



Adding Value to Local Foods for Food and Nutrition Security: Myth or Strategic Option

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Survey and Synthesis Report and Lead Paper on Agro-processing Enterprises in the Caribbean

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Summary

Soaring food prices have led to a global food crisis with negative social and economic impacts in developing Caribbean countries. The development of the agri-food/product sector through processing technologies can be an impetus for economic growth. Technological issues extend well beyond production, process and equipment technologies, to processing and food ingredient technologies, distribution technology, biotechnology and information technology.

This project's goal was to strengthen value-addition capability and improve the food and nutrition situation in the Caribbean. The specific objectives were to survey and report on agro-processing enterprises in the Caribbean which would assist in charting a three-year plan for adding value to local produce.

A questionnaire was developed to target individuals from agro-processing industries. Data were obtained on the respondent's affiliation, number of persons employed, the primary raw material and processed products utilised, processing methods, types of processed products, training, food analysis and labelling, knowledge on Hazard Analysis and Critical Control Point (HACCP), food regulation and legislation, marketing of the products and any recommended activities for food processing companies in the Caribbean. Most agro-processing companies were small (6-20 employees), one was medium (130 employees) and two were large with over 350 employees.

Consumers are demanding nutritious and healthy agro-processed products. They are demanding a wider range of convenient agro-processed products, which are flavourful and yet nutritious and health promoting, such as reduced sugar beverages, and products with low sodium, less saturated fat, whole wheat, and vegetarian and organic products.

Some of the recommendations for improving agro-processing were: improved cultivar varieties such as being resistant to diseases, contract farming to improve availability of local raw materials, inputs, traceability of raw materials, need for modern processing equipment such as automatic bottling, easy access to processing centres, adequate processing facilities, commercial settings for processing, better lay-out of processing operations, training in agro-processing, more quality analysis of products, improvement in quality standards, the expense of applying food safety management systems such as HACCP, food safety management standards such as ISO 22000 and more attractive terms in accessing finance to allow growth of small businesses. Training must be an integral part of a much more comprehensive programme of development.

Global food security

According to figures from the United Nations, the world population is projected to grow by 34% from 6.8 billion today to 9.1 billion in 2050. Nearly all of this increase will occur in developing countries (WSFS, 2009). About 70% of the world's population will be urban (compared to 49% today). Most of the growth in food demand will come from developing countries, and this is also where the greatest production capacity potential lies (WSFS, 2009). By 2050, the global demand for food is projected to be 70% higher than today, involving an additional annual consumption of nearly 1 billion t of cereals for food and feed and 200 million t of meat.

The sharp increase in food prices that occurred in recent years, and the resulting increases in the number of hungry and malnourished people, has drawn attention to the fragility of the global food system and the vulnerability of food security. Food security is defined by FAO as existing when all people, at all times, have physical and economic access to enough safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO World Food Summit, 1996). Through value-addition, there is an opportunity to increase the economic value and consumer appeal of agricultural commodities.

CARICOM food security – dependency on food imports

The Caribbean Community (CARISOM) has approximately 16 million inhabitants in its 15 member states and an annual food import bill of more than US\$4 billion (Kaiter News on-line, 2012). Consumer food products accounted for over 50% of exports from the United States to the Caribbean, with poultry, red meats, snacks, dairy products, and processed fruit and vegetables the top five export categories. In 2009, the United States also exported US\$36.5 million worth of seafood products to the region, an increase of over 22% from the previous year (Caribbean Market Profile, 2011). In fact, following a record high US\$878.7 million in US consumer-oriented exports to the Caribbean region in 2008, US exports during 2009 still managed to increase by 3% over the same period to US\$904.9 million (Food Export Association of the Midwest USA, 2011). Some hotel resorts and larger supermarkets often order larger shipments directly from US suppliers - compared to medium to smaller sized retail and food service businesses whose main resources are local importer/wholesalers - making them a target for smaller US exporters (Caribbean Market Profile, 2011).

A regional approach to agriculture production is “the obvious solution to addressing our high food import bill and our food and nutrition security” according to Ambassador Irwin Baroque, Secretary-General of CARICOM. A large segment of imports go directly into tourism and the growing fast food sector (Trinidad and Tobago, Government On-line, 2012). Very few countries have the required land mass to achieve 100%, with the exception of Belize, Guyana, and St Kitts and Nevis in the English-speaking Caribbean, according to an FAO study.

Why agro-processing?

The need to develop a competitive agro-industry is necessary for the creation of employment and income opportunities. Agro-processing enhances the quality of, and the demand for, farm products. Agro-processing companies have the potential to provide employment for the rural population not only in farming, but also in off-farm activities such as handling, packaging, processing, transportation and marketing of food and agricultural products. There are clear indications that agro-industries are having a significant global impact on economic development and poverty reduction, in both urban and rural communities. There is the need to recognise the importance of food processing industries as a force for economic development (Diouf et al., 2009).

Some examples of innovative agro-processed products in the Caribbean

From fresh cocoa pulp the following products could be produced: jams, jellies, ice cream, yoghurt, pancake syrup, juices and shakes, wine, vinegar, nata – a processed agar-like product packed in syrup

and consumed as a desert in Asia – and processed pulp for use in other products. The effect of xanthan gum on the physicochemical and sensory quality of cacao pulp (*Theobroma cacao*) pancake syrup has been investigated (Badrie et al., 2008). Another interesting research study conducted at the University of the West Indies was by Mounigan and Badrie (2007) on the effects of pectolase pre-treatments on the physicochemical and sensory quality of wines from red sorrel/roselle (*Hibiscus sabdariffa* L.) calyces.

