



Preserving African Food microorganism for Green Growth

Value Chain Analysis of Fura in Ghana

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TABLE OF CONTENT

1.0 Executive summary	
2.0 Introduction	
2.1 Background.....	
2.1 Product discription.....	
2.2 Value chain mapping.....	
2.2.1 Actors.....	
2.2.2 Processing.....	
2.2.3 Services.....	
2.2.4 Summary of Bottle necks, problems, opportunities, and key suceses factors from the Value Chain	
2.3 Marketing and New Business Development.....	
2.3.1 Product.....	
2.3.2 Price.....	
2.3.3 Place.....	
2.3.4 Promotiom.....	
2.3.5 People.....	
2.3.6 Physical evidence.....	
2.3.7 Positioning.....	
3.0 SWOT.....	
4.0 GAP.....	
5.0 Busines Model.....	
6.0 Conclusions and Recommendations	
7.0 References	

EXECUTIVE SUMMARY

This millet value chain survey was conducted with the support of DANIDA under the green growth project to identify actors who are stakeholders in a lesser use commodity in Ghana with immense potential of production against the global climate change draught factors, high nutritive factors, and plausible industrial processing factors into a well patronized product called fura in West Africa. DANIDA early on had sponsored some investigation on the microbiological composition of the microbial biota in the process of fermentation but was inconclusive of its innovativeness for commercial application. The gaps identified had to be further investigated under the green growth project to conduct survey and investigate into the biota for the fermentation transfer the technology to selected SMEs, develop business modules for the sustainable commercialization of an innovative reengineered fura product from 'farm to fork'.

The survey was conducted in some selected areas in Accra and Northern Regions where fura is indigenous food, further some survey were conducted in the University of Ghana, offices, shops and malls where fura is not mostly serve as outlet or consumed. Whiles labouratory work is ongoing to investigate and develop starter culture for the production of fura. The survey administrators were the two PhD students under green growth (Research Scientist and Head of Commercial Division with MSc Food Science and Technology and an MBA commercial), one PhD DANID fellow, two social scientist and two Research Scientist. Three intense students from the University were trained to support the survey work. After discussions with Dr. Moses, Ana and Prof Wisdom questionnaires were developed and administered.

All the Micro-scale processors were female with an average age of 35 years and a family size of six, 60% married 30% widowed and 10% unmarried of divorced. They were of mixed religions and about 40% employed people from outside the family to process, that limited them to process averagely about 7 bowls in a day. A bowl of millet gives about 60 tennis ball size pieces of fura. They employ about three people and the rest are family members.

Almost all the SMEs were females, with an average age of 40 years, all married, they were all Christians, and they employed 6 permanent staff and about 15 casuals. They already process about 160kg of millet per batch for an associated product *hausu koko* for export. They very happy to learn that they can have access to starter culture to process fura, after failing to commercially produce fura for sale. They are also happy to adopt a new business model and plan to help them succeed. They very sure of the market demand for fura and said the educated people will be able to buy it from shops and malls and even export to the diaspora.

The survey indicated that Green growth project was on the right path to solve two most important problems for the production and commercialization of fura. One is the development of starter culture for the SMEs and to large extent the Micro-processors. The few who fermented said that the cooking time was reduced. The second was to reengineer fura into a commercially viable product by developing a business model and a plan to ensure sustainability.

INTRODUCTION

Background

Traditional menu served in African homes are mostly prepared from cereal grain raw materials. They are important weaning foods for infants and dieting staples for adults. Millet based foods such as *fura* is a popular dumpling food consumed throughout West Africa, particular, Nigeria, Burkina Faso and Ghana as espoused by Owusu-Kwarteng et al 2010, He also indicated that the processing major identified steps of *fura* processing includes soaking or steeping the cereal grain, washing, dehauling and wet milling with the addition of aromatic ingredients to form the dough for fermentation (optional), initial moulding, cooking, pounding into sticky cohesive mass which is finally moulded before packaging for sale to consumers, who eat the *fura* by re-constituting with water, milk or groundnuts; the milk may be raw processed or fermented, with sugar added to taste. Owusu Kwarteng agreed with many microbiologists who thought that the development of starter cultures from the dominant microorganism involved in the spontaneous fermentation process is important and long overdue for the potential production of standardized *fura* to an up scaled commercial quantities. That means there will be an improvement of its commercial viability, acceptability, microbiological stability, acceptable hygienic and safe product which is difficult to achieve using spontaneous fermentation process that leaves much to be desired.

The Value Chain concept was developed and popularized in 1985 by Michael Porter, in “Competitive Advantage,” a seminal work on the implementation of competitive strategy to achieve superior business performance. Porter defined value as the amount buyers are willing to pay for what a firm provides, and he conceived that the “value chain” act as the combination of nine generic value added activities operating within a firm – activities that work together to provide value to customers. Porter linked up the value chains between firms to form what he called a Value System; however, in the present era of greater outsourcing and collaboration the linkage between multiple firms’ value creating processes has more commonly been called the “value chain.” This name implies, the primary focus in value chains is on the benefits that accrue to customers, the interdependent processes that generate value, and the resulting demand and revenue stream flows that are created, finally he noted that effective value chains generate profits.

The value chain for such a vibrant traditional cottage industry set up in homes which has been less researched and economically studied may be analyzed using the following mapping stages: The Upstream: (raw material value proposition optimization and transportation resource); The Processing/Transformation plant: (improved value addition processing or transformation technology; industry with starter culture introduction to replace spontaneous fermentation; thus reduce processing time and energy consumption for green growth; to optimize the quality; nutritional, consistency, physical and other customer value proposition for healthy products and

The Downstream: (commercialization technique employed using the seven P's of marketing mix and canvas business model developed concepts to increase demand sales and revenue.

Dietz 1999, noted that the role of the small-scale food processing as a sub-sector that can contribute significantly to the development of the rural economy is increasingly being realized. It is important to stimulate sustainable development in the rural and peri-urban areas of developing countries. It provides source of income and a means of poverty alleviation and contributes to variety in the diet and the food security of millions of people.

FAO 1997, indicated that small-scale food industry also provides linkages to local supplies of agricultural raw materials and to income generating activities such as the manufacturing of machinery, packaging and ingredients. There is the need to develop business models, particular for small-scale industry. To optimize raw material value, reduce time and drudgery of processing, employ strategic and tactic principles and concepts of commercialization to increase the revenue stream and profit margins. Throughout Africa, spontaneous fermentation has been used as part of traditional cereal-grain, cassava and dairy processing to obtain products such as Ogi and Marhew in Benin. Kenkey and Kokonte in Ghana, Ingera in Ethiopia, poto-poto in Congo. Ogi and Kunu-zaaku in Nigeria, uji and toguva in Tanzania, Kisra, in Sudan (Tourkinse et al, 1988, Hounhouigan et al:1993 Oyewole 1997 and Blandiro et al, 2003)

