

**COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH**



**FOOD RESEARCH INSTITUTE**

**COMMERCIALISATION OF THE TECHNOLOGY  
FOR THE PRODUCTION OF  
PALM PULP POWDER FOR MAKING SOUP**

**BUSINESS PLAN**

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## EXECUTIVE SUMMARY

The Food Research Institute (FRI) is one of the affiliate institutes and centres of the Council for Scientific and Industrial Research (CSIR) and is mandated to conduct applied research into problems of food processing and preservation, storage, marketing, distribution and utilisation, in support of the food industry and also to advise the Government of Ghana on its food policy. The Institute focuses on providing scientific and technological support to the growth of the food and agricultural sectors of the national economy by conducting market-oriented applied research and providing technical services and products to the private sector and other stakeholders.

Over the years, FRI has developed several technologies some of which have been successfully transferred to entrepreneurs and private individuals. One useful technology which was developed several years ago by the Institute was palm pulp powder, a dehydrated product from palm fruits which can be used as a base for making palm soup. This innovative product was developed because the process of preparing palm soup in the kitchen is laborious and time consuming. Unfortunately due to some technical problems, including breakdown of equipment, the technology could not be transferred to the Ghanaian food industry at the time even though a leading multi-national company expressed interest in the technology. Using palm pulp powder in the kitchen to prepare palm soup eliminates the drudgery associated with preparing palm and also shortens the process considerably and will be especially beneficial to working ladies.

The goal of the proposed project is to succeed in transferring the technology for the production of palm pulp powder from the laboratory bench to the Ghanaian food industry so that the product can be available to consumers in supermarkets and other shops. Successful transfer of the technology for the production of such an innovative and catchy product will demonstrate the capability of Ghanaian research institutions to contribute meaningfully to the development of the economy of Ghana. It will also establish a direct link from the scientist working in the laboratory to the targeted end user of the efforts of the scientist, the private sector. This will serve to raise the confidence of the Ghanaian entrepreneur and the general public in the scientist whose work is supported by the government through public funds. A scheme will be established for transferring the technology from the Food Research Institute to industry/entrepreneur which will ensure that the Food Research Institute will continually gain from the exploitation of the technology at the industrial level. In essence FRI will have a share in the profits accruing to the company and this will go to support research activities at the institute in line with Ghana Government's policy of commercialisation of research.

The project which will be implemented by the Food Research Institute, the Oil Palm Research Institute and the Commercial and Information Division of CSIR will resuscitate the palm pulp powder project of the Food Research Institute with the aim of transferring the technology to the Ghanaian food industry. It will involve setting up a pilot scale palm pulp powder production line and carrying out commercial and market studies in order to produce bankable results which can be used to approach industry, entrepreneurs and potential investors and be used for promoting the technology.

The project will be sited at the existing Pilot Plant of the Food Research Institute (FRI) which is located at Okponglo in Accra. Palm fruits will be obtained from the Oil Palm Research Institute at Kusi near Kade in the Eastern Region. The setting up of the plant will involve rehabilitation and repair of some food processing equipment already existing at the Pilot

Plant of FRI, and acquisition of additional equipment to establish a production line. The plant is proposed to have a capacity to process 1.5 tons of fresh palm fruits a day to yield 300 kg of palm pulp powder.

The innovative palm pulp powder has a potential market within and outside Ghana and can be a foreign exchange earner targeting the sizeable West African population living in the Diaspora. The only existing comparable product is canned palm cream used for making palm soup and currently there are 14 Ghanaian companies engaged in the production and export of canned palm cream to 13 countries, namely Austria, Belgium, Canada, France, Germany, Italy, Japan, The Netherlands, South Africa Spain, Switzerland, UK and USA. The total export of palm cream soup in 2000 was 498 MT valued at \$790,263, in 2001; 528 MT valued at \$898,438, 2002; 765 MT valued at \$1,189,083 and in 2003; 871 MT valued at \$1,637,698.

Palm pulp powder has advantage over palm cream since it is lighter and less bulky. Whilst canned palm cream contains a moisture content of more than 70%, palm pulp powder has less than 5% moisture. In comparison to canned palm cream, palm pulp powder will therefore command a much higher price per unit weight and be more convenient to handle both in the kitchen and also for export.

The total investment cost of the project is 1,803,000,000 cedis out of which the Food Research Institute will provide equity of 1,310,000,000 cedis. The total grant sought is 825 million cedis equivalent to 91,000 US dollars. For the second and third year of project implementation, palm pulp powder will be produced on pilot sale and sold to the general public in order to introduce, popularise and promote the product. The amount of palm fruits processed in a day will be 1.5 tons yielding 300 kg of palm pulp powder. For the first year of production (i.e. Year 2), the total cost of services for the year will amount to 652 million cedis and for the second year of production (Year 3), 782 million cedis. The projected cash flow for these two years will yield net incomes of 788 million cedis and 945.6 million cedis respectively.

