COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH – FOOD RESEARCH INSTITUTE (CSIR-FRI)

ACCRA-GHANA

TECHNICAL REPORT OF A TWO MONTH SUPERVISION AND MENTORING ON MISS SUSUAN BAKAH, A STUDENT OF UNIVERSITY OF ENERGY AND NATURAL RESOURCES (2022) AT CSIR-FRI'S COMMERCIAL DIVISION

BY

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1.0 EXECUTIVE SUMMARY

Food Research Institute (FRI) is one of the thirteen institutes of CSIR. Its mandate is to conduct applied market-oriented research into problems of food processing and preservation, food safety and storage, marketing, distribution, utilization, national food and nutritional security in support of the food industry and to advise government on its food policy. As such we have various processing technologies that are being used to process raw materials into finished products, ***Food Research***

CSIR- FRI has a policy to accept and mentor students from other universities who want to do attachments and internship programmes. It was on this base that Miss Sussuan Bakah from the University of Natural Resources Sunyani came for a two month internship programme at the Institute. She was sent to commercial division and to be supervised and mentored by Mr. Thomas Najah.

1.2 Commercial Division

Commercial Division (CD) has the role to see to it that the applicability of all research projects, benefits individuals and companies. In other words, the outcomes of all research works are commercialized by the division.

1.3 Marketing Officer

The Marketing Officer of the Commercial Division is responsible to do prospecting for all commercial cost centers of the Institute. He also drafts MoUs between companies who want to do businesses with the Institute. He develops business and marketing plans for the commercial division as well.

1.4 Requirements of Universities in Ghana

As a requirement of tertiary institutions in Ghana, students are required to attain working experience in the industrial sector. As a result, Miss **Susuan Bakah** from the University of Energy and Natural Resources, Sunyani, came for a two month industrial attachment at CSIR-Food Research Institute to acquire some industrial experience.

She was asked to be mentored and supervised by Mr. Thomas Najah, Marketing Officer of the institute.

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CHAPTER ONE

2.0 Introduction

Food Research Institute (FRI), one of the Institutes of the Council for Scientific and Industrial Research (CSIR) is mandated to generate technologies that are intend to meet the demands of the private sectors and other stakeholders for the socio-economic development of the country.

2.1 Mandate

The CSIR- FRI is mandated to conduct applied market oriented research into problems of food processing and preservation, food safety, storage, marketing, distribution and utilization, and national food and national food and nutritional security in support of the food industrial and also to advise government on its food policy.

2.2 Vision

The Food Research Institutes vision is to be recognized nationally and internationally as a Science and Technology institution that is playing as key role in the transformation of the food processing industry to be internationally competitive with particular reference to products safety, quality and preservation.

2.3 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 prioritization and national objectives.

Primarily, CSIR-FRI's mission is to conduct market-oriented applied research and provide technical services and products profitably to the private sectors and other stakeholders. To do this the Food Research Institute will conduct business in a conductive and transparent working environment with a cadre of high qualified and motivated staff for timely delivery of quality services and products to clients.