Jamaica's national dish is cakes and salt fish. Cakes are a bright red fruit that opens to reveal three large black seeds and a soft, creamy white flesh, often prepared like vegetables. When cooked, cakes are similar in texture and appearance to scrambled eggs, and they are a popular breakfast item – and a tantalising delicacy. The company Grace cans the cakes in salt water.

Many value-added food products have been processed from breadfruit (*Artocarpus altilis*) and breadnut seeds (*Artocarpus camansis*). Research conducted at the Faculty of Food and Agriculture at the University of the West Indies in St. Augustine has included: an investigation into the colour and sensory characteristics of fried chips from three breadfruit cultivars (Robert et al., 2007); nutrient composition of a commonly consumed West Indian meal of breadfruit oil down (Badrie et al. 2005); breadfruit consumption, cooking methods and cultivar preference among consumers in Trinidad (Roberts-Nkrumah and Badrie, 2005); the effect of cultivar and maturity on yield and nutrient composition of breadfruit (*Artocarpus altilis*) flour (Broomes et al., 2009); and methods of peeling breadnut seeds and the acceptability of canned breadfruit seeds in brine (Matthew et al., 2001).

In other countries, value-added products have been produced from yam (Kpodo, 1987) and breadfruit (Maa et al., 2011): as expandable extrudate products, baked products from wheat-breadfruit flours (Olaoye and Onilude, 2008); formulation of infant food (Nelson-Quartey et al., 2007); biscuit making (Olaoye et al., 2007); compositional characteristics and sensory quality of biscuits, prawn crackers and fried chips (Taiwo, 2003); properties of extruded products from breadfruit flour (Nochera and Moore, 2001); and effects of breadfruit and cocoyam starch mucilage binders on disintegration and dissolution behaviours of paracetamol (Adebayo and Itiola, 2003).

There have been several peer reviewed publications on cassava (*Manihot esculenta* Crantz) from the University of the West Indies, ranging from cassava/wheat flour composite muffins on the effects on quality and sensory characteristics (Riley-Mitchell et al., 2012), various applications to extruded cassava flour (Badrie and Comissiong, 1995; Badrie and Mellowes, 1992; Badrie and Mellowes, 1991) and an evaluation of cassava farine and wafer (Khan et al., 2001).

In a report with headline 'Sweet potato fries seal turns sour' revealed that the Trinidad and Tobago Agri-Business Association (TTBA), being the main supplier of fries could not supply to Kentucky Fried Chicken (KFC) (Sunday Guardian, 2012) which was aimed at adding value to locally grown sweet potatoes. The Trinidad and Tobago Ministry of National Food Production Action Plan 2012-2015 indicates that sweet potato production would need to be increased from 3,150 t to 8,727 t by 2012 and to 13,090 t by 2015.

Some constraints to the development of the agro-processing sector

Constraints which have previously been identified for the development of the agro-processing sector (Lambert, 2001; Wickham, 2003) were:

- An inconsistent and insufficient supply of raw material
- Seasonality of crops
- Poor quality of raw material supply and high losses during transport from farm to factory

- Availability of equipment and appropriate infrastructure
- Inappropriate or obsolete processing and ancillary equipment
- Poor and inconsistent quality of processed products
- Sub-optimal use of processing facilities and equipment
- Level of technical knowledge – poorly trained personnel and a lack of qualified food technologists
- A lack of proper hygiene and sanitation practices
- Inappropriate packaging materials and high packaging costs
- Weak or non-existent market development
- Absence of good management of the processing facility once commercialised
- Lack of funding for research and development activities
- Absence of appropriate backward linkages
- High cost of international certification as well as the lack of capacity for certification at the national level
- Shortage of trained personnel with respect to the needs of the sector

Goal-specific objectives

The goal was to strengthen value-addition capability and improve the food and nutrition situation in the Caribbean. The specific objectives were to survey and report on agro-processing enterprises in the Caribbean which would aid charting a 3-year plan for adding value to local produce.

Methodology

A questionnaire was developed to target individuals from agro-processing industries. The questionnaire gathered data on their affiliation with their company; primary raw material and processed products produced by the company; challenges experienced in food processing, methods and limitations of, and recommendations to improve, processing methods; constraints to the production of processed foods and possible expansion of present range of processed products or markets; availability of, and recommendation to improve, training; analysis and labelling of processed food; implementation of HACCP protocols; company's background knowledge of national food legislation; marketing; and recommendations to chart a 3-year plan for the food processing industries in the Caribbean, to increase food availability through value addition for food and nutrition security. The questionnaire can be viewed in Appendix 2.

Lists of agro-processors in the Caribbean were obtained and contacted. Table 1 list by country the number of participants who were asked to participate in the questionnaire by country. The questionnaire took 20-40 minutes to complete.

Table 1: List of agro-processors/specialists sent an invitation and questionnaire by country

Country	No. of participants contacted
Antigua and Barbuda	2
Bahamas	1
Barbados	2
Dominica	3
Grenada	2
Guyana	2
Jamaica	4
St. Kitts/Nevis	3
St. Lucia	2
St. Vincent and the Grenadines	1
Trinidad and Tobago	60
Total	80

An invitation letter (Appendix 2) was sent to a number of agro-processors and specialists in food processing to participate in a survey project on 'Adding Value to Local Foods for Food and Nutrition Security: Myth or Strategic Option'. The letter informed the invitees of the specific objectives which were to conduct a survey and report on agro-processing enterprises in the Caribbean. This information would also assist in charting a 3-year plan for adding value to local produce. The questionnaire was sent via email along with contact information so that invitees were able to get in touch via email, Skype or telephone.

Respondents

Thirteen respondents from agro-processing companies from Antigua and Barbuda, Barbados, Dominica, Guyana, Jamaica, St. Kitts, St. Vincent and the Grenadines and Trinidad and Tobago responded to the questionnaire (Appendix 3). The respondents held various positions from general manager, agronomist (non-sugar crops), secretary, research and development manager, quality assurance manager, quality system manager, scientific officer, director, managing director, quality assurance laboratory specialist, supervisor, and cook and department head. Two specialists in food processing, safety and quality were also asked for their input.

