

Council for Scientific & Industrial Research



Food Research Institute

2006 Annual Report



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Council for Scientific and Industrial Research

Food Research Institute



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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13. **Robert M. Yawson** - Secretary
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Principal Officers

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Director Dr. Wisdom A. Plahar

Deputy-DirectorMrs. 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

Scientific Secretary Robert M. Yawson

Members of the Internal Management Committee

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2. Dr. W. K. Amoa-Awua - Head FMD
3. Dr (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, PSPU-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. R. M. Yawson - Scientific Secretary
12. Mr. N. Adoboe-Mensah - Head, Accounts
13. Mr. D. Asiedu - Chairman, Staff Welfare
14. Mr. Ben Awotwi - Chairman, SSA-FRI
15. Mr. R. Mawuli - Chairman, TUC

TABLE OF CONTENTS

Contents	Page
Executive Summary	vii
PART I: GENERAL MATTERS: Non-Scientific Divisions	
1.0 Administration Division	1
2.0 Accounts Division	5
3.0 Commercial and Information Division	8
PART II: SCIENTIFIC DIVISIONS	
4.0 Nutrition and Socio-Economics Division	12
5.0 Food Chemistry Division	14
6.0 Food Processing and Engineering Division	19
7.0 Food Microbiology Division	23
PART III: RESEARCH ACTIVITIES	
SECTION I	
<i>Food Safety and Quality Assurance Activities</i>	
8.0 Summary on the Accreditation Project	28
SECTION II	
<i>Food Evaluation and Product Development Programme</i>	
9.0 Consolidated Scientific Report on Casava-SMEs	33

APPENDICES

APPENDIX I	FRI SENIOR STAFF LIST (2005)
APPENDIX II	SCIENTIFIC REPORTS AND PUBLICATIONS
APPENDIX III	INTERNALLY GENERATED INCOME
APPENDIX IV	FRI STAFF TRAINING
APPENDIX V	FRI STAFF TRAINING COMPLETION
APPENDIX VI	CONFERENCES, WORKSHOPS AND SEMINARS ATTENDED
APPENDIX VII	ORGANOGRAM

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 CSIR in its changing phases of corporate augmentation has become a centre of excellence in research and development (R&D) by generating appropriate technologies that are responsive to demands of the private sector and socio-economic development. 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. Technologies developed will be commercialized for private sector development in Ghana and abroad.

CSIR-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. CSIR-FRI's mission is primarily, to conduct market oriented applied research and provide technical services and 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 industries, contribute to food security, foreign exchange earnings and the application of cost-effective food processing technologies that are environmentally friendly.

CSIR-FRI 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, the 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 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- Scale Production Unit of the division conducted pilot scale studies into products developed by

FRI. The Commercial and Information Division coordinates all commercial activities of the Institute. The commercialization process of the Institute continued and the following areas were the major sources of income:

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

The total receipts for the year amounted to ₦12,555,138,263 of which 74% represents government subvention for personnel emolument and administrative expenditure, 1% represents subvention for service activities (research), 8% represents internally generated funds, and 18% represents donor-assisted fund. The net profit margin on the internally generated activities of the institute for the year under review was 15.6%.

The South Africa National Accreditation Service (SANAS), the accreditation body of South Africa, finally carried out an on-site inspection of the microbiology and chemistry laboratories from April and December, 2006 as a final step towards accreditation of fifteen laboratories methods of the Institute to ISO 17025. The inspection went well and the major non-conformances which were revealed by the audit were corrected and the report sent to SANAS. This was one of the major achievements of the Institute.

The year under review saw a high number of participation in local and international conferences by staff as shown in Appendix iv. In line with its mandate, the main programmes of the Institute during the year were centered on R&D activities for the solution of post-harvest and socio-economic problems of food quality and safety in the country. In this regards, the private sector Agro-processing development was a major component.

PART I: GENERAL ADMINISTRATION

1.0 ADMINISTRATION DIVISION

1.1 Movement to Okponglo

The year 2006 began on 4th January, 2006 after the Christmas recess. The beginning witnessed the movement of staff of the Josif Broz Tito offices to join their colleagues in the new two-storey office building complex at Okponglo. The movement was in March, 2006.

1.2 Staff Strength

The total staff strength at the close of the year stood at 163. The breakdown was as follows:

Category of staff	No. of Staff
Research Staff	36
Senior Staff	57
Junior Staff	70

1.3 Appointments

During the year under review, temporal appointments were given to the following staff:

- Mr. Reuben Owiredu as Assistant Technologist
- Ms. Angela Parry Hanson as Research Scientist
- Ms. Evelyn Serwah Ayeh as Assistant Research Scientist
- Ms. Anna Kuevi as Assistant Research Scientist
- Mrs. Amy Atter as Assistant Scientific Officer
- Mr. Frederick Agyeman Sarpong as Assistant Scientific Officer
- Mr. Kwabena Asiedu Bugyei as Assistant Scientific Information Officer
- Ms. Helena Ama Van-Ess as Technical Officer
- Ms. Vida Awidi as Technical Officer
- Mr. Thomas Najah as Technical officer
- Mr. Solomon R.N Dowuona as Technical Officer

1.4 Resignations

During the year under review, five (5) staff resigned from the Institute and the Council. They are

- Ms. Bernice Antwi whose resignation took effect from 6th February, 2006
- Mr. Samuel Tagoe, effective 1st April, 2006
- Reuben Owiredu, effective 1st July, 2006
- Ms. Angela Parry-Hanson effective
- Mrs. Patience Larweh
- Dr. (Mrs) N.T Annan, which would take effect from 31st March, 2007.

1.5 Funeral Announcement

Mr. George Akyea, a Senior Technical Assistant of the Processing and Engineering Division passed away after a long sickness. He was buried on 1st July, 2006.

1.6 Retirements

During the year under review, Mrs. Opoku Acheampong, Chief Technical Officer with the Processing and Engineering Division and Mr. John Anlobe, Principal Technologist, with the Food Microbiology Division proceeded on their terminal leaves to retirement on 22nd July, 2006 and 12th December, 2006 respectively.

1.7 Promotions

During the year under review, several promotions were announced for both Senior and Junior Staff. The following were the staff who had their promotions:

<i>Name</i>	<i>Promoted To</i>	<i>Effective date</i>
Janet Aggrey-Yawson	Assistant Admin. Officer	1 st September, 2006
Faustina Somuah	Senior Admin. Assistant	1 st September, 2006
Michael Amoo-Gyasi	Technologist	1 st January, 2006
Richard Takli	Technologist	1 st January 2006
David Ankrah	Senior Technologist	1 st January, 2006
Nelson Amey	Senior Technologist	1 st January, 2006
David Baisel	Senior Technologist	1 st January, 2006
Theophilus Annan	Senior Technical Officer	1 st January, 2006
Godwin Armah	Technical Officer	1 st January, 2006
Reuben Tetteh	Driver Inspector	1 st January, 2006
Gariba Alimiyao	Driver Inspector	1 st January, 2006
Anthony Servor	Driver Inspector	1 st January, 2006
Samuel Odjao	Driver Inspector	1 st January, 2006
Cofie Aikins Tutu	Chief Accounting Assistant	1 st January, 2006
Kenneth Aidoo	Chief Accounting Assistant	1 st January, 2006

1.8 Upgrading

Mr. Raphael Kavi was upgraded to Junior Assistant Librarian after obtaining his First degree in Information Studies with Politics. The Upgrading took effect from 31st May, 2005.

1.9 Study Leave with Pay

During the year under review, the Institute had eleven (11) of its staff on study leave pursuing courses at various levels in various institutions locally and abroad. They included;

- Mr. E.C.-T Tettey - University of Ghana, Legon (PhD)
- Mrs. Mary Obodai - University of Nottingham (UK)(PhD)
- Mr. Elvis A. Baidoo - University of Ghana, Legon (MPhil)
- Mr. Philip Baidoo - GIMPA (Marketing)
- Mr. John Asigbey - University of Ghana (BA)
- Mrs. Faustina Mante - Central Univ. College (BBA)
- Dr. (Mrs.) Pearl Adu-Amankwa - U.G.B.S (EMBA)
- Mrs. Ivy Yawson - University of Minnesota, U.S.A (MSc)
- Ms. Bernice Kudjawu - Purdue University, USA (MSc)
- Mrs. Linda Hagan - University of Ghana (MPhil)
- Charles Diako - University of Ghana (MPhil)
- Mr. Theophilus Annan - University of Cape Coast (BSc)

1.10 Leave without Pay

During the year under review, Mrs. Wilhemina Quaye, a Research Scientist with the Nutrition and Socio-Economic Division was granted a one-year leave without pay. This took effect from 1st March, 2006. Dr. (Mrs.) N.T Annan, Senior Research Scientist with the Food Chemistry Division was granted one year leave without pay. This also took effect from 31st March, 2006.

1.11 In-service Training

- i. SIST training Workshop organized by INSTI from 11th – 12th April, 2006 was participated by Mr. Robert Yawson, Scientific Secretary of the Institute.
- ii. Records management and archives administration workshop: This was organized by Laysia Info Consult on 26th -28th April, 2006 at Ebenezer Presby Church Hall. Mr. Eric Ofori participated in this workshop.
- iii. CTA/INSTI Workshop organized by INSTI in collaboration with CTA was participated by Dr. L. Abbey from 17th – 28th April, 2006.
- iv. Certificate Course in Procurement and Materials Management; GIMPA from 13th February – 7th April, 2006. This course was participated by Messrs. George Gyamfi and James Cromwell.
- v. Spokespersons training workshop on Biosafety systems, organized by BNARI at Ellking Hotel on 5th – 6th June, 2006. it was attended by R.M Yawson, the Scientific Secretary
- vi. Ghana SIST platform Launching Seminar: this was held at La Palm Royal Beach Hotel on 19th June, 2006. it was attended by the Scientific Secretary, the Librarian and some of the Senior Members.

1.12 Attachment Training/National Service Postings

During the mid-year under review, 15 National Service Personnel were posted to the Institute. They were attached to the various divisions. There were also 16 students from the universities and polytechnics who undertook their practical attachment with the various divisions of the institute.

1.13 Institute Visitors

The Institute had a couple of visitors from various institutions. Among them was the Committee on Environment, Science and Technology who paid a visit to the Institute on 2nd June, 2006.