2.4 Overall Goal

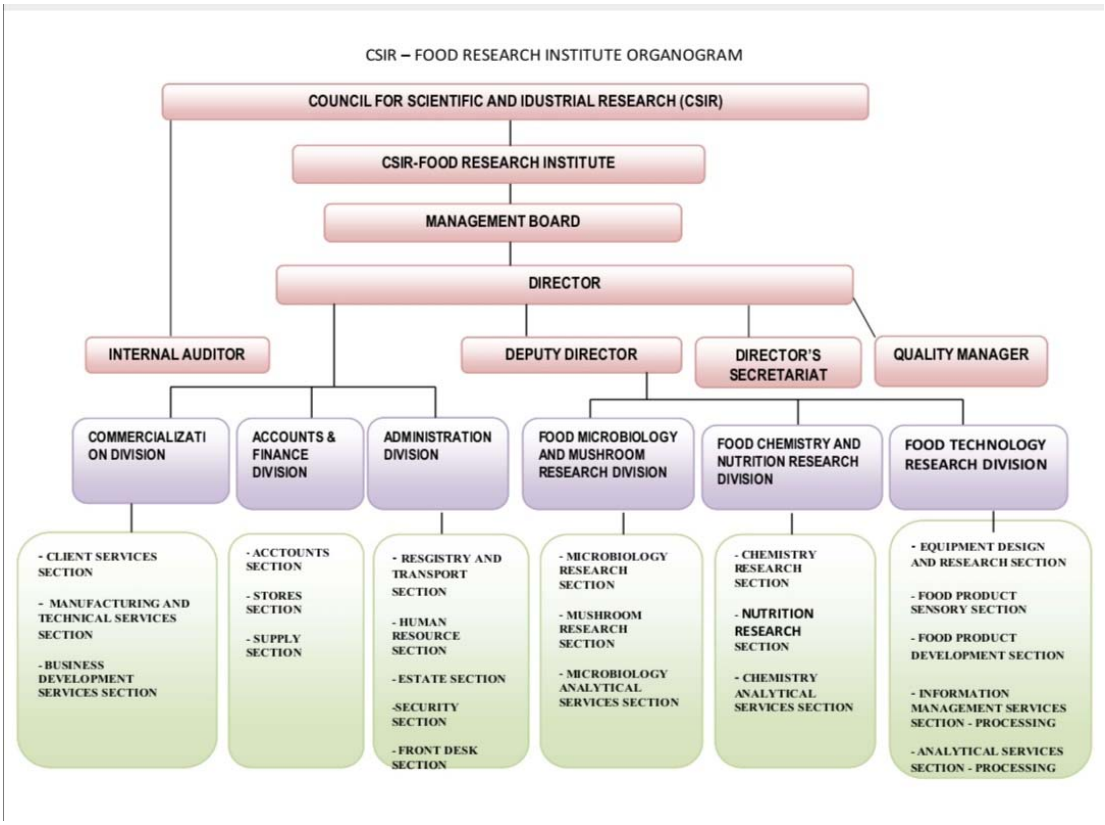
The overall goal of the institute is to assist in poverty alleviation through creation of opportunities for generating and increasing incomes within the micro, small, medium and large-scale food

industry; contributing to food security, foreign exchange earnings and the application of cost-effective food processing technologies that are environmentally friendly.

2.5 History

CSIR was established in 1963 on 1st October by the government of Ghana, the Food Research Institute became one of the affiliate Institutes of the Council for Scientific and Industrial Research (CSIR) which became one the thirteen institution of the CSIR.

Table 1.0: Organogram of the Institute



CHAPTER TWO

3.0 Activities taken through the 2 month attachment

Since her background was the Agric Business orientation, she was taken through almost all the activities of the Institute's commercial division such as attending exhibition shows, development of memorandum of understandings (MoU), Marketing and Business plans, personal selling and agro processing.

To acquire basic working experience, Miss Bakah was made to join the Institute's exhibition team to appreciate how to interact with prospective customers/clients and to make personal selling at some exhibitions.

3.1 Exhibition at the Accra Technical University

Food Research Institute, was invited as a participant to exhibit at the 2nd Edition of the Annual Applied Research Conference. This two-day event which took place at the Accra Technical University on 7th and 8th July, saw innovative technologies and new products being exhibited by students and faculty members of the various technical universities in the country; Sunyani Technical University, Kumasi Technical University, Cape Coast technical University, Koforidua Technical University, Ho Technical University, Takoradi Technical University, Bolgatanga Technical University, Tamale Technical University, Dr. Hilla Limann Technical University and the hosts, Accra Technical University. There were exhibitions by private individuals, groups and companies who showcased and created awareness on their new products.

The CSIR-FRI exhibiting team was led by Thomas Najah – Marketing Officer. He was ably assisted by Paul Fordjor – Marketing Assistant, Jessica Tweneboa – National Service Person, Susuan Bakah and Edinam Agbeko, both Interns who were present to learn and support. On day one, Mr. Najah presented briefly to the general public on CSIR-FRI's products and services.

On day two, the team educated observers and other individuals on the Institute's technologies and other programs that can benefit the general public.

