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Developments in food science and technology in Uganda: present situation and the way forward

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Abstract

More than 70% of agricultural GDP in Uganda comes from food crop production, comprising of bananas, root and tuber crops, grains and legumes and oil seeds. Sugar cane, livestock products, fisheries, forestry and export crops contribute the remainder. However, before these commodities are utilised, they undergo processing in one way or another, a job accomplished by application of food science and technology principles. This paper gives an overview of the developments in Food Science and Technology in Uganda by considering the Food Processing Industry, the factors that have contributed to its current status, its constraints and the way forward. It concludes that if the mentioned constraints are overcome and the suggested way forward seriously taken, our postharvest losses shall be greatly reduced and food utilisation diversified which are the basis for food security.

Key words: *Industry, processing, development*

Introduction

The economy of Uganda is dependent on agriculture which contributes about 60% of its GDP, 90% of total export earnings and about 90% of its employment (MFEP, 1996).

More than 70% of agricultural GDP in Uganda comes from food crop production, comprising of bananas, root and tuber crops, grains and legumes and oil seeds (Kyokunda, 1994). Sugar cane, livestock products, fisheries, forestry and export crops accordingly, contribute the remainder. However, before these commodities are utilised, they undergo processing in one way or another, a job accomplished by application of food science and technology principles (Potter, 1987).

The manufacturing sector currently contributes between 7 and 8% of the GDP but has potential to contribute much more in view of the fact that it is consistently showing high index growth rates, and its contribution to employment is about 6% (Kapasi-Kakama, 1987).

The Food Processing Industry in Uganda

Industrial food processing in Uganda was started to produce commodities that could substitute imported products. It was, however, heavily dependant on imported inputs (plant machinery, raw materials and packaging), and in all cases the operators were non-indigenous (Kapasi-Kikama, 1996).

Consequently, when the hard times of the 1970s/80s economic mismanagement set in, there was virtual collapse of the industry.

Although still dependent on imported inputs, the food processing industry in Uganda has made steady progress in acquiring inputs and employing qualified nationals. The industry ranks highest among the main contributors to the manufacturing sector, its contribution to the index of industrial production is approximately 32.7% (MFEP, 1996).

The industry also ranks among the fastest growing subsectors of the manufacturing sector (Table 1). It has direct linkage with agriculture, contributes to food security and foreign exchange saving through exports and import substitution. It has the potential to increase rural incomes through creating demand for raw materials especially when established in the rural areas by small-scale entrepreneurs.

Table 1: Performance of the Food Processing industry in relation to that of the manufacturing Sector and Total GDP (Percentage growth rates) for the Period 1986/87 to 1995/96.

Period	Total gdp	Manufacturing	Food Processing
1986/87	3.8	2.4	12.3
1987/88	7.6	17.1	39.1
1988/89	6.0	9.2	5.4
1989/90	5.8	6.4	9.4
1990/91	5.2	7.3	19.4
1991/92	3.1	15.6	8.9
1992/93	8.4	7.1	9.1
1993/94	5.3	15.1	9.2
1994/95	10.6	16.9	22.5
1995/96	8.5	18.1	23.6

Source: MFEP (1996)

Operations of the food processing industry in Uganda

The current operations range from large-scale, through medium to cottage industries and are mainly in the fields of grain milling, baking, brewing, distilling, bottling of soft drinks, fruit/vegetable processing, estate crop processing, edible oil production, meat processing, dairy products processing, fish processing and animal feed production. Detailed description of the activities that take place in each of these categories of industries are given below.

Grain milling industry

Grain milling in Uganda involves five cereal grains namely; maize, wheat, rice sorghum and millet (MFEP, 1996).

Maize milling

According to the surveys made during indicative Industrial Plan Study in 1992, there were about 275 registered maize flour mills, located in different areas of the country, including 4 large ones and 4 medium mills, the rest were small (UMA, 1995). More have come up since then.

The bigger mills are mostly located in the urban areas, the smaller ones are scattered in the countryside. Total capacity is of the order of 600,000 tonnes per annum (MFEP, 1996). The maize flour is mainly for domestic consumption. This is due to the fact that maize is traded internationally in grain form, where quality specifications are internationally recognised.

