Council for Scientific & Industrial Research

Food Research Institute

2007 Annual Report

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Council for Scientific and Industrial Research

Food Research Institute

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The Food Research Institute (FRI) of the Council for Scientific and Industrial Research (CSIR) is an internationally recognized centre of expertise in research into problems of food processing and preservation, storage, marketing, distribution and utilization, in support of the food industry and also to advise the Government of Ghana on its food policy.

This publication is an output of the FRI. The views expressed are solely that of the Institute.

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EXECUTIVE SUMMARY

The CSIR-Food Research Institute (FRI) is one of the thirteen affiliate institutes of the Council for Scientific and Industrial Research (CSIR). The mission of corporate CSIR is to generate and apply innovative technologies, which efficiently and effectively exploit S&T for socio-economic development in critical areas of agriculture, industry, health and the environment and improve scientific culture of the civil society.

The Food Research Institute's vision is to be recognized, nationally and internationally, as an S&T Institution that is playing a key role in the transformation of the food processing industry to be internationally competitive with particular reference to product safety, quality and preservation. Food Research Institute's mission is primarily to conduct market oriented collaborative applied research and provide technical services to enact products profitably to the private sector and other stakeholders. The overall goal of the Institute is to assist in poverty alleviation through the creation of opportunities for generating and increasing incomes within the micro, small, medium and large-scale food industry, contribute to food security, foreign exchange earnings and the application of cost-effective food processing technologies that are environmentally friendly.

Food Research Institute presently operates under seven divisions: Food Chemistry, Food Microbiology, Food Processing & Engineering, Nutrition & Socio-economics, Commercialization & Information, Administration and Accounts.

In line with its objectives, CSIR-FRI Microbiology and Chemistry Divisions continued with their task of providing analytical support to both research and industry. The Food Processing & Engineering Division continued with its functions of conducting collaborative applied research into the processing, preservation, packaging and storage of food as well as the development of new products from available raw materials. The Pilot Plant Unit of the division conducted pilot scale studies into products developed by CSIR-FRI. The Commercial and Information Division coordinates the commercial activities of all the other divisions of the Institute in order to raise the income of the Institute. The Commercialization process of the Institute continued and the following areas were the major sources of income:

- Consultancies
- Collaborative applied Research
- Equipment fabrication & Hire of Facilities
- Sale of Research By-Products
- Technical and Analytical Services
- Training

The total receipts for the year amounted to GH¢1,204,242 of which 81.8% represents government subvention for personnel emolument and administrative expenditure, 1.6% represents subvention for service activities (Research), 14% represents internally generated funds, and 2.6% represents donor assisted fund. The total expenditure for the year was ¢1,558,111. 84% of this amount was spent on personnel emolument and administrative expenses, 2% on Research activities, 9% on internally generated activities and 5% on donor projects.

The South Africa National Accreditation Service (SANAS), the accreditation body of South Africa, in May 2007 finally accredited fifteen microbiological and chemical laboratory tests of the Microbiology and Chemistry Division of the Institute. The laboratory tests were accredited to ISO/IEC 17025; a process that was started in August 2001. This was one of the major achievements of the Institute for the year under review, since it was the only accredited food testing laboratory in the West Africa sub-region.

The year under review also saw CSIR-FRI vigorously pursuing its mandate, the main programmes of the Institute during the year were centered on collaborative adaptive market oriented Research and Development (R&D) activities for the solution of post harvest and socio-economic problems of food quality and safety in the country, in this endeavor the private sector Agro-processing industrial development was a major component to boost the economy of Ghana.

Members of FRI Management Board

1. **Prof. A. Ayensu** - Chairman
   Dep. Director-General, INSS/CSIR

2. **Dr. W. A. Plahar** - Member
   Director, Food Research Institute (FRI)

3. **Dr. E. B. Hagan** - Member
   Director, Institute for Industrial Research (IIR)

4. **Prof. Anna Lartey** - Member
   Head, Dept. of Nutrition & Food Science, Legon

5. **Mrs. Juliana Kwakyewa Dennis** - Member
   Director, WIAD, MoFA

6. **Mr. Timothy Osei** - Member
   Oduro, Adiya, Osei & Co. SEDCO House

7. **Mr. Adu Gyamfi Darkwa** - Member
   Executive Director, Ghana Standards Board

8. **Mr. Kofi Asiamah-Asiedu** - Member
   CEO, Can & Kaa Ltd

9. **Dr. Josephine Nketsiah-Tabiri** - Member
   Head, Dept. of Fd. Sci. & Radiation Processing
   BNARI-GAEC, Kwabenya, Accra

10. **Mr. Charles Gunu** - Member
    Production Manager, Fish Cannery
    GAFCO, Tema

11. **Mr. Charles Debrah-Asante** - Member
    Production Manager, Cocoa Processing Company

12. **Mrs. Agnes Osei-Yaw** - In Attendance
    Deputy-Director, Food Research Institute (FRI)

13. **Robert M. Yawson** - Secretary
    Ag. Head of Administration, FRI

Principal Officers

Chairman, Management Board ... ... Prof. A. Ayensu

Director ... ... Dr. Wisdom A. Plahar

Deputy-Director ... ... Mrs. Agnes Osei-Yaw

Heads of Division

Commercialization and Information Division ... ... Agnes Osei-Yaw (Mrs.)

Food Processing & Engineering Division ... ... Dr. P. N-T Johnson

Nutrition and Socio-Economics Division... ... ... Phoebe Lokko (Mrs.)

Food Microbiology Division ... ... Dr. Wisdom Amoa-Awua

Food Chemistry Division ... ... Dr. Kafui Kpodo (Mrs.)

Ag. Administration Division ... ... Robert M. Yawson

Accounts Division ... ... Mr. N. Adoboe-Mensah

Members of the Internal Management Committee

1. Dr. W. A. Plahar	- Director
2. Dr. W. A. Amoa-Awua	- Head Food Microbiology Division
3. Mrs. Agnes Osei-Yaw	- Head, Commercialisation & Info. Division
4. Mrs. P. Lokko	- Head, Nutrition & Socio-Econ. Division
5. Dr. (Mrs.) K. Kpodo	- Head, Food Chemistry Division
6. Dr. P-N. T. Johnson	- Head, Food Proc. & Engineering Division
7. Dr. P. Adu-Amankwa	- Head, PPSU-FPED
8. Mr. R. M. Yawson	- Ag. Head of Administration
9. Dr. (Mrs). M. Ottah Atikpo	- Head, ISU-FMD/ President, Local RSA
10. Mr. Daniel Blay	- Head, EU-FPED
11. Mr. N. Adoboe-Mensah	- Head, Accounts
12. Mr. D. Asiedu	- Chairman, Staff Welfare
13. Mr. Ben Awotwi	- Chairman, SSA-FRI
14. Mr. R. Mawuli	- Chairman, TUC

IN ATTENDANCE

15. Ms. Mary Halm	- Quality Manager
16. Mr. S. Nketia	- Scientific Secretary

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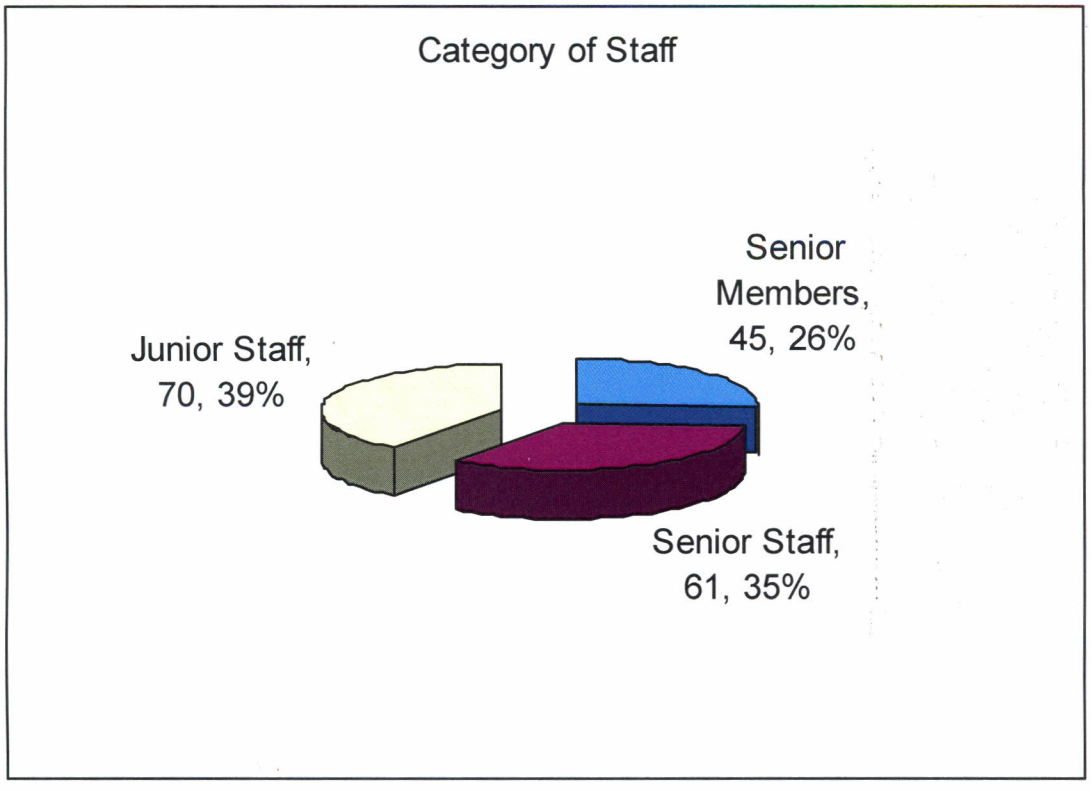
PART I: NON-SCIENTIFIC DIVISION

1.0 ADMINISTRATION DIVISION

The Institute began the year on 4th January 2007. During the year under review the Administration Division continued to provide support services and created an enabling environment to facilitate effective and efficient performance of work by all the Divisions of the Institute.

1.1 Staff Strength

Staff strength at the end of 2007 stood at one hundred and seventy six. This was made up of the following categories of staff.



1.2 New Appointments

(i) The following employees were given temporary appointments in 2006 and 2007 had their appointments confirmed and regularized during the year under review.

1. Mr. Fred Agyeman Sarpong	Assistant Scientific Officer
2. Mr. Foster Yao Mensah	Assistant Scientific Officer
3. Mrs. Amy Atter	Assistant Scientific Officer
4. Mrs. Evelyn Serwah Buckman	Assistant Research Scientist
5. Ms Anna Kuevi	Assistant Research Scientist
6. Ms Deborah L. Narh	Assistant Research Scientist
7. Mr. Kwabena Asiedu Bugyei	Assistant Scientific Info. Officer
8. Mr. Stephen Nketia	Scientific Secretary
9. Mr. Thomas Najah	Technical Officer
10. Mr. Solomon Dowuna	Technical Officer
11. Ms. Helena Ama Van-Ess	Technical Officer
12. Ms. Vida Awidi	Technical Officer
13. Ms Mercy Fianu	Technical Officer
14. Ms. Belinda Ayitey Adjin	Technical officer

(ii) Dr. Paa-Nii Johnson was appointed the Deputy Director of the Institute with effect from 1st July 2007, for a two-year term.

(iii) Mrs. Phoebe Lokko was given a post-retirement contract which took effect from 9th April 2007

(iv) The following were also given temporary appointments in the year under review.

1. Ms. Bernice Nina Nkrumah	Asst. Scientific Officer
2. Mr. Evans Agbamafle	"
3. Mr. Desmond Mensah	Technical Officer

1.3 Promotions and Upgrading

(i) Mr. Peter Addo was upgraded from Principal Technical Officer to Research Scientist after successfully completing his MPhil degree in Food Science

(ii) Mrs. Charlotte Oduro-Yeboah was also upgraded from Assistant Research Scientist to Research Scientist after successfully completing her MPhil degree.