2.0 ACCOUNTS DIVISION

2.1 Introduction

The Accounts Division is responsible for the delivery of costs effective and efficient accounting and financial systems, policies and processes that meet the current and future requirements of the Institute. The Division ensures that the Institute is in compliance with all internal policies and relevant regulations and ensures filings of returns are completed in a timely manner. It prepares the financial statements, annual budgets, maintains the books of accounts and documents. The Division supports all the other Divisions to carry out their financial obligations for the smooth running of the Institute. 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 2006, the staff strength of the Division stood at eleven (11). The head of the Division is Mr. N. Adoboe-Mensah. 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. These are 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) counterpart funding and disbursements
- Administering funds request from donors and ensuring compliance with programmed budgets.
- Ensuring 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 procures, documents and stores items 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 Operations

The total receipts for the year amounted to $\text{R}12,555,138,263$ of which 74% represents government subvention for personnel emolument and administrative expenditure, 1% represents subvention for service activities (research), 8% represents internally generated funds, and 18% represents donor assisted fund. The total expenditure for the year was $\text{R}12,569,835,145$. 74% of these amount was spend on personnel emolument and administrative expenses, 0.4% on service activities, 7% on internally generated activities and 19% on donor projects. The net profit margin on the internally generated activities of the institute for the year under review was 15.6%.

2.6 Constraints

- Funds released to run the Institute in the year 2006 was woefully inadequate.
- Delay in release of Government subventions to meet personnel emoluments and administrative activities and research activities, e.g. funds for research activities for the third and fourth quarter was release in the first quarter of 2007.
- The Scala Accounting Software currently in use automatically deletes details of transactions relating to previous years and brings only the outstanding balances such as trade debtors, creditors etc.

2.7 Planned activities for 2007

The following activities for the division have been planned for the year 2007:

- Preparation of comprehensive fixed assets register for the Institute
- Reconciliation of 2006 trade debtors which stood at ₪255,466,076
- Preparation of 2008 annual budget estimates
- Preparation and audit of 2006 final account
- Updating all accounts ledgers for 2007 final accounts
- Reconciliation of bank accounts, debtor, and imprest accounts
- Submission of quarterly returns to CSIR head office.

Currently, the Division has completed 65% of the above activities.

2.8 Migration into Government Pay roll system - IPPD 2

The government has embarked on a comprehensive programme of salary administration. The objective is to integrate all GoG manpower cost components, improve HR and payroll management reporting, enhance HR management and development and ensure effective and efficient payroll cost management. As a government policy all public agencies including subvented organizations would be migrating into the government pay roll system by the end of December 2007. In view of this, the CSIR Corporate Finance has scheduled a number of training workshops for the programme. The IPPD 2 is an internet-based programme. It is therefore expected that the Institute would expedite action on its local area network project so as to ensure a smooth take off.

3.0 COMMERCIALISATION AND INFORMATION DIVISION

3.1 Introduction

The Commercial and Information Division continued its basic task of coordinating all the commercial activities of the Institute in order to generate income for the Institute. The Division has three Units namely Client Services' Unit, Library and Publications Unit and the Public Relations Unit.

3.2 Staff Strength

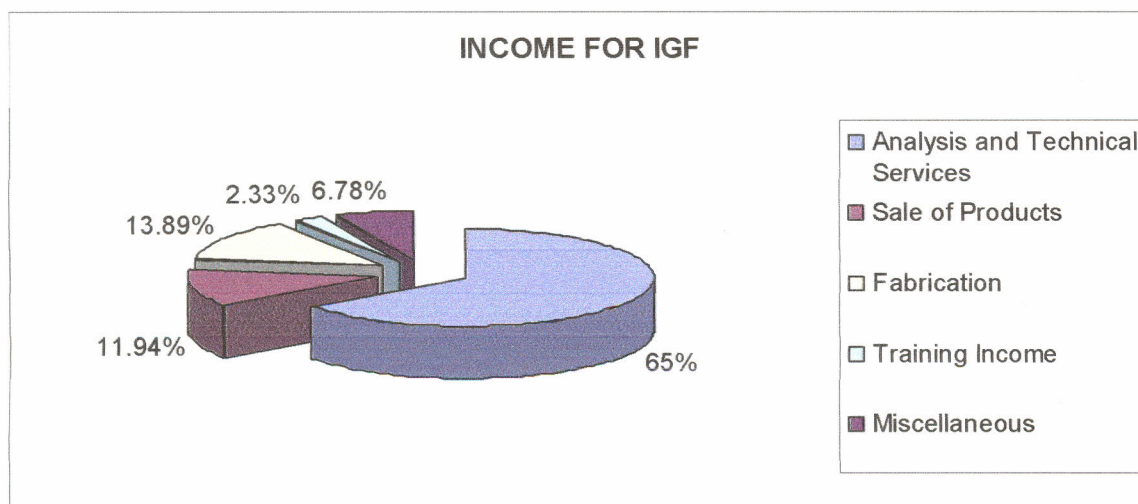
The staff was made up of Mrs. Agnes Osei-Yaw, Head of Division, Mr. Peter Addo, Mr. Augustine Andoh, Chief Technical Officer (C.T.O.), Public Relations, Mr. Ben Awotwi, C.T.O., Marketing, Mr. Raphael Kavi, Jnr. Assistant Librarian, Stephen Atta-Sonno, Library Assistant Gd. II, Mr. Philip Baidoo, Senior Accounting Assistant Ms Joana Dzikunu, Gd. Administrative Assistant, Ms. Mary Assimah, Clerk Gd. II, and Mr. Gariba Alimiyao, Driver II.

3.3 Commercialization Activities

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

3.4 Income Generation

The Institute generated a gross income of more than one billion cedis through its commercialization activities. The net Internally Generated Income (IGF) of the Institute amounted to about one hundred and sixty-seven million cedis. In 2006, 107 individuals, companies and/or organizations requested for microbiological services. The major clients for microbiological services were Pioneer Food Cannery Ltd., Cadbury Ghana Ltd, GAFCO (Agro Foods Co.), West African Mills (WAMCO), Promasidor, Burger Food Industries, Eurofood Ghana Ltd. Five hundred and five million was realized from 1210 samples analysed. There were 426 samples analyzed for 138 clients for chemistry.



3.5 Library report for 2006

The CSIR-FRI 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. A total of one hundred and forty persons (140) used the library during the period under review. On the whole, the clientele's acknowledge that the information provided was useful but there is the needed to improve its current stock.

The library during the period under review had its internet connectivity thus making it possible for the Institute's research scientists and technical staff to browse the net and access their electronic mails. The library also took delivery of a new computer and a USB Pen drive from GAINS Project under CTA Question and Answer Service.

3.6 Client Service

Queries received during the period under review covered soybean processing, rice processing, nutritional profile of groundnuts, utilization and consumption pattern of yam and other queries covered nutritional value of soymilk, nutritional values and processing of spices, *Solanum*

torvum, sorghum processing, quality assessment of iodated salt, tomato sauce. There were also queries on food-borne diseases, dietary studies in Ghana, mushroom cultivation, cashew nut, grass cutter rearing, fruits and vegetables, cereals and cereals processing

The assigned reasons given by the clientele's for the various requests were research, agro-processing, marketing information, personal use and Lecture/address.

The library received questions on food processing, food microbiology and food spoilage, maize and maize processing, soybeans processing, fruits and vegetables, mushroom cultivation and fish processing.

The library during the period under review referred some users queries to the research scientists to enable them avail themselves of certain information that was not available in the library.

The library directed some clientele's to MOFA library, CSIR-INSTI, and College of Agriculture and Consumer Science library (Univ. of Ghana) during the period under review.

3.7 Evaluation of service

During the period under review the users noted that the information provided was useful but remarked that there was the need to replenish the stock of the library with up to date publication and provision of e-resources.

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 TEAL Collection and GHAGRI database.

In the area of publicity of services, research scientists and technical staff were informed by word of mouth of certain information resources available in the library. The library also wrote some internal memos that alerted the research scientists of some publications that have been acquired by the library. The library placed various posters that had been received on the institute's notice boards and the various points in the library.

3.8 Recommendations

The users of the library made recommendations for the acquisition of a photocopier for the library, the acquisition of current publications to replenish the outdated stock and the provision of adequate library furniture that is appropriate reading chairs and tables

3.9 Public Relations activities

CSIR-FRI Media Exposure in 2006

The media was regularly monitored. There were no adverse comments in the media networks. Several articles were also published in the major Ghanaian Newspapers. Some of these were Addressing Poverty in National Development: Towards the Millennium Development Goals, “*The Role of Public Relations and Marketing* “ and “*The Truth about Genetically Modified foods*” By Dr. L.D. Abbey and Augustine Andoh

Exhibitions

The PR Officer undertook photographic project of FRI laboratories and prepared exhibitions laminated posters for exhibition readiness

Visitors

Visitors received were members of the Parliamentary Committee on Environment, Science and Technology, members of St. Theresa of the Child Jesus Society, and delegations from Nigeria and the United Kingdom.

PART II: SCIENTIFIC DIVISIONS

4.0 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 utilisation of food. The Division consists of the Socio-economics and the Nutrition Units. The latter handles community and human nutrition studies and runs a test kitchen which conducts sensory tests on products developed by the CSIR-FRI and Industry.

4.2 Staff Strength

The Division has a total staff strength of ten made up of 6 research-grade staff and 4 technical-grade staff. The staff comprises one Principal Research Scientist, two Research Scientists, four Assistant Research Scientists, one Chief Technical Officer, two Senior Technical Assistants and one Technical Assistant Grade II. Mrs Mina Quaye went on leave and Mrs. Patience Larweh resigned from her position as an Assistant Research Scientist with the Division. Ms. Anna Kuevi rounded up her MPhil project work. She and Ms. Evelyn Ayer, were appointed as Temporary Assistant Research Scientists. Both Mrs. Lynda Hagan and Ms Bernice Kudjawu went on study leave.

4.3 Research Activities

i) Peanut CRSP Project

Preparations were made to begin the final phase of the studies on the effect of peanut consumption on appetite, energy balance and cardiovascular diseases.

ii) AgSSIP

Research was conducted into the stabilization of groundnut paste with locally available products, namely shea butter, cocoa butter and refined palm oil.

4.4 Support of Research Activities

Sensory studies and Recipe Development

- Sensory evaluation was carried out to assess the acceptability of various groundnut soup samples prepared from pastes that had been stabilized with either shea butter, cocoa butter or refined palm oil.