The marketing strategy would focus on distribution channels developed along urban expansion that is increasing swiftly. In West Africa, population growth has increasingly shifted from rural into urban areas over recent decades. Between 1980 and 2010, urban populations grew 4.5 percent annually, compared with 1.8 percent in rural areas. This trend is expected to continue between 2011 and 2050, with urban population growth projected at 3.7 percent per year, compared with only 0.5 percent in rural areas (UNFPA 2010). By 2020, just over half of the people residing in West Africa are projected to live in urban areas (193 million) and urbanization is expected to reach 67 percent by 2050 (UNFPA 2010). Urbanization is not limited to primary cities. There is an equally rapid expansion in the number of new smaller cities of 10 000 or more inhabitants, primarily along major axes and in the periphery of larger metropolitan neighborhoods (Denis *et al.* 2008). Kaminski, *et al.* (2013), noted that urbanization is also driving changes in consumption habits through: (1) increasing demand for prepared food and for convenient, ready-to-cook and ready-to-eat food products (e.g. rice, wheat, millet and maize flours), particularly for urban women who have less time to prepare meals; and (2) increasing consumption of food and meals outside of the home (i.e. "street consumption"). These evolving changes are creating an increasingly segmented urban market comprised of many recently-arrived, low-income consumers with evolving "urban" tastes and a nascent urban middle class. The increasing number of urban poor will require large quantities of cheap food, including both staple foods and lower quality imported food. Over the last 20 years, evidence shows that urban consumers have gradually substituted regionally-produced coarse grains with imported rice and wheat (Singare *et al.* 1999). At the same time, a growing urban middle class creates additional demand for a diversified basket of higher value and processed goods, with preferences for high-quality imported products (FARM 2008). Income growth and distribution of purchasing power

(including poverty patterns and income distribution) are also powerful drivers that shape the structure and evolution of food demand. According to estimates of poverty headcount ratios expressed in purchasing power parities, more than half of the entire regional population in West Africa lives on less than US\$1.25 per day and three-quarters has less than US\$2.00 per day at their disposal. The value of total regional consumption of food staples (including farmers' own consumption) has been estimated at US\$20 billion, more than three times the value of West African international exports and 50 times the value of intraregional trade captured by official statistics (Hazell and Diao, 2005, cited in ReSAKKS, 2008).

Problem Statement

Consumption of millet as noted by Kaminski, *et al.* (2013), is influenced by urbanization and increasing evidence on growing rural urban income disparities, most of this market growth has taken place in urban areas. According to estimates from the international agricultural research center for development (*Centre International de Recherche Agronomique pour le Développement* – CIRAD), almost all wheat, two-thirds of rice and more than 40 percent of roots and tubers available in the West African region are consumed in urban areas. Even in the case of typical rural staples such as millet, approximately 20 percent is consumed in towns and cities. The total value of food transacted in the markets of eight West African capitals is considerably larger than the value of agricultural export revenues achieved by these countries. According to projected future demographic trends, the growth of the domestic food market will continue to take place mainly in urban areas. In addition, there will be growth in the demand for semi-industrial and industrial processed food and non-food products, which can stimulate the local agricultural sector if value-chain development effectively takes place. The rapid rate of urbanization has driven demand in urban markets for imported food staples, and this has fostered import dependency, while rural markets have continued to be served with domestic production such as millet and sorghum. New marketing strategies could make local production more accessible to central markets and meet the needs of urban consumers.

There is a clear consumption substitution from millet, sorghum and maize toward rice and wheat in West Africa. The three main cereals grown in West Africa (maize, sorghum and millet) represent 70 percent of consumers' on cereal needs. Key drivers supporting the development of millet value chain include meeting consumers' preferences and quality requirements. Even in the case of typical rural staples such as millet, approximately 20 percent is consumed in towns and cities. The total value of food transacted in the markets of eight West African capitals is considerably larger than the value of agricultural export revenues achieved by these countries. Kaminski, *et al.* (2013), future indicated that according to projected future demographic trends, the growth of the domestic food market will continue to take place mainly in urban areas. In addition, there will be growth in the demand for semi-industrial and industrial processed food

and non-food products, which can stimulate the local agricultural sector if value-chain development effectively takes place.

In Ghana, a survey conducted by the green growth project indicated that there has been some development in agro-processing, especially around Accra, Tamale and other major cities, with the emergence of small and medium enterprises (SMEs) many of which are run by women. Women play an important role in the small scale semi-industrial processing of cereals notably millet and sorghum based food products. Women are very active in various production-related capacities and income-generating activities in horticulture, bakeries, grocery, and more recently they have been involved in the promotion of millet through food processing, promotion and marketing. Porridge, fura and flour for bakery are the first millet derived food products that can play an important role in fostering demand-driven growth in the millet value chain. The agro-processors are facing three main problems with the quality of the raw material originating from millet farmers and suppliers, in descending order: (1) a low degree of cleanliness; (2) heterogeneity in grains; and (3) unstable/insufficient quality and quantity. For traditional processors, problems of grain quality are even more important than their heterogeneity. A high percentage of impurities can be attributed to a lack of appropriate post-harvest handling techniques in storage and preservation as well as a lack of quality certification systems in the domestic markets. Consistent product quality is necessary to develop customer loyalty. One of the main difficulties for agro-processors is to reproduce similar quality over time, since quality is affected by a lack of established standards and non-standardized processing techniques, such as a lack of control observed in spontaneous fermentation, about choice of ingredients, the heterogeneity in raw material and a lack of measuring instruments (e.g. pH-meters, scales).

Fermented food products are a major consideration for consumers' tastes in major cities in West Africa. Generally about 30 to 45 percent of cereal products are fermented and 85 percent of those are produced by artisanal processors. Cereals however, do not include essential amino acids such as lysine (Kaminski, *et al.* 2013), Although fermentation is the most cost-saving technique to increase cereal value, final quality varies significantly as a result of nutritional value, taste and other functional qualities of cereal products and uncontrolled natural fermentations. But natural fermentation is widely used in the observed marketed products (e.g. tchoukoutou, kenkey and dolo). Establishing controlled fermentation processes is thus a key challenge for small and medium agri-businesses (SMAs) as confirmed by Owusu-Kwarteng *et al* (2010). Diverse tastes, smells and colours are important for promoting the consumption of local products such as fura, and this can be addressed by designing new products to promote new consumption habits. Marketing specialists and sociologists can collaborate to study new innovated products that will better respond to consumers' preferences for convenience, preservation and safety while still remaining competitive using business model development.

Green growth survey conducted in Ghana revealed that quality standards and enforcement along the millet value chains is highly uneven. At the production stage, quality enhancing techniques (i.e. varietal purity, post-harvest techniques) are rarely practiced. Product quality (grain size,

uniformity of products, purity, taste and odor standards, and water composition) seems to be handled mostly by buyers, especially industrial large scale or institutional buyers as confirmed by Kaminski, *et al.* (2013). But in general, quality assurance is not yet developed in local or even urban markets, giving the intermediate consumer the task of upgrading the quality of the purchased cereal crops. This is a serious hindrance to the development of millet value chain and a significant demand-suppressing factor. Owusu-Kwarteng *et al.* 2010, noted that standardization and certification are necessary to promote the development of downstream millet value chains. Standard setting should aim to satisfy international norms (e.g., aflatoxin issues in cereals) of production and sales. Several studies have pointed out numerous constraints which have to do with a lack of norms, information, training and communication. Compliance with quality standards requires time, human resources, capital, physical investments and the involvement of all direct and indirect stakeholders in the value chain. Capacity-building is essential in the areas of standardization, quality control and promotion of agricultural and agro-food products. Quality improvements (e.g. by using tarpaulin sheet or mechanical threshers to decrease the rate of impurities) in raw millet enable producers to meet higher quality standards and thus set higher prices and enhance their profitability. An enabling business and market environment is essential for promoting high quality standards. Kaminski, *et al.* (2013), noted that distribution of margins among the main stakeholders always leaves a constant share for farmers, but the producers' share has decreased somewhat since 2005. The margins for intermediate actors between producers and consumers (e.g. traders, processors and retailers) have constantly increased; this can be attributed to marketing costs (e.g. transportation and credit rates) which have remained high.