Wheat milling

Wheat is the raw material for the bakery industry which uses wheat flour as its main ingredient (Potter, 1987). In 1996, there were three wheat mills in the country, including Uganda Grain Milling Company (UGMC) based in Jinja and Nkuruba Mill located in Fort Portal with processing capacities of 48,000 tonnes and 35000 tonnes annually of wheat flour respectively. A third mill (annual capacity 10,000 tonnes) was under construction in Kabale town in the Southwest (perhaps it is now complete). The capacity in the country of 51,500 tonnes per annum was likely to reach 61,500 tonnes when the Kabale mill starts operation. However, actual production of wheat flour in the country in 1996 was only about 40% of installed capacity (Anon, 1997b).

Rice, sorghum and millet

Rice, sorghum and millet mills are still small, both in output and in providing employment. However, there are three medium scale rice mills in Eastern parts of the country (UIA, 1998). Uganda grows over 80,000 tonnes of rice annually (MAAIF, 1997), but it has been estimated that the capacity to grow and mill is much greater.

Milling of sorghum and millet on industrial scale has of recent picked up and the prospects of increased consumption of the two products in the country are very high (UIA, 1998).

Bakery industry

The industry mainly comprises of small-scale bakeries, although large-scale industries like Britania foods exist. Bread, cakes and confectionery are the main products. According to a survey conducted in 1990 over 270 bakeries were identified (Anon, 1992). The majority were located in the high population density bell stretching from Jinja to Mukono, Kampala, Mpigi and Masaka.

Registered bakeries in the country by 1994 were 41 (Kapasi-Kakama, 1996). The rest of the small bakeries are confined in the informal sector. By 1996, processing capacity of the registered bakeries was estimated to be 35,000 tonnes per annum equivalent to 115 million standard loaves. The figure currently is actually much higher considering the extra 10 medium to large-scale bakeries, which started operating since late 1994.

Alcoholic beverage industry

Beer industry

Currently there are only two breweries in the country, namely Uganda Breweries which is a subsidiary of Kenya Breweries Ltd and Nile Breweries Ltd. a joint venture between Madhvan Group of Companies and South African Breweries Ltd, located in Kampala and Jinja respectively (UIA, 1998). Production capacities of the two breweries have greatly increased in the last four years especially at Nile Breweries after the Government handed over the plant to its former owners. By 1994 combined installed capacity was 49.1 million litres and actual production was 30.8 million litres of beer per annum.

A new line with installed capacity of 400,000 crates per month was installed in November 1995 at Nile Breweries, which increased the installed capacity in the whole industry by 50%. Current production is 220,000 hectolitres per year and the industry has diversified its brands more than Uganda Breweries. Similarly Uganda Breweries Ltd. has embarked on a project to expand its fermentation and bottling capacity which will raise the capacity from the present 180,000 crates per month to 300,000 per month. This will double the whole industry's bottling capacity to 700,000 crates of beer per month (UIA, 1998).

Spirits industry

The industry is dominated by the International Distilleries Uganda Ltd. (IDL) owned by International distillers and Vintners of Holland, with 90% of the market (UIA, 1998). The other manufacturer, West Nile Distillers Ltd. (WNDL) operates at a small-scale level (UMA, 1995).

The manufacturers produce blended spirits from raw alcohol made either from ethanol, a byproduct of sugar cane, or fruit (mainly banana) enguli or cassava (Liralira). Most of the industry's raw alcohol at present comes from one sugar factory, Sugar Corporation of Uganda Ltd (SCOUL) because it costs less than the price set by enguli and liralira producers (Anon, 1988). Accordingly, the main IDL product is Uganda Waragi, accounting for over 70%. The other product brands; Whisky, Gin, Brandy require imported concentrates to be added to the distilled spirits. All products are dependent on the import of bottles, crown corks and other inputs, thus making the industry very dependent on imports.