4.5 Product Development

- The Division commenced the processing of *Moringa oleifera* leaves into powder on pilot bases.
- Reactivation of work on *tatale* mix production using various anti caking agents.
- Development of baby foods using other cereals and legumes instead of corn and soybeans.

4.6 Consultation

Preparation and sensory evaluation of starter culture fermented Ga kenkey as part of Prof Shetty's research activity on spontaneous fermented and starter culture fermented corn dough in Ga kenkey production.

4.7 Meetings/Workshops/Exhibitions

- Monthly meetings were held by the Salt Iodization Committee.
- **25-27th July:** Mrs. Glover-Amengor attended the National Sanitary/Phytopsanitary Harmonisation Workshop organised by USAID/WATH for Ghana.
- **15-18th August:** Dr. (Mrs.) Phoebe Lokko, Mrs. Glover-Amengor and Miss Anna Kuevi participated in the 'African Nutrition Epidemiology' conference held at GIMPA in Accra. Mrs Lokko presented a paper on effect of peanut consumption on body weight.

5.0 FOOD CHEMISTRY DIVISION

5.1 Introduction

The Chemistry Division comprises two units, the Food Toxicology and Industrial Services Units. The Division has presently been conducting 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, however, to support 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:

- 2 Senior Research Scientists
- 1 Research Scientist
- 1 Assistant Research Scientist
- 3 Principal Technologists
- 2 Senior Technologists
- 1 Assistant Technologist
- 3 Technical Officers
- 1 Senior Technical Assistant
- 1 Technical Assistant

The following staff movements occurred during the year:

- (i) Dr. (Mrs) Nana Annan proceeded on one year leave of absence.
- (ii) Mr Charles Diako started his MPhil Programme at the Food Science Department of the University of Ghana in August 2006.
- (iii) Ms. Vida Awidi was offered temporary appointment to the Division after completing her National Service.

5.3 Analytical Services

During the year under review, the Division offered analytical services to several companies, establishments and individuals. A total of 426 samples were received by the Industrial Services Unit for analyses. This number represents a 73% increase over the 240 samples received in 2005.

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 UNHCR, Ghana Inspections Ltd., Ghana Standards Board, Eurofoods Ghana Ltd., Agricare Ltd., Panbros Salt Ltd., Capital 02 Natural Health Products, GAFCO Fish Cannery, Baron Distilleries, Ntoboase Distilleries Industry, Yedent Agro Processing Ventures Ltd., Kadesh Enterprises Ltd., Processed Foods and Spices Ltd., Cadbury Ghana Ltd., Divine Feedmills, D and S Ventures, Asutuare Poultry Farms, among others. Analysis of the 426 samples generated a gross income of One Hundred and Eighty Five Million, Eight Hundred and Eighty Six Thousand and Five Hundred Cedis. (¢ 185,886,500).

During the year, the Toxicology Unit received a total of 122 samples for aflatoxin analysis as against 145 samples for the year 2005. This represents a reduction of 16% 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, Yankee Nuts, 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, Ghana/UK Trade Ventures Ltd., Yedent Agro Processing Ventures Ltd., GAFCO, Ghana Inspections Ltd., Asutuare Poultry Farms, Guinness Ghana Ltd., Catholic Relief Services, C&S Foods Ghana Ltd. Ghana-China Foods, and General Mills Company Ltd among others. Total charges for the 122 samples amounted to Eighty Four Million, Six Hundred and Twenty Five Thousand cedis (¢84,625,000).

The gross total for the two Units of the Chemistry Division was therefore Two Hundred and Seventy Million, Five hundred and Eleven thousand, Five Hundred Cedis (¢270,511,500).

5.4 Movement from Broz Tito to Okplongo premises

The Division had a very busy year. The first half of the year was devoted to movement to the new offices and Laboratories at Okplongo. Settling down was not smooth. One reason was due to the delay in re-locating the fume cupboards for the laboratories from the old site at Broz Tito to the new site. This compelled staff to work at both sites till the latter part of the year when the fume cupboards were finally installed. In addition, staff had to prepare vigorously to receive the Accreditation Team from SANAS in November/December. All staff in the Division had to defer their leave and those already on leave were recalled to prepare for the visit.

5.5 Practical Training and Attachment

During the year the following benefited from attachment/training in the Division:

- (i) Two members of staff (Messrs Charles Parkouda and Michel Kombari) from the Department of Food Technology (CRNST) in Ouagadougou, Burkina Faso were on attachment training in the General Chemistry and aflatoxin laboratories from 21st to 30th April 2007.
- (ii) One student each from KNUST (Ms Ernestina Amo-Mensah) and UDS (Dambasea Raymond) undertook their Practical Attachment with the Division.
- (iii) Five students from Accra Polytechnic pursuing the HND course were also attached to the General Chemistry Laboratory from 16th to 31st October 2006.
- (iv) One PhD student (Mr Paul Houssou) from the Programme de Technologie Agricole et Alimentaire (PTAA), Benin, also undertook part of his studies in the Chemistry Division from 16th January to 3rd February 2006 and from 15th June to 15th September 2006.

5.6 National Service Personnel

- (i) During the year four National Service personnel (Kuuku Biney, Wilson Agbeko, Deborah Abban and Gustav Agbeley) who started their service with the Division in 2005 completed in August 2006.
- (ii) Four new Service personnel (Immaculate Tanoë, Jemima Adjei-Fah, Foster Mensah and Belinda Ayitey-Adjin) were assigned to the Division in November 2006. They will be with the Division till August 2007.

5.7 Efforts towards Accreditation of Chemistry Laboratories

(i) *Internal Audits*

In preparation towards the Accreditation of our chemical methods to ISO 17025 Quality System, two audits were conducted during the year under review. These were held in April and October 2006.

(ii) *Proficiency Tests*

As a requirement for accreditation, the methods have to be subjected to proficiency testing 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.

(iii) *On-Site visit by SANAS Accreditation Team*

The SANAS accreditation team visited and conducted the much-awaited external audit of the Chemistry Laboratories from 28th November to 1st December 2006. Accreditation for four chemical methods was recommended subject to the clearance of the non-conformities identified. The accreditation of the aflatoxin method had to be suspended. This was because the assessors felt the methods presently being used were not current enough to merit certification.

(iv) *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. The results are being awaited.

5.8 Divisional Meetings

The Division held several formal and informal meetings during the year. Most of these meetings were used to discuss the Division's movement from Broz Tito to the new site at Okponglo and address issues pertaining to the Accreditation exercise.

5.9 Training and Attendance at Meetings

(i) Dr Kafui Kpodo attended a Workshop on "*International Property (IP) Strategy and Technology Licensing*" at the Noguichi Institute for Medical Research, Accra, from December

4th to 8th 2006. The Workshop was organised by The World Intellectual Property Organisation (WIPO) in cooperation with the Ministry of Justice and the University of Ghana.

(ii) Mr George Anyebuno participated in a National Workshop on “*Structuring Documentation according to ISO 9001 and ISO 17025 Quality Management Systems*” held at the Ghana Atomic Energy Commission from September 11th to 15th 2006.

5.10 Other Matters

Staff of the Division will like to thank all staff of the Institute for their co-operation before and during the visit of the SANAS accreditation team.

6.0 PROCESSING AND ENGINEERING DIVISION

6.1 Staff Situation & Movements

6.1.1 Staff Position

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

Grade	Number of staff
Senior Members	- 16
Senior Staff	- 5
Junior Staff & Others	- 26

6.1.2 Study Leave

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

6.1.3 Retirement and Resignations

Mrs. Kate Opoku-Acheampong (CTO), supervising technician in the Pilot-Scale Production Unit (PSPU) retired after more than 30 years of active service with the Institute. Mr. Sam Tagoe, PTO, assistant supervising technician also of PSPU resigned from the Institute.

a. New Staff

Three new technical staff, Ms Ama Van-Ess, Mr, Solomon Dowouna and Mr. Thomas Najah were given temporary appointments, all three assigned to the PSPU.

b. Travels and Other Activities of Senior Members

- i. Dr. J.T Manful traveled to Belgium, in February, to attend a workshop on the science of wheat and milling at KU Leuven. He again traveled to Cotonou, Benin in October for a workshop at the African Rice Centre (WARDA).

- ii. Dr. N. T Dziedzoave traveled to Cotonou to attend the CTA Annual Seminar on Role of Information and Communication in the Development of Small and Medium Agri-Food Processing Units in Africa.
- iii. Dr. P-N. T. Johnson twice traveled to Turkey (in April and September) to attend international workshops on food packaging and food drying, organized by the UNIWORLD of the UNIDO and the Turkish Government. He again traveled twice to the NRI, Chatham, UK (in May and December) to attend coordination meeting of the EU/FRI Cassava SMEs Project.
- iv. Mrs. C. Oduro-Yeboah traveled in May to Montpellier, France to undergo a two-month attachment with a laboratory at CIRAD. She worked on the characterization of plantain starch.
- v. Dr. N. T. Dziedzoave and Dr. L. D. Abbey traveled to China in October to attend a short course on Integrated Plant Management.
- vi. Mr. Elvis Baidoo and G. Komlaga traveled to China in December to attend a course.
- vii. A number of senior members also served on technical and specialized committees of the Ghana Standards Board. These included Dr. (Mrs.) Adu-Amankwa on the Fruit and Vegetable Technical Committee, Dr. P-N.T. Johnson on the National Codex Committee, Dr. Abbey on the Fish and Fishery Products Committee etc.

c. National Service Personnel

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

6.2 The Units and Consultancy Services of the Division

6.2.1 *The Pilot-Scale production Unit (PSPU)*

During the year under review, several commercial activities were carried out at the PSPU. The major activity carried out was the dehydration of various food products received from clients both externally and internally (i.e. research scientists) Apart dehydration, other clients brought a variety of products for roasting as well as for processing into flour and dough. Among the major clients were Comas Co. Limited, Tayaako Co. Limited and MV Foods. A total gross revenue of ₵69,750,000 was realized from these activities for the year by the Unit.

6.2.2 *The Engineering Unit*

The 2006 year saw the Unit continuing with its routine maintenance of processing, analytical machine and equipment of all divisions of the Institute. All the air-conditioners in offices and laboratories were routinely maintained. Burnt-out bulbs in offices, laboratories and street lights were also replaced.

The Unit also constructed a number of processing machines and equipment ordered by Institute's clients.