The duties of the respondents varied from:

- conducting research in an effort to improve the agronomic practices in the cultivation of food crops and to determine performance yields of selected food crop cultivars;
- purchasing of raw and processed materials, overseeing operations, sales, deliveries and marketing;
- performance of secretarial duties and processing of cassava products;
- overseeing all product development projects and quality assurance (good manufacturing practices, product specifications and HACCP) documentation and implementation;

- programme manager for climate change and agriculture projects, science, technology and innovation systems deployment, small ruminants research and development;
- supervision of sales, equipment and purchases and seeking new markets;
- management of quality assurance laboratories and personnel, and implementation of ISO 17025 at factory laboratories;
- supervision of day-to-day plant activities and cooking of products;
- financial management, distribution, and interaction with external organisations.

Profile of agro-processing companies and types of processed products

Two agro-processing companies employed over 300 people, one employed 130 employees and the others were considered small companies, employing between 6-20 persons. Four of the companies only supplied agro-processed products to local markets, while the others supplied to both CARICOM countries and markets in the European Union.

The type of fresh produce processed included: carrot, cinnamon, citrus, cocoa, coffee, cucumber, golden apple (pommecythere), hot peppers, june plum, lemon grass, mango, milk, mousy, nutmeg, otaheiti apples, passion fruit, sea moss, sugar cane, and watermelon.

Processed products are: yoghurt, ice cream, brown sugar and the by-products of sugar production (e.g. molasses, fruit Jams and jellies), snacks (sweet potato and breadfruit chips), cassava products, fruit drinks, confectionaries, dried fruits, fruit drink concentrates, hot sauces, guava cheese (treats), smoked meats, smoked fish products, ready-to-drink beverages, drinking chocolate, roasted ground coffee, chicken samosas and pastry pies, beef samosas and pastry pies, vegetable samosas, potato pies, soya samosas, flavours, purees, fruit-drink concentrates, acids, starch derivatives, stabilizers, chilled roti, bake, dhal, pepper sauces and condiments, curried mango, curried pommecythere, hot pepper sauces, pimentos, cilantro or shadon bene/garlic, fresh fruit/ vegetable salads, green seasoning, salted fish and coconut jelly.

Most of the agro-processors indicated that they would like to expand their present range of agro-processed products by introducing different technologies, packaging formats and utilisation of by-products. However constraints highlighted include the cost of production, lack of space, capital and equipment, access to attractive funding, the high cost for processing, storage and marketing, shipping limitations, import restrictions of meat products in many countries, and the length of time required to bring the agro-processing company up to the required food safety standards.

Some agro-processors indicated that consumers are demanding affordable agro-processed products that are filling, nutritious and taste good. There is a market for products that are baked, contain whole wheat, are vegetarian, and use less salt and sugar (reduced sugar beverages). The agro-processing companies are interacting with more knowledgeable consumers who are demanding more flavourful and healthier products.

Raw materials and sources

For the large companies (> 300 employees), materials such as powdered milk, cups, lids, bottles, labels, jam, essence and lime were usually (95%) imported, while the smaller companies, sourced them locally.

Other materials such as additives, pectin, citric acid, flour, meat, vegetables, salt, seasonings, oil, butter, styrotex trays, film wrap, plastic bags, drums, boxes, paper, non-insulated containers, straws, closures, baking powder, saffron and geera (style of pork) were sourced locally by most small companies.

The main constraints to food processing were the seasonality of crops, high perishability of crops, inconsistent supply of raw produce, shortages of packaging materials and labels, fluctuation in costs, lack of storage and processing equipment (e.g. thermometer, refractometer), quality variation of raw materials from suppliers, and inadequate processing facilities. The removal of the preferential treatment by the European Union has also resulted in decreased revenue from the sale of brown sugar. This coupled with the high cost of production and deterioration of soils has resulted in a decline in the production of sugar-cane.

The companies put forward recommendations to improve the agro-processing through contract farming, web-listing of farmers and their associated produce, storage and refrigeration facilities, acquisition of appropriate equipment, availability of better cost of production data and imported items such as trays and film wrap, and a dedicated development bank to assist the agro-processors.

Agro-processing operations

Various processing operations applied include clarification of sugar using lime, cooking, kneading, use of high temperatures for the evaporation of moisture, centrifuging for the crystallization of the sugar, grinding of raw material, flavour extraction by distillation, acidification, dehydration, pasteurisation, canning, curing and smoking, roasting and vacuum packaging, blast chilling, refrigeration and freezing.

Agro-processors expressed concerns about the high cost of equipment, being old and labour intensive (manual and frequently breakdown). In most agro-processing companies, the filling of bottles was done manually which is labour intensive. Some equipment is automatic (electrical grater, hammer mill, blast chiller, commercial ovens, walk-in chillers and freezers) but constraints identified were inadequate maintenance of equipment, difficulty in sourcing replacement parts, inappropriate equipment and poorly organised flow processes.

The agro-processors reported that their companies are under-utilised due to the seasonality of the crops, unavailability of raw materials and inadequate access to funding. Out-of-season resources are often diverted towards planting, fertilisation and maintenance of fields and equipment.

Recommendations for improving agro-processing were: improving cultivar varieties such as being resistant to diseases; contract farming to improve availability of local raw materials and inputs; traceability of raw materials; modern processing equipment such as automatic bottling; easy access to processing centres; adequate processing facilities; commercial settings for processing; better lay-out of processing operations; training in agro-processing; more quality analysis of products and improvement in quality standards; reduction in cost of applying HACCP and ISO 22000; and more attractive terms in access to finance to allow growth of small businesses. Training must be an integral part of a much more comprehensive programme of development.