## **THE FOOD RESEARCH INSTITUTE OF THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, GHANA**

The Food Research Institute (FRI) is one of the affiliate institutes and centres of the Council for Scientific and Industrial Research (CSIR). It was established by the Government of Ghana on 1<sup>st</sup> October 1963 in recognition of the need for such an institution to support the growth and development of a growing economy. It was incorporated by Legislative Instrument No 438 of 19<sup>th</sup> March 1965 and started its operations in 1965 with assistance from the United Nations Development Programme (UNDP), with the Food and Agriculture Organisation (FAO) of the United Nations as the executing agency. This assistance was designated as UNDP/FAO Project – Food Research and Development Unit. The joint Ghana Government – UNDP/FAO project lasted for 5 years, from October 1968 to September 1970. When the Council for Scientific and Industrial Research was established by NLC Decree 293 in October 1968, Legislative Instrument No 438 was revoked and FRI incorporated into the CSIR. In 1996, the CSIR was re-established by an act of parliament, Act 521, to cater for such matters as private sector concerns and commercialization of research.

### **MANDATE**

The FRI is mandated to conduct applied research into problems of food processing and preservation, storage, marketing, distribution and utilisation in support of the food industry and also to advise the Government of Ghana on its food policy.

### **VISION**

The Food Research Institute's vision is to be recognised 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 presentation.

### **MISSION**

The Institute's mission focuses on providing scientific and technological support to the growth of the food and agricultural sectors of the national economy in line with corporate prioritisation and national objectives. Primarily, the FRI's mission is to conduct market-oriented applied research and provide technical services and products to the private sector and other stakeholders. To do this Food Research Institute presently conducts business in a conducive and transparent working environment. It has a cadre of highly qualified staff to render quality services and products to clients.

### **GOAL**

The overall goal of the Institute is to assist in poverty alleviation through the creation of opportunities for generating and increasing incomes within the micro, small, medium and large scale food industry; contribute to food security, foreign exchange earnings and the application of cost-effective food processing technologies that are environmentally friendly.

## **OBJECTIVES OF FRI**

The objectives of FRI are:

- To develop and provide technical information, training and services to the private sector and other stakeholders in the food industry.
- To provide appropriate technology packages for processing and storage of raw agricultural produce to facilitate curtailment of post-harvest losses, promote value addition for local and export markets.
- To strengthen the FRI's capability and linkages with industry through human resource and infrastructural development, restructuring and re-organisation for effective commercialisation of operations.

## **ORGANISATIONAL STRUCTURE**

The Food Research Institute is administered by the Council for Scientific and Industrial Research which is in turn governed by the Ministry for Environment and Science. FRI is managed by a Management Board which is made up of individuals from the Private Sector, the Universities, NGOs and other Research Institutes. The day to day administration of the Institute is the responsibility of the Director assisted by the Deputy Director and Heads of Divisions. The Director is responsible to a Deputy Director General and the Director-General of the CSIR

The Food Research Institute has three scientific divisions and four administrative/supporting divisions. The scientific divisions are (i) The Food Processing and Engineering Division comprising, The Cassava Processing and Demonstration, The Pilot-Scale Production Unit and The Engineering Unit, (ii) The Food Chemistry Division comprising the Chemistry laboratories/Industrial Service Unit and a Mycotoxicology Unit (iii) The Food Microbiology Division comprising the Microbiology laboratories/Industrial Services Unit and The Mushroom Research Unit. The administrative/support divisions are The Administration Division, The Accounts Division and The Commercialisation and Information Division.

## **STAFF STRENGTH**

No of scientists: 38  
No of technicians: 57  
Total no of staff: 173

In terms of qualification, 48% of the research staff have Ph.D degrees, 38% M.Sc degrees and 14% first degrees. The research scientists include:

- Agricultural, mechanical and chemical engineers.
- Food scientists and technologists.
- Biochemists, chemists and toxicologists.
- Entomologists.
- Microbiologists.
- Socio-economists.
- Nutritionists.

### Technical Expertise

The main strength of FRI lies in its organized technical and research grade staff with several years of experience and requisite expertise. These researchers have undertaken numerous research projects and have collaborated with scientists from several African and European countries, USA and Canada. Some collaborative projects of the institute have been funded by The World Bank, USAID, DANIDA (Denmark), DFID (U.K.), IDRC (Canada), The Netherlands Government amongst others. The institute has over the years achieved success in its research activities, which have won its recognition and respect both locally and internationally. Presently, the main weaknesses of the FRI are inadequate infrastructure and lack of funds.

FRI's other major strength is the availability of facilities for research and the existence of several project reports and technical publications that could be developed for the market or used as basis for consultancy and training.