In Ghana, there are three phases in the commercialization and marketing of millet throughout the year: from May to August, provision is slowing down and may stop; from September to November, there is a slow and careful revival of supply; and from December to April, there is a continuation and consolidation of supply/provision operations. The same timing roughly applies to maize (plus or minus one month in between each period).

There arise the need for both academicians and industrialists to re-engineer strategies to be successful with emerging globalization that comes with new technologies in processing and upgrading strategic and tactic business model for competitive advantage. There is the continuous need to better understand agro-processing value chains, optimize resources, introduce new technology, and develop commercially viable products for potential consumers in the ever increasing population at the peri-urban areas in developing countries in Africa that have high trade deficit and finding it difficult to fight influx of imported products. There is also the issue of an under developed processing sector that is unable to produce products that are demanded by the growing segment of the middle-income households. Local food processing remains too small and as a result high-value food imports have been increasing. The deliberate promotion of the local processing industry will be beneficial to the agricultural sector in Ghana. The bottlenecks that confront the agro-processing industry is a situation such as Ghana producing only 30% of the raw materials needed for agro-based industry as stated by (FAO, 2013) should be removed. These include high cost of overheads, constraints in infrastructure, high tariff on imports of spare

parts and insufficient agricultural financing for expansion and also to boost productivity. The Food and Agricultural Organization (FAO, 1997) reports that various challenges have hampered the efforts at mechanization in Ghana: (i) poor access of farmers to mechanization technologies due to low purchasing power; (ii) lack of skilled tractor operators; (iii) poor commercialization of agricultural produce (no guaranteed markets, low market prices, etc.); (iv) poor availability of spare parts because suppliers are concentrated in the major town (Accra); (v) Farmers usually do not consider agriculture as a business but as a way of life; and (vi) the existing land tenure system.

Fura is a semi-solid dumpling millet-based meal (Tideraniod Werida, 1994). Traditional fura processing has been developed largely as an art tended down from one generation to the other rather than through scientific concepts and principles (Owusu Kwarteng 2010). Although procedures and equipment used for fura processing are relatively simple. The microbiology and biochemistry aspects have not been adequately researched. Physical aspects, (temperature, time, relative humidity) and level of agita and aeration of the processing of millet into fura are poorly controlled, production techniques are not standardized. The process therefore results in products of variable quality due to poor hygienic practices and improper handling during fura production. Post-fermentation process occurs spontaneously and difficult to control the process is not predictable in terms of packaging and quality of products. It can therefore produce unwholesome products or product with a short-shelf life and may not be safe since they are liable to contamination by pathogens. If fura is to meet its full potential benefits and be able to compete favorably with imported and industrially processed cereal grain food, there is the need to upgrade processing technologies to add value and ensure safety. This requires much more research on the millet agro processing value chain, optimize raw materials value proposition, (quality, economy of scale and scope) introduce starter culture in the processing technology for the reduction of process time, less energy consumption, for green growth, reduce cost of production, to produce high quality nutritional value, improve physical characteristics for acceptability, safety and standardized products. That is well packaged, priced, distributed to ensure availability, reliability in a well-structured market system to improve patronage, revenue streams and profit margins in sustainable business model.

Research question

1. How will optimization of raw materials be achieved to obtain quality, safe, reliable economically effective and efficient raw materials for processing
2. How will a starter culture obtained scientifically be introduced as a new processing technique by small industry to reduce cost and increase value of products
3. How will a commercially viable business model be developed by small-scale industry to optimize the use of resources, reduce time, improve safety, increase patronage and revenue streams for wider profit margin
4. What are the risk factors involved for the small-scale industry to obtain proven starter culture.
5. What policies can be made to ensure safety, food security and nutritious products

Rationale for the Study

Production levels of maize have been increasing, rising from 1,219,600MT in 2007 to 1,949,897MT in 2012. The production of rice has also seen significant increase in recent years despite increasing imports, and this has been attributed to the intervention in this sub sector by government and civil society groups. Production levels of rice rose from 301,920MT in 2008 to 569,524MT in 2013. Sorghum and millet production has shown decreases in recent years. Production levels of sorghum decreased from 303,950MT in 2008 to 256,736MT in 2013 while that of millet decreased from 245,550MT in 2009 to 155,13MT in 2013 (see chart below). The decreasing trend may be due to the growing middle class who have developed preferences for other cereals especially rice imported into the country.

For both academicians and industrialists with emerging globalization, new technologies in processing and upgrading strategic and tactic business model for competitive advantage. There is the continuous need to better understand agro-processing value chains, optimize resources, introduce new technology, and develop commercially viable products for potential consumer for the ever increasing population at the peri-urban areas in developing countries in Africa that have high trade deficit and finding it difficult to fight influx of imported products.

There is also the issue of an under developed processing sector that is unable to produce products that are demanded by the growing segment of the middle-income households. Local food processing remains too small and as a result high-value food imports have been increasing.

The deliberate promotion of the local processing industry will be beneficial to the agricultural sector in Ghana. The bottlenecks that confront the industry such as Ghana producing only 30% of the raw materials needed for agro-based industry should be removed. These include high cost of overheads, constraints in infrastructure, high tariff on imports of spare parts and insufficient agricultural financing for expansion and also to boost productivity. The Food and Agricultural Organization (FAO, 2013) reports that various challenges have hampered the efforts at mechanization in Ghana: (i) poor access of farmers to mechanization technologies due to low purchasing power; (ii) lack of skilled tractor operators; (iii) poor commercialization of agricultural produce (no guaranteed markets, low market prices, etc.); (iv) poor availability of spare parts because suppliers are concentrated in the major town (Accra); (v) Farmers usually do not consider agriculture as a business but as a way of life; and (vi) the existing land tenure system.

Methodology

The makers of Business Model Generation and Strategizer, Business Model Foundry AG have designed questions and observation outlook for the development of business models which are important to guide the analysis along the value chain:

Key activities; What key activities do our value propositions require? How are our supply chain and distribution channels managed? What types of customer and consumer relationships are established? How do we ensure profitable revenue streams? The categories of activities should be effective and efficient production schedules, problem solving, and platform/Network driven.

Key partners: who are our key Partners? Who are our key suppliers? Which Key Resources are we requiring from partners? Which key Activities do partners perform? What do the Motivations for partnerships comes from? How do we optimize and economize? How do we reduce risk and uncertainty in a acquisition of particular resources and activities.