Some recommendations for the expansion of the agro-processed products

Recommendations given to assist in the expansion of agro-processed products include:

- Increase supply of high yielding and better quality raw materials such as local milk, vegetables, fruits and livestock;
- Increase the land area for farming;
- Access equipment for higher capacity agro-processing;
- Adequate and better lay-out of processing facilities;
- Greater collaboration between agro-processors in the value-chain;
- Sponsorship to expose members to training in agro-processing;
- Exposure to the research and development processing agencies such as the Caribbean Industrial Research Institute (CARIRI) on a regular basis, and research publications to keep abreast of the latest agro-processing technologies;
- Expansion of markets for agro-processed products to niche markets in CARICOM countries and international markets, such as North America for exotic specialty products such as hot pepper sauces;
- Focus on the development of local nutritious and health-promoting agro-processed products;
- Easing of market access restrictions in countries that use non-tariff trade barriers to protect their markets;
- Accessibility for funding for entrepreneurs;
- Assistance for advertising;
- Establishment of appropriate financial institutions as part of an overall policy (both local and regional to bring change to our production and consumption patterns for sustainable economic development through food security.
- A more aggressive and pro-active approach in shaping tastes and preferences in local eating habits while maintaining international standards for competitiveness;
- Build on the analytical work done on our fruits and vegetables by the Caribbean Food & Nutrition Institute and the University of the West Indies;
- Need for Government patronage and incentive for the agro-processed products.

Consumers demand for nutritious and healthy products

Consumers are demanding nutritious and healthy agro-processed products which could be linked to an effort to reduce non-communicable life-style diseases (obesity, diabetes and hypertension). They are demanding a wider range of convenient agro-processed products, which are flavourful and yet nutritious and health-promoting, such as reduced sugar beverages, low sodium products, less saturated fat, whole wheat, and vegetarian and organic products.

Training

Staff training at agro-processing companies varied from unskilled to highly skilled and was linked to the type of job. Areas of training deemed important by agro-processing companies include:

- Familiarity with occupational health and safety hazards;
- Knowledge on the application of vendor food badges;

- The ability to source information privately from quality assurance managers and booklet from CARIRI on 'Basic Principles of Processing of Sauces';
- Good manufacturing practices, basic food processing, quality assurance;
- Basic HACCP concepts – however effective implementation of training has been problematic;
- Basic training from the public health authorities in good manufacturing practices, product development expertise in beverage production, safety, flavour extraction techniques, and pre-processing technologies;
- Basic training in microbiology, sensory, laboratory methods and good manufacturing processes.

Specific agro-processing training courses attended

Some courses which respondents and employees have attended were: Small Manufacturing Enterprises Consultation to Labeling Requirements for Export by the Trinidad and Tobago Bureau of Standards; CARIRI and Food and Beverage Industry Development Corporation (FBIDC) Food Sensitization Programme; Developing and Implementing Good Manufacturing Practices in Small and Medium Sized Agro Industries organised by CARIRI, FBIDC, and Trinidad and Tobago's Ministry of Trade and Industry; Basic HACCP training; Customer service, safety and food processing; Quality and safety; Good manufacturing practices, basics of financial literacy and business management. Workers are routinely trained and supervised in good manufacturing practices but often leave or retire from companies.

Recommendation for further agro-processing training courses

It was reported than any basic/advanced training must be accompanied by access to finance to implement training. There is currently insufficient time allotted to the training, method validation, and verification of trained personnel. It is difficult to maintain high competency levels due to the nature of the fast moving industry. Some advanced training courses were suggested:

- Food safety and handling of dairy products;
- Advanced courses in agro-processing such as HACCP, establishment of adequate production line system and use of preservatives;
- Underlying concepts of food processing to improve staff competencies;
- Basic sciences including the use of mathematics to calculate quantities in process formulation;
- Improving customer relations;
- Proper use of processing equipment to enhance output;
- Analytical methods such as chemical, water analysis, microbiology, and calibration of more sophisticated equipment – milkoscans, moisture analyzers, titrators, refractometers;
- Food service hospitality;
- Small business accounting.

Suggestions for future training course

- HACCP training to obtain an international certificate of standard;
- New agro-processing updates such as processing of osmotically-dehydrated products from tropical fruits, fruit flavours for ice-cream and fruit wines;
- Business organisational courses to explain role and authority;

- Online training courses for laboratory personnel and employees who work a shift system;
- Training in microbiology at the BSc. level;
- Analysis of contaminants – advanced methods;
- Advanced HACCP training;
- Visual and practical training such as food safety videos and practical training.

Analyses and food labelling

Some agro-processing companies conducted no analyses on their product while others have some facilities. A few companies outsource analysis on agro-processed products. A service is offered by the Food & Drug Department based on the ingredients of the product submitted to them. The information is drawn from a data bank. The basic analyses conducted on agro-processed products were sucrose content, fibre content, clarity of juice, yield, pH, titratable acidity, Bostwick consistency, and soluble solids as °Brix. The physical chemical, microbiological, and sensory analyses were conducted in the quality assurance laboratory.

When the respondents were asked to suggest how to improve the types and quality of analyses, most had no responses, but some highlighted the need for analytical training. They suggested the establishment of cooperatives with analytical capabilities for analyses such as pH, soluble solids such as °Brix and temperature recording, and some respondents suggested that certain analytical equipment could be provided free to assist businesses. Some companies outsourced analyses but felt that prices should be reduced. It was indicated that the cost of analyses at CARIRI was too prohibitive for an entrepreneur and the Trinidad and Tobago Chemistry Food and Drugs laboratory had too limited a range of analyses.