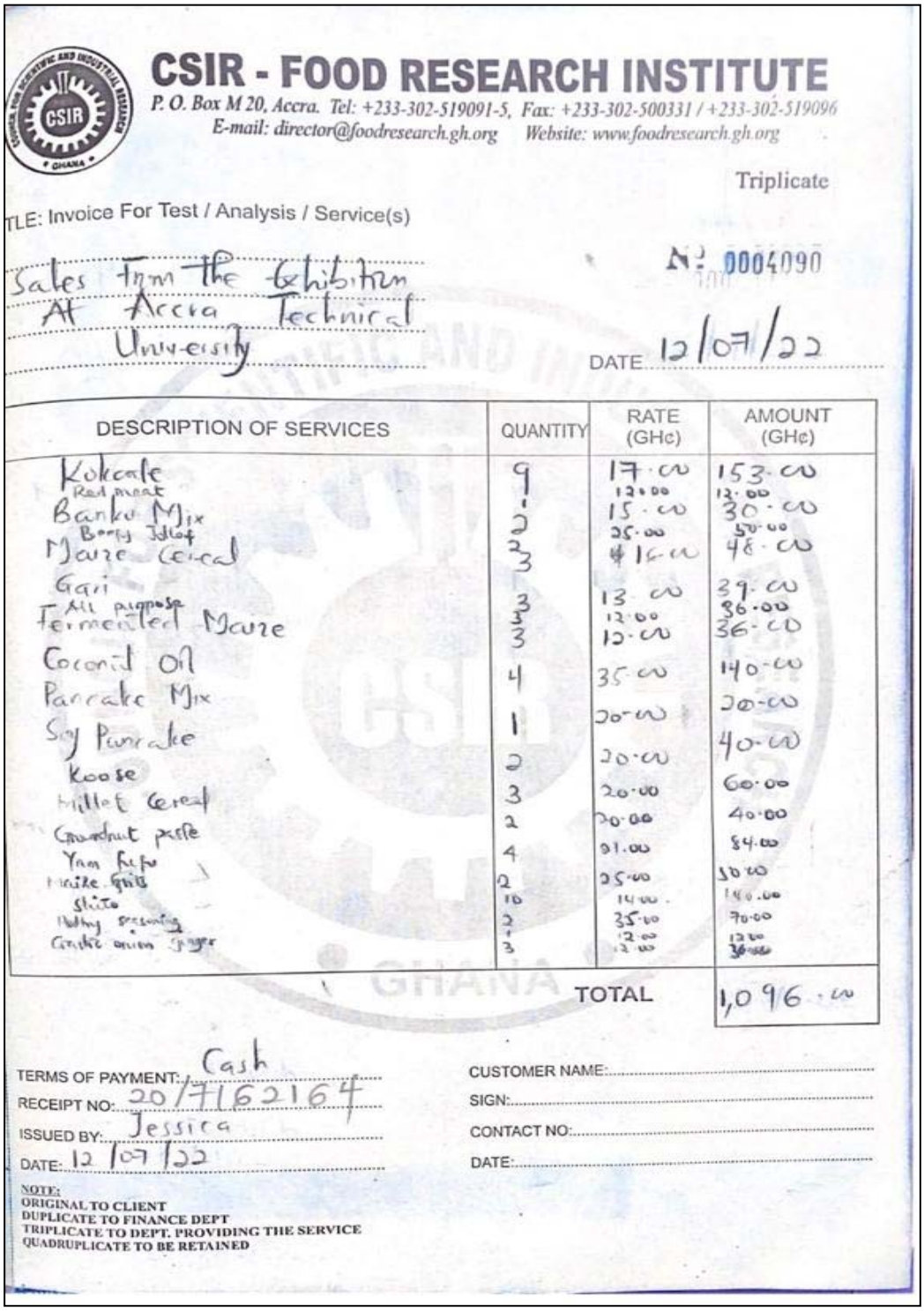
All in all, it was massively successful and by participating in this conference, the team was able to achieve the following:

- Awareness Creation on CSIR-FRI
- Sales of Products
- Engagements with stakeholders who are potential clients of CSIR –FRI and Prospecting.

Fig 1.0: Products mix exhibited at the Accra Technical University

Fig 2.0: Interactions at the exhibition

Table 2.0: Sales at the Accra Technical University



CSIR - FOOD RESEARCH INSTITUTE

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Triplicate

TLE: Invoice For Test / Analysis / Service(s)