(iii) The following promotions were announced during the year:

	Name	Grade Promoted To	Effective Date
1.	Dr. John T. Manful	Senior Research Scientist	1st January 2007
2.	Mr. Daniel Blay	Senior Scientific Officer	1st July, 2004
3	Ms. Joana B. Dzikunu	Snr. Admin. Assist.	1st January, 2007
4	Mr. Patrick Mintah	Snr. Technical Officer	1st January, 2006
5	Mr. Joseph Akoto	Snr. Works Supt.	1st January, 2007
6	Ms. Greta Akpokli	Asst. Admin. Assist.	1st January, 2007
7.	Mr. Emmanuel Agblo	Foreman	1st January, 2007
8	Mr. Samuel Osafo	Traffic Supervisor	1st January, 2006

1.4 Human Resource Development

The Institute continued to grant training opportunities to its staff to enable them acquire skills and knowledge needed to enhance their performance. The following staff were on study leave with pay during the reporting period:

○ Mr. E.C-T. Tettey	PhD, University of Ghana
○ Mr. J.F. Asigbey	BA, University of Ghana City Campus
○ Mr. Theophilus Annan	BSc, UCC
○ Mr. Eric Ofori	BA, IPS
○ Mr. Elvis Baidoo	MPhil, University of Ghana
○ Mr. Charles Diako	MPhil, University of Ghana
○ Mrs. Linda Hagan	MPhil, University of Ghana
○ Ms. Matilda Dzomeku	MPhil, KNUST
○ Ms. Bernice Kudjawu	MSc, Perdue University/University of Ghana
Mrs. Ivy Yawson	MSc. Univ. of Minnesota/Univ. of Ghana
Ms. Margaret Owusu	PhD University of Denmark

1.5 Resumption of Duty After study Leave

Dr. (Mrs.) Mary Obodai returned to post on the 28th of May 2007 after the completion of her PhD at the University of Nottingham, U.K.

1.6 Attachment Training

The Institute continued to offer attachment training to a number of students from the various Universities and Polytechnics in the country.

1.7 National Service

Ten (10) National Service Personnel were posted to the Institute during the period.

CID had 4, Chemistry had 2, Processing had 3, FNSE had 1

1.8 Visitors

The Institute hosted the 214th DMC on 21st and 22nd November 2007

A staff durbar was organized to afford staff to meet with the Director-General and other directors of the various institutes to express their concerns. This went quite well.

The Institute also hosted a number of pressmen from the various local press houses and other dignitaries in our bid to publicise the accreditation of some of our laboratory methods to ISO 17025

1.9 Retirement

(i). Dr. Phoebe Lokko, Principal Research Scientist and Head of FNSED retired after 35 years service to the Institute.

(ii) Mrs. Agnes Osei Yaw, Principal Research Scientist, Deputy Director and Head of CID proceeded on voluntary retirement after 31 years service to the Institute

(iii) Mr. Emmanuel Allotey a Senior Technologist with the Food Chemistry Division retired after 38 years service to the Institute.

1.10 Resignation

Dr.(Mrs) Nana Tekyiwa Annan, a Principal Research Scientist resigned form the service of the Council effective 31st March 2007

1.11 Obituary

Mr. Samuel Buabeng, Technical Assistant of the Food Processing and Engineering Division, died on 27th August 2007 at Nkawkaw after a protracted illness. The Director and staff of the Institute joined his family to accord him a befitting burial. May his soul rest in peace Amen.

2.0 ACCOUNTS DIVISION

2.1 Introduction

The Finance and Accounts Division is responsible for maintaining effective and efficient accounting and financial systems. The Division ensures that, the Institute is in compliance with the CSIR stores and financial regulations and other statutory legislations. The Division supports all the other divisions to carry out their financial obligations for the smooth running of the Institute. It prepares the financial statements, annual budgets, and administers funds from donors. There are two main sections of the Division, these are the main finance and accounts and the Stores sections. The main section is made up of the ledger, the payroll, procurement and the cash sections.

2.2 Staff Strength and Movement

As at the end of the year 2007, the staff strength of the Division stood at eleven (11). The main section had six (6) members of staff they are Mr Tutu Aikins, Mr. Ken Aidoo, Mr. Christian Amegah, Mr. J. K. Larbi, Mrs. Angela Addy and Ms Mabel Aryee. The stores section is made up of four (4) staff, Mr. John Mintah Nakotey, Mr. George Ohene Gyamfi, Mr James Cromwell and Mr. Samuel Tawiah Odoi.

2.3 Major Activities

The major activities of the Division include;

- Preparation of Financial Statements for the Institute ,
- Preparation of financial report on Government of Ghana (GoG) fund and disbursements
- Ensure that funds from donors comply with programmed budgets.
- Ensure Compliance with Taxation and other Financial reporting procedures
- Manage the payroll function ensuring efficient systems, process and controls.
- Oversee the External Audit, review and analyze reports and give recommendations.
- Preparation of quarterly financial returns to CSIR Secretariat,

The Stores section receives and issues items procured for effective running of the Institute. These items include chemicals, media, stationary etc.

2.4 Accounting System

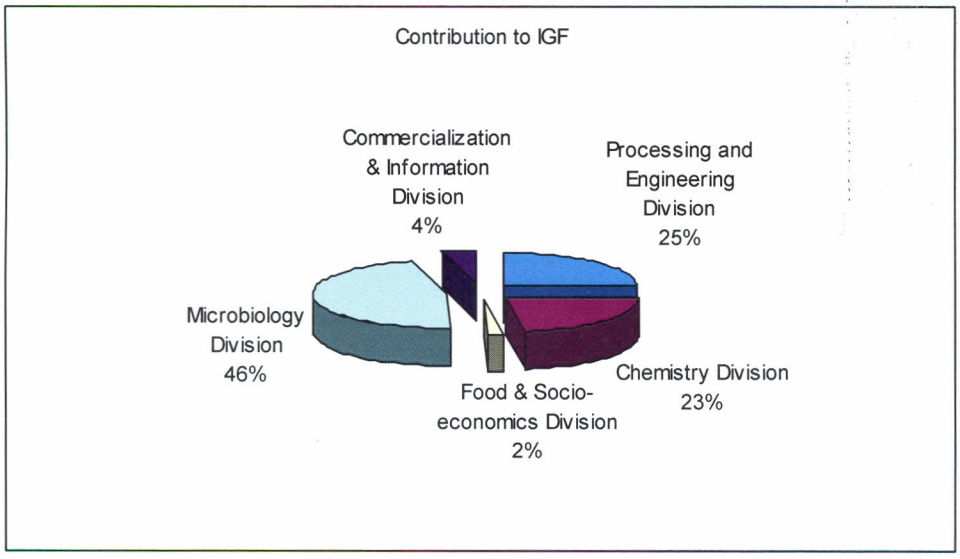
The accounting system of the Institute during the year under review was assessed to be in-line with the stores and financial regulations of the CSIR. The system established is satisfactory for capturing financial data i.e. revenue, expenditure, assets and liabilities. Segregation of duties was found to be adequate and well spelt out with different staff responsible for different functions e.g. Pay roll, final accounts, cash receipts and payments, procurement etc.

2.5 Financial Overview

The total receipts for the year amounted to GH¢1,204,242 of which 81.8% represents government subvention for personnel emolument and administrative expenditure, 1.6% represents subvention for service activities (Research), 14% represents internally generated funds, and 2.6% represents donor assisted fund. The total expenditure for the year was GH¢1,558,111. 84% of these amount was spend on personnel emolument and administrative expenses, 2% on Research activities, 9% on internally generated activities and 5% on donor projects.

2.6 CSIR-FRI Internally Generated Funds (IGF)

The actual income for the year was GH¢172,892. Actual expenditures was GH¢138,015 given a net income of GH¢12,619. The net profit margin on the internally generated activities for the year under review was 7.3%.



Total expenditure to income ratio from IGF is very high 79.8%. 94% of this came from the Processing and Engineering division, Chemistry 49% and the lowest from the Micro-Biology lab. 38.8%. Effort should be made to reduce it. Contribution from IGF to Corporate CSIR amounted GH¢2,674. Amount of GH¢ 52,457 was used to support institute's activities.

2.7 Constraints of the Division

i) Lack of Funds to run the Institute activities.

ii) Delay in release of Government subventions to meet personnel emoluments, administrative activities and research activities.

iii) The Division is still having problem with the Scala Accounting Software.

iv) The government's pay roll system - IPPD 2 is yet to take off within the CSIR

v) Delay in accounting for imprest taken by staff – GH¢ 19,655 (2007), GH¢ 9,008 (2008)

2.8 Plan activities for 2008

The following activities for the division have been planned for the year 2008,

- Preparation of comprehensive fixed assets register for Food Research Institute
- Preparation of 2009 annual budget estimates
- Preparation and audit of 2007 final account
- Updating all accounts ledgers for 2008 final accounts
- Reconciliation of bank accounts, debts, and imprest accounts
- Submission of quarterly returns to CSIR head office.

3.0 COMMERCIALISATION AND INFORMATION DIVISION

3.1 Introduction

The basic task of the Commercial and Information Division (CID) is to coordinate the commercial activities of all other Divisions of the Institute in order to generate income for the Institute. The Division has three Units namely the Public Relations Unit, Client Services Unit and Library and Publications Unit.

3.2 Staff Strength

The staff is made up of Dr. (Mrs). Pearl Adu-Amankwa, Head of Division, Mr. Augustine Andoh, Chief Technical Officer (C.T.O.), Public Relations, Mr. Ben Awotwi, C.T.O., Marketing, Mr. Raphael Kavi, Jnr. Assistant Librarian, Stephen Atta-Sonno, Library Assistant Gd. II, Mr. Philip Baidoo, Senior Accounting Assistant, Ms Joana Dzikunu, Snr. Admin. Asst, Ms. Mary Assimah, Admin. Assistant, and Mr. Gariba Alimiyao, Driver Inspector.

Four marketing interns were engaged during the year. They were Messrs. Enoch Asare Wiafe, Addo Wisdom Selassie Chormey Elorm Doe and Renner Dafeamekpor.

3.3 Commercialisation Activities

The Division continued its work of co-ordination of commercialization activities. The main activities carried out in 2007include collection of samples for analysis, transfer of technology, hiring of Institute's facilities, and organization of training programs and sale of research by-products and compilation of client database

3.4 Income Generation

The net Internally Generated Income (IGF) of the Institute amounted to about seventeen thousand and eight hundred new Ghana cedis. Overall about 1,800 samples were tested

3.5 Public Relations activities

3.5.1 FRI Media Exposure in 2007

Media relations were excellent. The media was regularly monitored. There were no adverse comments in the media networks. The news conference to announce the accreditation of 15 FRI analytical methods came off successfully with the attendance of all the major newspapers and electronic media. Several articles were also published in the major Ghanaian Newspapers. One of such articles was 'Consume More Cocoa' by Dr. L.D. Abbey, P Adu-Amankwa and Augustine Andoh

The PRO was also the secretary of the Press conference Committee set up by the Director to plan the press conference to announce the accreditation of 15 laboratory methods to ISO 17025. He also coordinated press activities and invitations for the news conference. A press release was prepared to help the press in reporting the event. A story was prepared for the updating of the CSIR website.

3.5.2 Exhibitions

The public relation officer, in collaboration with the Scientific Secretary, undertook photographic project of FRI laboratories and prepared exhibitions material for the Ghana@50 Exhibition at the Trade Fair Centre in Accra. Two new banners and 6 posters were prepared. They also coordinated press activities in connection with Press conference and new colour brochures on the (achievements, laboratories and profile of the institute) were prepared and printed.

3.5.3 Meetings

The PRO and Scientific Secretary attended four meetings of the CSIR Committee of PRO's and Scientific Secretaries.

3.5.4 Visitors

The Institute received groups of students as usual: 60 students came from the University of Cape Coast (UCC) branch of the Laboratory Technology Students Association of Ghana and Students of the Faculty of Engineering Science of the University of Ghana and the Berea Social Foundation. Other visitors were students of Morning Star School in Accra and Brentu Secondary School.

3.6 Database of Clients

The PRO also updated the client database for analytical services of the institute. Our top clients were acknowledged and invited to the celebration of the achievement of the accreditation of 15 laboratory methods to ISO 17025, the first of it kind in West African as at the time.

3.7 Library report

The Food Research Institute library is one of the most important libraries that provides and disseminates information in the field of food science and technology, nutrition, food microbiology, aflatoxin and mycotoxins, agricultural economics and food engineering in the country. The library has about four thousand books (4000) and over two hundred (200) back issues of scientific journals in its stock. The library also currently has a subscription for ten scientific journals.

The clientele of the library has extended beyond the Institute's research and technical staff to include students from the various universities and polytechnics in Ghana. The library is also patronized by lecturers, farmers, industrialists, journalist, civil servants and public servants, consultants and many others. A total of one hundred and twenty-one persons (121) used the library during the period under review. On the whole, the clienteles' acknowledge that the information provided was useful but there was the need to improve the current stock. The library acquired some new furniture to replenish the existing furniture in the reading room and the internet room.