In some countries, there is a multi-purpose laboratory which provides services in microbiological analysis and food composition for labelling. However some of these laboratories were not equipped for measuring the presence of aflatoxins, certain pathogens, allergens and contaminants. Testing for contaminants and allergens are instead outsourced to laboratories which are ISO17025 certified.

Importance of food labelling

It was noted that the food label was first seen by the purchaser of agro-processed products and was very important to gain consumer confidence and inform the consumer about the products. It was indicated that bulk packaging does not have a major influence on the small consumers but on the big suppliers. Labels have importance in informing consumers who have allergens concerns, on expiry dates and ingredients. Some big companies are requiring Certificate of Free Sale and colour tags for First in First out (FIFO) rotation. Many agro processed products are rejected for exports due to poor labeling such as illegible coding quality and improper positioning of labels on the products.

HACCP

All the respondents had heard of HACCP. About half had applied some form of HACCP at their agro-processing company. One company was fully HACCP compliant and another had some pre-requisite programmes and good manufacturing practices in place.

When asked if foreign companies were demanding HACCP applications in their agro-processed countries, the responses were: some said that HACCP was not demanded while larger agro-processors indicated that HACCP was required to ensure their products are exported to foreign markets.

When asked if HACCP compliance was a constraint to food processing, many reported that HACCP training was not seen as a hindrance or constraint to food processing but as an asset to the company to guarantee food safety of agro-processed products, and to be able to target new markets. However on-going training and supervision are required. While HACCP is necessary, it is costly and hence it is difficult for small processors to fully comply. For HACCP, implementation requires standard facilities designed for a range of agro-processed products, supervised by trained staff and availability of short-term loans for small and medium enterprises

Food regulations/legislations

The respondents indicated that the following organisations were responsible for regulation/legislation in agro-processed products in their respective countries:

- Ministry of Health, Antigua and Barbuda;
- Barbados National Standards Institution (BNSI), Department of Commerce and Consumer Affairs, Ministry of Economic Affairs, Empowerment, Innovation, Trade, Industry and Commerce;
- St. Kitts and Nevis Bureau of Standards, Department of Standards, Ministry of International Trade , Industry, Commerce and Consumer Affairs;
- The Dominica Bureau of Standards;
- Chemistry, Food and Drugs, Ministry of Health, Trinidad and Tobago;
- Public Health Division, Environmental Health Division. Ministry of Health, Trinidad and Tobago;
- Bureau of Standards, Jamaica;
- Guyana National Bureau of Standards which works in collaboration with the Food & Drugs Department of the Ministry of Health;
- Ministry of Trade, St. Vincent.

About third of the respondents found that food legislation was not easily available and understandable. One agro-processor obtained information through networking. When the agro-processors were asked whether the regulations/legislations were in need of update, more than half (58%) were not sure or gave no response to the question. Some indicated that regulations would need to be updated as deemed necessary. The legislative framework takes a long time to be developed and enforced which makes it difficult for legislation to keep pace with the technological age.

More than half (58%) of the agro-processors had not heard of the Food Safety Modernization Act (FSMA, 2011). One agro-processor was not sure of the present state of legislation, another indicated that there should be no legislation as it could unfairly affect developing countries (LDCs), and one respondent said that the legislation was up to date. There were varying responses in suggesting recommendations in respect to food legislation. About half of the respondents had no responses but recommendations put forward by others included the to constantly reevaluate legislation to maintain relevance, enact new food legislation, label Genetically Modified Organisms (GMOs), and require legislation to ensure that all locally produced raw materials supplied to the food industry are within permitted contaminant levels.

Marketing of your agro-processed products

All agro-processors marketed their products to the local markets through supermarkets, hotels and caterers and about 35% exported to international markets. The majority self-distributed their agro-processed products. Few had distributors, particularly for marketing to foreign markets such as those in the US. Marketing strategies included advertisements, billboards and gourmet markets and shops.

Nearly all of the agro-processors rated markets as being strong for their products, particularly in international markets. Although local Caribbean markets may be small, there are opportunities to market to neighboring Caribbean markets. There were strong markets in particular for hot sauces, jams, jellies and drink concentrates, and opportunities for new and innovative agro-processed products, but these would need to be heavily marketed by sampling at various locations.

Three year plan for value additions in the agro-processing food industry

Table 2 depicts a three year plan for the agro-processing industries in the Caribbean, with activities/recommendations. These are according to priorities to increase food availability by value addition for food and nutrition security.

Table 2: Proposed three year plan to increase food availability through value addition and nutrition security

Year	Proposed activities
1	<ul style="list-style-type: none">• Increased primary production through contract farming solely for the agro-processing sector must first take place in order to meet new demand;• Increase production of raw materials through the establishment of new farms;• Improve agronomic practices for crops currently under cultivation;• Identify improved crop cultivars;• Consult with stakeholders in the region and identify raw food priorities;• Strengthen farm groups and increase access to capital;• Facilitate partnerships between farmers and agro-processors;• Provide training, land, wages, equipment, tools and labour for farmers and local food providers and local food regulators;• Conduct market analysis for the identification of suitable products and markets. This includes investigating demand patterns to successfully compete with foreign markets that are exporting a large amount of produce to the region;• Establish small-scale industrial multi-purpose processing plants that are accessible to smallholder farmers to stop the reliance on importing semi-processed materials for finished product processing;