They were:

- A 500kg/hr Hammer Mill for Rodimays Company Limited
- 4 ton/hr Cassava Grater for John wise Company Limited
- 1 ton/hr cassava press for John Wise Company Limited
- A 24 – tray cabinet dryer for the FRI/UNIDO Sorghum Project

Two sets of the following machines which were under construction the previous year were completed and installed for two clients, Nene Osranam and Mrs. Poku:

- 500kg/hr Hammer Mill
- 500kh/hr Pneumatic conveyor with cyclone
- 500kg/hr Centrifugal flour sifter

The above-mentioned machines for Mrs. Poku have been test-run successfully. In connection with the revitalization of the then CPDU, now (RTPDU), the Unit rehabilitated the grater, centrifugal flour sifter, two presses and a diesel engine. The Unit also relocated the water sterilization plant from the PSPU to the RTPDU and in addition installed a new water pump to connect the existing water lines and systems.

The Unit also assisted the Sorghum Project with the installation of the Brewing Plant at the newly designated area accommodating the Project. The Unit immensely contributed in the final year activities of the two AgSSIP projects:

- i. FRI-AGP 2: Improving the hot-air processing of fresh fish using the chorkor smoker.
- ii. FRI-AGP 2: Development of diesel/kerosene operated drying machines for food grains for the small-and medium scale producers.

6.2.3 The Cassava Products' Developments Unit (now referred to as the Root and Tuber Products' Development Unit).

During the year under review the RTPDU processed a total of 30.02 tons of fresh cassava into 2.76 tons of *Kokonte* flour, 2.54 tons of *Agbelima* Flour and 0.33 tons of High quality Cassava flour (HQCF). Studies on the work rates for different unit processes were also undertaken as well as variations in temperature in the solar dryers used in production processes. Quality control studies were conducted on all incoming raw materials, intermediate as well as end products

6.3 Divisional Meetings

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

6.4 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 specialized training programme.

In addition, a number of customized training workshop were organized by the Division for clients. The training included *fufu* flour production, fruit processing into jam, juices and drinks.

6.5 THE CFC/UNIDO/FRI Sorghum Project

Screening of sorghum samples at laboratory level to identify good varieties for commercial brewing continued during the period under review. Forty eight (48) sorghum varieties were screened during the period. Out of the 48 samples screened, six (6) were found to have potentials for commercial brewing. The 6 samples include *Global 2000*, *Kazea*, *Kazea Manga*, *Belko Pielik 1*, *Dwaagy*, *Nakpaji*. The varieties identified above are yet to be brewed on the pilot brewing plant at Food Research Institute (FRI) to confirm their suitability for use as commercial grains (malt) for brewing.

7.1 Introduction

The main activities carried out by the Food Microbiology Division in 2006 were:

- (i) renovation of laboratories
- (ii) analytical services to clients
- (iii) accreditation of eleven microbiological methods to ISO 17025
- (iv) mushroom spawn production
- (v) research activities

7.2 Renovation of the Food Microbiology Laboratories

A Media Sterilization Room was constructed in the Food Microbiology Division by enclosing a portion of the veranda in front of the laboratories. This made it possible to remove all heat-generating equipment such as the wet and dry autoclaves from Media Preparation Room. These were installed in the Media Sterilization Room. Construction of the Autoclave Room was carried out as part of the EU/CSIR-FRI/Cocoa Project.

Revocation works were carried out in all the laboratories of the Food Microbiology Division. The target laboratories were the Media Preparation Room, the Balance Room, the General Laboratory and the two Inoculation Rooms. The renovation works has greatly improved the working conditions in the laboratories and also helped to maintain a more sterile environment in the laboratories. This was carried out as part of the preparations for the on-site visit by SANAS, the Accreditation Body of South Africa. The louver blades in the General Laboratory and the Inoculation rooms were replaced with sliding windows. The plywood ceiling of the Inoculation Rooms were replaced with plastic T&G to prevents insects from crawling through the ceiling into the rooms. The gate at the side of the Food Microbiology Division was walled off to prevent cars from driving behind the laboratories. This was done to prevent cars from kicking up dust to contaminate the laboratories. Renovation of the laboratories (apart from the construction of the Media Sterilization Room) was paid for by the Institute.

7.3 The Client Services Unit: Analytical services carried for customers

The Food Microbiology Division continued with its routine analytical services carried out for customers through the CID. A total 1,121 samples were analysed for clients involving a total number of 5,496 individual analysis (Table 1). The most important clients during the year were Pioneer Food Cannery and Cadbury Ghana Ltd. (Table II)

Table I. Breakdown of analysis carried out for clients by the Food Microbiology Division in 2006

Period	No of samples analysed	No of analysis carried out
1 st Quarter	369	1,392
2 nd Quarter	288	1,366
3 rd Quarter	213	1,407
4 th Quarter	251	1,331
TOTAL	1,121	5,496

Table II. The most important clients of the Food Microbiology Division in 2006

Most important clients	No of samples analysed	No of analysis carried out
Pioneer Food Cannery Ltd.	666	2,177
Cadbury Gh. Ltd.	196	1,276
GAFCO Fish Cannery Ltd.	86	407
West Africa Mills Ltd.	62	98
Promasidor Ghana Ltd.	43	163
Euro Food Gh. Ltd	24	112
Airways Catering Ltd.	14	39
Burger Food Industries	13	78
Cocoa Processing Co. Ltd	10	40
Ghana Inspection Ltd.	8	32

7.4 Accreditation of eleven microbiological methods to ISO 17025

SANAS, the accreditation body of South Africa finally carried out an on-site inspection of the microbiology laboratories as a final step in the accreditation of eleven methods of the Division to ISO 17025. The inspection went well. The major non-conformances revealed by the audit were corrected and the report sent to SANAS. SANAS has subsequently granted accreditation to the eleven microbiological methods.

7.5 The Mushroom Unit – Production and sale of mushroom spawns

A total of 1,347 bottles of mushroom spawns were produced by the Mushroom Unit and sold to mushroom growers throughout the country. Reactivation of mushroom cultures in the Mycelium Bank was started and is still in progress. Six cultures received from China were transferred onto agar and sorghum grains.

Groups which visited the Mushroom Unit included students from

- Department of Applied Biology of the University of Development Studies, Navrongo
- Ohawu Agric Collage

7.6 Research activities carried out in the Food Microbiology Division

- Work continued on the EU funded Project ‘Development of biochemical and molecular markers for determining quality assurance in the primary processing of cocoa in West Africa’ which was started in 2002
- Work was also carried out in the Mushroom Unit on the FAO mushroom project using fish wastes for the cultivation of mushrooms

7.8 Personnel

7.8.1 Retirement

Mr John Anglobe went on retirement during the year after 36 years of service to the Institute.

7.8.2 Employment

Mrs Amy Atter and Mr Frederic Agyeman Sarpong were employed as Assistant Scientific Officers by the Institute into the Food Microbiology Division.

7.8.3 Training

- Dr. Mary Obodai completed her PhD studies on “ *Characterization of the dominant flora of ‘nyamire’ a Ghanaian fermented milk*” at the University of Nottingham, U.K. and was awarded a Ph.D degree.
- Miss Mary Boham attended a training programme on mushroom cultivation in Hongkong in December 2006.
- Ms Matilda Dzormeku attended an intensive training course on mushroom cultivation in Beijing, China from 1st August to 31st September, 2006.
- Dr. W.K. Amoa-Awua & Ms Margaret Owusu participated in the 7th Biennial Seminar on African Fermented Foods in May 2006 in Cotonou, Benin.
- Dr. Margaret Ottah-Atikpo visited the Institute of Hygiene and Toxicology of the Federal Research Centre for Nutrition and Food in Karlsruhe, Germany to work on the Cocoa Project from 1st May to 31st April 2006.
- Dr. W.K. Amoa-Awua participated in Food Micro 2006 in Bologna, Italy from 29th August to 2nd September 2006.
- Dr. W.K. Amoa-Awua visited the Faculty of Life Sciences, University of Copenhagen Denmark from 2nd December 2006 to 7th February 2007 to work on the EU/CSIR-FRI Cocoa project.

7.8.4 National Service

The following completed their 2005/2006 national service in the Food Microbiology Division during year:

- Mr Foster Afranie
- Mr. Dela Ayivi
- Miss Asiya Labaran
- Mr Emmanuel Lawson
- Miss Afua Osei.

The following started their 2006/2007 national service during the year:

- Miss Deborah Narh
- Mr Evans Agbemafle
- Miss Nina Bernice Nkrumah

7.8.5 Attachment

- Miss Brigid Nkrumah started her professional attachment to the Food Microbiology Division during the year.
- Six undergraduate students did their vacation attachment training in the Food Microbiology Division during the year.

PART III: RESEARCH AND DEVELOPMENT ACTIVITIES

SECTION I

8.0 PILOT STUDIES AND TRANSFER OF PROCESSING TECHNOLOGIES PROGRAMME

8.1 CFC/UNIDO/GOG-FRI Project on industrial development of sorghum malt and its utilization in food industries

8.1.1 Background

The CFC/UNIDO/GOG-FRI project on industrial development of sorghum malt and its utilization in food industries was initiated as an intervention to solve the high cost of importation of malt by the brewery industries and to promote locally grown substitutes. The varieties of locally grown sorghum were to be identified by CSIR-FRI and also to be used for brewing. These were to be carried out on the pilot brewing plant at CSIR-Food Research Institute (FRI) to confirm their suitability for use as commercial grains (malt) for brewing.

8.1.2 Screening of sorghum samples

Screening of sorghum varieties at laboratory level to identify those foods for commercial brewing continued during the period under review. Forty eight (48) sorghum varieties were screened during the period. Out of the 48 samples, forty-two (42) were received from Savanna Agricultural Research Institute (SARI), five (5) was bought from the Nima market in Accra and one sample was bought in Zebila market in Upper region of Ghana. Out of the 48 varieties screened, six (6) were found to have potentials for commercial brewing. The 6 varieties include *Global 2000, Kazea, Kazea Manga, Belko Pielik 1, Dwaagy, Nakpaji*. The varieties identified above are yet to be brewed on the pilot brewing plant at Food Research Institute (FRI) to confirm their suitability for use as commercial grains (malt) for brewing.