### **INFRASTRUCTURE**

FRI is sited on three different locations:

- Broz Tito Avenue/Rangoon Close, Cantoments – which hosts the Directorate, Administration, Accounts, Commercial and Information Division and the Food Chemistry Division.
- The Okponglo site – which hosts the Food Microbiology Division, Food Processing and Engineering Division and Nutrition and Socio-Economics Division.
- Pokuase – where the Cassava processing and Demonstration Unit is sited.

FRI is equipped with:

- Analytical laboratories for chemistry, microbiology, molecular biology, biochemistry, mycotoxicology and nutrition.
- An engineering and maintenance workshop.
- A pilot plant equipped with operational wet and dry processing lines.
- A cassava processing and demonstration unit.
- Mushroom studies and production unit.

### **OPPORTUNITIES**

The success of Ghana's drive for diversification of exports provides a number of opportunities for FRI to exploit in terms of securing additional funds for its research activities and commercialisation of its research findings. Growth prospects in the economy in areas such as food, agriculture and industry are expected to offer FRI opportunities for both fundamental and applied research as well as sale, on commercial basis, of some of its research findings, which are beneficial to the above-mentioned sectors of the economy.

One other important opportunity is the high population growth rate (currently estimated at 2.6 % per annum) with its resultant high increase in population and demand for food. Such development would present FRI with opportunities to derive revenue through rendering consultancy services to the food production and processing sectors of the economy by using the expertise at the institute.

## **THREATS**

Increasing pressure on the national budget and government's desire for private sector-led development are likely to result in further reduction in the levels of subventions to FRI. Another threat that FRI is expected to face in the near future may be loss of skilled and experienced research personnel to the private and other public sectors. Another major threat is the role and contributions of Non-Governmental Agencies. Though the Institute does recognise and appreciate their roles as development partners in Ghana, sometimes the activities of some of them have tended to appear as though they are in competition to what the FRI can offer to the general Ghanaian public.

## **COMMERCIALISATION OF RESEARCH: DEVELOPMENT AND TRANSFER OF TECHNOLOGIES**

The Council for Scientific and Industrial Research has carried out research and development activities since it was first established in 1968. However, the re-establishment of CSIR by the act of parliament, Act 521 in 1996, sought to refocus the scope of its operations and activities in order that it will play a more effective role in national development. Therefore some of the key provisions in Act 521 cater for such matters as private sector concerns and commercialization of research, which marks a radical departure from the principles that characterized CSIR originally. Due to the refocusing of the scope of its operations and activities, it has become overwhelmingly imperative for CSIR to offer needed services to the business and industrial sector more directly so that it can play a more effective role in national development. The CSIR therefore, seeks to make its contribution to enhance the translation of the vision of Government's Golden Age of Business into reality and also facilitate a deepening of the private sector's participation and voice in policy formulation.

The vision of the Government of Ghana is to see the nation transformed into a middle-income country by 2010. In pursuance of this, the Government has proclaimed the Golden Age of Business which foresees a situation where Ghana enjoys a world-class business environment that enables and encourages businesses to be competitive in local and international markets and attract investments. To realize this ambition, the Government has developed the Medium-Term National Private Sector Development Strategy which articulates the Government's commitment to facilitating a private sector led growth of the Ghanaian economy. The ultimate objective of the strategy is wealth creation which will be achieved through equitable, widespread business-led growth throughout Ghana. Thus emphasis is placed on the private sector as the engine of growth of the Ghanaian economy, and the sustainable growth which will be achieved will be broad based and be of benefit to all the people of Ghana.

As a national organization that is mandated to carry out research and development activities which will bring benefit to the people of Ghana, the CSIR does and seeks to generate and apply technologies that efficiently and effectively exploit science and technology for socio-economic development of the country in the critical areas of agriculture, industry, health and the environment, and improve the scientific culture of the civil society. Because technologies generated by the CSIR need to be responsive to the demands of the private sector and the socio-economic development of the country, the CSIR sees itself directly as a partner of the private sector. In line with the refocusing of the operations and activities of CSIR, a commercialisation programme was launched within the CSIR, which requires that each Institute generates 30% of its budgetary requirements from non-government sources and

this is to be mainly through commercialisation of its research results such transferring/sale of technologies developed within the CSIR to the private sector.