	<ul style="list-style-type: none"> • Provide HACCP certification training and free testing services; • Encourage consumers to support local farmers and food manufacturers by buying local; • Create a well coordinated plan to implement the Jagdeo Initiative (2007) which is a strategy for removing constraints to the development of the agriculture sector in the Caribbean; • A concerted effort to apply the Caribbean Agribusiness Association's (CABA) Strategic Plan through the development of food chains is required to converge production and consumption in the region; • Financial institutions across the region are needed to support a Regional Food Security Programme; • Increase training for more communities and food processing companies.
2	<ul style="list-style-type: none"> • Train food producers and food processors in good agricultural practices, good manufacturing practices, HACCP, and labelling; • Consult with stakeholders in the region and identify raw food priorities; • Increase production of raw materials through the establishment of new farms. • Critically review the past activities for year 1 examine the human resource development needs in this sector and convince agro-processing firms of the need to bring on trained and competent staff; • Introduce the concept of Caribbean cuisine to local and international markets; • Sponsor food expositions in other countries; • Assist in accounting and management of agro-processing companies; • Enhance the appeal of agriculture by ensuring proper support – building a strong culture within the workforce, supply agricultural equipment, promote high quality fruit and vegetable products that grow well under tropical conditions, construct more greenhouses, provide high quality labour, promote networking opportunities, ensure international standards are met, work in unity to ensure food security at a local level; • Market the agriculture/local food sector as a desirable and necessary job.

3	<ul style="list-style-type: none"> • Implement identified processing activities; • Improve the availability of technology to process locally produced foods; • Monitor activities, evaluate performance and continue training of those involved; • Integrate concerns about processing and Caribbean cuisine into local/regional production activities; • Advertise and implement export assistance; • Invest in new technology that ensures the maintenance of high quality fruits and vegetables after they are processed; • Apply Good Agricultural Practices (GAPs) for safe agricultural produce and Good Manufacturing Practices (GMPs) to ensure consistent quality of processed food products; • Apply predictive microbiological modelling in the control of microbial hazards in food processing; • Improve food safety regulations and inspections.

References

- Adebayo, A.S. and Itiola, O.A. (2003). Effects of breadfruit and cocoyam starch mucilage binders on disintegration and dissolution behaviours of paracetamol I table formulations. *Pharmaceutical Technology*, 27(3):78-90.
- Akanbi, T.O., Nazamid, S., Adebowale, A.A., Farooq, A. and Olaoye, A.O. (2011). Breadfruit starch-wheat flour noodles, preparation, proximate compositions and culinary properties. *International Food Research Journal*, 18:1283-1287.
- Badrie, N. and Comissiong, E. (1995). Extrusion processing of breadfruit flour. *Extrusion Communique*, 8(1):24.
- Badrie, N. and Mellowes, W.A. (1992a). Soybean oil and wheat-bran addition effects on characteristics of cassava (*Manihot esculenta* Crantz) flour extrudate. *Journal of Food Science*, 57(1):108-111.
- Badrie, N. and Mellowes, W.A. (1992b). Cassava starch or amylose effects on characteristics of cassava (*Manihot esculenta* Crantz). *Journal of Food Science*, 57(1):103-109.
- Badrie, N. and Mellowes, W.A. (1991). Effect of extrusion variables on cassava extrudates. *Journal of Food Science*, 56(5):1334-1337.
- Badrie, N. and Mellowes, W.A. (1991). Texture and micro-structure of cassava (*Manihot esculenta* Crantz) flour extrudate. *Journal of Food Science*, 56(5):1319-1322.
- Badrie, N., Lakhan, C. and Motilal, L. (2008). Effects of xanthan gum on the physicochemical and sensory quality of cacao pulp (*Theobroma cacao*) syrups. In: Tomasik, P., Bertoft, R. and Blennow, A., (Eds.) *Starch, Recent Progress in Biopolymer and Enzyme Technology*, Polish Society of Food Technology, Cracow, pp. 275-285.
- Badrie, N., Balfour, S., Ottley, K. and Chang-Yen, I. (2005). Nutrient composition of a commonly consumed West Indian meal of breadfruit (*Artocarpus atilis* Fosberg) oil down, *Journal of Nutrition in Recipe & Menu Development*, 3(3/4):19-35.
- Broomes, J.L., Badrie, N. and Roberts-Nkrumah, L. (2009). Effect of cultivar and maturity on yield and nutrient composition of breadfruit (*Artocarpus atilis*) flour. Forty-fifth Annual Caribbean Food Crops Society Meeting, St. Kitts and Nevis.
- Caribbean Market Profile. (2011). Food Export Association of the Midwest USA and Food Export USA – Northeast. <http://www.foodexport.org/Resources/CountryProfileDetail.cfm?ItemNumber=1005>
- Diouf, J., Yumkella, K.Y. and Kanayo Nwanze, K. (2009). Foreword. In: da Silva, C.A., Baker, D., Shepherd, A.W., Chakib, J. and Miranda-da-Cruz, S. (Eds.) *Agro-industries for Development*. CABI and FAO, Rome.
- Lambert, I. (2001). Problems and Constraints to the Development of the Agro-Processing Sector. <http://www.cavehill.uwi.edu/BNCCde/dominica/conference/papers/Lambert.html>.

Jagdeo Initiative. (2007). Private Sector Commission. Technical Information Bulletin. No 8. The Private Sector Commission of Guyana Limited, Georgetown, Guyana.

Kaiteur News Online. (2012). CARICOM alarmed over high import bill.
<http://www.kaiteurnewsonline.com/2012/10/20/caricom-alarmed-over-high-food-import-bill/>.

Khan, S., Badrie, N., Baccus-Taylor, G., and Comissiong, E. (2001). An evaluation of cassava 'farine' and 'wafer' (*Manihot esculenta*). African Journal of Root and Tuber Crops, 4(2): 54-56.

Kpodo, K.A. (1987). Puffing characteristics of yam (*Dioscorea alata*) flour. University of the West Indies, Trinidad and Tobago.

Ma, H., Pan, Z., Li, B., Atungulu, G.G., Olson, D.A., Wall, M.M., and McHugh, T.H. (2011). Properties of extruded expandable breadfruit products, LWT - Food Science and Technology, 46(1):326-334.