8.1.3 Project staff

Two technical staff were employed in the first quarter of 2006 to assist in laboratory analysis and plant operation but had worked for only a month and left the project. Two Technicians in persons of Mr. Solomon Dowuona and Mr. Thomas Najah were later employed (October 2006) to

replace those who had left. Mr. Patrick Mintah who was earlier assigned to the project was asked to return to the Engineering Unit.

8.1.4 *Challenges*

- **Malfunction of the pilot malting plant:** The frequency modulator of the air blower on the panel of the pilot malting plant had been down. The component had been bought but yet to be installed.
- **Sudden death of the international consultant:** The international consultant on the project in person of Prof. Jean-Pierre Dufuor, passed away on an official duty to Nigeria in February 2007. The death had slowed down progress of the project. Notwithstanding, much effort had been made to keep the work going with the leadership of the national consultant on the project.
- **Funds from Government of Ghana (GOG):** The GOG represented by Ministry of Trade, Industry and PSI failed to release funds to the project for work to go on. This had slowed down the work so much that the late Prof. had to use his personal money to pre-finance some of the work with the hope of retrieving the money when the funds are released from the government. It therefore stands that part of the funds that is expected from the government must be paid to the late Prof. Dufuor
- **Low pressure of fermentation tanks:** The fermentation tanks of the pilot brewing plant can hold pressure up to only 0.7bar currently. It is expected to have about 0.5% carbonation pressure in the final bottled beer. To attain this pressure in the bottles of the final product, the pressure in the holding tanks must be around 2 bars. The tanks at the pilot brewing plant therefore need some adjustments to hold such pressure. The suppliers had been informed and they promised to look at it in the near future.
- **Motivation of FRI staff:** It takes so much time to make a brew. The staff most of the time had to report to work as early as 6:30am and leave for home around 9pm or more when there is brewing to be done. It was therefore agreed by the project team to motivate the staff on the project for the extra hours being spent on the project. UNIDO tasked the government to do this since payment of staff was the responsibility of GOG as captured in the project document. UNIDO also promised to motivate staff alongside what GOG was going to do. UNIDO honoured this promise just for three months and stopped. No motivation had been paid to staff since

beginning of 2007. This is really making the morale of staff so down and something needed to be done before it gets out of hand.

8.1.5 Socio-economic impact

At the end of the project more farmers would be commissioned to produce the selected varieties in large quantities for ready market. They can also be trained to malt the sorghum on their own and sell at a higher cost. This ultimately would reduce poverty amongst the populace.

8.2 GATSBY/CSIR/MOFA – The Plantain and Banana Project for technology transfer

8.2.1 Background

The Gatsby Foundation is a UK charitable organization funding the technology to introduce black-sigatoga-resistant hybrid varieties of banana and plantain into 6 regions of Ghana since in 2002.

8.2.2 Phase I

The Phase I of the project was to obtain and introduce these varieties from IITA and CRABAP in Cameroon into the 6 regions of Ghana. In Phase II, the project was seeking 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.

8.2.3 Phase II

The Phase II was undertaken jointly by the FRI and WIAD of MoFA, with the ff objectives:

- To increase and diversify plantain and banana utilization in Ghana so as to reduce post harvest losses.

- To improve the living standards of women in the POZ through the production of marketable high quality plantain and banana products.

The role of FRI was to help develop the technologies for adding value to banana and plantain, as well as to assist WIAD to transfer the technologies developed into the three Project Operating Zones for plantain and banana in Ghana

A consultative workshop for stakeholders was held in May, 2006 at CSIR-FRI. Following that CSIR-FRI was tasked to do the following:

- development of recipes
- using 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 CSIR-FRI staff involved the following research staff; *P-N.T. Johnson, S.Noamesi J. Gayin, C. Tortoe, E. Aryeh* and the technical staff were; *I. Tamakloe A. Nyarko, G. Armah, A. Van Ess, C. Boateng, A. Padi, J. Thompson*

The WIAD officers in the POZs were to;

- ✓ organize women groups including processors and
- ✓ entrepreneurs to be sensitized and trained in the selected plantain and banana processing technologies at the project lead centers.

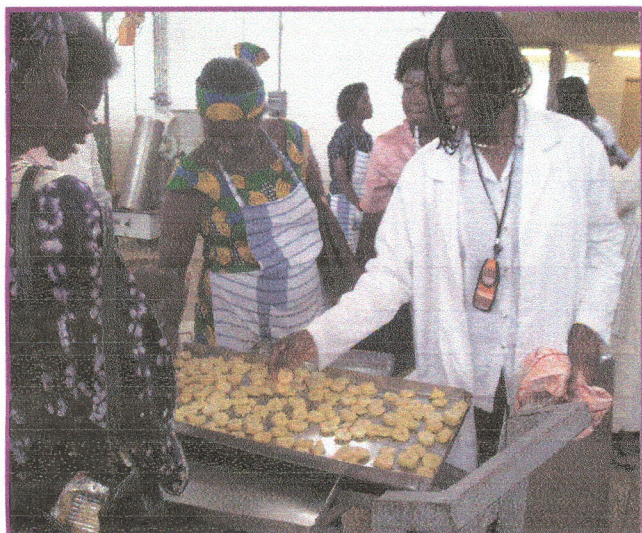
The action plan:

- ♥ Development of training materials,
- ♥ Training of Trainers Programme for WIAD officers
- ♥ Training of women and processors in processing technologies identified among others in three Project Operation Zones (POZs), Ashanti, Brong Ahafo and Eastern Regions

The CSIR-FRI was then commissioned

- to validate processing methods and recipes of the selected banana and plantain products April- May 2007.

- Prepare a draft manual on the processing of banana & plantain as well as recipes for banana and plantain products
- In June, a TOT workshop was organized involving the WIAD officers to
 - Train them
 - Validate the manual
- A draft manual has now been accepted and is being published to be used for the subsequent training at the three POZs in the Ashanti, Brong-Ahafo and Eastern in Sept & Oct.



Scenes during the Consultative & TOT Workshops involving the WIAD officers

SECTION II

9.0 FOOD EVALUATION AND PRODUCT DEVELOPMENT AND FOOD BIOTECHNOLOGY PROGRAMME

9.1 EU – Project on Development of biochemical and molecular markers for determining quality indices in the primary processing of cocoa in West Africa

9.1.1 Background

The CSIR-Food Research Institute, Ghana, undertook activities under the following Work Packages: WP2, WP3, WP5, WP6 and WP7. The following objectives were used

- ❖ CSIR-FRI under WP2 was to establish microbial succession during cocoa fermentation and also determine microbial profiles using the DGGE technique in collaboration with Project Partner 1, KVL.
- ❖ Under WP 3 CSIR-FRI was to isolate, identify and make available to P2 moulds that are present in cocoa beans during fermentation, sundrying and storage in order to study their implications for the safety of cocoa beans especially with respect to the production of ochratoxin A.
- ❖ WP 5 was to help CSIR-FRI to develop and document Good Manufacturing Practice for the primary processing of cocoa and also to provide information for developing a quality system for the same purpose.
- ❖ WP 6 work carried out by CSIR-FRI was to develop a quality management system based upon HACCP principles for the primary processing of cocoa including transportation and storage of the beans.
- ❖ CSIR-FRI in the WP 7 was to raise awareness on quality issues among primary cocoa processors and national agencies and to train staff of relevant cocoa agencies on appropriate quality standards for dissemination to farmers, purchasing clerks and quality control laboratory staff.

9.1.2 *The Microbial Ecology of Cocoa Fermentation and Isolates*

The studies covered the microbial ecology of cocoa fermentation and obtain isolates for the European project partners, the CSIR-FRI team arranged with the Cocoa Research Institute of Ghana (CRIG) and cocoa farmers to carry out “*heap and tray fermentations*” of cocoa which were sampled periodically for analysis. Samples taken during fermentation and sundrying were examined on Plate Count Agar for aerobic mesophiles, Nutrient Agar for *Bacillus* species, Malt Extract Agar for yeasts and moulds, MRS for lactic acid bacteria, M17 for lactococci, Glucose-Yeast Extract-Calcium Carbonate Agar (GYC) and Yeast Extract-Peptone-Mannitol Agar (YPM) for acetic acid bacteria and Violet Red Bile Agar for enterococci.

Ms Margaret Owusu from FRI also visited KVL, Denmark, from 22/09/05 to 05/12/05 to work on the determination of the DGGE profiles of the cocoa samples from Bompata. Dr. Margaret Ottah-Atikpo from FRI visited BFE, Germany, from 01/04/06 to 31/05/06 to work on the identification of lactobacilli isolates from Nigerian cocoa by phenotypic characterization and pediococci by Rep-PCR and sequencing. Dr. Wisdom Amoa-Awua visited KVL, Denmark, from 04/12/06 to 05/02/07 to work on identification of yeasts isolated during the sundrying and storage of cocoa beans using Rep-PCR and sequencing. DGGE equipment and reagents were purchased and shipped to Accra to complete the transfer of the DGGE technique to CSIR-FRI which already has a PCR machine.

9.1.3 *Supply of P2 with Moulds Isolated from Cocoa For Toxicological Studies*

CSIR-FRI had the responsibility to supply P2 with moulds isolated from cocoa for toxicological studies. Under WP 3, CSIR-FRI enumerated and isolated moulds from both heap and tray fermentation and sundrying of cocoa carried out at CRIG and by a farmer at Tafo. The moulds were also identified to the species level at CSIR-FRI using colony and cell morphology. Cocoa beans were also stored in jute bags and sampled for isolation of moulds weekly over a period of 5 months. During Dr. Margaret Atikpo’s visit to Germany she worked with P2 on the production of ochratoxin A by moulds isolated from cocoa.

9.1.4 Good Manufacturing Practice (GMP) Development

The GMP developed for the primary processing of cocoa is documented as part of the Quality Manual developed for the primary processing of cocoa under ISO 22,000:2005. The GMP is based on the following *Eighteen Golden Rules*.

Cocoa variety

Select cocoa varieties which give good cocoa beans of uniform sizes.

Harvesting of cocoa pods

Avoid damage to the cocoa trees or pods during harvesting.

Do not store pods for more than 6 days before pod breaking.

Process only ripe and healthy pods.

Remove infested pods from the cultivation area.

Breaking of cocoa pods

Avoid damage to the beans.

Use only good beans; discard infested, mouldy and decomposed beans.

Fermentation of beans

Cover the fermenting mass completely; no beans should be visible.