Sales from the Exhibition At Accra Technical University

No: 0004090

DATE 12/07/22

DESCRIPTION OF SERVICES	QUANTITY	RATE (GH¢)	AMOUNT (GH¢)
Kokoole	9	17.00	153.00
Red meat		12.00	12.00
Banku Mix	2	15.00	30.00
Boiled Yellow Maize Cereal	3	25.00	50.00
		16.00	48.00
Gari	3	13.00	39.00
All purpose Fermented Maize	3	12.00	36.00
		12.00	36.00
Coconut Oil	4	35.00	140.00
Pancake Mix	1	20.00	20.00
Soy Pancake	2	20.00	40.00
Koose	3	20.00	60.00
Millet Cereal	2	20.00	40.00
Groundnut paste	4	21.00	84.00
Yam fufu	2	25.00	50.00
Maize grits	10	14.00	140.00
Shito	2	35.00	70.00
Nutty pressing	3	12.00	12.00
Garlic onion ginger		12.00	36.00
		TOTAL	1,096.00

TERMS OF PAYMENT: Cash
RECEIPT NO: 20/7162164
ISSUED BY: Jessica
DATE: 12/07/22

CUSTOMER NAME:
SIGN:
CONTACT NO:
DATE:

NOTE:
ORIGINAL TO CLIENT
DUPLICATE TO FINANCE DEPT
TRIPLICATE TO DEPT. PROVIDING THE SERVICE
QUADRUPLICATE TO BE RETAINED

3.2 Exhibition at Accra Metropolitan Assembly

On the 27th and 28th of August, 2022, Citi FM and Citi TV launched Ghana's biggest fair and exhibition to enable small and medium enterprises to showcase indigenous products and services, where CSIR Institutes, including Food Research Institute were invited to participate in the food fair.

The theme for the fair was; **Ghana Exhibition created space for promotion of Ghanaian products and services to boost made in Ghana products**.

The exhibition held at the Accra Metropolitan Assembly gathered small and medium enterprises, start-ups, home grown businesses and indigenous corporate bodies offering them a unique opportunity to showcase local industry innovations.

About 50 exhibitors were present, some products that were displayed included Ghanaian made shoes, beads and jewelry, home care products, local spices, solar panel, agriculture produce among other product.

Fig 3.0: The Vice President, Dr. Bawumiah delivering his speech at the CITI TV/FM fair

3.3 Activities at the Institute's sales point

For Miss Bakah to broaden her experience, she was moved to assist at the Institute's sales point. Sales point is basically where the Institute's *Foodsearch* products are sold to the public. Some of the products produced by the institute are yam fufu, plantain fufu, kokontey, gari, banku mix, fermented maize, soy pancake, pancake mix, prekese syrup, honey, coconut oil, cereal mix, groundnut paste and many others. Here, the student had the opportunity to interact with new customers and to have a network relationship with them. At some point at the sales point Miss Bakah was asked to explain CSIR-FRI businesses to individuals that visited the shop at the auspices of her supervisor.

Throughout the attachment, it was observed that there was a high demand for all products from the Institute

The challenge noted was that the production base could not produce enough to meet the demand.

All products available for sales are natural, organic and are FDA approved.

The table below indicates the quantity of products purchased by consumers from 18th July to 2nd of September. And it is obvious that kokonte was highly purchased by the consumers and red meat seasoning powder was list purchased by the consumers. The empty spaces in the box shows the unavailability of the products. The student was tasked to make weekly reports as below;

Table 3.0: Showing weekly sales records from July 18 to 29 July 2022

DESCRIPTION	RATE	WEEK 3	AMOUNT	WEEK 4	AMOUNT
Kokonte	17	67	1139	73	1241
Red meat	12	3	36	2	24
Banku mix	15,	14	210	39	585
Beefy jollof	25	7	175	2	50

Maize cereal	16,	18	288	39	624
Gari	13	19	247	1	13
All purpose	12	2	24	7	84
Fermented maize	12,	13	156	13	156
Coconut oil	35	19	665	8	280
Pancake mix	20	6	120	23	460
Soy pancake mix	20	18	360	18	360
Koose mix	20	18	360	22	42
Millet cereal	25	25	625	11	275
Groundnut paste	21,	14	294	0	0
Yam fufu	30	0	0	0	0
maize grits	14,	16	224	26	364
Shito	35	5	175	3	105
Poultry seasoning	12	4	48	6	72
Garlic, ginger and onion seasoning	12	1	12	5	60
Plantain fufu	40	95	3800	68	2720
Soy milk big	10	8	80		
Soy milk small	6	5	30		
Hauza koko	25	31	682	7	175
Fresh fish	12	4	48	5	60