Customer Value Proposition along the value chain of post-harvest agro-processing of any commodity in developing country is very important; in this case what the customer wants has effect on the finished product. **The customer values** that must be noted and adhere to will include; what value do we deliver to the customer? Which one of our customer's problems are we helping to solve? What bundles of products and services are we offering to each Customer Segment? Which customer needs are we satisfying? The characteristics of such activities include; Newness, Performance. Customization "Getting the Job Done", Design, Brand/Status, Price, Cost Reduction, Risk Reduction Accessibility, Convenience/Usability

Key Resources needed to complete the value chain must be noted and the right attention assigned to them, these can be unearthed by asking the following questions; What Key Resources do our Value Propositions require? What type of Distribution Channels can we employ? Who are the key suppliers, key internal and external customers and how do we maintain these Relationships? Which incomes are the key Revenue Streams? Are the types of resources are Physical, Intellectual (brand patents, copyrights, data), Human and Financial

Customer Relationships must be established by questions such as, what type of relationship does each of our Customer Segments expect us to establish and maintain with them? Which ones have we established and which once has not? How are they integrated with the rest of our business model? How costly are they? Is it related to brand, product or personnel? **Examples** Personal, assistance, Dedicated Personal Assistance, Self-Service, Automated Services, Communities, Co-creation,

Key Channels of distribution must be considered since two main products would be moved (starter cultures and end products), through which Channels do our Customer Segments want to be reached? How are we reaching them now? How are our Channels integrated? Which ones work best? Which ones are most cost-efficient? How are we integrating them with customer routines? The **Channel phases to considered are**, 1. **Awareness**; How do we raise awareness about our company's products and services? 2. **Coordination**; How do we network the activities of customers? How do customers learn from each other? How do they support themselves without us? 3. **Evaluation**; How do we help customers evaluate our organization's Value Proposition? 4. **Purchase**; How do we allow customers to purchase specific products and services? 5. **Delivery**; How do we deliver a Value Proposition to customers? 6. **After sales**; how do we provide post-purchase customer support?

Costs Structure along the value chain there must be identification and thoroughly analyses of cost to minimize it as much as possible with the following questions; what are the most important activity costs base inherent in our business model? Which Key Resources are most expensive? Which Key Activities are most expensive? **Is your business more?** Cost Driven (leanest cost structure, low price value proposition, maximum automation, extensive outsourcing) Value Driven (focused on value creation, premium value proposition) Sample

characteristics are **Fixed Costs** (regulatory commitment, salaries, rents, utilities), **Variable costs** (disposables, waste management). Economies of scale and economies of scope are employed to ensure prudence of expenditure: Whereas **economies of scale** for a firm primarily will enable it consider reductions in the average cost (cost per unit) associated with increasing the **scale** of production for a single product type, the **economies of scope** will enable it to consider lowering the average cost for by producing two or more products types or forms (brands).

Revenue Streams must be identified and sustained with the following questions; for what value are our customers really willing to pay? For what do they currently pay? How are they currently paying? How would they prefer to pay? How much does each Revenue Stream contribute to overall revenues? Types of revenue streams are; Asset sale, Usage fee, Subscription Fees, Lending/Renting/Leasing, Licensing, Brokerage fees, Advertising, Fixed pricing, List Price, Product feature dependent, Customer segment dependent, Volume dependent **Dynamic pricing**, Negotiation (bargaining), Yield management, Real-time Market price, The developing countries like Ghana, mostly practice imperfect **monopolistic market system** which is a market structure in which several or many sellers each produce similar, but slightly differentiated products. Each producer can set its price and quantity without affecting the marketplace as a whole. For these reason in **monopolistic competition**, products and services seek to gain advantage through differentiation in physical appearance, marketing strategies, human capital, distribution, and other factors.

Customer

The customer and consumer identification and classification along the value chain must be done with care since it could breed dissatisfaction. We must know who are customers and consumers by association product offering or need and want assessment. Fulfillment is important for customer or consumer loyalty. **Customer Segmentation** is also necessary to be able to serve all categories of potential clients and so the questions asked include; for whom are we creating value? Who are our most important customers? How many types of customers can we have? Are we joining the Mass Market or Niche Market or Multi-sided Platform? The consumers need to know much information about the product capability and service enhancement provided by our creation to generate more revenue streams.

Product

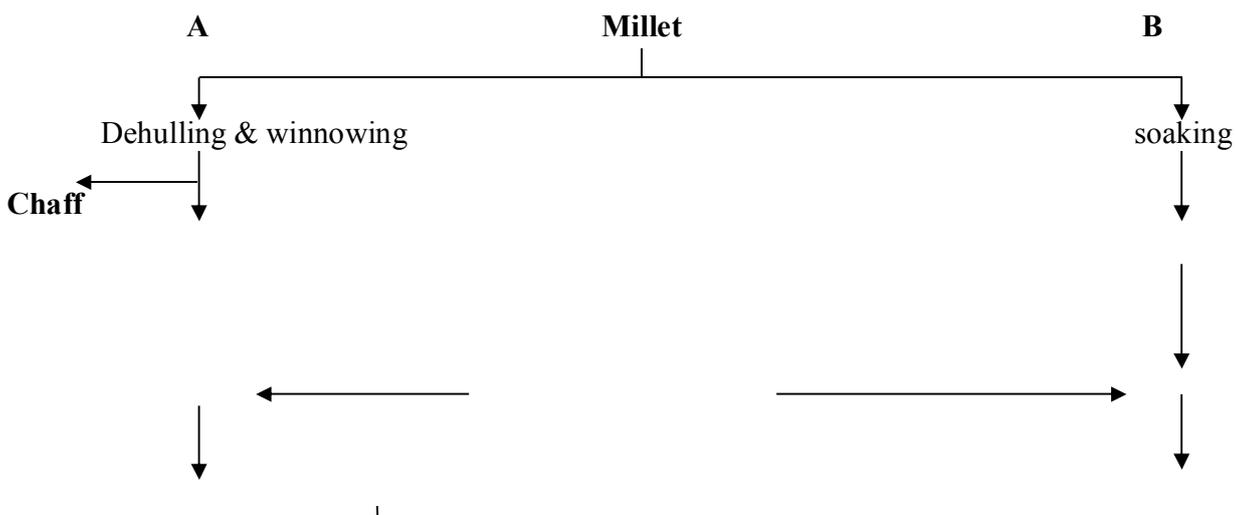
The Northern regions of Ghana are home to several forms of grain-based and seed fermented foods, such as *pito* (from sorghum), *dawadawa* (from bambara groundnuts), *kantong* (from silk-cotton seeds), *hausa koko* and *fura* (from millet). *Fura* is a semi-solid dumpling millet-based meal (Jideani and Wedricha, 1994) or cereal porridge. It is a traditional staple food in West Africa particularly in Nigeria, Ghana and Burkina Faso (Jideani *et al.*, 2001) produced mainly from millet blended with spices and water, compressed into dough balls and cooked (Kordylasi, 1990, Jideani *et al.*, 2001). The cooked dough balls are broken up and made into porridge by mixing with yoghurt (*nunu*), fresh milk or water (Kordylasi, 1990). Sugar may be added to taste. The mixture of fermented milk and cooked spiced millet (*fura de nunu*) is almost a complete food with milk serving as a source of protein while the cooked spiced millet provides energy. The sour taste is known to be particularly suited for quenching thirst.