Soft drinks industry

The industry mainly consists of four companies, namely

Crown Beverages (U) Ltd., Century Bottling Co. Ltd., Kampala Bottlers (has been bought by Century Bottling Co.) Ltd. And Vimto. Others include International Bottling

Company, Britania Beverages, and those which produce mineral water: Uganda Mineral Water, Rwenzori Beverages and Elgonia Industries (UIA, 1998).

Actual production of soft drinks by the four plants in 1993 and 1994 was 26.8 million litres and 41 million litres respectively. Crown Beverages has 58% of the market share. The plant production output in 1995 was 4.6 million crates, compared with 1.8 million crates in 1994 (MFEP, 1996). However, according to UIA (1998) most of these plants still operate below their installed capacities. For example, Crown Beverages has an installed capacity of 945,000 crates per month, but presently its operating capacity ranges between 400,000 – 600,000 crates per month.

Fruits and vegetables processing

Processing of fruits and vegetables as an industry is still in its infancy in Uganda. Despite the fact that most of Uganda is endowed with very good soil and a tropical climate suitable for horticultural crops (ADC, 1997), the fruits and vegetables produced are basically for domestic consumption and to some extent for export (unprocessed) under the High Value Non-traditional Export Program of the IDEA Project.

The potential to commercially produce a variety of tropical fruits and vegetable exists. There are many cottage scale enterprises processing and preserving fruits and vegetables. Presently a number of small to medium sized companies are involved in processing of fruits. Pineapple, banana, oranges, passion fruit, tomatoes and mangoes are the principle fruits processed (ADC, 1997).

The outstanding enterprises according to URA (1997) are four, namely;

- RECO located in Kasese, produces jams, chilli sauce, papain, fruit concentrates
- Elgonia Industries located in Tororo, produces passion and orange squash, tomato and chilli sauces.
- Magatrends located in Kampala produces tomato sauce and chilli sauce
- Britania Foods located in Ntinda, Kampala produces a variety of fruit products including squashes

There are some small sized enterprises; some are owned by women groups, which are involved in drying of banana, Apple bananas, Bogoya (Gros michel), pineapple, mangoes and papaya into slices and also mushrooms (Owori, 1995). Solar drying techniques are used in this business. Fruits of the Nile industry exports these dried commodities to Europe.

Banana, pineapple and oranges are processed into altar wines, white sweet and medium wines of the "Banapo" brand in Kabale. Capacity at the Kabale plant is about 15,000 bottles per month. In Jinja similar fruits are processed at Theresa Winery (Kapasi-kakama, 1996).

Estate crop industry

In Uganda, this industry is mainly comprised of sugar, coffee and tea processing.

Sugar industry

According to UIA (1998) there are three enterprises in the industry, namely:-

- The Kakira Sugar Works (KSW) located in Kakira and is a joint venture between the Government of Uganda (30%) and the Madhvan Group of Companies (70%).
- Sugar Corporation of Uganda (SCOUL) located in Lugazi and is a joint venture between the Government of Uganda (51%) and the Metha Group (49%).
- The Kinyara Sugar Works located in Masindi and owned by Government of Uganda.

These enterprises manufacture sugar from sugar cane under integrated farm/factory ownership. The by-products from the manufacture of sugar are bagase and molasses. Bagasse is principally burnt as fuel for the factories' boilers.

SCOUL converts molasses into alcohol, which is mainly consumed as raw material input by the International Distilleries and KSW manufacturers some confectionery from sugar. The total installed capacity in the industry is 160,000 tonnes of sugar per annum.

At present, the sugar produced is only for domestic market. There is no export of sugar even to the EU, despite Uganda's quota of 5,000 MT of sugar per year existing under the ACP/EU agreement.

Coffee processing

Coffee is the largest single foreign exchange earner of Uganda since the 1970s. According to UCDA (1997) Uganda's volume of coffee exports went up from 4.14 million bags in 1995/96 to 4.24 million bags in 1996/97, an increase of 2.1%. These were the highest export records ever recorded in Uganda and they were attributed to the increased farm level productivity due to good weather and husbandry. However, although there was a rise in the volume of the export, the associated value dropped from US $ 388.9 million compared to $355.2 million in 1997, representing a drop of 8.7%.