The library during the period under review continued to enjoy the availability of internet connectivity making it possible for the institute's research scientists and technical staff to browse the net and access their electronic mails and access full text articles for their work.

Queries received during the period under review included Maize Processing, Palm Kernel Oil Processing, Shelf life of Fante kenkey, Agro-processing of gari and tapioca, Agro-chemicals, Extrusion of cassava products, Food analysis and food balance sheet for Ghana, Processing of orange fruits, Kenkey production, Sorghum processing, Post harvest quality of plantain, Post harvest handling of vegetables, Cassava processing and it's utilization, Transformation of muscle to meat, Mushroom cultivation, Cashew nut processing , Grass cutter rearing Plantain and Banana, Food commonly used in Ghana, Data on nutritional value of brown rice, Nitrogen compounds in Food , HACCP in food processing, Griffornia simplicifolia, Effect of processing on maize, Cocoa, Cheese and fermented milk food , Food and meat products, Pharmacopoeia on West African plants Food processing and preservation, Salt Iodization, Shea butter processing, Food security and Solanum Torvum.

Users who visited the library personally to source for information had various information materials provided for their perusal. These included books and journal articles that was acquired from CTA/SDI Service and also others made use of the TEEAL Collection and Ghagri database. It is recommended that Institute subscribed to at least one more major newspaper such as the *Ghanaian Times*. Other Institutes subscribe to a whole spectrum of newspapers.

PART II: SCIENTIFIC DIVISION

4.0 FOOD NUTRITION AND SOCIO-ECONOMICS DIVISION

4.1 Introduction

The Nutrition and Socio-economics Division (NSED) conducts surveys and feasibility studies into the economic viability and socio-economic impacts of on-going projects in the Institute. In addition, the Division also conducts studies into consumer demands and the utilization of food. The division consists of the socioeconomics unit and the nutrition unit. The latter handles community and human nutrition studies and runs a test kitchen which conducts sensory tests on products developed by the FRI and industry.

4.2 Staff Strength

The total staff strength as at December 2007 stood at 13 i.e. 8 Research grade staff and 4 Technical grade staff. The staff comprises one Principal Research Scientist, three Research Scientists, four Assistant Research Scientists, one chief Technical Officer, two Senior Technical Assistants and One Technical Assistant Grade II.

4.3 Study Leave

Three members of the division are currently on study leave.

○ Ms. Matilda Dzomeku	MPhil, KNUST
○ Ms. Bernice Kudjawu	MSc, Perdue University/University of Ghana
Mrs. Ivy Yawson	MSc. Univ. of Minnesota/Univ. of Ghana

4.4 Attachment/Internship

One student from the Kumasi Polytechnic had a two month attachment with the division.

4.5 National Service

Miss Henrietta Gyamfua Boateng was posted to the division to do her national service which is scheduled to end in August 2008.

4.6 General Activities

The activities of the Food Nutrition and Socio-economic Division during the year under review can be summarized as follows:

- Retail of Potassium Iodate to salt producers.
- Nutritional surveys
- Baby food formulations and supply
- Consultation services
- Exhibition of divisional formulated products
- Recipe development and documentation.

4.7 Student Projects

- consumer acceptability of corn bread
- sensory evaluation of French fries and couscous made from locally grown water yams
- Fat replacement in rock buns and fruit pies.

4.8 Consultancy Services

- Formulation and sensory evaluation of Soy fortified cocoa powder -IKEG cocoa company limited
- Consumer acceptability studies of instant fufu flour samples - Ms Anna Marie Gordon
- Sensory evaluation studies of 4 flavours of kalypo drinks-Acqua Fresh Company limited.
- Product development and consumer acceptability of seven brands of wheat flour-Ghana Standards Board.
- Consumer acceptability studies of 8 samples of locally grown rice - CSIR/CATSBY programme

4.9 Training

- In July, 15 Regional Directors of WIAD (Women in Agriculture Development) were trained in food product development with plantain flour under CSIR/GATSBY project.

- A *Moringa olefiera* leaf processing training workshop was organised for processors In November.

4.10 Projects

- The last of subjects recruited for participation in the CRSP project completed their regimen. Data entry and analysis is being wrapped up.
- Collaborative work with Noguchi Memorial Institute for Medical Research (NMIMR) on Alfalfa Supplementation for HIV/AIDS patients commenced in August. The division was tasked to carry out weekly measurement of the body composition of participants.
- Recipe development for *Moringa olefiera*. Trials included moringa candies, and incorporation of moringa in polo biscuits.

5.0 FOOD CHEMISTRY DIVISION

5.1 Introduction

The Chemistry Division comprises two units namely the Food Toxicology Unit and the Industrial Services Unit. The Division presently conducts applied research relating to chemical contaminants (mycotoxins) in foods and feeds as well as food flavour (aroma) analyses. A major function of the Division is the support it gives to the commercialisation activities of the Institute by offering analytical services to Industry, local and International students, as well as other clients.

5.2 Staff Strength and Movements

The Division has staff strength of 15 as follows:

1 Senior Research Scientist
1 Research Scientist
1 Assistant Research Scientist
1 Assistant Scientific Officer
2 Principal Technologists
2 Senior Technologists
1 Assistant Technologist
4 Technical Officers
1 Senior Technical Assistant
1 Technical Assistant

The following staff movements occurred during the year:

(i) Dr. (Mrs) Nana Annan resigned from the Institute effective 31st March 2007.

(ii) Mr Emmanuel Adokwei Allotey retired on 18th May 2007 after attaining the compulsory retiring age of 60. We all wish him a happy retirement.

(iii) Mr Charles Diako continued with his MPhil Programme at the Food Science Department of the University of Ghana.

(iv) Messrs. Foster Mensah, Divine Addo, Ms. Vida Awidi and Ms Belinda Ayitey-Adjin were offered appointments to the Division during the year under review. Mr Divine Addo however resigned few weeks after being employed.

5.3 Analytical Services

During the year under review, the Division offered analytical services to several companies, establishments and individuals. A total of 382 samples were received by the Industrial Services Unit for analyses. This number represents a 10% decrease over the 426 samples received in 2006.

The samples analysed included maize, rice, sorghum, cashew nuts, soybean and soybean products, milk and milk products, spices, animal feed, beans cocoa powder, cocoa liquor, Burger Peanut snacks, Snappy Peanut snacks, beans, honey, alcoholic beverages, fruit drinks, edible oils, tuna among several others.

The clients included Ghana Inspections Ltd., Ghana Standards Board, Afrotropic Cocoa Processing Agricare Ltd., Ningo Salt Ltd., Elsa Foods Ltd., Veterinary Services (MOFA), Tata Beverages Co. Ltd., Panbros Salt Industries., Mamps Services Ltd., UT Logistics, Yedent Agro Processing Ventures Ltd., Royal Sweet Ltd., Ruker Ventures, Cadbury Ghana Ltd., among others. Analysis of the 382 samples generated a gross income of Two Hundred and Six Million, One Hundred and seventy Six Thousand and Three Hundred and Fifty Cedis. (¢ 206,176,350).

During the year, the Toxicology Unit received a total of 150 samples for aflatoxin analysis as against 122 samples for the year 2006. This represents an increase of 23% over the previous year.

The samples consisted of Wheat Soy Blend, Corn Soy Blend, Maisolet Soya Blend, Banku Mix, Cocoa, Hausa Koko Flour, Burger peanut snacks, groundnut kernels and paste, cassava chips, gari, maize grits, bean flour, rice, and animal feed among others. The major clients included Ghana Standards Board, Burger Food Industries, Elsa Foods, Comas Foods, Yedent Agro Processing Ventures Ltd., GAFCO, Ghana Inspections Ltd., Nkulenu Industries, Guiness Ghana Breweries Ltd., Ghana Nuts Ltd., C&S Foods Ghana Ltd. Agricare Ltd., among others. Total charges for the 150 samples amounted to One Hundred and Eighteen Million, Six Hundred and Eighty Six Thousand, Two Hundred cedis (¢118,686,200).

The gross total for the two Units of the Chemistry Division was therefore Three Hundred and Twenty Four Million, Eight Hundred and Sixty Two thousand, Five Hundred and Fifty Cedis (¢324,862,550 or G¢ 32,486.26).

5.4 Practical Training and Industrial Attachment

(i) Two students, Kenneth Akama and Laar Baaman both from Accra Polytechnic were on Practical Attachment in the Division from 2nd October – 21st December 2007.

In addition, the following were also attached to the Division:

Isaac Mensah (UDS) from 17th June - 17th August 2007

Felix Amuzu (KNUST) from 4th June - 20th July 2007

Crystal Gordon (KNUST) from 4th June - 20th August 2007

Daniel Hammond (KNUST) from 4th June - 20th August 2007.

(iii) One PhD student (Mrs Generose Vierra) from Benin was here to analyse her GC-MS data with Mr Charles Diako from 18th to 25th July 2007.

5.5 National Service Personnel

(i) During the year four National Service personnel (Immaculate Tanoe, Jemimah Adjei Fah, Foster Mensah and Belinda Ayitey-Adjin) who started their service with the Division in October 2006 completed in July 2007.

(ii) Two new Service personnel (William Arko and Isaac Mensah-Boansi were assigned to the Division in October 2007. They will be with the Division till August 2008.

5.6 Accreditation of Chemistry Laboratories

(i) External Audit and non-conformities

Staff of the Chemistry Division started the year on a very busy note since they had to work extremely hard to address all the non-conformities detected by the SANAS Team during their On-Site visit in December 2006. Once again, leave for all staff in the Division was deferred till all the non-conformities had been addressed and communicated to SANAS. The divisional problems were compounded by the steeling of the divisions computer containing most of the Accreditation data. Despite all the odds we managed to meet the deadline set by SANAS.

(ii) Internal Audits

In compliance with the Accreditation Quality Manual, two internal audits were conducted during the year under review. These were held in February and September 2007.

(iii) EU External Audit of Aflatoxin Laboratory

As a result of several alerts issued to the Ghana Government about aflatoxins in peanuts exported from Ghana, the European Commission's Food and Veterinary Office (FVO) sent a Mission to Ghana from the 11th to 20th September 2007. The team was to assess the official control systems put in place by the Ghanaian authorities to prevent mycotoxin contamination of peanuts and peanut products intended for export to the European Union. As part of this mission the Institute's Mycotoxin Laboratory was audited by the EU Team on the 17th of September 2007. Non-conformities observed are currently being addressed.

(iv) Proficiency Tests

The Institutes' Quality Manual requires that all the methods be subjected to proficiency testing at least once every two years. The Division therefore participated in these tests during the year. The Testing Body used was the Food Analysis Performance Assessment Scheme (FAPAS) of the Central Science Laboratory of the U.K. The General Chemistry Laboratory took their test in January 2007 whilst the Mycotoxin Laboratory took theirs in May 2007.

(v) Inter-Laboratory Exercise

To further test the reliability of our laboratory results, the Chemistry Laboratory participated in an Inter-Laboratory exercise with four Laboratories in South Africa and Kenya in June 2007. The laboratories were ARC Irene Analytical Services, Pretoria, SABS, Pretoria, SAGL, Pretoria all in South Africa, SGS Kenya Limited, Mombassa, Kenya and CSIR, Accra, Ghana. The results have been received and the Z-scores obtained for all four analyses were satisfactory and acceptable.

5.8 Divisional Meetings

The Division held several formal and informal meetings during the year. Most of these meetings were used to discuss ways to address the non-conformities identified by the SANAS team. Other issues pertaining to the Division were also discussed at these meetings.

5.9 Other Matters

Staff of the Division will once again like to thank all staff of the Institute for their co-operation with them during those stressful times when they had to ensure all the non-conformities were addressed on time to meet the SANAS deadline. It is the hope of the Division that all will endeavour to continue to help us make the Accreditation exercise a success to help boost the image of the whole Institute.