seasoning					
Total			9798		7810

Table4.0: WEEKLY SALES RECORDS FROM 1ST AUGUST TO 2ND SEPTEMBER

DESCRIPTION	RATE	W1	AMT	W2	AMT
Kokonte	20			120	2400
Red meat	12	6	72	2	24
Banku mix	15	27	405	12	180
Beefy jollof	25	2	50	6	150
Maize cereal	16	32	512	12	192
Gari	13	4	52	0	0
All purpose	12	3	36	5	60
Fermented maize	12	1	12	8	96
Coconut oil	38	4	152	9	342
Pancake mix	20				
Soy pancake mix	20				
Koose mix	20				
Millet cereal	25				
Groundnut paste	25				
Yam fufu	30	21	630	14	420
maize grits	14	16	224	19	304

Shito	35	3	105	1	35
Poultry seasoning	12	0	0	1	12
Garlic, ginger and onion seasoning	12				
Plantain fufu	40				
Soy milk big	10				
Soy milk small	6				
Hauza koko	25			5	125
Fresh fish seasoning	12	1	12	0	0
Rice ceareal	16	47	752	28	448
Nosh peanut	8	0	0	1	8
Nosh coconut	8	0	0	4	32
Share moringa	12	2	24	6	72
Share tiger nut	12	13	156	1	12
Share cashew	12	6	72	3	36
Total			2636		4528

4.0 Fruits Juice Processing laboratory

The third place of the institute she was moved to is processing laboratory. This is where training of fruit juice extractions are done. This was to enable her to appreciate how raw materials are being processed. She was taking through the under listed skills.

4.1 Things to Note before Processing Fruit Juice

4.1.1 **Washing of Hand**

She was made to appreciate that the first activity needed to be done before beginning the whole process was thorough washing of hands. There may be a lot of bacterial on the hands, therefore washing hands would prevent the fruits from contaminating. Hence, unwashed hands can spread germs in the kitchen. Some germs such as salmonella can cause harm on the fruit as well us when it gets into our body.

4.1.2 Wearing Gloves to Protect the Fruits from Cross Contamination

Wearing gloves protects the fruit from any kind of bacterial from ones hands to the fruits. This action does not only protect the fruits but also protect ones hands against any further injury.

4.1.3 Wearing of Hair Covers

This is very key because it prevents human hair from falling into the food. Some individuals may touch their hair or even scratch it when it is itching, this action can spread bacterial into the fruit juice especially if it is unwrapped.

4.1.4 Wearing Protective Clothes

Lab coat is worn to prevent any kind of spillage onto ones cloths

4.2 Processes of Fruits Juice Extraction

4.2.1 Sorting and washing of fruits

Sorting of damaged fruits from healthy ones would make the final products wholesome for consumption as well as increasing the shell life of the fruits juice.

Fruits were rinsed under running water. This was needed to help remove dirt hence.

Washing fresh produce helps minimize surface germs and residues that could cause sickness of consumers.

The fruits need to be washed three times. Firstly, washing the fruits with portable water to take away the dirt from the fruits

Secondly, washing the fruits with chlorine to kill the bacteria that may be present on fruits

Lastly, washing the fruit to take away or clean the chemicals from the fruits which would be toxic for consuming.

4.2.2 Peeling and Slicing of Fruits

Peeling is done by removing the outer covering of the fruits, Slicing of fruit is the act of cutting fruit into small parts to enable smooth blending. However, before cutting of fruits the whole working table has to be neatly sterilized

Fig 4.0: Showing mass peeling of fruits

4.2.3 Extraction of fruits juice

Extraction is basically removing the juicy part of the fruit. The pineapple was the first to be extracted followed by the water melon and mango, using a fruit grinder by dropping the fruits into grinder systematically. Afterwards the juice is poured into a container separately. An amount of honey, sugar or any additives may be added to suit ones taste. However, for this particular fruit juice ginger paste was added to it. After that, the fruits juice is sieved with a cheese cloth which may be optional.

Fig 5.0: Fruits juice extraction processes

4.2.4 Formulation of fruits juice

Formulation is basically the way of mixing the fresh juice in a desired way, there were three different fresh juice that is water melon fresh juice, pineapple and mango including ginger paste.