There was an increase in the number of registered sector participants (exporters, processors and store men) from 469 in 1995/96 to 492 in 1996/97, representing a 5% rise. The increase was due to decentralisation of licensing procedure by UCDA (UCDA, 1997). The number of export processing plants rose from 18 in 1995/96 to 25 in 1996/97 with a combined processing capacity of 10 million bags. This was an excess capacity considering that Uganda's average annual production is 4.0 million bags.

Quality awareness campaigns have been launched in all coffee districts with particular emphasis on good postharvest handling at primary storage and processing levels, hence there has been an overall improvement in the quality of coffee exported both in appearance and in the cup.

Tea processing

Tea is the third major important crop in Uganda after coffee and cotton. Since 1986 to today, there has been significant rehabilitation of the tea sector in Uganda. As a result, tea production has increased from 3,335 MT in 1986 to 21,000

MT in 1997 (UIA, 1998). Similarly, during the same period tea exports increased from 2,800 MT in 1986 to 18,479 MT in 1997.

Factories process the green leaf by withering, fermentation and drying to produce black tea, which is usually called tea. Tea is graded in six grades of which three are primary and the rest secondary (UTA, 1997). Over 40% of the tea are sold at the Mombasa and London Auctions (UIA, 1998).

Edible oil industry

Oil seed milling capacities in Uganda can be described under three categories:-

1. High-capacity oil mills in excess of 20,000 tonnes per annum.
2. Medium-capacity oil mills between 9,000-19,000 tonnes per annum
3. Low-capacity oil mills up to 9,000 tonnes per annum

Category 1 consists of three enterprises and are centred in Jinja and Kampala. The combined capacity is estimated at 46,000 tonnes. Category 2 consists of mills concentrated around Kampala-Kawempe area. Most of these mills are very old and were commissioned in 1940's.

The production levels rose from 46 tonnes in 1991 to 7,000 tonnes in 1995. In 1994 actual production of edible oil in Uganda was 6,265 tonnes (MFEP, 1996).

Meat and fish processing industry

Meat and poultry processing

Presently, no large-scale meat processing activity is carried out in the country. The only meat processing factory is the Soroti meat canning factory which is now not in operation and is in a sorry state. The factory had an installed capacity of 400 animals/shift (Kapasi-Kakama, 1996).

The Uganda Meat Packers Ltd. Factory in Kampala has an installed capacity of 150 animals/day and is only a slaughter house for supplying institutions and butchers around Kampala

However, there are few small processors of meat products. These include: Rosa Brothers Ltd., Food World Ltd. and Quality Cuts Ltd. which produce sausages, bacon, ham, salami and other products. A new meat processing plant has been constructed at Lubowa and produces almost similar products.

Ugachick Poultry Breeders are currently the only processors of poultry products and they export their products to Rwanda and Democratic Republic of Congo (Ssekalala, 1998).

Fish processing

By 1995 twelve fish processing companies all located on the shores of Lake Victoria were operating. Currently more than fourteen other companies have been licensed. All of them rely on Nile Perch. Production is mainly of chilled and frozen fish of which about 90% is exported to EEC countries, Israel, North America and South East Asia. Dry/smoked fish is mainly by artisan processors and is mainly consumed on the local and regional markets. Only one firm located in Misooli, Entebbe is documented as involved in export of sizeable volumes (UIA, 1998).

Installed production capacity of fish plants in Uganda is estimated at a minimum of 73,000 tonnes of raw input per year (Anon, 1997a).

Dairy industry

The Uganda Dairy Industry has nine medium to large-scale enterprises that include Dairy Corporation, G.B.K Dairy Products, Western Highland Creameries, Country Taste, Ra Milk, and Dairy Bell among others. The largest is Dairy Corporation with milk processing operations in Kampala, Entebbe and Mbale. It has a network of milk collecting centres, which feed, into the three processing sites where fresh and reconstituted milk is pasteurised and packaged into sachets. The Entebbe plant has a pilot-scale plant for training needs and uses the equipment to commercially produce butter, cheese, ice-cream, yoghurt and ghee, although they also process fresh milk and pack it in quarter litre sachets.