6.0 PROCESSING AND ENGINEERING DIVISION

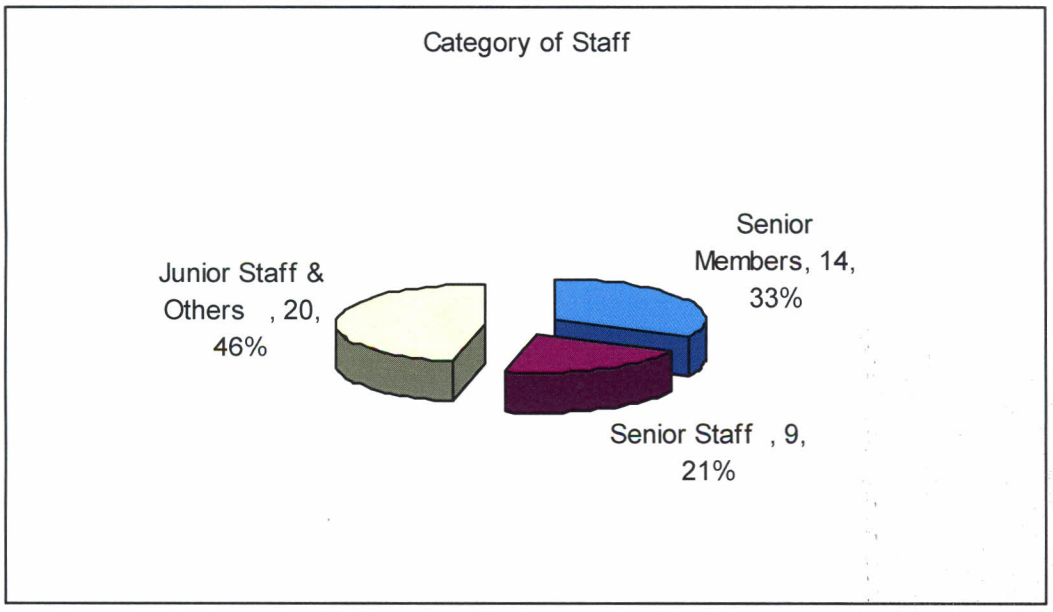
6.1 Introduction

The Food Processing and Engineering Division is largest division in the Food Research Institute. Its main role is to undertake research and development activities in food processing to add value staple food crops. It also helps many clients wanting to start up food processing centres, as well as offer a number of processing services to clients.

6.2 Staff Situation & Movements

6.2.1 Staff Position

The number of staff at the FPED, during the year under review, totaled 47; made of:



6.2.2 Study Leave

Two senior members, Messrs. E-C. Tettey and Elvis Baidoo continued their courses to complete their (PhD) and (MPhil) respectively at the Department of Nutrition and Food Science, University of Ghana.

6.2.3 Death

During the year under review, the division lost one of most dedicated technical staff, Mr Samuael Buabeng.

6.2.4 Travels & Other Activities of Senior Members

Dr. J.T. Manful traveled to the International Rice Research Institute in the Philippines from the 15th to 20th April 2007 to attend a workshop on "*Clearing Old hurdles with New Science: Improving Rice Grain Quality*". This workshop was organised by the International Network for Quality Rice.

Mrs C. Oduro-Yeboah traveled to the Cote d'Ivoire to attend a conference on "*Potential for Cassava Processing in West Africa (Manihot Esculenta Crantz)*" in June 4-7, 2007, Abidjan-Côte d'Ivoire to present two papers. "*A case study to develop an appropriate quality assurance system for two cassava-based convenience foods*" and " Profiling the textural attributes of *fufu* from casava-plantain fufu flour using sensory profile analysis".

In September, she again traveled to UK to attend the "5th International Symposium on New Crops and Uses" hosted by the University of Southampton, UK. She presented a poster on Characterization of fingers, flour and starch two varieties of plantains, *Apem and Apentu* from Ghana.

6.2.5 National Service Personnel

Five national service personnel were attached to the Division during the year.

6.3 The Units & Consultancy Services of the Division

6.3.1 The Pilot-Scale Production Unit (PSPU)

During the year under review, commercial activities in the PSPU continued with renewed vigour. The major activity carried continued to the dehydration and processing of various food products received from clients both externally and internally (researchers and projects of the FRI). There were however other clients who brought a variety of products for roasting and milling into flours and pastes. Some of the major clients of the Unit during 2007 were Tayaako Co. Ltd, Plaspack Industries and MV Foods.

Major Challenges

- The old Rolls Royce dryer needs rehabilitation or replacement.
- The water storage facilities in the Unit are in a poor state of disrepair and urgent rehabilitation.
- The floors and walls of the main processing hall also need polishing and painting respectively.
- Measures need to be put in place to control rodents and spiders in the processing hall.

6.3.2 The Engineering Unit (E.U)

The 2007 year saw the Unit continuing with its routine maintenance of processing and analytical machines and equipment of all divisions of the Institute. Air conditioners in all offices and laboratories also experienced routine maintenance and burnt-out lights in offices and laboratories as well as street lights were also replaced.

Major fabrication jobs that were undertaken by the Unit at the request of a number of Institute's clients include the following:

- Construction, delivery and installation at Ashongman of a 102-tray dryer for KASDAR Ltd. This work was expanded to cover after sales maintenance of the dryer for a one year period.
- Modification of a gas oven into an electric dryer for WAD AFRICAN FOODS LTD at GICEL, near Weija, Accra.
- Construction of a stainless steel hammer mill for REV. NUNOO OF DANSOMAN.
- Design and construction of two stainless steel horizontal mixers for WORLD FOOD PROGRAM (WFP).
- Fabrication and installation of cassava grater, screw press and a centrifugal flour sifter for CASSACOXA CO. LTD.
- Fabrication of a hammer mill for ZINIE GROUP OF COMPANIES.
- Fabrication of milk mixture for MAPOUKA CO. LTD.

A six-tier scaffold was constructed for use at the new building and elsewhere to enable technicians reach higher heights to repair and maintain equipment. The Unit contributed immensely in the Institute's final preparation towards the accreditation process. The unit

installed six street lights on top of the new building to improve security. A change-over switch was also installed at Bungalow 21 at the Broz Tito Avenue campus.
A vacuum pump at Toxiocology laboratory was also rehabilitated.

6.3.3 The Root and Tuber Products Development Unit

A total of 72.64 tons of fresh cassava was processed during the year. The main products were Agbelima (15.45tons), kokonte (1.14 tons), gari (0.05 tons) and starch (0.58 tons). The Unit also determined the work rates for some selected unit operations used for the processing of cassava. This was done with the view to improving the efficiency and quality management of the products.

6.4 Divisional Meetings

During the year under review, the Division held two meetings. One of such meeting was devoted to senior members only in the Division. During such meetings, a number of issues were discussed.

6.5 Training Workshops

During the year under review, there was a special review training workshop for micro-small and medium-scale food companies involved in fruit processing in Ghana. This was jointly organized by the CSIR-FRI and Food and Drugs Board (FDB) of Ghana. Fifteen companies took part in the training specialized training programme.
In addition, a number of customized training workshops were organized by the Division for a number of clients. The training included fufu flour production, fruit processing into jam, juices and drinks.

6.6 CFC/UNIDO/FRI Sorghum Project

During the year under review the CFC/UNIDO/FRI Sorghum Project continued with its activities. Unfortunately, the international consultant attached to the project Prof Jean-Pierrie Dufour died whilst attending at workshop on Sorghum development in Nigeria. This temporarily affected the pace of work since he was the main technical backstopping officer behind the research activities.

7.0 THE FOOD MICROBIOLOGY DIVISION

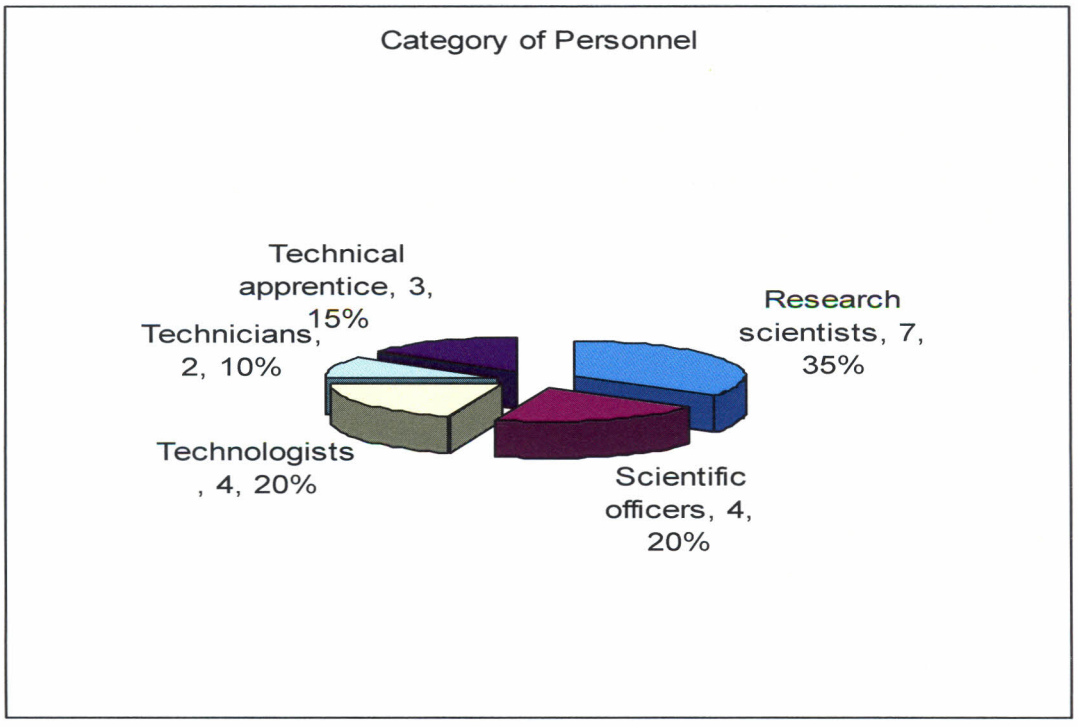
7.1 Introduction

The Food Microbiology Division comprises two units namely the Mushroom Unit and the Industrial Services Unit. The Division conducts applied research relating to Food microbiology and food mycology. A major function of the Division is the support it gives to the commercialization activities of the Institute by offering analytical services to Industry, local and International students, as well as other clients.

7.1 Staff of Food Microbiology Division

Dr. W.K Amoa-Awua	Principal Research Scientist (Head of Division)
Dr. Margaret Ottah-Atikpo	Research Scientist (Head of Industrial Services Unit)
Dr. Mary Obodai	Research Scientist (Head of Mushroom Unit)
Ms Margaret Owusu	Research Scientist (on study leave)
Mr Peter Addo	Research Scientist
Ms Matilda Dzormeku	Assistant Research Scientist (on study leave)
Ms Deborah Narh	Assistant Scientific Officer
Mrs Amy Atter	Assistant Scientific Officer
Mr Frederic A. Sarpong	Assistant Scientific Officer
Mr Evans Agbemafle	Assistant Scientific Officer
Miss Nina Nkrumah	Assistant Scientific Officer
Mr David Asiedu	Principal Technologist (Technologist-in-Charge)
Mr David Baisel	Senior Technologist
Mr Michael Amoo-Gyasi	Technologist
Mr Richard Takli	Technologist
Mr Theophilus Annan	Senior Technical Officer (on study leave)
Miss Mary Boham	Senior Technical Officer
Mr Godson Agbleley	Technical Apprentice
Mr Emmanuel Tetteh	Technical Apprentice
Ms Rose Agorkor	Skilled labourer

7.3 Personnel



Mr Peter Addo was appointed a Research Scientist after the award of MPhil he offered at KNUST.

Permanent appointment

Ms Debarah Narh	Assistant Research Scientist
Mrs Amy Atter	Assistant Scientific Officer
Mr Frederic A. Sarpong	Assistant Scientific Officer

Temporary appointment

Mr Evans Agbemafle	Assistant Scientific Officer.
Miss Nina Nkrumah	Assistant Scientific Officer.

7.4 Activities Carried Out in the Division

The main activities carried out by the Food Microbiology Division in 2007 were:

(i) Analytical services to clients.
(ii) Accreditation of eleven microbiological methods to ISO 17025.
(iii) Mushroom spawn and compost bags production and sales.
(iv) Research activities.

7.5 The Client Services Unit

7.5.1 Analytical services carried for customers

The Food Microbiology Division continued with its routine analytical services carried out for customers through the CID. A total 1,225 samples were analysed for clients involving a total number of 491,303 individual analysis (Table 1). The most important clients during the year were Pioneer Food Cannery and Cadbury Ghana Ltd.

Table I. Breakdown of analysis carried out for clients by the Food Microbiology Division in 2007

Period	No of samples analysed	No of analysis carried out
1st Quarter	281	110,995
2nd Quarter	276	127,512
3rd Quarter	238	88,536
4th Quarter	430	164,260
TOTAL	1,225	491,303

7.5.2 Clientele Base

The most important clients of the Food Microbiology Division in 2007 were:

- Pioneer Food Cannery Ltd.
- Cadbury Gh. Ltd.
- West Africa Mills Ltd.
- Promasidor Ghana Ltd.
- Euro Food Gh. Ltd
- Airways Catering Ltd.
- Burger Food Industries
- Cocoa Processing Co. Ltd
- Ghana Inspection Ltd.