Matthews, R., Baccus-Taylor, G.S.H., Comissiong, E. and Badrie, N. (2001). Effect of peeling methods on breadnut (*Artocarpus altilis*) seeds and acceptability of canned breadnut seed in brine. Journal of Food Science and Technology, 38(4):402-404.

Mounigan, P. and Badrie, N. (2007). Physicochemical and sensory quality of wines from red sorrel/roselle (*Hibiscus sabdariffa* L.) calyces: effects of pre-treatments of pectolase and temperature/time. International Journal of Food Science and Technology, 42(4):469-475.

National Food Action Plan. (2012). Agriculture Now. Ministry of Food Production, Land and Marine Affairs. [http://www.agriculturegov.tt/food production](http://www.agriculturegov.tt/food%20production). Accessed 24th November, 2012

Nelson-Quartey, F.C., Amagloh, F.K., Oduro, I.N. and Ellis, W.O. (2007). Formulation of an infant food based on breadfruit (*Artocarpus altilis*) and breadfruit (*Artocarpus camansi*). Acta Horticulturae, 757:215-223.

Nochera, C. and Moore, G., (2001). Properties of extruded products from breadfruit flour. American Association of Cereal Chemists, 45(10):488-490

Olaoye, A.A., Onilude, A.A. and Oladoye, C.O. (2007). Breadfruit flour in biscuit making: effects on product quality. African Journal of Food Science, 1(2):20-23.

Olaoye, O.A. and Onilude, A.A. (2008). Microbiological, proximate analysis and sensory evaluation of baked products from blends of wheat-breadfruit flours. African Journal of Food Agriculture, Nutrition and Development, 8(2):192-203.

Omobuwajo, T.O. (2003). Compositional characteristics and sensory quality of biscuits prawn crackers and fried chips produced from breadfruit. Innovative Food Science and Emerging Technologies, 4:219-225.

Riley-Mitchell, Badrie, N., and Yarde, J. (2012). Cassava (*Manihot esculenta* Crantz)/Wheat Flour Composite Muffins: Effects on Quality and Sensory Characteristics. Tropical Agriculture (Trinidad), 89(2):104-111.

Roberts-Nkrumah, L. and Badrie, N. (2005). Breadfruit consumption, cooking methods and cultivar preference among consumers in Trinidad, West Indies. *Food Quality and Preference*, 16:267-274.

Sunday Guardian. (2012). Sweet potato fries deal turns sour. Local Market Summary, Sunday Guardian November 18th, 2012. www.guardian.co.tt. Accessed 24th Nov, 2012.

Trinidad and Tobago Government Online. (2012). Coordinated efforts needed to tackle high food import bill. October 19th, 2012. <http://www.news.gov.tt/index.php?news=11931>

Wickham, L. (2003). Research and product development issues in the Caribbean food industry. Institute of Food Technologist Meeting.

WSFS. (2009). Feeding the World, Eradicating Hunger. World Summit on Food Security. INF/2, Rome 16-18th November, 2009.

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Appendix 1 - Invitation letter to participate in a survey



THE UNIVERSITY OF THE WEST INDIES

ST. AUGUSTINE, TRINIDAD AND TOBAGO, WEST INDIES

FACULTY OF FOOD AND AGRICULTURE

DEPARTMENT OF FOOD PRODUCTION

TELEPHONE: (868) 662-2002, Ext. 82090 FAX: (868) 645-0479

E-mail: food.production@sta.uwi.edu

10/10/12

Dear

Project on **'Adding Value to Local Foods for Food and Nutrition Security: Myth or Strategic Option'**.

The Faculty of Food and Agriculture, University of the West Indies, St. Augustine Campus, Trinidad and Tobago, West Indies is participating in a project entitled **"Adding Value to Local Foods for Food and Nutrition Security: Myth Or Strategic Option"**. This is a joint project between the Technical Centre for Agricultural and Rural Cooperation ACP-EU (CTA) and the Caribbean Council for Science and Technology (CCST). The project is being executed by CCST in collaboration with the National Institute for Higher Education, Research Science and Technology, Trinidad and Tobago (NIHERST).

The project's goal is to strengthen value-addition capability and improve the food and nutrition situation in the Caribbean. The specific objectives are to:

- Reflect on the experiences of the marketing boards, food processing enterprises, nutritionists and dieticians, communities, researchers, academia and other support agencies in increasing food availability through value addition in the Caribbean.
- Identify the major limitations to growth in agro-processing for food and nutrition security and explore possible options and scenarios.
- Develop a 3-year action plan/roadmap associated with the Caribbean Research Innovation & Entrepreneurship Network (Reined) <http://www.rienet.net/> which aims to help achieve empirically measurable progress in increasing food availability through value addition for food and nutrition security.
- Facilitate the implementation and monitor the outcomes.

One aspect of the project is to undertake a survey and produce a report on agro-processing enterprises in the Caribbean and to chart a 3-year plan for adding value to local products. In this respect, you have been identified as a focal point to answer this survey (see attached).

Your participation is voluntary. The details of the specific responses of your organization will not be revealed.

I look forward to your active participation and an early response by October 20th 2012.

You may contact Dr. Marsha Singh (marsha_ggg@hotmail.com; 1-868-777-4759) or Professor Neela Barrie (nbadrie@yahoo.com; neela.badrie@sta.uwi.edu; Tel: 1-868-662-2002 ext 83211 or 82090; Fax: 1-868-645-0479).

Thanking you in advance for your participation.

Professor Neela Badrie
Deputy Dean of Research and Innovation
Leader of CTA/CCST project

Appendix 2 – Questionnaire – Agro-processing companies

Project on “Adding Value to Local Foods for Food and Nutrition Security: Myth Or Strategic Option”

You have been asked to participate in this survey. Your participation is voluntary. Some questions may not be applicable to you. It is anticipated that this survey should take between 15-20 minutes to complete.

