C.E.
17	Mr. Isaac G. Ampon- sah	Supervisor Grade I	NVTI GD II
18	Mr. Robert Achandi	Supervisor Grade II	M.S.L.C.
19	Mr. Francis Ayarik	Supervisor Grade II	Nil
20	Mr. Abdul Wahab Usman	Senior Headman	Nil