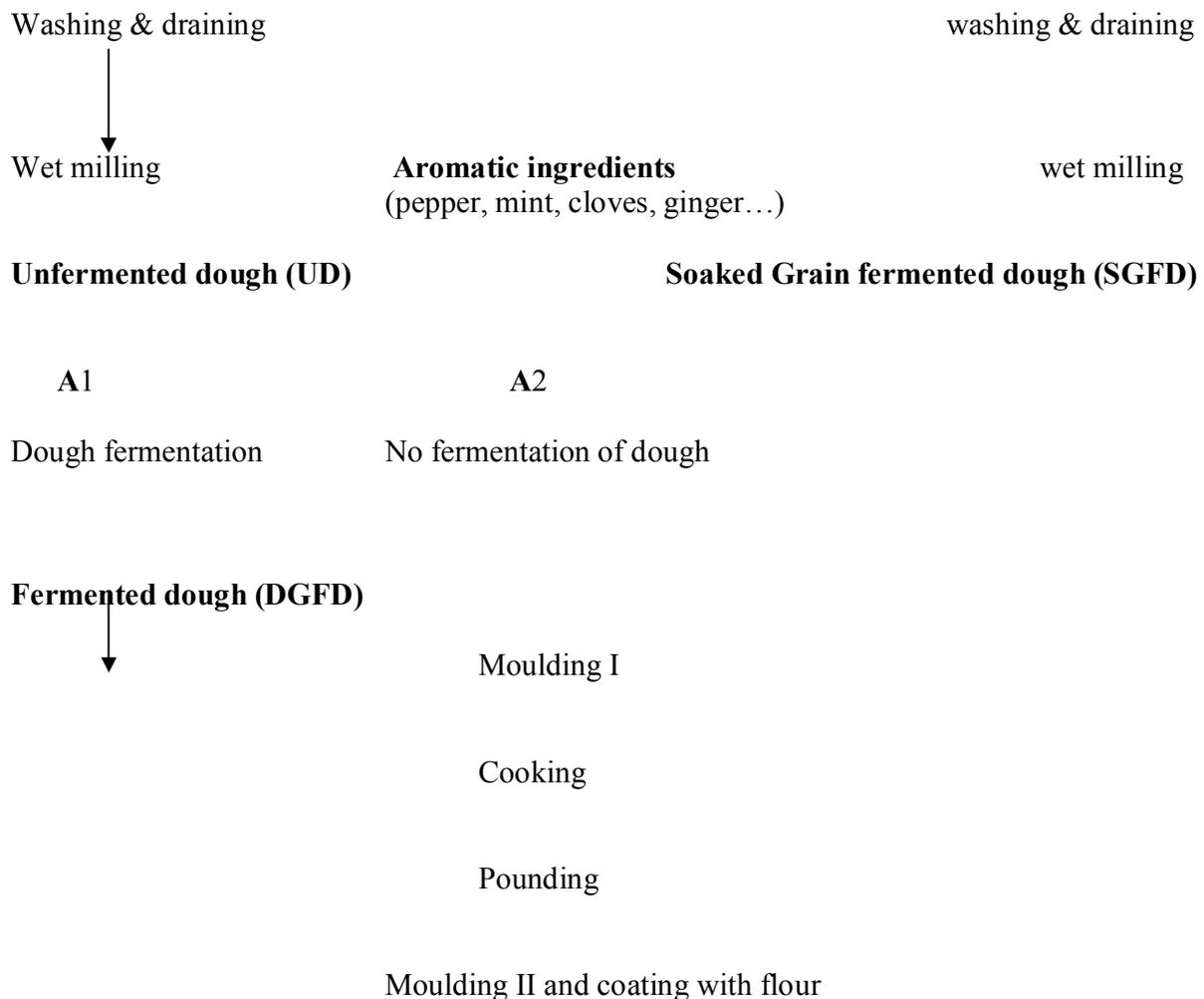
Fura Processing

The main ingredients for *fura* processing in Ghana are the pearl millet (*Pennisetum* spp.) and spices such as pepper, cloves, mint and ginger. The scales of operation for the processing units surveyed varied based on the quantity of millet processed daily. The amounts ranged from about 6 kg to 27 kg, with an average of about 12 kg. There were also some significant variations in the processes, as regards the techniques used and the parameters involved. Figure 1 summarizes the traditional *fura* process, with the variations observed. As the first step, some processors dehull the millet grains while others soak the grains without dehulling. The duration of soaking varies, ranging from about 18 hours to 28 hours, and with an average of about 23.3 hours. At all the processing units visited, washing of the grains before milling was practiced. This constitutes the second major step in processing millet into *fura*. The extent of washing apparently depends on the quantity and quality of the raw material (millet). Following washing, wet milling is done using the plate attrition mill. It is during this time that the ingredients (pepper, mint, cloves, and ginger) are added. Some processors ferment the dough formed. Depending on the variations in the processes as depicted in Figure 1, three different doughs result; the dehulled grain unfermented dough (DGUD), the soaked grain fermented dough (SGFD), and the dehulled grain fermented dough (DGFD). Once the doughs are produced, they are hand-moulded into balls of about 10cm in diameter and then cooked for about 30 minutes. The cooked millet balls are pounded with a mortar and pestle. They are finally moulded into much smaller balls for sale. The balls may be coated with maize flour before being packed for sale. The shelf stability of the final product at ambient conditions was noted to vary from 1 to 6 days. The duration varied depending on the producer's expertise and processing techniques. Indicators of spoilage included mold growth, caking, and excessive souring resulting from continuous fermentation after processing. All unit operations were observed to be performed under uncontrolled, open environmental conditions. The dehulling and milling are done at small commercial community milling centers. The main by-product of *fura* processing is the chaff resulting from the partial dehulling and winnowing which consists of the hulls and sometimes the germs of the millet grains, and is used as animal feed.

The processing of millet into *fura* was studied in Northern Ghana to isolate the microorganisms involved by Owusu-Kwarteng et. al., 2010. He was able to give a vivid description of the indigenous processes to produce fermented and unfermented *fura* as shown in figure 1 below.

Figure 1: Flow diagram for the traditional processing of *fura* using different millet dough preparations (Owusu-Kwarteng et. al., 2010)





Fura

Owusu-Kwarteng et. al., 2010 concluded and recommended that for the first time a study of the traditional processing of pearl millet into *fura* in northern Ghana has been established with detailed flow diagram and the various steps involved characterizing, providing a rational basis for further investigations to ensure reproducible conditions for the production of constant food quality. The results he said also indicated that a wide variety of microorganisms, notably lactic acid bacteria and yeasts, are associated with *fura* production. These microorganisms spontaneously come from raw materials, the environment, processing equipments and persons involved in the production. Further work on this is required using modern molecular techniques to fully characterize the predominant microorganisms and to establish their technological roles and contribution to the product quality and safety. Owusu-Kwarteng et. al., 2010 further noted that the development of starter culture from these organisms is important for the potential production of *fura* on a commercial, small industrial scale, and for the improvement of its acceptability, microbiological stability, hygienic and safety product. They finally recommend that the establishment of national culture collection of lactic acid bacteria and yeasts from Ghanaian fermented foods was eminent as it will open the way for gene banks for future studies.

VALUE CHAIN MAPPING FOR FURA AGR-PROCESSING

Actors

Several Actors play significant role along the value chain of fura production from farm to the fork. These include; millet farmers, millet vendors, millet transformers to fura/fura processors, fura vendors and consumers. The upstream is made up of the farmer who harvest, dry and package for the vendor, miller or transformer, there may be the need to transport to market center picked at farm gate. The millet vendor may winnow and dry to increase the premium he/she may transport to the market or the processing plant of the transformer, the miller may winnow, dry and dehull to add value and increase the premium he/she may transport to the market or the processing plant of the transformer. At the processing plant the transformer may employ people to clean the millet grain, winnowing, washing in clean water before processing. The processing goes through several processes fermented or unfermented to get the fura product. Packaged for the fura vendors, The downstream is the marketing through the channels which is very simple for fura, Since it does not stay for not more than three days, vendors have to hawk from place to place to finish selling it to the consumer for the consumer to consume it before the third day.