The installed capacity of processed milk in Uganda is about 60 million litres per annum but the actual production is 40-50 million litres per annum (MFEP, 1996).

The above-described industries basically rely on improved technologies. However, traditional food processing technologies exist and are part and partial of the rural economy and include sundrying and grinding of grains and tubers; juice extraction and fermentation; fish and meat drying, smoking and salting; milk fermentation, and alcoholic spirits distillation among others.

Major factors that have contributed to the current developments in the food industry of Uganda

There are several factors that have contributed to the developments that have taken place in the area of Food Science and Technology in Uganda, especially in the current Food Industry.

Human resource development

Several institutions have been involved in training manpower for the application of food science and technology in various aspects. These include the Department of Food Science and Technology, Makerere University which offers BSc and MSc in Food Science and Technology, Uganda Polytechnic, Kyambogo which offers a Diploma in Food Processing; Veterinary Training Institute, Entebbe which offers a Diploma in Dairy Processing; and the Fisheries Training Institute offers a Certificate and Diploma in Fish Technology.

Sokoine University of Agriculture, under the Inter-university Exchange Program has also trained several graduates in Food Science and Technology; plus other institutes which incorporate subjects of Food Science and Technology in their curricula.

The graduates from the Department of Food Science and Technology, Makerere University are mainly absorbed by the Food Industry in Uganda and records indicate that out of about 120 graduates so far trained, more than 80 are employed in the Ugandan Food Industry, the rest joined research and training institutions while others are self employed.

One of the requirements to obtain the "Quality Mark" from the UNBS is that the industry has to employ qualified personnel in the field of Quality Assurance. Therefore manning of the Food Industry by the qualified personnel from the above-mentioned institutions indicates that quality

control is ensured at all stages of processing which is one way of producing safe and wholesome products.

Research thrust

Research has been going on in processing of foods of both animal and plant origin and several research institutes are involved. In the Department of Food Science and Technology, Makerere University research work is going on in the following areas:

- Fruits and vegetables: Banana processing (banana juice extraction and preservation, banana starch characterisation, banana drying and production of instant banana flour), processing, stabilisation and preservation of passion fruit juice using tamarind, extraction of pectin from jack fruit waste and wine processing from Carambola fruit;

- Roots and tubers: Processing of sweet potato jam and candies and extraction of Mulondo flavour and its use in flavouring beverages.
- Cereals, legumes and oil crops: Formulation of weaning foods to solve malnutrition problems in children under 5 years, cereal fermentation technologies, baking potential of composite flours in bread manufacture, production and fortification of soymilk and extraction and characterisation of oil from Shear nut;
- Estate crops: Extraction of coffee flavour and its use in flavouring beverages, effects of blending and Roasting of Robusta and Arabica coffee on cup quality and prevention of browning in fresh, cut, read-to-chew sugar cane pieces;
- Dairy products: Various research on milk fermentation technologies involving identification of specific micro-organisms and processing of various milk products.
- Meat and Fish Products: Investigating the effectiveness and acceptability of pawpaw latex as a meat tenderiser, assessing microbial loads and susceptibility to spoilage of different meat and fish products on market, changes in quality of frozen Nile Perch stored at different temperatures, storage stability of Mukene sun-dried and stored under modified and traditional conditions, utilisation of fish waste and comparison of quality characteristics indigenous and exotic chicken eggs;

In the Department of Chemistry, Makerere University, cassava value added products that include cakes, bread, buns, infant foods, glucose and glue for industries are being processed. Some of these products are already being commercialised.

The Government of Uganda through the Ministry of Trade and Industry has established the Uganda Industrial Research Institute at Nakawa which is currently undertaking research in value added meat products. The institute is also establishing several pilot plants to handle research and training in other commodities.

Other institutions conducting research in food science and technology include NARO (Food Science Research Institute and The Postharvest Program, Kawanda Agricultural Research Institute), Botany and Biochemistry departments of Makerere University and the Fisheries Department, Entebbe among others.