The gross amount of money generated through the provision of analytical services by the Food Microbiology Division was 797,558,600 cedis according to our records.

75.3 Laboratory Accreditation

1. The Food Microbiology Division finally received ISO 17025 Accreditation for eleven microbiological methods from SANAS in May 2007.

2. Two internal audits were carried out during the year:
   - February audit: 5 non-conformances identified
   - September audit: 3 non-conformances identified.

7.6 The Mushroom Unit

7.6.1 Training programmes organised

The Mushroom Unit organized two training programmes in 2007

1. Training in mushroom production for 17 participants in February 2007.
2. Training for an NGO, Hope for Life in June 2007.

7.6.2 Production and sale of mushroom spawns and compost bags

MONTH	NO OF SPAWN BOTTLES SOLD	NUMBER OF COMPOST BAGS SOLD
January	453	-
February	171	-
March	83	-
April	-	-
May	-	-
June	-	-
July	22	-
August	23	205
September	184	202
October	320	53
November	600	2,477
December	405	4
TOTAL	**2,266**	**2,941**

Total no of bottled spawns sold: 2,266.

Total no of compost bags: 2,941.

Gross amount generated: 2,500

7.7 Research activities carried out in the Food Microbiology Division

1. The EU funded Project 'Development of biochemical and molecular markers for determining quality assurance in the primary processing of cocoa in West Africa' was completed in April 2007.
2. Work on cultivation of *Pleurotus* species of mushroom, M.Phil project of Ms Matilda Dzormeku.
3. Validation of fish waste utilization for Mushroom Cultivation. FAO project completed in 2007. Dr Margaret Atikpo team leader.

4. Comparative studies of chokor smoker and FRI Improved Smoking Oven. FAO project. Team Leader Dr Margaret Atikpo.

7.8 Training

1. Ms Matilda Dzormeku MSc. KNUST
2. Mr Theophilus Annan continued his BSc degree course in laboratory technology at the University of Cape Coast.
3. Ms Margaret Owusu began her Ph.D studies on 'The Influence of fermentation method of cocoa beans and processing parameters on chocolate quality' at the Faculty of Life Sciences, University of Copenhagen.

7.9 Conferences, Workshops and Seminar attended

- Dr. Margaret Atikpo: First International Conference on Environmental Research, Technology and Policy, Accra July 17-19, 2007.
- Dr. W.K. Amoa-Awua: Food Safety in Africa at the University of Stellenbosch, South Africa, Nov 26-Dec 1, 2007
- Dr. W.K. Amoa-Awua: Role of Chemistry in Sustainable Development and Wellbeing at Stellenbosch University in South Africa from Dec 2-5, 2007

7.10 National Service

Gideon Agbeshie and Gblende Amefa Adzoa completed their 2005/2006 national service in the Food Microbiology Division during year.

7.11 Vacation training

Four students from KNUST, University of Cape Coast and UDS undertook their vacation training in the Food Microbiology Division during 2007

PART III: RESEARCH ACTIVITIES

SECTION I

8.0 TECHNICAL REPORTS

8.1 Effect of Osmo-Dehydration, Blanching and Semi-Ripening on the Viscoelastic, Water Activity and Colorimetry Properties of Flour from Three Varieties of Plantain. (*Musa*AAB). FRI/CSIR, Accra, Ghana. pp.24.

Tortoe, C., Johnson, P-N.T. and Nyarko, A. I. (2007)

Abstract

The viscoelastic properties, water activity and colorimetry measurements of plantain flour produced by hot-air dehydration of three varieties, French Horn, False Horn and True Horn local plantains were studied. Treatments given to the plantains before the hot-air dehydration were osmo-dehydration, hot-water blanching and semi-ripening.

The best pasting characteristics occurred for True Horn local and False Horn osmo-dehydrated flours. Water activity and moisture content was 0.27 - 0.39 a_w and 5.08 - 7.25 %, respectively with the lowest recorded for False Horn osmo-dehydrated flour. Colour parameters were in the range of 87.34 - 79.56 and 15.71 -26.74 for L* and b*, respectively. The least browning colour (a*) was exhibited by True Horn local and False Horn osmo-dehydrated flours. Statistical significances ($P < 0.05$) was recorded for water activity, moisture content and a* colour parameter between process treatments for unripe, semi-ripe, osmo-dehydration and blanching whereas no statistically significances occurred for varietal differences for False Horn, True Horn local and French Horn plantains. However, the viscoelastic properties were significant for F-ratios at $P > 0.05$. Process treatments of osmo-dehydration, blanching and semi-ripening contribute significantly to the differences for water activity, moisture content, browning effect and viscoelastic properties compared to plantain varieties, with osmo-dehydration emerging as the best treatment method.

A copy of this has been submitted for publication in *Journal of Sci., Agri. & Food*

8.2 Validation of Fish Waste Utilization for Mushroom Cultivation

Ottah Atikpo, M.A. and Dzomeku, M. (2007)

Abstract

Oyster mushrooms (*Pleurotus* species) were cultivated on sawdust mixtures composted with fresh fish waste (FF), cooked fish waste (CF) and rice bran (RB) as control in the validation of the substrates' suitability for mushroom cultivation. Composting with the fish waste produced higher temperatures in the heaps and therefore ensured breakdown of macro-nutrients efficiently than with rice bran. The average sizes and weights of the mushroom fruiting bodies produced with both FF and CF were bigger, and heavier and firmer respectively than produced on rice bran. The mushrooms were succulent and with high moisture and low fat levels. Mercury was not detected in any of the mushroom samples cultivated with waste from tuna. No pathogen was detected, indicating that the products were good for human consumption. Spent bags that accumulated after harvesting the mushrooms were used as organic fertilizer for vegetables and root crops. The technology in the use of spent bags ensures maximizing of resources to eliminate wastage and environmental pollution.

8.3 Comparative Studies of Chorkor Smoker and Food Research Institute Improved Smoking Oven (FRIISMO)

Ottah Atikpo, M.A. and Blay, D.(2007)

Abstract

A comparative analysis of the performance characteristics of Chorkor oven and a new oven developed by the Food Research Institute of the Council for Scientific and Industrial Research (CSIR) was conducted. This oven, called the Food Research Institute Improved Smoking Oven was code-named FRIISMO. The two types of ovens were constructed in the same location and next to each other in each of two regions, during which local tradesmen/artisans in masonry and carpentry were trained. The two locations were Tsokome in the Greater Accra region and Apam in the Central region of Ghana. Trial smoking was conducted using horse mackerel, tuna and sardines in both ovens under the same environmental conditions and normal working conditions of the

operators. Tests were performed on assessment of the ovens using equal weight of fish in both ovens and also testing the full capacity in each oven. Analyses included microbiological, chemical (proximate analyses and polyaromatic hydrocarbons), organoleptic in the smoked fish. FRIISMO was reported in an earlier study to have advantage over the Chorkor oven in reducing tar deposits (polyaromatic hydrocarbons) on smoked fish, drudgery and health hazards to processors.

Results of this study showed that fuel wood consumption rate for smoked fish was generally less and with comparatively greater percentage yield in products using FRIISMO than Chorkor oven. The smoking rate of FRIISMO was also generally greater than Chorkor. However, the percentage weight loss was higher when using Chorkor to smoke than FRIISMO, indicating lower moisture levels and longer shelf life of products from Chorkor oven. However smoked fish left in FRIISMO overnight attained comparative moisture levels. Proximate analyses of smoked fish samples Fish smoked with FRIISMO were glossy and more attractive and thus had more consumer appeal than fish smoked in Chorkor oven. However, all samples were microbiologically safe for consumption since no pathogens were isolated. Chemical analyses included concentration of protein, ash and fat measured as g/100g of smoked fish sample. Fish samples from Chorkor oven had much more smoke deposits such that organoleptically there was a reduction in the colour, flavour, taste and overall acceptability scores of the soup prepared as compared to higher scores for soup prepared with smoked fish from FRIISMO. This was evident from the high levels of polycyclic aromatic carbon concentration in fish smoked with Chorkor oven than samples from FRIISMO. However, a larger sample size needs to be analyzed to ascertain this.

Stakeholders' workshop with leaders and representatives of fish smoking associations from Dzemeni in the Volta region, Central region, Brong Ahafo region, and Ashanti region demonstrated preference for FRIISMO due to its ease of use and health relatedness. FRIISMO required only one person to operate, whereas the Chorkor oven needed a minimum of two people. Drudgery and health hazard due to smoke inhalation was also completely absent in the operation of FRIISMO as compared to the Chorkor oven where there was intermittent interchanging of the trays with great loss of heat energy. Cost of construction of the two ovens showed Chorkor oven to be cheaper and about one-third the cost of FRIISMO. With the Chorkor oven, bricks, cement, sand, wood, wooden battens, nails, wire mesh and corrugated asbestos sheets were the principal

construction materials totaling ¢3,131,000, amounting to $340.33 at the present exchange rate of ¢9,200 to one dollar. FRIISMO was 3.25 times the cost of the Chorkor smoker; since more materials needed included bricks, cement, sand, wood, wooden battens, nails, chicken mesh, aluminium plate, binding wire and iron rod, angle iron, corrugated asbestos sheets, tower bolts and door handles totaling ¢10,190,000 or equivalent of $1,107.61. The metal frame of the FRIISMO would ensure operation of the oven for a period spanning over ten years, as opposed to the Chorkor oven that would need replacement of the wooden trays and plywood cover every year. This study sought to implement comparative studies between the Chokor smoker and the FRI improved smoking oven, by conducting smoking trials in two villages in the Central and Greater Accra regions of Ghana.

8.4 Report on Training Workshop on Plantain Processing and Recipe Development. Gatsby/CSIR/MOFA Banana and Plantain Project, 15th-17th May, 2007, Accra, FRI/CSIR, Ghana. Pp. 32.

Tortoe, C., Gayin, J, Johnson, P-N.T., Noamesi, S. K., Tamakloe, I. and Adiepena, N. (2007).

Abstract

In response to the implementation of the Gatsby Banana and Plantain Project Phase II, a training workshop for plantain processing was organized at Food Research Institute in collaboration with Women in Agriculture Development (WIAD) Directorate of Ministry of Food and Agriculture (MOFA). The two institutions are responsible for evaluation and dissemination of post-harvest processing options for plantain and banana under the Gatsby project. The Gatsby Banana and Plantain Project Phase II seeks to increase food security and diversifying income opportunity through an efficient collaborative scheme for delivery of improved varieties of plantain and banana with associated value-adding post-harvest processing options. The training workshop was a follow-up on a consultative workshop held in May, 2006 at Food Research Institute in collaboration with Women in Agriculture Development (WIAD) Directorate of Ministry of Food and Agriculture (MOFA), where an action plan was drawn for the execution of the subcomponent of the Gatsby project. At the consultative workshop, FRI and WIAD officers, processors from the Project Operation Zone (POZs) and other stakeholders brainstorm on recipes and

processing technologies available and selected those that could be adapted for use by all peoples across the nation particularly rural farm families in plantain and banana producing areas, food processors and industrialists. The action plan included development of training materials, training of WIAD officers and subsequent training of women and processors in processing technologies identified among others in three Project Operation Zones (POZs), Ashanti, Brong Ahafo and Eastern Regions. A training manual ''*Your Plantain Processing and Recipe Manual*'' was developed after the consultative workshop and served as the main training document during this training workshop. The three day training workshop was participatory, where trainees had the opportunity to question facilitators, pass comments and suggestion in a lively atmosphere. Training materials included a manual ''*Your Plantain Processing and Recipe Manual*''. Trainees were taken through a step-by-step production of plantain flour and group practical work was done on the first day of the training workshop. Demonstration and group practical work on plantain flour recipes was conducted on the second and third day. Twelve recipes including plantain and wheat flour, *tatale*, noodles, doughnuts, pastry chips, queen's cake, *ofam*, cookies, baby food formulation, *kaklo*, *mpotompoto* and *fufu* formulation and reconstitution. On the third day of the training workshop trainees discussed and made suggestions for the finalization of the training manual, which saw the formation of an editorial board comprising of team members from FRI and WIAD to finalized the training manual for use in the POZs.