### **COMMERCIALISATION OF THE TECHNOLOGY FOR THE PRODUCTION OF PALM PULP POWDER FOR MAKING SOUP (PROPOSED PROJECT)**

Over the years, the Food Research Institute has developed several technologies some of which have been successfully transferred to entrepreneurs and private individuals. One useful technology which was developed several years ago by the Institute was palm pulp powder, a dehydrated product from palm fruits which can be used as a base for making palm soup, a staple diet eaten extensively in Ghana and some other West African countries. This product was developed because the process of preparing palm soup in the kitchen is laborious and time consuming involving the cutting up of the palm bunches, picking of the fruits, boiling, pounding, expressing the pulp, and preparation of the soup. To make palm soup readily preparable and also eliminate drudgery in its preparation, the Food Research Institute developed a powder from palm fruit which can be used as a base to prepare palm soup i.e. palm pulp powder. The product was developed several years ago but due to some technical problems, including managerial changes and breakdown of equipment, the technology could not be transferred to the Ghanaian food industry even though a leading multi-national company expressed interest in acquiring the technology. In the studies itself, palm pulp powder was processed from palm fruits using three possible dehydration methods. The powder was produced on a pilot scale for about a year and assessed extensively. The studies led to the design of an industrial scale process which had a capacity for processing 20 tons of palm fruits into 148 kg of palm pulp powder per hour or 4,000 tons of palm fruits into 298.5 tons of palm pulp powder per year of 250 days.

Evaluation of soup prepared from the palm pulp powder found it comparable to soup prepared directly from fresh palm fruits. The powder had a shelf life of 6 weeks when stored on the shelf, 10 weeks when stored in the dark, 9 months when stored under refrigeration and 14 months when kept in a freezer.

#### *Goal of the project*

The goal of the project is several-fold.

- To demonstrate to the Ghanaian public, the relevance of Ghanaian research scientists/institutions to the socio-economic development of Ghana.
- To demonstrate a direct process of research effort carried out in the laboratory evolving and culminating in a catchy, innovative and convenience product produced by industry for the local and international markets, thereby, building up the confidence of the private sector and the general public in the capability of Ghanaian research scientists/research institutions.
- To demonstrate the financial viability of the technology developed for the production of palm pulp powder for making palm soup

#### *Objective of project*

To resuscitate the palm pulp powder project of the Food Research Institute with the aim of transferring the technology to the Ghanaian food industry through commercial and marketing studies, and awareness creation.



### *Specific objectives*

To set up a pilot scale palm pulp powder production line through rehabilitation, fabrication and acquisition of equipment.

To carry out feasibility studies for the production of palm pulp powder based on commercial and market studies in order to produce bankable results which can be used to approach industry, entrepreneurs and potential investors for the transfer of technology.

### **KEY PROJECT PERSONNEL**

The project will be implemented by the Food Research Institute in collaboration with the Oil Palm Research Institute of the CSIR and the Corporate Commercialisation and Information Directorate of the CSIR

The execution of the project will be led by a team comprising:

- Dr. Wisdom Kofi Amoa-Awua (team leader): Deputy Director and Head of Food Microbiology Division, FRI – BSc (Gen), BSc (Hons) (Food Science) University of Ghana, MAPPSc, (Food Technology & Biotechnology) University of New South Wales, Australia, Ph.D, (Food Microbiology) Royal Veterinary and Agricultural University, Denmark & University of Ghana. Dr. Amoa-Awua has been involved in research for over 20 years and has over 20 research publications in international journals. He has been a project leader for many collaborative projects involving the Food Research Institute and universities and institutions in Denmark, Germany, Burkina Faso, Nigeria, Cote d'Ivoire, Kenya, Tanzania and Zimbabwe. These projects have been funded by UNDP, UNIDO, Daninda, EU and IFAD.
- Mrs Agnes Osei-Yaw: Head of Commercial and Information Division, FRI. - BSc (Gen) University of Ghana, MSc (Food Science and Nutrition) Washington State University, USA. Mrs Osei-Yaw has been involved in research for over 20 years and has been involved in collaborative projects with local and foreign institutions,
- Mrs Josephine Okutu: Director, Corporate Commercialisation and Information, CSIR - BSc (Biology) KNUST, MBA (Marketing Option), University of Ghana. Mrs Okutu has worked as the Commercial Manager, then General Manager in charge of marketing at the Schwepps Co., at the export desk in charge of marketing at the Ministry of Trade and also as a management consultant.

The project team members have the necessary wealth of experience to successfully execute the project which involves finalising and fine tuning the technology which has already been developed through research and the marketing/transfer of the technology to the private sector. Since the project is executed by the Food Research Institute, other members of staff will be involved in the implementation of the project.

### **PRODUCTION PLAN (Pilot scale production of palm pulp powder)**

The aim of the project is to facilitate the industrial scale production of palm pulp powder by the private sector through pilot scale demonstration of the feasibility and viability of the technology. For the industrial scale operations which will eventually be implemented in industry the following considerations are made.

### Material balance

The material balance for the pilot scale process is based on the production of 75 tons of palm pulp powder per year of 250 working days i.e. 37.5 kg of palm pulp powder per hour. The daily raw palm fruit requirement would amount to 1.5 tons per 8 hours working days or 187.5 kg per hour. This amounts to 12.5 bunches of fresh palm fruits per hour or 100 bunches of palm fruits a day assuming an average bunch weight of 15kg. Assuming that each acre of palm oil plantation contains 60 trees, the total acreage required for 250 working days is 417.