Group and Individual research is also going on in areas of solar drying of fruits and vegetables for export, juice extraction, packaging of individual commodities, oil extraction and characterisation and fermentation technologies.

Acquisition of plant machinery and laboratory e quipment

As a result of increase in the number of investors and institutions involved in food science and technology aspects, a number of up-to-date food processing machinery and laboratory equipment for various food analyses have been acquired. Thus, various categories of quality food products can be processed and also raw materials and food products can be tested for various quality aspects. For example, there is now no need of sending food samples to Europe for Aflatoxin analysis.

Constraints facing food science and technology

Despite the developments discussed above, there are several constraints affecting the progress of food science and technology which in-turn hinder the development of the Food Industry. These are highlighted below.

- Fluctuating prices and unsteady supplies of raw materials;
- Inadequate and poor storage facilities thus high postharvest losses;
- Poor infrastructure and utilities in the country especially in the areas of electric power and water supplies and rural roads;
- Poor packaging and the need to import packaging materials;
- Lack of standards for some of the locally manufactured and fresh market food products;
- Uneducated consumers. This, for example, has been clearly implicated in the consumption of dried fruits;
- Threat from imported processed products;
- Lack of information on processing and preservation methods, market opportunities and poor access to markets;
- Sophisticated and expensive processing equipment;
- Shortage of trained manpower

The way forward

The way forward here concentrates mainly on the research that needs to be immediately carried out in order to boost more the area of food science and technology in Uganda.

Sugar

The current demand for cane sugar is high and increasing daily. There is need to pay attention to quality and quantity in order to produce sugar as raw material for other industries. Brown and white sugar are very important raw materials for the food industry.

Instant foods

There is need to consider adding value to our foods by producing instant foods. For example, research is needed in the areas of instant coffee, tea, matooke and many other foods so as to reduce on the amount of energy required in

the preparation of these foods. Right now, Uganda imports instant coffee (Nescafe) from Kenya.

Brewing and distillation
Demand for alcoholic beverages is high and is likely to remain so. There is need to consider using local raw materials, say for malt, such as maize, sorghum and millet for brewing, than depending on imported barley and other cereals.

Flavour Chemistry
There are a lot of raw materials here where flavours could be extracted, concentrated and stored. Such flavours can be used as raw materials for the food industry as food flavours and also for cosmetics.

Fish
There is need to address the quality aspects of our fish by adding value to what is currently processed. In order to develop more markets other than EEC countries, research is needed to have new products beyond freezing and filleting by producing ready to eat products.

Meat and Poultry
There is need to address quality and hygiene in abattoirs. Transportation of slaughtered meat from Mbarara and Ngoma needs to be done rather than whole animals which are abused during transportation. The nature of treatment the animals get during transportation has a direct bearing on the quality of meat after slaughter.

Research in meat processing should be carried out, for example, substitution of meat with extenders, substitutes in burgers, sausages, to reduce costs; processing of rabbit and turkey meat should be promoted since farmers have been encouraged to rear rabbits. Exports of meat and poultry could be a very good venture with the experience from Ugachick Poultry Breeders.

Dairy products
There is need for the production of powdered milk which has a longer shelf life and at the same time it could be a raw material for industries which could reconstitute it. Utilisation of whey (by-product of cheese) could also be researched.

Food Biotechnology
There is need to exploit fermentation processes involving say microbial activities in order to produce food ingredients and nutrients. Enzymes important in the food industry can also be produced through biotechnology.

Packaging industry
There is need to develop the packaging industry to include glass packages, metallic packages and others which the country is now importing. The current packaging industry in Uganda concentrates on plastics majority of which are not food-grade plastics.

Technology transfer
Institutions like NARO and Makerere University should improve on technology transfer by providing relevant information to the end users.

Conclusion

This paper has revealed that in Uganda, the area of Food Science and Technology is progressing especially in the area of processing. If the above-mentioned constraints are overcome and the suggested way forward seriously taken, our postharvest losses shall be greatly reduced and food utilisation diversified which are the basis for food security.

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