8.5 Your Plantain Processing and Recipe Manual. FRI/CSIR, Accra, Ghana. pp. 22.

Johnson, P-N.T., Noamesi, S. K., Tamakloe, I., Tortoe, C., Gayin, J., Dennis, J. and Adiepena, N. (2007).

Abstract

The Food Research Institute (FRI) of the Council for Scientific and Industrial Research (CSIR) aims to develop and provide technical information, training and services to the private sector and other stakeholders in the food industry, provide appropriate technology packages for processing and storage of raw agricultural produce to facilitate curtailment of post-harvest losses and promote value addition for local and export markets, strengthen the institute's capability and linkages with industry through human resource

and infrastructural development, restructuring and re-organisation for effective commercial operations. Gatsby is a Charitable Foundation seeking among other things, to alleviate poverty in rural areas through micro-credit. It introduced black-sigatoga-resistant hybrid varieties of banana and plantain into 6 regions of Ghana through a project which ended in 2002. Three hybrids were highly rated by farmers. The Eastern, Ashanti and Brong Ahafo regions were subsequently selected for a 3-year project on 'Processing and Utilization of Banana and Plantain Varieties' which started in October 2004. In 2007, a Consultative Workshop brainstormed for products to be developed at the farm gate considering the expected increase in production. Processing plantain into flour and using the flour in recipes appeared to be the best preservation option. It is expected that 20 plantain growing communities with at least 50 farmers each would receive training through the extension officers of the "Women in Agriculture Development" (WIAD) in collaboration with the Food Research Institute of the Council for Scientific and Industrial Research. The Women in Agriculture Development (WIAD) Directorate of Ministry of Food and Agriculture (MOFA) and the Food Research Institute (FRI) of the Council for Scientific and Industrial Research (CSIR) are the institutions responsible for evaluating and disseminating post-harvest processing options for plantain and banana under the Gatsby project. An action plan drawn for the execution of this subcomponent of the Gatsby project includes identifying products and technologies to disseminate, potential markets for the processed products, procuring relevant equipment, developing training materials, training WIAD officers and subsequently training women and processors in the Project Operation Zones (POZs) in the technologies identified among others. This training manual is one of the outputs of this action plan.

8.6 Bio-control of Food Borne Pathogens *Listeria Monocytogenes* and *Salmonella Typhimurium* on Fresh Lettuce Leaves with Naturally Occurring Yeast Antagonists.

Obodai M., Dickson, M. & Dodd, C.E.R. (2007)

Abstract

The inhibitory potential of *Rhodotorula* and *Pichia* species against the food-borne pathogens *Listeria monocytogenes* and *Salmonella typhimurium* were studied using both culture-independent and culture-dependent methods. Samples of lettuce cultivars (*Evola*

species) were sprayed with *Listeria monocytogenes* strain E6G serotype 1/2a and *Salmonella typhimurium* wild type (Turner) singly and in combination. Microbial counts were determined on selective media. The microbial diversity showing these two interactions were also evaluated using the Terminal restriction fragment length polymorphism (TRFLP). *Escherichia coli*, *Listeria monocytogenes*, *Pseudomonas* sp. *Pantoea oleae* were some of the bacteria species identified. Fungal species identified on the lettuce leaves were *Geotrichum* spp. *Saccharomyces cerevisiae* and *Candida* sp. *Pichia* species used as a bio-control agent at levels of $2x10^6$ showed a 100% reduction of *L. monocytogenes* strain E6D after 7 days of inoculation. The growth of *S. typhimurium* together with *Pichia* species at cell concentrations of $1.3x10^5$ and $3.40x10^5$ respectively showed a 3 log cycle reduction of *S. typhimurium* on lettuce leaves after 12 days of inoculation. *Pichia* species has the potential as a bio-control agent. **Vao day nghe bai nay di ban http://nhatquanglan.xlphp.net/**

SECTION II

9.0 DEVELOPMENT REPORT

Report on Activities Carried Out towards Achievement of Accreditation of Fri Thirteen Microbiological, One Mycotoxin and Four Chemical Methods to ISO/IEC 17025

1. Introduction

The Food Research Institute has established and is implementing a quality management system according to ISO/IEC 17025 Standard since August 2001. The main objective was to obtain accreditation for 4 chemical, one mycotoxin and 13 microbiological methods to ISO/IEC 17025: Standard. This was to ensure that the Food Research Institute's Chemistry and Microbiological laboratories produce technically valid analytical results that can be internationally accepted by customers.

Director General, Directors of CSIR Institutes, Board Members of CSIR-FRI supports Accreditation

Prof. E.S. Ayensu making remarks on the celebration of Accreditation

In the previous year, the Institute applied for accreditation of 18 methods from the South African National Accreditation System (SANAS). The initial assessment of the management system and the technical competence of staff were conducted in November/December 2006. A total of 27 non-conformances were found made up of seventeen major and ten minor non-conformances.

The assessors recommended accreditation for eleven microbiological methods and four chemical methods provided the twenty-seven non-conformances were corrected within three months beginning January 2007 to end of March 2007. The methods recommended were as follows:

Dr. W. A. Plahar, Director CSIR-FRI assiduous effort to win Accreditation

A. *Chemistry* – For Food and Feed (Dried)

i. Protein as total nitrogen – Kjeldahl Method AOAC 984.13 (1990)

ii. Determination of crude fat content – Soxhlet Method. AOAC 39C (2000)

iii. Determination of Ash – AOAC 923.03 (2003)

iv. Determination of moisture – Air oven method AOAC 925.10 (1990)

CSIR-FRI Chemistry Laboratory Technologist working tirelessly towards Accreditation

B. *Microbiology*

Fish and fish products, chocolate and cocoa products, water, fruit juices and soft drinks, biscuits, toffees, dairy products, flour and flour products, meat and meat products, poultry, spices, flavourings and condiments, and vegetables

i. Enumeration of yeasts and moulds (ISO 7954, 1987 (E).)

ii. Enumeration of presumptive *Escherichia coli* (ISO 7251, 2005)

iii. Detection of *Salmonella* (NMKL No. 71, 1999 5th Ed.)

iv. Coliform bacteria detection in foods (NMKL No. 44, 2004).

v. Determination of *Bacillus cereus* in foods (NMKL No. 67, 2003)

vi. Determination of aerobic microorganisms (NMKL No. 86, 2006)

vii. Detection of thermo-tolerant coliform bacteria in foods after pre-incubation (NMKL No. 125, 2005).

viii. *Enterococcus* determination in foods (NMKL No. 68, 2003 3rd Ed.)

ix. Determination of total number of microbes with the swab method on utensils in contact with food (NMKL No. 5, 2001.)

x. Canned foods, aerobic & anaerobic. (NMKL No. 59, 2004.)

xi. Enumeration of coagulase positive *Staphylococcus aureus* in foods.(NMKL No. 66, 2003)

CSIR-FRI Microbiology Laboratory Technologist working tirelessly towards Accreditation

The Assessment Team also recommended the approval of the following personnel: Dr. Kafui Kpodo (Head, Chemistry Division), Mr. Charles Diako (Assistant Research Scientist, Chemistry Division) and Mr. William Amevor (Principal Technologist, Chemistry Division) as Technical Signatories for Chemistry; Mr. David Asiedu (Principal Technologist, Microbiology Division) and Mr. David Baisel (Senior Technologist, Microbiology Division) as Technical Signatories for Microbiology; and Ms. Mary Halm as the Management Representative (Quality Manager).

This report covers the activities of the FRI Quality Management System implemented in the Chemistry, Mycotoxin and Microbiology laboratories; Customer services Unit of the Commercial and Information Division (CID) and the Stores and Purchasing Units of the Accounts Division., for the year January to December, 2007.

2.0 Activities

2.1 *Correction of Non-Conformances Identified By SANAS from Initial Assessment of November/December 2006*

All the 27 non-conformances identified during the assessment visit by SANAS in December 2006 were corrected during the period January to March 2007 and the corrective action completion report was compiled and sent to SANAS on 26th March, 2007.

CSIR-FRI Chemistry Laboratory Technologist working tirelessly towards Accreditation

2.2 *Internal Audits*

According to the FRI Quality Management System, a minimum of two internal audits are to be conducted annually in each of the three laboratories i.e. Chemistry, Mycotoxin and Microbiology; the Client Services Unit of the CID and the FRI Stores to verify whether the operations comply with the requirements of FRI Quality Management System and the International Standard ISO/IEC 17025 and also whether the defined methods, procedures and instructions as stated in the documents are properly carried out.

Two internal audits were conducted during the year, one in February and the second in September. The audits were conducted by Dr. P.N.T. Johnson and Dr. Charles Tortoe both of the Processing and Engineering Division of the Food Research Institute.

The audit conducted in February mainly followed up on the non-conformances from the October/November 2006 audits and the external audit of November/December 2006 by SANAS to ensure that the corrections were completed and cleared by the end of March 2007. The September audit was a routine audit to check whether the system was being successfully implemented.

Only a few non-conformances were observed at the September audit indicating that the system was being implemented successfully

2.3 *Management Review Meetings*

Management review meetings are held twice a year to ensure the continuous suitability and effectiveness of the quality management system and introduce necessary changes and improvements.

Two meetings were held on 8th May and 19th November 2007, respectively.

The main matters discussed were:

- *Status of work in the Divisions*
- *Problems and difficulties encountered*
- *Suggestions for improvements*
- *Internal /External Audit findings*
- *Corrective and preventive actions*
- *Results of Proficiency tests and Internal quality controls*

- *Purchasing/Procurement*
- *Customer feedback and Complaints*
- *Resources and Staff training*
- *Other matters.*

Members of the Management Review Meeting include the Director (Chairperson); Deputy Director; Head Commercial and Information Division; Head Microbiology Division; Head Chemistry Division; Head Accounts and Stores Division; Head Administration Division and the Quality Manager as Member/Secretary.

2.4 *Participation in Proficiency Tests/Inter Laboratory Comparisons*

The Microbiology Laboratory participated in General Food and Dairy Microbiology Scheme organized by Bio Services UK Ltd. (formerly known as Senate QA Proficiency Testing Scheme, Great Britain). The Chemistry and Mycotoxin Laboratories participated in General Chemistry and Mycotoxin Proficiency Testing Scheme organized by FAPAS of UK.

CSIR-FRI Microbiology Laboratory Technologist working tirelessly towards Accreditation

The laboratories performed satisfactorily in these tests but when unsatisfactory z-scores were obtained corrective actions were taken as required.

The Chemistry Laboratory also participated in an inter laboratory comparisons kindly organised by SANAS with three accredited laboratories in Pretoria, South Africa and one accredited laboratory in Kenya.

A soya powder sample was analysed for fat, moisture, protein and ash by the five laboratories.

The z-scores obtained for the different analyses by the five laboratories were all satisfactory and acceptable i.e. z-scores of -2 to +2.

2.5 *Accreditation to* ISO 17025

On the 7th of June 2007, the Institute received notification from the Chief Administrator of SANAS dated 1st June 2007, that Approved Accreditation to ISO/IEC 17025: 2005 has been granted to CSIR- Food Research Institute Ghana (T0279) from May 2007 to May 2012.

The joy of Accreditation with our Director General, Prof. Owusu-Bennoah

The scope of the accreditation included the eleven microbiological and four chemical methods that were recommended by the assessment team as listed in the introduction of this report.

The following personnel were also approved: Ms. Mary Halm - Management Representative;
Mr. D.K. Aseidu and Mr. D.K. Baisel - Technical Signatories for Microbiology; Dr. K.A. Kpodo; Mr. W.K. Amevor and Mr. C. Diako- Technical Signatories for Chemistry.

2.6 *Activities to Publicise Attainment of Accreditation to* ISO 17025

Ms. Mary Halm, CSIR-FRI Quality Manager expressing her joy for the Accreditation

Following the accreditation of the 15 laboratory methods to ISO 17025 by the South African National Accreditation System, the FRI Management Board recommended that publicity be given on this achievement by the Institute. . The Board recommended that a press conference be held, newspaper advertisements be made (with possible sponsorship from FRI clients), review of FRI analytical charges and a new letter head for the Institute be made to reflect the accreditation. A seven member

committee was formed by the Director of the Institute to plan and implement the following:

- *Press Conference by the Director General of the CSIR*
- *Newspaper advertisement on the accreditation (with possible sponsorship from FRI clients)*
- *Revision of FRI letterhead to include the SANAS accreditation logo*
- *New sign posts for the Institute*
- *An internal seminar to educate staff on the accreditation*
- *TV programs*
- *New brochures for the Institute reflecting the accreditation attained*
- *Thank you letter to DANIDA*
- *Review of FRI analytical charges*
- *Letters to ten most important clients of the Institute informing them about the accreditation.*

The Committee held a series of meetings starting from 20th of June, to 26th September, 2007 and submitted a report to the Director for approval and subsequent implementation of the proposed activities.