Ensure that the fermentation starts well:

- The temperature must reach a minimum of 48°C during the first 2 days.
- The fermenting mass must develop the odour of acetic acid (vinegary odour during the first 2 days.

Ferment in heaps and boxes for 6 days and in trays for 4 days. Beans should appear dark brown on the outside.

Remove and discard all mouldy beans.

Drying of beans

Remove mouldy beans, flat beans, broken beans, placenta and other foreign materials during drying.

Dry in thin layers, maximum depth of 5 cm.

Cover the beans during the night or when it is raining.

The moisture level should be between 6 and 8 % at the end of drying.

Bagging/Storage/Distribution

Bag cocoa beans in clean jute sacks which are intact.

Store the bagged cocoa on pallets about a foot from the ground and the walls.

Store cocoa in a clean well ventilated room which is cool and dry.

9.1.5 Development of Quality Management System Based upon HACCP Principles

ISO 22000:2005 combines a prerequisite programme and HACCP as a food safety management system. The quality manual developed by Cocoqual combines GAP and GMP as prerequisite programmes for the food safety/quality management system.

Section one covered (i) the importance of cocoa including the safety of cocoa beans, (ii) cultivation of cocoa, (iii) primary and industrial processing of cocoa beans and (iv) management of cocoa quality and safety based on ISO 22000. Section two covered (i) Good Agricultural Practices and (ii) Good Manufacturing Practices. Section three is the quality manual for the primary processing of cocoa including the operational prerequisite programmes, hazard analysis, the HACCP plan, monitoring, verification, and improvement of the food safety management system. The manual is to be published in due course and distributed to stake holders in the cocoa industry in West Africa including agricultural extension officers and cocoa buying companies.

9.1.6 Awareness creation on Quality Issues among Primary Cocoa Processors and National Agencies

The seminar and training workshop was very successful to raise awareness on quality issues among primary cocoa processors and national agencies and to train staff of relevant cocoa agencies on appropriate quality standards for dissemination to farmers, purchasing clerks and quality control laboratory staff and offered a platform to bring the various stakeholders in the cocoa industry in Ghana and also representatives from Nigeria and Cote d'Ivoire together. According to the participants, it was the first time that agricultural extension officers from the Ministry of Food and Agriculture in Ghana had been brought together as a group and trained in the application of GAP, GMP and ISO 22000 to cocoa production and processing.

9.2 *Tatale* Mix Development Programme

9.2.1 *Background*

Tatale Mix is convenience powder made from ripened plantain, wheat flour and fermented corn dough. It was developed by the CSIR-FRI in the 1970s as a contribution to reducing post-harvest losses in plantain. Over the years, it has been found the *tatale* mix tend to cake during storage.. The present study is therefore aimed at identifying suitable anti-caking agents for improving the shelf –life *tatale* mix.

9.2.2 *Sensory evaluation*

Four (4) sets of sensory evaluation were carried out on *Tatale mix* samples during the period under review. The sensory was carried out on three different *Tatale mix* samples prepared with ripe plantain and wheat flour, ripe plantain with a mixture of wheat flour and fermented maize meal and finally ripe plantain with roasted corn flour. Fifteen (15) trained panelists were involved in each set of the sensory analysis and they scored marks on a nine point hedonic scale of 1-9. Standard methods of preparing the samples were followed for all the four sets of evaluation. Overall acceptability of the samples showed the best sample as sample prepared with wheat flour. The second best sample was the sample prepared with mixture of wheat flour and fermented maize meal flour followed by the sample prepared with roasted corn flour.

9.2.3 *Challenges*

- Difficulty in scraping dried *Tatale mix* samples from drying trays; this is a major setback on the work which needs attention. The *Tatale mix* samples at a stage during processing had to undergo dehydration. This is done by spreading the wet samples thinly in stainless steel drying trays and placing them in a dryer. The samples during drying stick to the trays and very difficult to scrape off after drying. Various methods such as oiling the trays before spreading samples, sprinkling flour in the trays before spreading samples and the use of aluminium foil were employed to reduce the stickiness but all did not work out.
- The right stage to arrest ripening; normally, green plantain is bought and allowed to ripe in the laboratory. There were various visual inspections done on the

plantain samples to stop the ripening process at a stage for further processing. This stage had been referred to a firm ripe stage. However, the visual inspections sometimes do not coincide with the right stage of ripeness and turn out to give products that did not meet the sensory qualities that panelists expect. A scientific measure of level of ripeness would be much reliable.

9.2.4 Team members

CSIR-FRI staff members involved with this project includes Gregory Afra Komlaga , Iris Tamakloe (Mrs), Evelyn Serwah Aryeh

9.2.5 Socio-economic impact

At the end of the project more commercial food vendors would be trained and encouraged to produce the selected tatale mix composition in large quantities for the market. This ultimately would reduce post harvest losses at farm gate and markets and also reduce poverty amongst the populace.

SECTION III

10.0 FOOD SAFETY AND QUALITY ASSURANCE PROGRAMMES

10.1 AgSSIP – programme; studies on the characteristics, development and utilization of food products from groundnuts varieties grown in Ghana

10.1 Background

Groundnut (*Arachis hypogaea*) grows well in tropical, subtropical and warm temperate climates such as found in Ghana. In Ghana, apart from being eaten raw, boiled, roasted and in confectionary snack foods, groundnuts are also processed into groundnut paste and used as bread spread, in the preparation of groundnut soup, *dzowe*, *oto*, *saaboo* and also added to palmnut and *nkontomire* soup.

10.2 Stabilization of groundnut paste with locally available products

Since moisture content of groundnut paste is low, it is seldom susceptible to microbial spoilage. However its high fat content makes it prone to oxidative and hydrolytic changes which affect its flavor and quality and also cause oil separation. One method which is used to prevent oil separation in groundnut paste is the incorporation of hydrogenated oil. Although this is highly effective, concerns have been raised about possible adverse effects that trans fatty acids contained in the hydrogenated oils can have on cardiovascular health.

Owing to this health risk and also because commercial stabilizers are not easily accessible and affordable to small scale groundnut paste processors, this work explored the use of unhydrogenated locally available products, namely shea butter, cocoa butter, and refined palm oil to effectively stabilize groundnut paste and compared these to a well-known commercial stabilizer (Fix-X).

In conclusion these results suggest that the use of cocoa butter and shea butter as groundnut paste stabilizers is feasible. However further studies must be carried out examine any long-term storage and physicochemical effects that they may have on groundnut paste.

10.2.5 Socio-economic impact

At the end of the project more commercial groundnut paste processors would be trained and encouraged to produce groundnut paste with cocoa butter and shea butter as groundnut paste stabilizers in large quantities for the market. This would ultimately reduce cost of production and also reduce poverty amongst the populace.



SECTION IV

11.0 INSTITUTIONAL STRENGTHENING PROGRAMME

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

11.1.2 Background

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 is to obtain accreditation for 4 chemical, one mycotoxin and 13 microbiological methods to ISO/IEC 17025: Standard. This is to ensure that the Food Research Institute's Chemistry and Microbiological laboratories produce technically valid analytical results that can be internationally accepted by customers.

11.1.3 Document Review

The FRI Quality Manual was updated to reflect the revised edition of the International Standard ISO/IEC 17025: 2005 Ed. The sections revised were the following:

Management Requirements

Five chapters were revised and an additional chapter on Improvement was included as follows: - QM 4.1. The Food Research Institute of the Council for Scientific and Industrial Research, QM 4.2. Quality System, QM 4. 7. Service to the Customer, QM 4.10. Improvement (A new chapter), QM 4.12. Preventive Actions and QM 4.15. Management Reviews.

Technical Requirements

Two chapters were revised:- QM 5.2. Personnel and QM 5.9. Assuring Quality of Test Results. The team also revised some quality forms and made new ones where applicable.

11.1.4 Internal Audits

It is a requirement of the FRI Quality Management System, that a minimum of two internal audits 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. The objective is 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.

The internal audits of the FRI Quality Management System, the three laboratories, the Client Services Unit of the CID and the Stores were conducted by Dr. P.N.T. Johnson and Dr. Charles Tortoe both of the Processing and Engineering Division of the Food Research Institute.

11.1.5 Participation in Proficiency Tests

The laboratories continued to participate in inter-laboratory proficiency testing schemes to assure the quality of the test results. The Microbiology Laboratory participated in General Food and Dairy Microbiology Scheme organized by 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. The performances in these tests were generally satisfactory.

11.1.6 Management Review Meetings

Management review meetings were 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 during the year 2006 on 8th May 2006 and 7th November 2006, respectively. Members of the Management Review are Director (Chairperson); Deputy Director; Head Commercial and Information Division; Quality Manager (Member/Secretary); Head Microbiology Division; Head Chemistry Division; Head Accounts and Stores Division; Head Administration Division.

11.1.7 Internal Seminar

One internal seminar was held on 6th May 2006 to educate staff involved in the quality management system on the requirements of the system. The topic was Document Control and Control of Records.

The seminar discussed the procedures and requirements for Document Control and Control of Records (Chapters 4.3 and 4.12 of the FRI Quality Manual).

11.1.8 Steering Committee Meetings

This Committee was set up in 2002 to further develop and implement the quality system to a level where accreditation is achievable. Initially the Committee met fortnightly to plan the work and discuss progress but later meets on ad-hoc basis to discuss issues on implementation of the system.

11.1.9 Upgrading of Microbiology Laboratories

The Microbiology laboratories were renovated to improve upon the environmental conditions in the laboratories and the premises at a cost of seventy seven million six hundred thousand cedis (¢77,600,000.00) early 2006 in preparation for the on-site assessment by SANAS.

11.1.10 Participation in Training Programmes/Conferences

Five members of the FRI Quality Management System participated in the National Workshop on Structuring Documentation According to ISO 9001 and ISO 17025 Quality Management Systems held at the Ghana Atomic Energy Commission from 11-15th September, 2006.

The following members of staff participated in the training programme:

- Ms. Mary Halm, Principal Research Scientist /Quality Manager
- Ms. Margaret Owusu, Research Scientist/Deputy Quality Manager
- Mr. W. Amevor, Senior Technologist/Technologist in charge Chemistry Laboratory
- Mr. George Anyebuno, Research Scientist, Chemistry Division
- Mr. Peter Addo, Principal Technical Officer (CID Technical Officer-In-Charge of Client Services).