Your affiliation

Name of company/institution:

Address of company/institution:

Your post in the company/institution:

Your duties at the company/institution:

Your contact details e.g. tel number, fax number, e-mail, skype name

How many persons are employed in your company/institution?

Are your processed products solely for the local market?

Yes No

If yes, to the above question, where do you export your processed products? e.g. local, CARICOM market, International market (USA, Canada, Europe)

Primary produce/processed products

List the types of fresh produce and livestock processed at your company/organisation e.g. tomatoes, poultry

List types of processed products manufactured at your company/organisation e.g. tomato ketchup, chicken nuggets

List other raw materials/ingredients which are required for processing of your processed products e.g. additives, bottles, labels

Where do you obtain your raw materials for processing? Locally, imported

Would you say that most of your raw materials are imported? If yes explain

Indicate the constraints which you face in the acquisition of these raw materials/ingredients e.g. seasonality, shortage, high cost, high post-harvest losses

Could you suggest any recommendations to assist these constraints identified above?

Processing Methods

Identify the type of processing methods applied to your products e.g. dehydration, curing- (salting/smoking), low temperature (refrigeration/freezing), high temperature (pasteurization, canning) e.g. salt fish – processing techniques salting and drying

Do you have adequate and modern equipment for processing? E.g equipment being manual, automatic, energy saving, labour intensive

Is the infrastructure (e.g. plant layout) in keeping with minimum food safety standards? e.g. ease of cleaning.

Are there any constraints you face in processing techniques identified? e.g. adequate equipment, maintenance of equipment

Is your company underutilised with respect to processing due to seasonality of crops and lack of raw materials or inadequate funding?

Do you have any recommendation to improving food processing in your company/institution? e.g. more analyses, modern equipment

Types of processed products

Would you like to expand the present range of processed products or target markets? Explain

What are some of the constraints which would prevent you from expanding the present range of processed products or markets?

In your opinion are consumers demanding nutritious and healthy processed products? Explain

Any recommendations to assist in the expansion of the range of processed products or markets?

Training

What type of training do you and your staff possess? Detail any type of training e.g. basic food processing, quality and safety, advance training, training in good manufacturing practices

Is there a need for advance training? Please suggest training needs

Is insufficient training a constraint to food processing in your company? If yes, please explain

Is there a constraint with access to appropriate information? e.g. food standards. Explain

Could you suggest any recommendations in respect to training? E.g. types of programmes, improvement of programmes, on-line training courses

Analyses and food labelling

Do you conduct any analyses at your company/institution? E.g. compositional for labelling, microbiological, sensory analysis, physical on your products? If yes, please explain the types of analyses

Do you have adequate equipment, reagents and training to conduct proper analyses on your products? Explain

How important is food labelling in your company? Explain e.g. Are any of your products rejected due to poor labelling?

What would be your recommendations to improve the types and quality of analyses?

HACCP

Have you heard of Hazard Analysis and Critical Control Points (HACCP)? Yes or No

Is there any form of HACCP applied in your company/institution?

Do foreign companies who import your products demand HACCP compliance? Explain

Is HACCP compliance a constraint to food processing? Explain e.g. require training in HACCP?

Food Regulation/Legislation

Which organizations are responsible for food regulation/legislation in your country? Please identify

Are food legislations easily available and understandable to you as a processor or as an academic?

Do the regulations/legislations need to be updated? Explain

Are you aware of the Food Safety and Modernization Act (FSMA)?

What recommendations would you suggest in respect to food legislation?

Marketing of your products

How do you market your products? E.g. yourself, distributor

Which markets do you target? E.g. local

Is there a strong or weak market for your products? Explain

Three Year Plan

If you were to chart a 3-year plan for the food processing industries in the Caribbean, which activities/recommendations would be your priorities to increase the food availability through value addition for food and nutrition security?

Year 1 Activities/ Recommendations:

Year 2 Activities/ Recommendations:

Year 3 Activities/Recommendations:

Thank you for your participation. Please do not hesitate to contact us for any further information: Professor Neela Barrie (neela.badrie@sta.uwi.edu; 1-868-662-2002 ext 83211 or 82090); Dr. Marsha Singh (marsha.singh@sta.uwi.edu; marsha_ggg@hotmail.com; 1-868-777-4759)

Appendix 3 – List of respondents

Antigua Dairy Limited, St. John, Antigua and Barbuda

Barbados Agricultural Management Company Ltd. (BAMC), St. Michael, Barbados

Bertie's Pepper Sauce, St. Anns, Port-of-Spain, Trinidad and Tobago

Caribbean Agricultural Research and Development Institute (CARDI), University Campus, Trinidad and Tobago

Deli Delights Ltd, Valsayn, Trinidad and Tobago

HK Product Limited, 9 Ings Court Piarco Old Rd., Dabadie, Trinidad and Tobago

Jamaica Exotic Flavours and Essences Company Limited, St. Elizabeth, Jamaica

KATERSERV Limited/Allied Caterers Limited/Allied Energy Services Limited, Trinidad and Tobago

Nestle Trinidad & Tobago, Churchill Roosevelt Highway, Valsayn, Trinidad and Tobago

Oui Cuisine, 7A Weekes Street, St. James, Port of Spain, Trinidad and Tobago

P.W. Bellot and Co. Ltd, 101 Main Street, Castle Comfort, Roseau, Commonwealth of Dominica

Phoenix Enterprises, East Coast Demerara, Guyana

St. Kitts Agro-Processors Co-operative Society Ltd, St. Peters, St. Kitts

St. Vincent and the Grenadines Community College-Division of Technical and Vocational Education, Kingstown P.O, St. Vincent and the Grenadines