Fig 6.0: Formulation of Fruits Juice

To measure the sugar level of the juice, a refractometer is used, however, in making fruit juice the sweetness level should be between 10 to 12(%). Checking sugar levels with the refractometer is done in duplicate. The sugar level of watermelon ranged between 7.0 and 7.1, pineapple was 14.8 and 14.19 and lastly mango was 10.0 and 10.2 The mixtures were pineapple, watermelon, mango and ginger mix, watermelon and ginger mix, mango and watermelon mix.

Before pouring it into a glass bottle the bottle has to first sterilize to kill any harmful bacterial present in and around the bottle, at this moment the juice was poured into the glass bottle and was heated for 75degree.

4.3 Activities at Plant one (1)

This is the production plant of the Institute. All Foodsearch products in the Institute but cassava products are processed here (1).

Food processing involves washing, cutting, and combining ingredients to produce edible products. Processed foods should be consistent in texture, taste, and appearance. The production process also involves dispersing food products into appropriate reheating and serving sizes.

All food raw materials are processed to finish products for consumption, cooking, or storage is called food. Brand name for CSIR-FRI products is '***Foodsearch***'. Cereal milling, fruit & vegetable processing, milk products, beverages, fish, poultry, meat products etc are all processed here.

Food processing is the transformation of agricultural products into food, or of one form of food into other forms. Food processing includes many forms of processing foods, from grinding grain to make raw flour to home cooking to complex industrial methods used to make convenience foods. Some food processing methods play important roles in reducing food waste and improving food preservation, thus reducing the total environmental impact of agriculture and improving food security.

4.4 Banku mix Production

4.4.1 Sorting of maize

This is the separation and removal of foreign bodies and damaged grains such as stones, sticks, chaff, soil, dust, broken cobs from the healthy maize. Sorting is necessary because it increases the shell life of the product

4.4.2 Steeping of Maize

This is basically the soaking of the sorted maize into water for about two or three days depending on the weather conditions. Steeping is important because it makes the maize soft which would be appropriate for the dough

4.4.3 Washing

After steeping the maize for some few days, the maize is washed thoroughly after the water is being drained, afterwards the maize is being milled at it wet state. At this point the mill dough has to be pressed into a pan and enable fermentation to take place for about two days.

4.4.4 Spreading/mechanical drying

Subsequently the fermented dough is being spread on a tray for drying at 60 degrees Celsius using a hot air dryer or mechanical dryer. The purpose of the frying of the dough is to take away the moisture content of THE dough. At that moment the dry corn dough is being milled into corn powder.

Fig 7.0: Spreading of fermented corn dough

4.4.5 Milling

Spreading of cassava dough on tray and drying them in a mechanic dryer at 60 degree Celsius. Afterwards you mill the dry cassava into powder. To end the whole process a portion of the cassava dough and corn dough are mixed using the ‘y’ cone mixer with at a ratio.

Fig 8.0: Milling processes

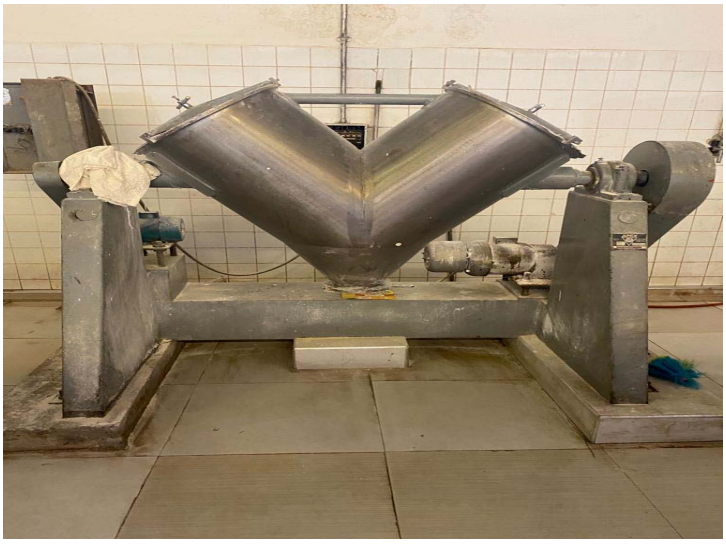

Fig 9.0: Showing the Y Cone mixer

4.4.6 Packaging of Banku Mix

This is when the banku powder is put in a primary and in a secondary packaging respectively. It makes handling of the food products very easy and convenience.