11.1.11 Application for Accreditation/On-site Assessment

The Institute applied for accreditation to the South African National Accreditation System (SANAS) in November 2004. A quotation for the initial assessment was received at the end of June 2006. Upon subsequent acceptance of the quotation on 30th July 2006 by FRI, an invoice was received and the amount transferred to SANAS on 10th August 2006.

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. Seventeen of these were major non-conformances meaning that if these were left unattended they could have a significant effect on the accuracy of results. Ten were minor non-conformities which would have no impact on final results but had to be corrected.

The assessors recommended accreditation for fifteen methods made up eleven microbiological methods and four chemical methods provided the twenty-seven non-conformances were solved.

11.1.12 Methods Recommended for Accreditation to ISO 17025

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)

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 <i>Escherichia coli</i> | ISO 7251, 2005 |
| iii. | Detection of <i>Salmonella</i> | NMKL No. 71, 1999 5 th 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. Aerobic & anaerobic microorganisms in canned foods. NMKL No. 59, 2004.
- xi. Enumeration of coagulase positive *Staphylococcus aureus* in foods.
NMKL No. 66, 2003

The assessors recommended that the Institute could reapply for the assessment of the two microbiological methods and one aflatoxin method during subsequent surveillance visits.

11.1.13 Approval of Personnel

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

11.1.14 Unapproved Methods

- i. Enumeration of *Clostridium perfringens*. ISO 7937.
- ii. Detection of *Vibrio parahaemolyticus*. ISO 8914.

11.2 Status of the FRI-LAN and the Way Forward

11.2.1 Background

The FRI-LAN Technical Committee was set up to develop proposals for the establishment of a Local Area Network within the Food Research Institute. The Committee submitted its report in January, 2005 and it was accepted. Implementation of the report began in February, 2005.

The establishment of the FRI Local Area Network/Intranet and Internet connectivity was divided into three phases:

Phase 1: Networking of the Okponglo Site

Phase 2: Networking of the Broz Tito Site

Phase 3: Establishment of FRI Website

11.2.2 Phase 1: Networking of the Okponglo Site

Networking of the Okponglo Site is about 80% complete. A Wireless LAN that was in place had a few challenges. The fish block had just enough connectivity, while the microbiology and processing blocks had virtually no connectivity.

The technical committee is working on the problems to ensure that all the blocks have full robust connectivity.

11.2.3 Phase 3: Establishment of FRI Website

The CSIR-FRI has registered a domain name: www.csir.org.gh/fri.html . A webmail has also been created and it is working perfectly.

The technical committee is preparing to review and update the website

11.2.4 Phase 2: Networking of the Broz Tito Site

Networking of the Broz Tito Site has not started. It has been put on hold due to the following reasons:

1. To wait for the complete test running of the Networking of the Okponglo Site to make sure the system is robust and working properly.
2. the entire staff have relocated to Okponglo site
3. Financial Constraints

11.3 Project Financing

The project is being financed through CSIR-FRI's own resources. The Director of Finance released the funds from FRI foreign accounts, and that amount was used to finance project phase

1.

The recurrent expenditure and the cost of completing Phase 2 & 3 are being financed through IGF, Projects and LUTTA. It has been agreed by all Research Staff that an amount of \$60 per annum should be deducted from each member's LUTTA to help meet the recurrent expenditure. This amount was deducted accordingly from last year's LUTTA and the same is expected to be deducted this year. Project leaders also agreed to contribute \$300 per project per year. Specific Projects are contributing far in excess of the minimum rate of \$300 per project.

APPENDIX I

FRI SENIOR STAFF LIST (2006)

Directorate

1. W. A. Plahar - Director
BSc (Gen.), BSc (Hons) MSc Fd. Sci. (Ghana)
PhD (Washington) (Chief Research Scientist)
2. W. K. Amoa-Awua - Deputy Director
BSc (Ghana) MSc. App. Sci. (New South Wales)
PhD (Ghana) (Principal Research Scientist)
3. R. M. Yawson - Scientific Secretary
BSc. (Hons) M. Phil. (Biochem) Ghana
Post Grad. Cert. Fd. Mgt. (Jerusalem) (Research Scientist)
4. J. Aggrey –Yawson (Ms.) - Prin. Admin Assistant.
5. F. Somuah (Ms.) - Admin Assistant

Food Microbiology Division

1. W. A. Amoa -Awua - Principal Research Scientist
BSc (Ghana.) MSc. App. Sci. (New South Wales)
PhD. (Ghana) (Head of Division)
2. M. Halm (Ms) - Senior Research Scientist
BSc (Gen.) BSc (Hons), MSc Botany (Ghana)
Post Grad. Dip. Rural Fd. Tech (Netherlands)
3. M. Ottah Atikpo Dr. (Mrs.) - Research Scientist
BSc Microbiology, MSc Fisheries (ABU, Zaria)
4. M. Obodai (Mrs.) - Research Scientist
BSc (Hons), MPhil. Botany (Ghana)
5. M. Owusu (Ms.) - Research Scientist
BSc (Hons), MPhil. Botany (Ghana)
6. Matilda Dzomeku (Mrs.) - Asst. Res. Scientist

BSc Biological Sciences (UST)

- | | | |
|----------------------|---|---------------------|
| 7. D. K. Asiedu | - | Snr. Technologist |
| 8. J. Anlobe | - | Snr. Technologist |
| 9. B. Amoako | - | Snr. Technologist |
| 10. Peter Addo | - | Prin. Tech. Officer |
| 11. D.K. Baisel | - | Technologist |
| 12. R. Takli | - | Asst. Technologist |
| 13. M. Amoo-Gyasi | - | Asst. Technologist |
| 14. Theophilus Annan | - | Technical Officer |

Food Chemistry Division

- | | | |
|--|---|------------------------------|
| 1. Dr. (Mrs.) K. Kpodo
BSc (Gen.) BSc (Hons) Ghana
MPhil (West Indies) PhD (Ghana) | - | Senior Research Scientist |
| 2. G. A. A. Anyebuno
BSc (Hons), MPhil. Botany (Ghana) | - | Research Scientist |
| 3. C. Diako
BSc (Hons), Fd. Sci & Nut. (Ghana) | - | Asst. Res. Scientist (Temp.) |
| 4. E. A. Allotey | - | Snr. Technologist |
| 5. W. K. Amevor | - | Snr. Technologist |
| 6. Mensah Toku | - | Snr. Technologist |
| 7. D. N. A. Ankrah | - | Technologist |
| 8. N.Y. Amey | - | Technologist |
| 9. K.K. Essel | - | Asst. Technologist |
| 10. Jeremiah Lartey-Brown | - | Technical Officer |

Nutrition & Socio-Economics Division

- | | | |
|--|---|--|
| 1. P. Lokko Dr.(Mrs.)
B.Sc. (Gen.) BSc (Hons) MSc Biochem (Ghana)
Dip. Fd. Sci. & Nut. (The Netherlands)
PhD. (Ghana) | - | Principal Research Scientist
(Head of Division) |
| 2. W. Quaye (Mrs.)
BSc (Hons) MPhil Agric. Econs (Ghana) | - | Research Scientist |
| 3. P. Larweh (Mrs.) | - | Assistant Research Scientist |

- BSc (Hons) Home Sci. (Ghana)
4. I. Johnson-Kanda (Ms.) - Assistant Research Scientist
BSc (Hons) Fd. Sci & Nut. (Ghana)
 5. L. Larweh (Ms.) - Assistant Research Scientist
BSc (Hons) Home Sci. (Ghana) (Temporary Staff)
 6. B. Kudjawu (Ms.) - Assistant Research Scientist
BSc (Hons) Home Sci. (Ghana) (Temporary Staff)
 7. I. A. Tamakloe (Mrs.) - Chief Tech. Officer

Commercialization & Information Division

1. A. Osei-Yaw (Mrs.) - Principal Research Scientist
BSc (Gen.), Ghana, (Head of Division)
MSc. Fd. Sci. & Nut. (Washington)
2. A. Andoh - Chief Tech. Officer
3. B. Awotwi - Prin. Tech. Officer
4. R. Kavi - Prin. Lib. Assistant
5. B. P. Osae - Technical Officer
6. P.O. Baidoo - Technical Officer
7. Joana B. Dzikunu - Admin. Assistant

Food Processing & Engineering Division

1. Dr. P-N. T. Johnson - Principal Research Scientist
BSc (Hons), Biochem. (UST) (Head of Division)
MSc. Agric. Eng. (Cranfield)
PhD Food Tech. (Reading)
2. Dr. P. Adu-Amankwa (Mrs.) - Senior Research Scientist
BSc (Hons) Biochem (UST)
MSc. Fd. & Mgt. Sci.,
PhD Post-Harvest Physiology (Lond.)
3. Dr. N. T. Dzedzoave - Senior Research Scientist
BSc (Hons), Biochem. (UST)
Post Grad. Dip. in Fd. Sci. & Nut., (Gent, Belgium)
MSc Fd. Sci. & Tech. (UST). PhD (Greenwich)

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|-----|--|---|--------------------|
| 4. | D. Blay
MSc Chem. Eng. (Moscow) | - | Research Scientist |
| 5. | E. C. Tettey
BSc (Hons) Agric (UST)
Post-Grad. Dip. Fd. Tech.,
MPhil, (Humberside, UK) | - | Research Scientist |
| 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. J. T. Manful
BSc (Agric), Dip. Ed. (Cape Coast)
MPhil Biochem. (UST)
PhD. (Greenwich) | - | Research Scientist |
| 9. | Dr. K. A. Vowotor
B.Sc. Zoology Dip. Ed. (Cape Coast)
M. Phil. PhD Crop Science (Ghana) | - | Research Scientist |
| 10. | B.A. Mensah
MSc. Fd. Press. Tech. (Kransnodar, USSR) | - | Research Scientist |
| 11. | S. K. Noamesi
BSc (Agric) MSc Fd. Sc. (Ghana) | - | Research Scientist |
| 12. | J. Gayin
BSc (Hons) Biochem (UST)
MSc Fd. Tech. (Gent) | - | Research Scientist |
| 13. | Dr. C. Tortoe
BSc (Hons) MPhil. Botany(Ghana)
PhD. (Greenwich) | - | Research Scientist |
| 14. | G. A. Komlaga
BSc (Hons) Biochem (Ghana)
MSc Fd. Sc. & Tech. (UST) | - | Research Scientist |

15. C. Oduro-Yeboah (Mrs.) BSc (Hons) Biochem (Ghana)	-	Assistant Research Scientist
16. E. A. Baidoo BSc (Hons) Biochem (UST)	-	Asst. Res. Scientist
17. J. F. Asigbey	-	Chief Admin. Asst.
18. S. A. Sampare	-	Chief Tech. Officer
19. K. Opoku-Acheampong (Mrs.)	-	Chief Tech. Off.
20. J. R. Addo	-	Snr. Tech. Off.
21. E. Ablorh	-	Snr. Tech. Off.
22. S. A. Tagoe	-	Snr. Technical Officer
23. J. A. Asafu-Adjei	-	Prin. Works Supt
24. R. Y. Anthonio	-	Prin. Works Supt.
25. C. T. Yeboah	-	Works Supt.
26. G. K. Akleih	-	Works Supt.
27. R. M. Mawuli	-	Works Supt
28. J. L. Lamptey	-	Works Supt.