Table 1,

ACTORS	TYPE/ROLE/RESPONSIBILITY	DISCUSSION	VALUE PROPOSITION FOR CAVAS BUSINESS MODEL
FARMERS (both sexes) millet producers	Cultivate, does cultural practices, harvest, winnow, dry and store. Send by transport to the market center sell at farm gate to the vendor miller or transformer	Farmers prefer to sell to vendors, millers or transformers at the farm gate. Cultivation needs extra care than sorghum, rice or maize. The way it is harvested adds sand stones which are undesirable for processing it waste time, energy and increase cost of processing.	Vendors, millers and transformers prefer that millet farmers cultivate using certified seed, use improved cultural practices to increase yield, harvest unto a tarpaulin, winnow and dry before packaging for sale, and improve quality and quantity for premium price. The majority (82%) of transformers would pay extra 10% for clean grain.
MILLET VENDORS (both sexes)	Purchase millet grains from farmers, may winnow, dry, package and store ready to sell to transformers	Cereal vendors include wholesalers and retailers, they obtain their millet grain from the northern part of Ghana or from Burkina faso. Mali. They may transportation the southern part of Ghana	Transformers prefer that vendors clean the grains by winnowing and drying to remove the immature, husk, stones and sand to increase the quality of the grain for premium price and are willing to pay about 10% more, 90 % of the transformers said yes and 10% said they would pay less than that.
MILLET MILLERS (males)	Purchase millet grains from farmers, may winnow, dry, mill/dehull, package and store ready to sell to transformers	Cereal millers, mill different types of cereal grains and so there may be cross contamination, loss of flour and weight. They may be wholesalers and retailers, they obtain their millet grain from the northern part of Ghana or from Burkina faso. Mali. They may transportation to the southern part of Ghana	Transformers prefer that mills clean the grains by winnowing and drying to remove the immature, husk, stones and sand to increase the quality of the grain for premium price and are willing to pay about 10% more, 90 % of the transformers said yes and 10% said they would pay less than that.

ACTORS	TYPE/ROLE/RESPONSIBILITY	DISCUSSION	VALUE PROPOSITION FOR CAVAS BUSINESS MODEL
TRANSFORMERS/PROCESSORS (female)	<p>Large scale commercial fura processors, They purchase the grains from the farm gate, vendors, or millers. They may winnow, wash to clean grains before processing. Majority 95% said they buy it from the northern part of Ghana where they pay about 25% less than buying it from the market in Accra.</p>	<p>The large scale processors have organized processing plant and equipment. They are all females. They have reduced production of fura and now process the millet into dry porridge flour for export and local market, 80% of them reduced their production while 20% stopped ion of fura due to the short shelf live which made it impossible to export the product. 70% of them said there were challenges with poor analytical results with aflatoxins and microbial counts. The way it is harvested adds sand stones which are undesirable for processing it waste time, energy and increase cost of processing.</p>	<p>Consumers prefer longer shelf live fura product that is also of high quality and standard quantity. Most of them are indifferent with the colour, but majority loved the tasty; spicefull strong aroma and slightly rough texture. They also prefer an enhance packaging with the additives; sachet of sugar, milk, and groundnut, inclusive for sale. They pay extra 10% for delivery services in the office or at home.</p> <p>The processors prefer the use of starter cultures rather than spontaneous fermentation. They also need training to use the starter cultures, Standard Operation Procedure system and Hazard Analytical Critical Control Point in place to improve standards, quality and quantity of fura produced with high healthy, nutritious fura for premium price. These will enable them to increase production again and export fura onto the USA and European market majority (82%) of transformers would pay for starter culture to reduce time of processing and energy usage.</p>

ACTORS	TYPE/ROLE/RESPONSIBILITY	DISCUSSION	VALUE PROPOSITION FOR CAVAS BUSINESS MODEL
TRANSFORMERS/PROCESSORS (female)	<p>Medium scale commercial fura processors, They purchase the grains from the farm gate, vendors, or millers. They may winnow, wash to clean grains before processing. Majority 95% said they buy it from the markets in Accra. But about 5% buy it from the northern part of Ghana where they pay about 20% less.</p>	<p>The medium scale processors do not have organized processing plant and equipments but mostly produce in their home as cottage agro processing industry. They are all females and about 84% have their families depending on them. They do not export but sell on the local market, most of them said they not produce in large quantities for sale due to the short shelf live which made it impossible to keep and sell for more than three days. All of them complain that the way the grain is harvested adds sand stones which are undesirable for processing it waste time, energy and increase cost of processing.</p>	<p>Consumers prefer longer shelf live fura product that is also of high quality and standard quantity. Most of them are indifferent with the colour, but majority loved the tasty; spicefull strong aroma and slightly rough texture. They also prefer an enhance packaging with the additives; sachet of sugar, milk, and groundnut, inclusive for sale. They were willing to pay extra 10% for delivery services in the office or at home.</p> <p>The processors prefer the use of starter cultures rather than spontaneous fermentation. They also need training to use the starter cultures, Standard Operation Procedure system and Hazard Analytical Critical Control Point in place to improve standards, quality and quantity of fura produced with high healthy, nutritious fura for premium price.</p>

ACTORS	TYPE/ROLE/RESPONSIBILITY	DISCUSSION	VALUE PROPOSITION FOR CAVAS BUSINESS MODEL
TRANSFORMERS/PROCESSORS (female)	Small scale commercial fura processors, They purchase the vendors or millers. They may winnow, wash to clean grains before processing. All of them said they buy it from the markets in Accra.	The small scale processors mostly produce in their home as cottage agro processing industry. They are all females and about 95% have their families depending on them. They do not export but sell on the local market, most of them said they not produce in large quantities for sale due to the short shelf live which made it impossible to keep and sell for more than three days. All of them complain that the way it is harvested adds sand stones which are undesirable for processing it waste time, energy and increase cost of processing.	Consumers prefer longer shelf live fura product that is also of high quality and standard quantity. Most of them are indifferent with the colour, but majority loved the tasty; spicefull strong aroma and slightly rough texture. They also prefer an enhance packaging with the additives; sachet of sugar, milk, and groundnut, inclusive for sale. They were willing to pay extra 10% for delivery services in the office or at home. The processors prefer the use of starter cultures rather than spontaneous fermentation. They also need training to use the starter cultures, Standard Operation Procedure system and Hazard Analytical Critical Control Point in place to improve standards, quality and quantity of fura produced with high healthy, nutritious fura for premium price.