### Components of the production plant

The production flow chart which will be used to produce palm pulp powder is shown in fig 1 and will have the following components:

#### Bunch sterilizer

*Purpose:* The purpose of the bunch sterilizer is to sterilize fresh palm fruit bunches under stream in order to:

- Break further development of acidity in the oil.
- Facilitate loosening of fruit from the stalks.
- Prepare the fruit pulp for further treatment, extraction and clarification of the oil where applicable
- Improve the kernel recovery rate i.e. pressure makes the kernels easily loosened from the shells.

*Specifications:* The sterilizer should be rectangular and capable of sterilizing 300 kg of fresh fruit or 20 bunches of palm fruits in an hour at a pressure of 4-5 bars. The total operation time of the sterilizer should be approximately 60 minutes in a total production period of 5 hours. The sterilizer should have a rectangular door at the top through which the bunches drop into the sterilizer and a rectangular hinged door at the foot for discharge. There should be a sloping perforated plate at the bottom of the sterilizer to aid in the manual discharge.

#### Palm fruit stripper

*Purpose:* The stripper or thresher is to loosen the fruit from the bunches.

*Specifications:* The stripper or thresher should be of the beater arm type and be power operated. It should consist of an inclined curved cradle of curved bars between which the beater arms attached to the stripper shaft can pass. Bunches will be fed into the top of the cradle inclined to be knocked and turned by the tip of the beater arms and pass gradually down the cradle. The capacity of the stripper should be 300 kg per hour.

#### Cooker/steam jacketed kettle

*Purpose:* The cooker is to cook and soften the fruits by direct steam heating to prepare it for the wet extraction process in the digester.

*Specifications:* The cooker is to be a steam-jacketed cylindrical vessel with a suitable fruit discharge door at the bottom. Fruit cooking will be at a temperature of 100 °C for not less than one hour.

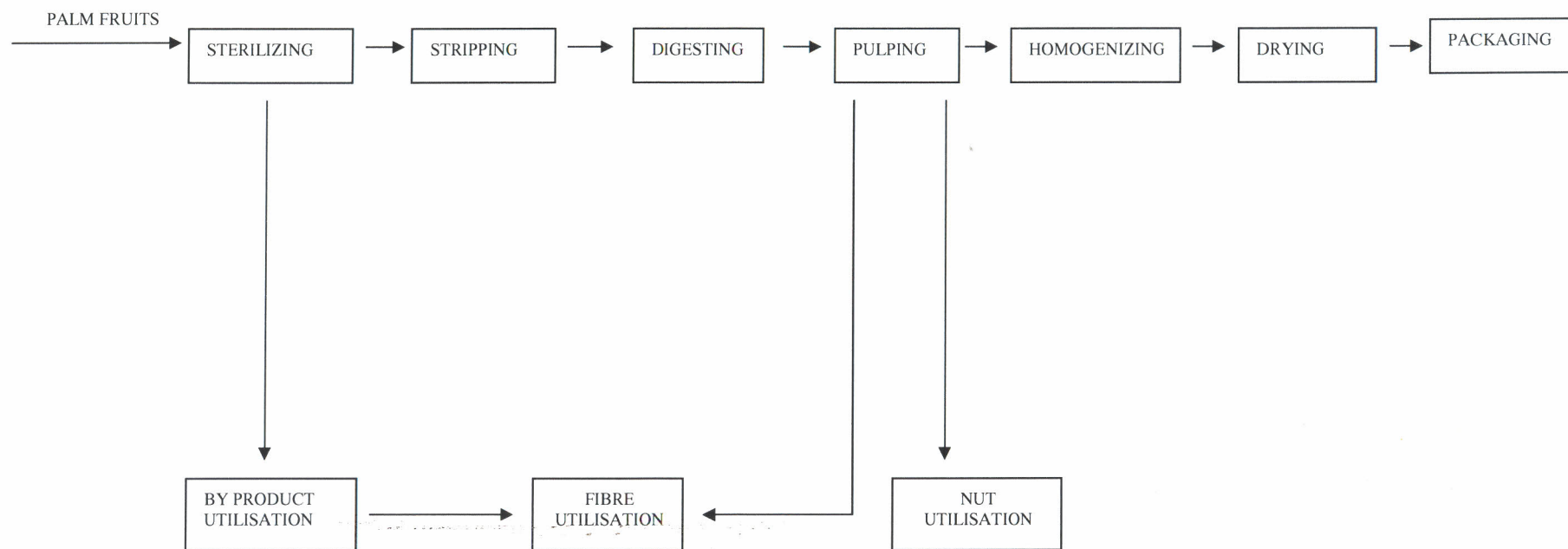


Fig. 1. Flow chart for pilot scale production of palm pulp powder for making soup.