Accounts Division

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

Administration Division

1. R. M. Yawson BSc. (Hons) M. Phil. (Biochem) Ghana Post Grad. Cert. Fd. Mgt. (Jerusalem)	-	Scientific Secretary (Research Scientist)
2. J. F. Assigbey	-	Chief Admin. Asst
3. E. A. Larbi	-	Prin. 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

International Conference Papers & Posters

1. Sakyi-Dawson, E.O, Lamptey, J. A., **Johnson, P-N. T.** Annor, G.A. & Budu, A. (2006) Effect of cowpea on the quality and sensory characteristics of cassava-cowpea composite flour. IUFOST, 13th World Congress of Food Science & Technology, France.
2. Sakyi-Dawson, E.O, Lamptey, J. A., **Johnson, P-N. T.** Annor, G.A., Budu, A. & **Oduro-Yeboah, C (2006)** Effect of processing method on the chemical composition and rheological properties of cassava flour from new varieties. . IUFOST, 13th World Congress of Food Science & Technology, France.
3. **Johnson, P-N. T,** Oduro-Yeboah, C., Sakyi-Dawson, E.O. & Budu, A. (2006) Application of response surface response methodology to optimise the process characteristics of cassava flour used for cassava-plantain *fufu* flour.14th Triennial Symposium of ISTRC, 20 -26 Nov, 2006, Kerala, India.
4. Westby, A. Tomlins, K.I, Adebayo, K, Oyewole, O, Ayinde, I, **Johnson, P-N.T,** Jumah, A. Attengdem, P., Pesey, P., Sanni, L, Dipeolu, A, Anaglo, J & Coote, H.C (2006) Issues in post-harvest development of root and tuber crops. 14th Triennial Symposium of ISTRC, 20 -26 Nov, 2006, Kerala, India.
5. **Johnson, P-N.T (2006).** The drying industry in Ghana: Prospects and Problems. UNIDO UNISWORK International Training in Food Drying, Tubitak, Gbeze, Turkey, 11-15 Sept., 2006.
7. **Yawson R. M., Osei-Yaw A and Yawson I., (2006).** The Strategic Role of the Food Research Institute in Productivity Enhancement and the Private Sector Development in Ghana. In: The Business of Innovation. Proceedings of 18th Biennial Congress of WAITRO. Saskatoon, SK, Canada August 7 - 10, 2006
<http://www.waitro.org/modules/wfsection/article.php?articleid=183>
8. **Kpodo, K. A.,_Ayernor, G. S., Shephard, G. and Jakobsen, M. (2006).** Exposure to fumonisins through *Kenkey*-A Ghanaian fermented maize product. **In: *Mycotoxins and Phycotoxins – Advances in determination, toxicology and exposure management***, pp. 209-216. Eds. Njapau, H., Trujillo, S., van Egmond, H. P. and Park, D. L. Publ. Wageningen Academic Publishers, The Netherlands
9. **Amoa-Awua, W.K,** Terlabie, Sakyi-Dawson E. (2006). Screening of forty-two *Bacillus* isolates for ability to ferment soybeans into dawadawa. *International Journal of Food Microbiology*, 106, 343-347. (CSIR-FRI/JP/AAWK/2006/001)

10. **Yawson, R., Amoa-Awua, W.K.,** Sutherland, A.J., Smith, D.R., Noamesi, S. (2006). Developing a performance management framework to enhance the impact orientation of the Food Research Institute, Ghana. *R & D Management*, 36, 161-172. (CSIR-FRI/JP/YRM/2006/002)
11. Terlabie, N.N., Sakyi-Dawson E., **Amoa-Awua, W.K.** (2006). The comparative ability of four isolates of *Bacillus subtilis* to ferment soybeans into dawadawa. *International Journal of Food Microbiology*, 106, 145-152. (CSIR-FRI/JP/TNN/2006/003)
12. Kostinek, M., Ban-Koffi, L., **Ottah-Atikpo, M.,** Teniola, D., Schillinger, U., Holzapfel, W. H. and Franz. C. M. A. P.(2006). Diversity of predominant lactic acid bacteria associated with cocoa fermentation in Nigeria. Submitted to *Current Microbiology*
13. **Ottah Atikpo, M., Dzomeku, M.,** Boateng, L., Awumbilla, B., Abazinge, M. and Onokpise, O. (2006). Utilization of fish waste for mushroom cultivation. Paper presented at the FAO Workshop on Fish Technology, Utilization and Quality Assurance. November 14 – 18, 2005, Bagamoyo, Tanzania. *FAO Fisheries Report* No.819.
14. **Blay, D. and Ottah Atikpo, M.** (2006). Design And Construction Of Afsmo – 150, An Improved Fish Smoking Oven. Paper Presented At The Fao Workshop On Fish Technology, Utilization And Quality Assurance. November 14 – 18, 2005, Bagamoyo, Tanzania. *Fao Fisheries Report* No.819.
15. **Ottah Atikpo, M.** (2006). Phenotypic Grouping, Genotypic Characterization Of Microorganisms And Ochratoxin A (Ota) Production By Moulds Isolated From Cocoa Beans. Submitted To Institute Of Hygiene And Toxicology Of The Federal Research Centre For Nutrition (Bfel-Iht), Karlsruhe, Germany, April 1 – May 31, 2006.
16. **Ottah Atikpo, M., Dzomeku, M.,** Boateng, L., Awumbilla, B., Abazinge, M. and Onokpise, O. (2006). Mushroom cultivation on fish waste substrate for improved nutrition, health and economic development. WAITRO 2006 Congress, Saskatoon, Saskatchewan, Canada. August 7 – 10, 2006.

Local Conference & Workshop Reports

1. **Johnson, P-N. T.** (2006) Overview of technologies for improving the post-harvest management of banana and plantain. Consultative Workshop for Stakeholders, Gatsby CSIR Banana and Plantain Project, May,2006, Apesiwa Conference Room, Food Research Institute.
2. **Ottah Atikpo, M., Dzomeku, M.,** Boateng, L., Awumbilla, B., Abazinge, M. and Onokpise, O. (2006). Small and medium scale mushroom cultivation enterprise using fish waste for nutrition, health and economic development in Ghana by Presented at 2nd Africa Nutritional Epidemiology Conference, Executive Conference Center, Ghana Institute of Management and Public Administration (GIMPA), Legon. August 15 - 18, 2006.

Technical Reports

1. **Tortoe, C. Johnson, P-N.T, Oduro-Yeboah, C., Mensah, B.A., Anaglo, J & Quayson, E.T (2006)** Report on technology transfer for *fufu* flour at Sokode in the Volta Region of Ghana. **EU/FRI Cassava SMEs Project.**
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3. **Tortoe, C. Johnson, P-N.T, Oduro-Yeboah, C., Mensah, B.A.(2006)** Report on quality assurance for ELSA Foods Limited, **EU/FRI Cassava SMEs Project.**
4. **Tortoe, C. Johnson, P-N.T, Oduro-Yeboah, C. & Tomlins , K.I (2006)** Development of appropriate quality assurance system for small and medium-scale enterprises involved in *fufu* flour Production. **EU/FRI Cassava SMEs Project.**
5. **Johnson, P-N. T, Oduro-Yeboah & Sakyi-Dawson, E.O (2006)** Report on optimization of processing technology to produce affordable, high quality, nutritious and convenient *fufu* flour for the urban market. . **EU/FRI Cassava SMEs Project.**
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8. **Johnson, P-N. T, Quayson, E.T. Diako, C. Van Ess, A, & Nyarko, A (2006)** Effect of home-cooking methods on the iron, zinc, and carotenoids contents of two varieties of plantain, False Horn (Apentu) and French Horn (Apem). **HarvestPlus/ IPGRI/ INIBAP FRI Plantain Project.**
9. **Egyir, I., Sugri, I & Johnson, P-N.T (2006)** Impact of Musa-based processed foods on malnutrition in Ghana. **HarvestPlus/ IPGRI/ INIBAP FRI Plantain Project.**
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11. **Manful J. T., Gayin, J., and Toku, P. (2006)** – Whole Grain Brewing and Malting Potential of 17 Sorghum Varieties: Final Report for the Food Crops Development Project (FCDP) of the Ministry of Food and Agriculture

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2. **Johnson, P-N. T., Tortoe, C. & Mensah, B.A. (2006)** Pictorial manual on processing of fruits into juices and concentrates.
3. **Johnson, P-N.T., Oduro-Yeboah, C., Tortoe, C (2006)** Manual on Production of Fufu flour.
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2. Ban-Koffi, L., **Ottah Atikpo, M., Hanak, A. and Holpzafel, W. H. (2006).** Ochratoxin A (OTA) concentration in African cocoa beans. Peer reviewed paper.

APPENDIX III

2006 1GF

<u>Income</u>	<u>cumulative total</u>
Analysis and Technical Services	693,797,900.00
Sale of Products	127,466,000.00
Fabrication	148,175,000.00
Training Income	24,900,000.00
Miscellaneous	<u>72,370,000.00</u>
Total Income	1,066,708,900.00
Less:	
<u>Direct Expenses</u>	
Chemicals	234,924,615.00
Raw Materials	159,628,949.00
Fabrication Expenses	62,438,626.00
Training Expenses	28,118,000.00
Operational Expenses	<u>415,412,850.00</u>
Total Direct Expenses	900,523,040.00
Net Income	166,185,860.00
<u>Distribution of Net Income</u>	
15%-CSIR	24,927,879.00
85% FRI	<u>141,257,981.00</u>

APPENDIX IV

ORGANOGRAM