ACTORS	TYPE/ROLE/RESPONSIBILITY	DISCUSSION	VALUE PROPOSITION FOR CAVAS BUSINESS MODEL
<p>VENDORS (female)</p>	<p>Purchase fura in commercial quantities for sale. Except the large scale producers who also export 86% of the processors are also vendors. Some of the medium scale processors sell to hawkers or retailers to sell on commission to consumers.</p>	<p>The large scale processors export their fura to the USA and European market through agents who pay about 70% down and the rest 30% is paid on agreed terms which last for at least a month and most three months.</p> <p>The medium scale processors who process above 5kg a day give some to hawkers to sell on commission. Those who process less than 5kg a day and small scale processor mostly sell all that they produce.</p> <p>They do not sell to the middle class, sedentary staff and officers who may need it but for availability and convenience of reconstituting the fura may not be able to buy it.</p> <p>There is the larger market in West Africa especially Nigeria the most populous country in Africa</p>	<p>Consumers prefer longer shelf life fura product that is also of high quality and standard quantity. Most of them are indifferent with the colour, but majority loved the tasty; spiceful strong aroma and slightly rough texture. They also prefer an enhance packaging with the additives; sachet of sugar, milk, and groundnut, inclusive for sale. They were willing to pay extra 10% for delivery services in the office or at home.</p>

ACTORS	TYPE/ROLE/RESPONSIBILITY	DISCUSSION	VALUE PROPOSITION FOR CAVAS BUSINESS MODEL
<p>CONSUMERS (both male and female)</p>	<p>Regular consumers; Purchase fura almost every day to consume as a meal 86% of them are low irregular income earners self-employed a few 12% are high regular income earners.</p> <p>Irregular consumers; Purchase fura once to thrice in a week to consume as a meal. Many of them are high regular income earners most attributed it to availability some are also on diet.</p> <p>Potential consumers; They would love to Purchase fura almost every day to consume as a meal Majority have heard of it from friends as healthy meal that can help to reduce weight and prevent some ailment. Some have taken it in their childhood and want their family to enjoy it too.</p>	<p>The regular consumers are loyal clients; there could be more of them if the market is segmented well with niche services to reach much more potential loyal clients in their offices and homes.</p> <p>Since Africans in the overseas love to have their cultural meal that can help them to fight cold weather many more clients could be assessed.</p> <p>They do not sell to the middle class, sedentary staff and officers who may need it but for availability and convenience of reconstituting the fura may not be able to buy it.</p>	<p>They were willing to pay extra 10% for delivery of services in the office or at home and also better inclusive packaged.</p>

Marketing and new business model developed

The use of marketing mix is important to the achievement of high volume of sales to different classes of potential clients with different cultural background so that there can be profit made from different streams of revenue, adopting the diagram below from www.marketingmix.co.uk;



Product

The analysis of existing types of fura (thus fermented and unfermented fura) in the form of balls or powdery food products could be reengineered using the canvas business development model to obtain commercially viable industrial venture. The old product was sold to customers who were of low income earners, like artisans, fitters, and menial construction workers. The reengineered new fura prepared with technology infusion along the value chain from farm to fork: postharvest-using tarpaulin spread on

the ground before trashing and using winnowing mechanical separators to obtain premium grains as raw material for the agro-industry. The use of starter cultures to make the product safe, increase available nutrient, release more energy, well augmented packaged in different shapes with ingredients and have a long shelf life to stay in the distribution channel, could attract more potential customers as shown using the nine lead canvas business model propositions in a survey which indicated that potentially new clients who are higher income earners, who stay in their office and sit for long time, people with obese challenges are ready to patronize this reengineered fura. They also indicated that they would not mind to pay about 5% of the current price for services such as door to door or personal sell to make the product available.

Price

The changes in prices is affected by availability of raw materials with the main one being millet. It is in season for only five months the rest of the year is its lean season with a price range changing from One hundred and fifty Ghana cedis GHS 150.00 in (October to February) to four hundred Ghana cedis GHS 400.00 in (March to September) per 50 kg bag which is fifty bowls. The cost build up in the processing of the old product did not include labour, new technologies; mechanical winnowing, starter cultures and packaging systems with marking over heads. When the new technology is applied it will reduce time for fermentation and energy used to boil dough. One bowl which should be approximately 1kg gives 80balls of small size fura (size like tennis ball) which are not standardized, with an average price of fifty pewas (0.50p). The new reengineered fura may cost a little higher because of the cost of starter culture and packaging material proposed by potential customers and notwithstanding safe, healthy, standardized delivered product will be a value for price. The introduction of the reengineered fura to the niche, segmented market will be done by value based pricing and skimming.

Place

Traditionally prepared commercial fura is currently being sold in the open monopolistic market; hawkers move from one point to another to do personal selling a few stay at some points along the streets to sell. There are no commercially packaged fura in small shops, supermarkets or malls in Ghana. The survey conducted indicated that the reengineered fura that had certification from Food and Drugs authority (FDA) in Ghana will be accepted and sold in all outlets. Thus the channel of distribution will expand to increase the revenue streams in addition to the proposed services to be rendered to clients. Beside the 'prebiotic', safe, healthy and standardized fura with longer shelf life due to the introduction of relevant starter cultures different forms will be produced to increase the scope of products of fura, such as powdered, moldered in different shapes and possibly slurry in disposable cups with longer shelf life which was a problem for the exporters who stopped exporting fura.

Promotion

The media landscape in Ghana is quite large and expensive. The less expensive ones like making flyers with pictorial, preparation and benefit information will be used frequently. Introduction of Catchy Television advertisement, documentary and radio advertisement will be carefully chosen. Other promotions such as sponsoring educational programmes to attract the youth in the educational institutions will be adopted, T-shirt advertisement with attractive messages may be used along the product life cycle especially at the maturing phase to rejuvenate the fura product. Health benefit to women and children will be stressed as it contains Lignans, an essential phytonutrient present in millet, that are very beneficial to the human body, which act against different types of hormone-dependent cancers, like breast cancer and also help reduce the risk of heart disease and also prevent obesity as espoused by Pranati Das a Principal Scientist at the Department of Food & Nutrition Assam Agricultural University Jorhat-785013 in a presentation Millets for scientific Research and Food security.

Process

This occurs in the type of service delivery to customers, most of them from the survey indicated that they eat the product at the point of sales, some take it home and others eat it in the office, for these reasons the offering of fura must be done in such a way as to increase availability and convenience of consumption. The proposition of the potential customers is to have it in an augmented packaged form with sachets of sugar, milk and groundnut. They were willing to pay up to 10% of the price for service delivery to the office, home e.t.c.. In the survey interviewed potential consumers that proposed processing centers must be certified by regulators such as Ghana Food and Drugs Authority. Most of the old ways were in homes in Ghanaian compound houses with health implications.

Physical evidence

The thoughts of potential consumers were the fact that the indigenous cottage agro-processing Industry were sited in the home of the processor most of the time compound house (a large area boarded rooms of family members or tenants). These thoughts keep some potential customers off from buying fura made in such environment. 97.5% of the respondents preferred the fura made from facilities that did not have human occupancy. The rest 5.5% were indifferent to the facility where the fura is being made.

People

In most recent times companies who apply this marketing mix become successful, their hawkers wear branded 'T' shirt, containers and packaging rappers. It makes them stand out amongst their competitors especially those who sell along the traffic in Ghana. It was realized from the survey conducted that the tradition where the fura originated from patronize it more than the others followed by those who had associated fermented food and least are those who do not have any associated

traditional food to fura. The indigenous processors come from the traditional area where fura originated, they are able to process it very well than the others and so the potential processors said they employed them to help them with the processing of fermented fura. All the indigenous processors were Muslims while all the potential processors were Christians.