A press conference was held on 12th December 2007 at the Food research institute premises to announce the accreditation of the Institute's eleven microbiological and four chemical methods to the press for dissemination. The Press Conference was chaired by the Chairman of the Council for Scientific and Industrial Research Professor E. S. Ayensu and the press statement was delivered by the Director General of the Council for Scientific and Industrial Research, Professor E. Owusu-Bennoah.

Twenty seven journalists representing more than ten Press Houses were present to cover the press conference. Also present were Directors of other CSIR Institutes, members of FRI Management Board and representatives from the Ghana Standards Board, Food and Drugs Board, Ghana Atomic Energy Commission as well as clients of the Institute.

All the activities planned were implemented except for the TV programmes which were not implemented as at the end of December 2007 and have been re-scheduled for 2008.

Invited guest and scientists of CSIR-FRI gathered to share their joy for the Accreditation

APPENDIX I

FRI STAFF LIST (2007)

Directorate

1. W. A. Plahar - Director
   BSc (Gen.), BSc (Hons) MSc Fd. Sci. (Ghana) (Chief Research Scientist)
   PhD (Washington)

2. Dr. P. N. T. Johnson - Deputy Director
   BSc (Hons), Biochem. (UST) (Principal Research Scientist)
   MSc. Agric. Eng. (Cranfield)
   PhD Food Sci. & Tech. (Reading)

3. M. Halm (Ms) - Quality Manager
   BSc (Gen.) BSc (Hons), MSc Botany (Ghana) (Senior Research Scientist)
   Post Grad. Dip. Rural Fd. Tech (Netherlands)

4. R. M. Yawson - Senior Scientific Secretary
   BSc. (Hons) M. Phil. (Biochem) Ghana
   Post Grad. Cert. Fd. Mgt. (Jerusalem)

5. S. Nketia - Scientific Secretary
   BSc. (Hons) Zoology& Botany (Cape Coast)
   Msc. (Fd. Sci. & Tech) KNUST
   MBA (KNUST)

6. F. Mante (Mrs.) - Snr.Admin Assistant
   Diploma in Business Studies (Sec)

Food Microbiology Division

1. W.A. Amoa -Awua - Head of Division
   BSc (Ghana) MSc. App. Sci. (Principal Research Scientist)
   (New South Wales)
   PhD (Ghana)

2. M. Ottah-Atikpo (Mrs.) - Research Scientist
   BSc Microbiology, MSc Fisheries (ABU, Zaria)
   PhD. (Ghana)

3. M. Obodai (Mrs.) - Research Scientist
   BSc (Hons), MPhil. Botany (Ghana)
   PhD University of Nottingham UK

4. M. Owusu (Ms.) - Research Scientist
   BSc (Hons), MPhil. Botany (Ghana)

5. Peter Adoquaye Addo - Research Scientist
   BSc. (Biological Sciences) Cape Coast
   MPhil (Biological Sciences) KNUST

6. Matilda Dzomeku (Mrs.) - Asst. Res. Scientist
   BSc Biological Sciences (KNUST)

7. Amy Atter (Mrs.) - Asst. Scientific Officer
   BSc Lab. Tech. (UCC)

8. Frederick A Sarpong - Asst. Scientific Officer
   BSc Lab. Tech. (UCC)

9. Deborah L. Narh - Asst. Res. Scientist
   BSc. (KNUST)

10. Nina Nkrumah - Asst. Scientific Officer
    BSc Lab. Tech. (UCC)

11. Evans Agbamafle - Asst. Scientific Officer
    BSc. Lab. Tech (UCC)

12. D. K. Asiedu - Snr. Technologist

13. D .K. Baisel - Technologist

14. R. Takli - Asst. Technologist

15. M. Amoo-Gyasi - Asst. Technologist

16. Theophillus Annan - Technical Officer
    Diploma in Lab. Tech (UCC)

Food Chemistry Division

1. Dr. (Mrs.) K. Kpodo - Head of Division
   BSc (Gen.) BSc (Hons) Ghana (Senior Research Scientist)
   MPhil (West Indies) PhD (Ghana)

2. G. A. A. Anyebuno - Research Scientist
   BSc (Hons), MPhil. Botany (Ghana)

3. C. Diako - Asst. Res. Scientist

BSc (Hons), Fd. Sci & Nut. (Ghana)

4.	F. Y. Mensah	-	Asst. Scientific Officer
5.	W. K. Amevor	-	Snr. Technologist
6.	P.Mensah Toku	-	Snr. Technologist
7.	D. N. A. Ankrah	-	Technologist
8.	N.Y. Amey	-	Technologist
9.	Jeremiah Lartey- Brown	-	Technical Officer
10.	Mercy Fianu	-	Technical Officer
11.	Vida Awidi	-	Technical Officer
12.	Belinda Ayitey Adjin	-	Technical Officer

Nutrition & Socio-Economics Division

1.	W. Quaye (Mrs.) BSc (Hons) MPhil Agric. Econs (Ghana)	-	Research Scientist
2.	M. Glover Amengor (Mrs.) Bsc.(Hon)Biochem. MSc. Environ. Sci. &Tech, MSc. Public Health	-	Research Scientist
3.	A. Kuevi (Ms.) BSc Fd Sci &Nutri. (University of Ghana) MPhil in Nutrition (University of Ghana)	-	Research Scientist
4.	I. Yawson (Mrs.) BSc (Hons) Fd. Sci & Nut. (Ghana)	-	Assistant Research Scientist
5.	L.Hagan (Mrs) BSc (Hons) Home Sci. (Ghana)	-	Assistant Research Scientist
6.	B. Kudjawu (Ms.) BSc (Hons) Home Sci. (Ghana)	-	Assistant Research Scientist
7.	E. Ayeh (Ms) Bachelor of Education (UCC)	-	Assistant Research Scientist
8.	I. A. Tamakloe (Mrs.)	-	Chief Tech. Officer
9.	Alice Padi (Mrs.)	-	Technical Officer
10.	Constance Boateng	-	Technical Officer

Commercialization & Information Division

1. Dr. P. Adu-Amankwa (Mrs.) - Head of Divison
   BSc (Hons) Biochem (UST) (Senior Research Scientist)
   MSc. Fd. & Mgt. Sci.,
   PhD Post-Harvest Physiology (Lond.)

2. K.A. Bugyei - Asst. Scientific Info. Officer
   BA Computer Science &Econs
   (University of Ghana)

3. A. Andoh - Chief Tech. Officer
4. B. Awotwi - Chief Tech. Officer
5. R. Kavi - Jnr Asst Librarian
6. B. P. Osae - Principal Technical Officer
7. P.O. Baidoo - Technical Officer
8. Joana B. Dzikunu - Snr. Admin. Assistant
9. Mary Assimah - Admin. Assist.

Food Processing & Engineering Division

1. Dr. P. N. T. Johnson - Head of Division
   BSc (Hons), Biochem. (UST) (Senior Research Scientist)
   MSc. Agric. Eng. Tech. (Cranfield)
   PhD Food Sci. &Tech. (Reading)

2. Dr. N. T. Dziedzoave - Senior Research Scientist
   BSc (Hons), Biochem. (UST)
   Post Grad. Dip. in Fd. Sci. & Nut., (Gent, Belgium)
   MSc Fd. Sci. & Tech. (UST)
   PhD (Greenwich)

3. Dr. J. T. Manful - Senior Research Scientist
   BSc (Agric), Dip. Ed. (Cape Coast)
   MPhil Biochem. (UST)
   PhD (Greenwich)

4. D. Blay - Research Scientist
   MSc Chem. Eng. (Moscow)

5. E. C. Tettey - Research Scientist
   BSc (Hons) Agric (UST)
   Post-Grad. Dip. Fd. Tech.,
   MPhil, (Humberside)

6. Dr. L. D. Abbey BSc (Hons), Biochem. (UST) MSc. App. Sci. (Fd. Tech.) New South Wales PhD (Ghana)	-	Research Scientist
7. C. K. Gyato Nat. Dip. in Agric. Mech. (Ghana) MSc Agric. Eng. (Bulgaria)	-	Research Scientist
8. Dr. K. A. Vowotor B.Sc. Zoology Dip. Ed. (Cape Coast) M. Phil. PhD (Ghana)	-	Research Scientist
9. B.A. Mensah MSc. Fd. Pross. Tech. (Kransnodar, USSR)	-	Research Scientist
10. S. K. Noamesi BSc (Agric) MSc Fd. Sc. (Ghana)	-	Research Scientist
11. J. Gayin BSc (Hons) Biochem (UST) MSc Fd. Tech. (Gent)	-	Research Scientist
12. Dr. C. Tortoe BSc (Hons), MPhil. Botany (Ghana) PhD Osmotic Drying of Foods (University of Greenwich, UK)	-	Research Scientist
13. G. A. Komlaga BSc (Hons) Biochem (Ghana) MSc Fd. Sc. & Tech. (UST)	-	Research Scientist
14. C. Oduro-Yeboah (Mrs.) BSc (Hons) Biochem (Ghana) MPhil (Ghana)	-	Research Scientist
15. E. A. Baidoo BSc (Hons) Biochem (UST)	-	Asst. Res. Scientist
16. S. A. Sampare	-	Chief Tech. Officer
17. J. R. Addo	-	Snr. Tech. Off.
18. E. Ablorh	-	Snr. Tech. Off.
19. J. A. Asafu-Adjei	-	Prin. Works Supt
20. R. Y. Anthonio	-	Prin. Works Supt.
21. R. M. Mawuli	-	Works Supt.
22. J. L. Lamptey	-	Works Supt.

Accounts Division

1.	N. Adoboe-Mensah ICA Ghana	-	Head of Accounts
2	J. Mintah Nakotey	-	Chief Stores Supt.
3.	C. Aikins Tutu	-	Chief. Accounting Asst.
4.	K. K. Aidoo	-	Chief Accounting Asst.
5.	C. Amega	-	Snr.Accounting Asst.
6.	S. O. T. Oddoye	-	Prin. Stores Supt.
7.	G. O. Gyamfi	-	Prin. Stores Supt.
8.	J. K. Larbi	-	Accounting Asst.

Administration Division

1.	J. Aggrey –Yawson (Ms.) Institute of Chartered Sec & Administrators Certificate in HRM	-	Asst. Admin Officer.
2.	J.F. Asigbey	-	Chief Admin. Asst.
3.	E. A. Larbi	-	Chief Works Supt.
4.	G. Aklieh	-	Prin. Works Supt.
5.	C. Ketsie (Ms.)	-	Admin Asst.
6.	Eric Ofori	-	Admin Asst
7.	Victoria Alambire (Ms.)	-	Admin. Assistant
8.	Beullah Adadevor-Sallah (Mrs.)	-	Admin. Assistant

APPENDIX II

RESEARCH REPORTS, PAPERS PRESENTED AT CONFERENCES, SEMINARS AND MEETINGS

Edited Research Report

Abu-Bakar, S., **Dziedzoave, N. T.,** and **Akoto, V. (2007).** Selection of First Four RTIMP GPCs. In Tano North, Techiman, West Gonja and Sekyere West Districts. Report submitted to the RTIMP, MoFA, Ghana. 36pp

Tortoe, C., Johnson, P-N.T. and Nyarko, A. I. **(2007).** Effect of osmo-dehydration, blanching and semi-ripening on the viscoelastic, water activity and colorimetry properties of flour from three varieties of plantain. (*Musa*AAB). FRI/CSIR, Accra, Ghana. pp.24.

Tortoe, C., Gayin, J, Johnson, P-N.T., Noamesi, S. K., Tamakloe, I. and Adiepena, N. **(2007).** Report on training workshop on plantain processing and recipe development. Gatsby/CSIR/MOFA Banana and Plantain Project, 15th-17th May, 2007, Accra, FRI/CSIR, Ghana. pp. 32.

Journal Paper

Amoa-Awua, W. K. Sampson, E., Tano-Debrah, K. **(2007).** Growth of yeasts, lactic and acetic acid bacteria in palm wine during tapping and fermentation from felled oil palm (*Elaeis guineensis*) in Ghana. *Journal of Applied Microbiology,* 102, 599-606.