### Digester

*Purpose:* The digester is to agitate the cooked fruits in order to;

- Loosen the pulp from the nuts.
- Crush the cells to release the oil and pulp they contain.

*Specifications:* The digester is to be a steam jacketed cylindrical vessel with vertical rotating shaft driven from the top or bottom. The capacity of the digester would be such of such size as to provide for 1 hour pressing and be adjusted to the rate of work of the pulper. Fruit will be fed at the top as charges and the homogenous mash without any undigested fruit to be removed from the bottom into the open feed hopper of the pulper. Digesting to be at a temperature of about 100 °C for about 15 minutes per discharge.

### Pulper/finisher

*Purpose:* The pulper finisher is to extract, strain and refine the pulp from the mash in order to produce a homogenous and high quality palm pulp concentrate.

*Specifications:* The pulper is to have a large open feed hopper into which the fruit can be fed. The beaters should be fitted with adjuster near or further from the screen. Capacity of pulper should be 300 kg per hour of mashed fruits.

### Homogenizer/holding tank

*Purpose:* The homogenizer is to reduce and mix particles of the palm pulp emulsion through high pressure homogenization in order to stabilise the various ingredients of the emulsion so as to prevent ingredients separation on standing for an extended period of time, therefore improving the consistency. Homogenisation will also improve the body and texture of the palm pulp. Could be steam jacketed and have an agitator at the bottom. Will also hold palm pulp slurry till fed into dryer.

*Specifications:* The homogenizer is to homogenise 125 litres of palm pulp slurry an hour.

### Freeze dryer

*Purpose:* This is the first choice dryer to dry the homogenised palm pulp slurry.

*Specifications:* Should be capable of drying 60 litres of palm pulp an hour to a moisture content of less than 5% i.e. produce 300 kg of palm pulp powder in 8 hours.

### Spray dryer

*Purpose:* This is the second choice dryer to dry the homogenised palm pulp slurry.

*Specifications:* The dryer will be a counter current flow type and capable of 60 litres of palm pulp an hour to a moisture content of 5% or less.

### Holding bin

*Purpose:* To accumulate the palm pulp powder.

*Specification:* The bin will be a stainless steel conical tank with a gate at the bottom for feeding the palm pulp powder into the hopper of the packaging unit.

#### Packaging machine

*Purpose:* The packaging machine to be used in the packaging of the palm pulp powder.

*Specifications:* The packaging machine should be of a vertical form, fill and seal equipment. It should be fitted with an impulse heat sealer jaws suitable for aluminium laminated polythene or film for packaging dried products containing oil.

#### Coiled-tube boiler

Suitable for pressures and temperatures quoted above.

#### BY-PRODUCT UTILISATION

The wet kernels produced as by product may be processed into palm kernel oil.

#### **PROJECT ACTIVITIES**

Activities to be undertaken are as follows (see also the logical framework in Table 1.)

1. Fabrication of equipment.
  - a. Palm fruit digester.
  - b. Pulper/finisher
  - c. Homogenizer/holding tank.
  - d. Holding bin.
2. Rehabilitation/repair of equipment.
  - a. Bunch sterilizer
  - b. Spray dryer.
3. Acquisition of equipment.
  - a. Bunch stripper.
  - b. Freeze dryer.
  - c. Cooker/Steam jacketed kettle.
  - d. Coiled-tube boiler.
4. Installation of equipment.
5. Establishment of a production line.
6. Production trials.
  - a. Fine tuning of technology.
  - b. Laboratory analysis.
7. Production.
8. Packaging studies.
9. Storage studies.
10. Commercial and market studies
11. Promotion of technology.
12. Transfer of technology.



The project will be sited at the pilot plant of the Food Research Institute (FRI) which is located at Okponglo in Accra. Palm fruits will be obtained from the Oil Palm Research Institute at Kusi near Kade in the Eastern Region.

The Pilot Plant of the Food Research Institute has adequate processing space and some of the equipment which will be needed for the project such as a basket centrifuge. Other equipment which will be needed are also available but will need to be rehabilitated or repaired, including a pilot scale spray dryer. FRI also has 38 research scientist including food scientists and technologists, mechanical and chemical engineers and socio-economists who can all offer their services to the project. The institute also has an engineering workshop where some of the needed equipment can be fabricated. FRI also has Accounts and Administration Divisions who will assist in the project. The Oil Palm Research Centre has its own oil palm plantation and can supply the raw materials for the project. The Commercial and Information Divisions of both the CSIR and FRI have staff trained in marketing and are focused on commercializing the research results of CSIR.