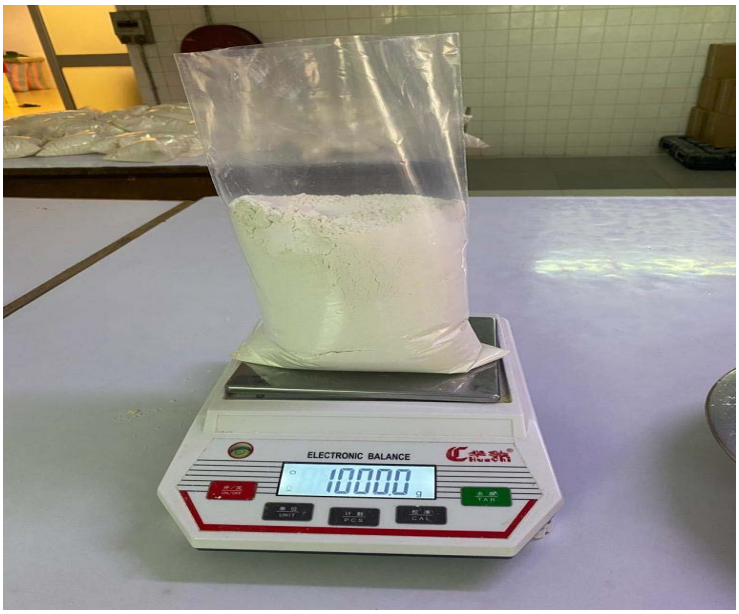

Fig 10.0: Showing a Primary Packaging procedure

Fig 11.0: Banku mix in a secondary packaging

4.4.7 Nutritional facts of Banku mix

Banku Mix Flour (0.25 cup) contains 22g total carbs, 21g net carbs, 1g fat, 1g protein, and 100 calories.Banku Mix Flour (0.25 cup) contains 22g total carbs, 21g net carbs, 1g fat, 1g protein, and 100 calories.

Cassava flour contains resistant starches. There are a variety of possible health benefits to eating resistant starches. These potential health benefits may include improved digestive and colon health and improved insulin sensitivity. Resistant starch in cassava flour may also help with weight loss efforts.

4.5 Groundnut Paste Processing

4.5.1 Sorting of Groundnut

This is the process of removing the bad nuts from good ones to prevent aflatoxin and other contaminants.

Fig 12.0: Roasted Groundnut

4.5.2 Roasting of Groundnut

Nuts are generally roasted to improve their taste, aroma and crunchy texture. Roasting is defined as cooking using dry heat, which cooks the nut evenly on all sides and eventually takes away the moisture content of the nut. Roasting of groundnut can take about 30 minutes depending on the quality, however when the not changes color and there is an aroma it proves that the nut is cooked

Fig 13.0: Roasting of groundnuts

4.5.3 De-hulling of groundnut

De-hulling is the removal of the husk from the nuts for production. Dehulling can be done by the de-huller or man power.

Fig 14.0: De-hulling of roasted groundnuts

4.5.4 Milling of Groundnut

The roasted and de-hulled groundnuts is allowed to cool and then milled.

Fig 15.0: Milling of groundnut into paste

Fig 16.0: Groundnut paste ready for packaging

4.5.5 Packaging of groundnut paste

Packaging is an art and technology of enclosing or protecting products for distribution, storage, sale, and use. Groundnut paste can be used for soup, stew and spread.

Fig 17.0: Groundnut paste ready for the market

4.5.6 Nutrients and Health Benefit from Groundnut

Groundnuts are especially good source of healthful fats, protein, and fiber. They also contain plenty of potassium, phosphorous, magnesium, and B vitamins. Despite being high in calories, peanuts are nutrient-rich and low in carbohydrates.

Eating peanuts has three main health benefits:

- supporting heart health
- maintaining a healthy weight
- managing blood sugar

4.6 Plantain fufu Processing

Matured plantain is required for making fufu because it helps in getting the yellowish color of the fufu. It also enables the recovery rate to be high. The starchiness also helps the fufu to thicken effectively. Green plantains are tough which makes it suitable for fufu. In Ghana, plantain fufu is normally mixed with cassava or cassava starch.

It has been observed that unripe plantain contains antioxidant compounds that help prevent diseases and provides vitamins. It generates a slow release of glucose and may help prevent colon cancer and constipation, while lowers cholesterol and triglycerides in the blood.