Amoa-Awua, W.K., Ngunjiri, P., Anlobe, J., **Kpodo, K., Halm, M. (2007).** The effect of applying GMP and HACCP to traditional food processing at a semi-commercial kenkey production plant in Ghana. *Food Control,* 18, 1449-1457.

Nielsen, D.S., Schillinger, U., Franz, C.M.A.P., Bresciani, J., **Amoa-Awua, W.**, Holzapfel, W.H., Jakobsen, M. (2007). *Lactobacills ghanaensis*, sp. a novel, motile, lactic acid bacterium isolated from Ghanaian cocoa fermentations. *International Journal of Systematic and Evolutionary Microbiology.* Accepted for publication.

Sablah, M., Sefa-Dedeh, S., Zagre, N.M., **Amoa-Awua, W. K. (2007).** The application of HACCP principles to evaluate quality and aflatoxin levels in the handling of post harvest maize in Ghana. Accepted for publication by *Africa Journal of Food, Agriculture, Nutrition and Development (AJFAND).* Accepted for publication.

Tomlins, K., **Manful, J., Gayin J., Kudjawu B.** and **Tamakloe I. (2007)** – Study of sensory evaluation, consumer acceptability, affordability and market price of rice. Journal of the Science of Food and Agriculture 87: Pp. 1564-1575.

Attiogbe F.K., **Glover-Amengor M.**, Nyadziehe K.T.. **(2007).** Correlating Biochemical and Chemical Oxygen Demand – A Case Study of Selected Industries in Kumasi, Ghana. West African Journal of Applied Ecology vol 11: 155 - 164

Glover-Amengor M., Tetteh F. M. **(2007).** Effect of Pesticide Application Rate on Soil Microbial Communities and Yield of Vegetables. West African Journal of Applied Ecology vol 12:

Quaye, W. (**2007**) Food Sovereignty and combating poverty and hunger in Ghana. *Tailoring Biotechnogies* Vol 3. Issue 2; 101-108.

Quaye, W., and Stosch L. (**2007**) A Study of Fuel Consumption in Three Types of Household Charcoal Stoves in Ghana. Accepted for publication in Vol.42(2007) of the *Ghana journal of Agricultural Science*

Quaye, W., and Ameleke G. (**2007**) Sorghum Market Intergration Study in Ghana. Accepted for publication in Vol.42(2007) of the *Ghana journal of Agricultural Science*

Quaye, W., Johnson Kanda I. and **Plahar W. A.** (**2007**) Adoption and Impact of High Quality Bambara Flour Technology Transfer in the Northern Region. Accepted for publication in *Ghana journal of Agricultural Science*

Quaye, W. (**2007**) Food Sovereignty Vs Food Security, Implications for the Ghanaian Economy. Biotech.Ghana-Forging Partnership to achieve Food Sovereignty through Biotechnology. Vol5 No. 1, September 2007

Onokpise O., Abazinge, M., **Ottah Atikpo, M.,** Baptiste, J.J., Louime, C., Uckelmann, H, and Awumbilla, B. **(2007).** Stabilization and utilization of seafood processing waste as a slow release nitrogenous fertilizer for production of cabbage in Florida, USA and mushroom in Ghana, Africa. *American-Eurasian J. Agric. & Environ. Sci.*, 2 (6):00-00.

Tortoe, C., Orchard, J., Beezer, A. and O' Neil, M. **(2007).**Potential of calorimetry to study osmotic dehydration of food materials. Journal of Food Engineering **78**, 933-940.

Tortoe, C., Orchard, J., Beezer, A. **(2007).** Osmotic dehydration kinetics of apple, banana and potato. International Journal of Food Science and Technology **42**, 312-318.

Tortoe, C., Orchard, J., Beezer, A**. (2007).** Prevention of enzymatic browning of apple cylinders using different solutions. International Journal of Food Science and Technology **42**, 1475-1481.

Tortoe, C., Orchard, J., Beezer, A. **(2007).** Comparative behaviour of cellulosic and starchy materials during osmotic dehydration. Journal of the Science of Food and Agriculture **87,** 1284-1291.

Johnson, P-N. T., Adebayo, K., **Ottah Atikpo, M.**, Essel, K., Ellis, W. O., Awudza, J. and Tomlins, K. I. **(2007).** Institutional lessons from the partnership to improve food safety management and livelihoods of street food vendors and consumers in Ghana. Journal of Sustainable Development, Vol. 4, No. 1/2, pp. 39 – 44.

Oduro-Yeboah, C., Johnson, P-N.T., Sakyi-Dawson, E. O. and Budu, A. **(2007).** Instrumental andSensory Textural Profile Attributes of Fufu Flour from Cassava-Plantain Flour. Journal of root crops, 33,(1), (2007) 23-27.

Tortoe, C., Orchard, J., Beezer, A. **(2007).** Artificial cell studies in simulated apple and potato starch cell complex during osmotic dehydration. Journal of Food Quality (Accepted for publication on 10-10-2007).

Tortoe, C., Orchard, J., Beezer, A. and Tetteh, J. **(2007).** Artificial neural networks in modeling osmotic dehydration of foods. Journal of Food Processing and Preservation (Accepted for publication on 12-12-2007).

Conference Paper

Johnson, P-N. T., Tomlins, K. I., **Oduro-Yeboah, C**., **Tortoe, C**. and Quayson, E. **(2007).** A case study to develop an appropriate quality assurance system for two cassava-based convenience foods. Proceedings of the International Workshop: Potential of Cassava (*Manihot esculenta* Crantz) processing in West Africa. 4-7 June, 2007. Abidjan, Cote d' lvoire. 274-281.

Atikpo, O. M. A., Onokpise, O., Abazinge, M., Louime, C., Uckelmann, H. and Awumbilla, B. **(2007).** Utilization of fish processing waste as a slow release nitrogenous fertilizer for mushroom production in Ghana, Africa. In Proceedings: ERTEP 2007: First International Conference on Environmental Research, Technology and Policy. July 17 – 19, 2007. La Palm Royal Beach Hotel, Accra, Ghana.

Manual

Amoa-Awua, W.K., Madsen, M., Takrama, J., Olaiya, A., Ban-Koffi, L., Jakobsen, M. **(2007).** Quality Manual for the production and primary processing of cocoa

Johnson, P-N. T., Noamesi, S. K., Tamakloe, I., Tortoe, C., Gayin, J., Dennis, J. and Adiepena, N. **(2007).** Your plantain processing and recipe manual. Gatsby Banana and Plantain Project, FRI/CSIR Accra, Ghana. pp. 22

Technology Transfer

Gayin J. Sampare, A. Mensah, M. Naaikuur, L. & Johnson P-N.T (2007) Report on Workshops to ?Introduce the Technology of Flour Fortification with Vitamin Premix to Women Groups in Tanina and Saan in the Upper West of Ghana, Report of MI/WFP/CSIR-FRI FLOUR FORTIFICATION PROJECT, HELD: 21-22 AUGUST 2007

Unedited Conference Paper

Quaye, W. (2007) Poster presentation on Adoption and Impact Study of High Quality Bambara Flour Technology Transfer in Northern Ghana: 3rd Symposium on Recent Advances in Food Analysis 7-9 November 2007. Diplomat Hotel-Conference Center Prague, Czech Republic

Quaye, W. (2007) Review of Socio-economic Aspects of Street Foods in Ghana presented at 2nd Food Safety in African Workshop held at University of Stellenbosh, South Africa, 26 November to 1st December,2007; Organized by International Committee on Food Microbiology and Hygiene (ICFMH)

Quaye, W. (2007) Enhancing Food Sovereignty for better future Nutrition in Ghana: A case study of the local cowpea food network presented at TELFUN Workshop held at Wageningen University Netherlands , 12th to 16th Febraury ,2007;

Ottah Atikpo, M. A., Onokpise, O., Abazinge, M., Louime, C., Uckelmann, H. and Awumbilla, B., **(2007).** Utilization of fish processing waste as a slow release nitrogenous fertilizer for mushroom production in Ghana. Poster presented at ERTEP 2007: First International Conference on Environmental Research, Technology and Policy. July 17 – 19, 2007. La Palm Royal Beach Hotel, Accra, Ghana.

APPENDIX III
COMMERCIALIZATION ACTIVITIES-INTERNAL GENERATED FUND

Divisions/Units	*Actual Income for the year*	*Actual Expend. for the year*	*Net Income for the year*	*Balance as at 1/1/2007*	*Balance as at 31/12/2007*
Micro-Biology					
Laboratory Analysis	60,999.11	23,373.64	***37,625.47***	5,438.27	**43,063.74**
Mushroom	6,000.26	2,617.59	***3,382.67***	(686.18)	**2,696.49**
Sub-total	66,999.37	25,991.23	***41,008.14***	4,752.09	**45,760.23**
Chemistry					
General Chemistry	21,928.70	15,824.13	***6,104.57***	(1,561.92)	**4,542.65**
Aflatoxin Analysis	10,617.33	150.00	***10,467.33***	(246.65)	**10,220.68**
Sub-total	32,546.03	15,974.13	***16,571.90***	(1,808.57)	**14,763.33**
Processing & Engineering					
Pilot-Scale Production Unit	20,435.80	17,869.80	***2,566.00***	(195.38)	**2,370.62**
Engineering unit	15,517.63	16,080.66	***(563.03)***	904.00	**340.97**
Roots & Tuber Production & Dev. Unit	26,278.19	22,257.14	***4,021.05***	(6,002.05)	**(1,981.00)**
Sub-total	35,953.43	33,950.46	***2,002.97***	708.62	**2,711.59**
Food & Socio-economics	1,292.50	776.44	***516.06***	151.50	**667.56**
MORINGA Training	1,540.00	500.65	***1,039.35***	-	**1,039.35**
Commercialization & Infor.					
FRI shop	5,887.90	5,969.80	***(81.90)***	(321.80)	**(403.70)**
Others - Institutional Expenditures	2,394.55	54,852.73	***(52,458.18)***	0.80	**(52,457.38)**
Total	**172,891.97**	**138,015.44**	***12,619.39***	***(2,519.40)***	***10,099.98***

APPENDIX IV

FRI STAFF TRAINING – 2007

	NAME OF STAFF	DESIGNATION	COURSE	INSTITUTION OF STUDY
1.	E. C. T. Tettey	RS	PhD (Fd. Sci)	Univ. of Ghana,
2.	E. A. Baidoo	ARS	MPhil (Fd. Sci)	Univ. of Ghana, Legon
3.	Charles Diako	ARS	MPhil	Univ. of Ghana, Legon
4.	Linda Hagan	ARS	MPhil	Univ. of Ghana, Legon
5.	Theophilus Annan	Tech. Officer	BSc (Lab Tech)	UCC
6	J.F. Asigbey	CAA	BA Hons	Univ. of Ghana,Legon (City Campus)
7.	Ivy Yawson	ARS	MSc	University of Minnisota (USA)
8.	Bernice Kudjawu	ARS	MSc	Perdue University (USA)
9.	Eric Ofori	SAA	BA	IPS Ghana
10.	Margaret Owusu	RS	PhD	University of Denmark

APPENDIX V

FRI STAFF TRAINING COMPLETION – 2007

	NAME OF STAFF	DESIGNATION	COURSE	INSTITUTION OF STUDY
1.	M. Obodai (Mrs.)	RS	PhD	University of Nottingham

APPENDIX VI

APPOINTMENTS

1. Mr. Fred Agyeman Sarpong	Assistant Scientific Officer
2. Mr. Foster Yao Mensah	Assistant Scientific Officer
3. Mrs. Amy Atter	Assistant Scientific Officer
4. Ms. Nina Nkrumah	Assistant Scientific Officer
5. Mr. Evans Agbamafle	Assistant Scientific Officer
4. Mrs. Evelyn Serwah Buckman	Assistant Research Scientist
5. Ms Anna Kuevi	Assistant Research Scientist
6. Ms Deborah L. Narh	Assistant Research Scientist
7. Mr. Kwabena Asiedu Bugyei	Assistant Scientific Info. Officer
8. Mr. Stephen Nketia	Scientific Secretary
9. Mr. Thomas Najah	Technical Officer
10. Mr. Solomon Dowuna	Technical Officer
11. Ms. Helena Ama Van-Ess	Technical Officer
12. Ms. Vida Awidi	Technical Officer
13. Ms Mercy Fianu	Technical Officer
14. Ms. Belinda Ayitey Adjin	Technical officer

APPENDIX VIII
ORGANOGRAM