## **PRODUCTS**

The goal of the project is to succeed in transferring the technology for the production of palm pulp powder from the laboratory bench to the Ghanaian food industry. A scheme will be established for transferring the technology to an industrialist/industry/entrepreneur which will ensure that the Food Research Institute will continually gain from the exploitation of the technology at the industrial level. In the second and third year of project implementation, palm pulp powder will be produced on pilot scale for commercial and marketing studies and also for sale to the general public in order to popularise and promote the product.

## **MARKET ANALYSIS**

The palm pulp powder is an innovative product which has a great potential for the local, sub-regional, and international markets due to the convenience of its use. On the local market, the customers will be mainly working mothers who will find it very convenient to use the palm pulp powder to reduce the drudgery associated with the preparation of palm soup, restaurants, etc. Also Ghanaians and West African nationals living in the sub-region and the Diaspora are expected customers since the product is more convenient to handle than any existing comparable product. The only comparable product is canned palm cream soup and the market for this product gives an indication of the potential export market for palm pulp powder. Currently there are 14 Ghanaian companies engaged in the production and export of canned palm cream soup to 13 countries; Austria, Belgium, Canada, France, Germany, Italy, Japan, The Netherlands, South Africa Spain, Switzerland, UK and USA. The total export of canned palm cream in 2000 was 498 MT valued at \$790,263, in 2001; 528 MT valued at \$898,438, 2002; 765 MT valued at \$1,189,083 and in 2003; 871 MT valued at \$1,637,698.

## **PROJECT COST AND FINANCING PLAN**

The investment cost of the project is shown in Table 2. The total investment cost of the project is 1,803,000,000 cedis out of which the Food Research Institute will provide equity of 1,310,000,000 cedis. The total grant sought from the Ghana Development Marketplace is therefore 493 million cedis. For the second and third year of project implementation, palm

pulp powder will be produced on pilot sale and sold to the general public in order to introduce, popularise and promote the product. The cost of services for the second and third year is shown in Table 3. The amount of palm fruits processed in a day will be 1.5 tons yielding 300 kg of palm pulp powder. For the first year of production (i.e. project year 2), the total cost of services for the year will amount to 652 million cedis and for the second year (project year 3), 782 million cedis. The projected cash flow for the second and third years of project implementation when production and sale of palm pulp powder to the general public will be undertaken will give an expected net income of 788 million cedis for Year 2 and 945.6 million cedis for Year 3 (Table 4).

## **CONCLUSION**

This goal of this project is bring the technology developed for the production of palm pulp powder by the Food Research Institute, to a level where it can be transferred to a company/entrepreneur who will run it as a business to generate revenue and also provide an invaluable service to the country. This is because of the usefulness and ingenuity of the technology. The technology has already been developed and proven. What is important to the Food Research Institute is that such an important technology is not allowed to continue to sit on the shelf without being adopted by industry as has often been the fate of a lot of research results generated by the Council for Scientific and Industrial Research, Universities and other agencies involved in research in Ghana. Successful transfer and utilisation of such technology will enhance the confidence of the private sector in the capability of research institutions in Ghana and forge a closer and necessary collaboration between the two, leading eventually to the support of research by the private sector and the uptake of research results by the private sector. This is necessary for the development of the country and it is the hope of the management of the Food Research Institute of the Council Scientific and Industrial Research that this proposal will be funded as a step in forging closer collaboration between research and industry in Ghana. The financial analysis shows that palm pulp powder can be produced profitably yielding a profit of 788 million cedis in the second year of project implementation based on the production of 300 kg of palm pulp powder a day requiring a grant of 825 million cedis equivalent to 91,000 US dollars to initiate the project.



Table 2. Total investment cost for project

<b>INVESTMENT COST (€'000)</b>			
<b>ITEM</b>	<b>EXISTING</b>	<b>ADDITIONAL</b>	<b>TOTAL</b>
<b>FIXED ASSETS</b>			
(i) Land and building	250,000		<b>250,000</b>
<b>(ii) Equipment</b>			
Palm fruit sterilizer (repair)	10,000	5,000	15,000
Digester		10,000	10,000
Palm fruit stripper		10,000	10,000
Spray dryer (repair)	100,000	30,000	130,000
Freeze dryer		480,000	480,000
Basket centrifuge	40,000	-	40,000
Steam generator		30,000	30,000
Tank		10,000	10,000
Packaging machine	40,000		40,000
	-		-
<i>Subtotal</i>			<b>765,000</b>
<b>Total</b>	<b>440,000</b>	<b>575,000</b>	<b>1,015,000</b>
<b>(iii) Office furniture</b>			
Laboratory	200,000		200,000
Office	20,000	20,000	40,000
	<b>220,000</b>	<b>20,000</b>	<b>240,000</b>
<b>PRE-OPERATIONS EXPENSES</b>			
Miscellaneous	50,000		
	<b>50,000</b>	-	<b>50,000</b>
<b>Working Capital</b>			
	-		-
Salaries, wages, labour	600,000	50,000	650,000
Transportation		50,000	50,000
Materials		70,000	70,000
Commercial and marketing studies		30,000	30,000
Promotion and transfer of technology	-	30,000	30,000
	<b>600,000</b>	<b>230,000</b>	<b>830,000</b>
<b>TOTAL</b>	<b>1,310,000</b>	<b>825,000</b>	<b>2,135,000</b>
<b>FINANCING PLAN (€'000)</b>			
	<b>EQUITY</b>	<b>GRANT</b>	<b>TOTAL</b>
<b>FIXED ASSETS</b>	620,000	615,000	<b>1,255,000</b>
<b>PRE-OPERATIONAL EXPENSES</b>	50,000		<b>50,000</b>
<b>WORKING CAPITAL</b>	600,000	230,000	<b>830,000</b>
<b>TOTAL</b>	<b>1,310,000</b>	<b>825,000</b>	<b>2,135,000</b>