Fig 18.0: Harvested plantain for processing

4.6.1 Peeling of Plantain

This is where the peel of the plantain is been removed, making it ready for slicing.

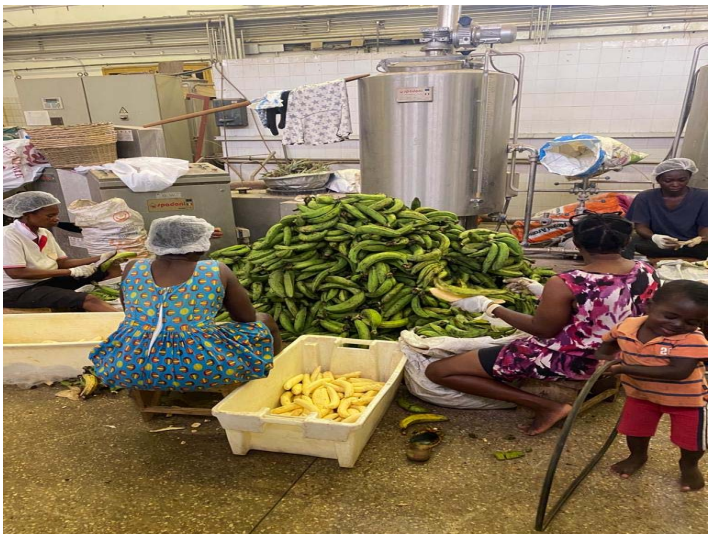

Fig 19.0: Peeling processes of plantain

4.6.2 Slicing of peeled plantain

Slicing is done with a slicer which cuts peeled plantain into slices. Slicing plantain makes it easier for drying.

Fig 20.0: Slicing processes

4.6.3 Blanching of Sliced Plantain

This occurs when the sliced plantain is partially cooked for 1 minute before drying, which would help it maintains its yellowish color.

Fig 21.0: Blanching processes

4.6.4 Spreading and Drying

This happened when the sliced plantain is been spread on the tray.in addition a knife can be used to cut the plantain into smaller pieces ones more to aid it to dry quickly


Fig 22.0: Mechanical drying processing

4.6.5 Milling into Powder

Dried plantain slice is milled into powder. Cassava starch is then mixed at a ratio.

5.0 Observation, Challenges and Solution

5.1 Observation

5.1.1 Punctuality

One of the most important thing she noticed at the institute is that most of the employees are punctual to work. Some even come from long distances yet they make it possible to meet the reporting time at 8.00am. Punctuality is a sign of professionalism and helps to stand out as a reliable and trustworthy employee. If an employee does not get his or her part of a project completed on time, he or she keeps others from being able to finish their tasks. Being punctual helps to establish an employee reputation as a dependable and consistent worker. And that was exactly what was observed during my two month industrial attachment in the Institute.

5.1.2 Unity

Unity at work is superb in CSIR-FRI. Staff work together to achieve their common goal. It was observed that, all the employees are united, they treat one another as a big family.

This is providing significant morale boost to the Institute as employees are happier on their jobs. When people appreciate their jobs and the people they work with, it enhances staff retention.

5.1.3 Waste Management

The Institute provides appropriate containers and suitable waste storage areas. Established adequate procedures for the storage and removal of waste. This prevents build-up of waste and pests and reduces risk of contamination of ingredients, equipment and products. In addition, waste from processing of food such us plantain peel, groundnut husk, soya bean husk is giving to CSIR animal research to be used as feed.

Fig 23.0: Waste Management systems

5.2 Challenges

5.2.1 Supply Chain Issues

Forecasting and projection help companies to determine how to streamline their production process despite issues. Even the most planned events can still be met with challenges that were not expected. Shortages or irregular supply is rampant in CSIR-Food Research Institute. This puts a lot of stress on wholesalers and retailers in the value chain.

Customers come from afar only to be told that such a product has ran out of stock. The Institute loses customers through this situation.

5.3 Solution

The Institute must practice production management methods. There should be a lee time within which to restock the finish products. In this case, customers will take FRI serious.

6.0 Conclusion

Working in CSIR-FRI was an opportunity for the student to practice concepts learnt at school and to appreciate working environment, human behaviors in organizations. Her stay was successful since even though she was here to learn, she contributed her quota to the development of the institute in that short period.