COST OF SERVICE						
	<u>1ST QTR</u>	<u>2ND QTR</u>	<u>3RD QTR</u>	<u>4TH QTR</u>	<u>TOTAL</u>	<u>TOTAL</u>
	<u>YEAR 2</u>	<u>YEAR 2</u>	<u>YEAR 2</u>	<u>YEAR 2</u>	<u>YEAR 2</u>	<u>YEAR 3</u>
	€	€	€	€	€	€
<b>Labour</b>						
Hired labour	10,000,000	10,000,000	10,000,000	10,000,000	40,000,000	48,000,000
FRI salaries (for production only)	15,000,000	15,000,000	15,000,000	15,000,000	60,000,000	72,000,000
	<b>25,000,000</b>	<b>25,000,000</b>	<b>25,000,000</b>	<b>25,000,000</b>	<b>100,000,000</b>	<b>120,000,000</b>
<b>Material</b>						
Electricity	3,000,000	3,000,000	3,000,000	3,000,000	12,000,000	14,400,000
Water	2,000,000	2,000,000	2,000,000	2,000,000	8,000,000	9,600,000
Palm fruits	60,000,000	60,000,000	60,000,000	60,000,000	240,000,000	288,000,000
Packaging materials	10,000,000	10,000,000	10,000,000	10,000,000	40,000,000	48,000,000
Transportation of materials	50,000,000	50,000,000	50,000,000	50,000,000	200,000,000	240,000,000
	<b>125,000,000</b>	<b>125,000,000</b>	<b>125,000,000</b>	<b>125,000,000</b>	<b>500,000,000</b>	<b>600,000,000</b>
<b>Other Expenses</b>						
Vehicle maintenance costs & fuel	4,000,000	4,000,000	4,000,000	4,000,000	16,000,000	19,200,000
Repairs & Maintenance of equipment	4,000,000	4,000,000	4,000,000	4,000,000	16,000,000	19,200,000
Administrative costs	5,000,000	5,000,000	5,000,000	5,000,000	20,000,000	23,000,000
	<b>13,000,000</b>	<b>13,000,000</b>	<b>13,000,000</b>	<b>13,000,000</b>	<b>52,000,000</b>	<b>62,400,000</b>
<b>TOTAL</b>	<b>163,000,000</b>	<b>163,000,000</b>	<b>163,000,000</b>	<b>163,000,000</b>	<b>652,000,000</b>	<b>782,400,000</b>

Table 3. Cost of services for Years 2 & 3.

**Projected Cash flow Statement for Years 2 & 3**

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	YEAR 2	YEAR 3
<b>Cash Inflows</b>						
Cash Sales	360,000,000	360,000,000	360,000,000	360,000,000	1,440,000,000	1,728,000,000
<b>Total Inflows</b>	<b>360,000,000</b>	<b>360,000,000</b>	<b>360,000,000</b>	<b>360,000,000</b>	<b>1,440,000,000</b>	<b>1,728,000,000</b>
<b>Cash Outflows</b>						
Cash Purchases	125,000,000	125,000,000	125,000,000	125,000,000	500,000,000	600,000,000
Labour	10,000,000	10,000,000	10,000,000	10,000,000	40,000,000	48,000,000
Other expenses	13,000,000	13,000,000	13,000,000	13,000,000	52,000,000	62,400,000
Salaries	15,000,000	15,000,000	15,000,000	15,000,000	60,000,000	72,000,000
<b>Total Outflows</b>	<b>163,000,000</b>	<b>163,000,000</b>	<b>163,000,000</b>	<b>163,000,000</b>	<b>652,000,000</b>	<b>782,400,000</b>
<b>Net Flow</b>	<b>197,000,000</b>	<b>197,000,000</b>	<b>197,000,000</b>	<b>197,000,000</b>	<b>788,000,000</b>	<b>945,600,000</b>

Table 4. Projected cash flow statement for years 2 and 3.