The strengths, weaknesses, opportunities and threats (SWOT) for the production of fura

Table; SWOT ANALYSIS FOR FURA PRODUCTION

<p>STRENGTHS</p> <ul style="list-style-type: none"> - Long tradition of the production of fura - Availability of raw material - The ease of packaging of fura - Cheap source of micronutrients - Fura is consumed all age group of people - Government established policy of tax exemption for five year for agro-processors who use local raw material 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> - Short shelf life of commercial fura - Unaddressed Health concerns with consumption - Inappropriate scientific standardize processing technology - Unavailability of starter culture for controlling fermentation of dough for fura - non aggressive marketing strategy - Labour had not been effectively taken into consideration during costing
<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> - Possibility of developing relevant starter cultures to control the spontaneous fermentation - Possibility to mechanize the processing - Possibility of standardizing fermentation conditions to upscale fura to a higher commercial economic profit - Possibility of creating market segments that can capture officers and sedentary workers who cannot travel to buy fura during working hours - Possibility to improve presentation by packaging - Venture into the export market to capture the Africans (traditional food) and the Asians (traditional spicy meal) people - Health benefits can be used to promote fura to the obese and Diabetic - Possibility of processors of <i>hausa koko</i> associated millet product to process fura 	<p>THREATS</p> <ul style="list-style-type: none"> - Behavioral changes in elite/youthful consumers for imported food products - weak policy on cereal production in Ghana to meet commercial agro-processing - Millet production in Ghana is also affected by the climate change

The proposition by potential customers (e.g., Bankers, officers, tertiary students' e.t.c.,) are all geared towards a potential commercial reengineered fura for a high class niche marketing proposal in the higher earning class of consumers;

Current customer preposition	Potential customers proposition
<ul style="list-style-type: none"> - Very hot spicy fura - Rough texture fura - Simple package fura to reduce cost - Spicy aroma 	<ul style="list-style-type: none"> - Medium spicy fura with a sachet of spice attached - Smooth texture fura - Well packaged fura with a sachet of milk, sugar and possibly groundnut - Fermented spicy aroma - A powdered fura but easy to reconstitute - Slurry fura in a cup with spoon attached a sachet of sugar, milk, and ground nut

The reengineering proposition by medium scale processors to the Scientist and Technologist for starter cultures and an improved shelf life is to expand their nontraditional export to USA and UK. They had tried it before but all of them indicated that it could not stay on the shelf for long and so the vendors did not demand any longer. The economic gains is enormous to encourage the farmers, Vendors, Processors, consumers and the last but not the least is the Government of Ghana for foreign exchange.

Gap analysis

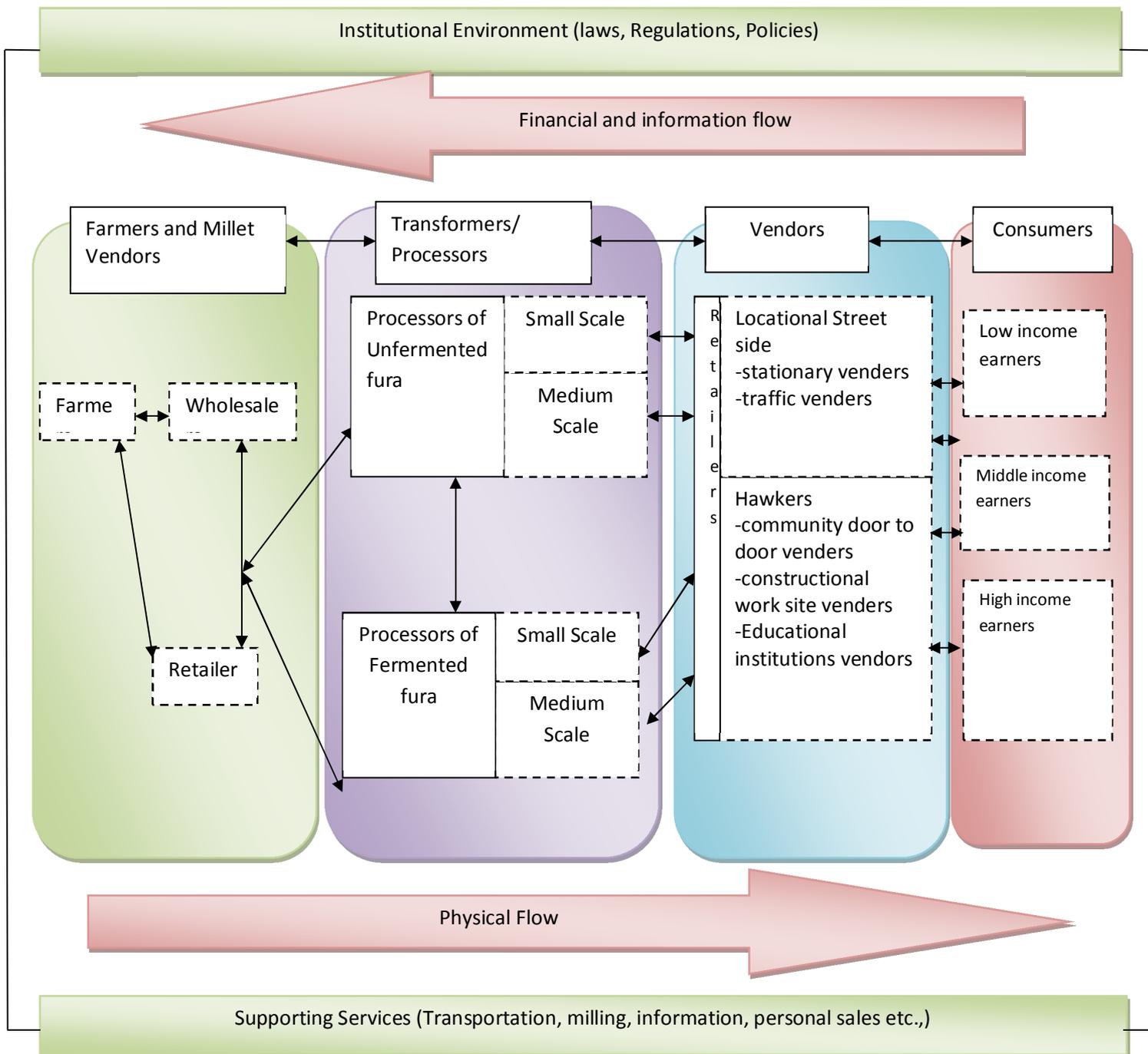
The earlier studies by scientist have lead to the isolation of the microorganism that ferment fura in its spontaneous processes. The scientific and technological intervention to reduce the drudgery of tedious unit operations, change the spontaneous fermentation process to controlled process of fermentation using starter cultures will ensure safety. After the reengineering to obtain a new enhanced fura as espoused by the prepositions guide by the CAVAS business model the market for fura will be expanded and the profit increased.

What may be used in promotional activities in Ghana

Pranati Das (2015) indicated that millets are crop of food sovereignty. Nutritive profile of many elements is much higher compared to other crops. Compared to irrigated commodity crops currently promoted, millets require just 25% rainfall. The crop does not fail. Women will be empowered. **Health benefits of eating millets** Lignans, an essential phytonutrient present in millet, are very beneficial to the human body, which act against different types of hormone-dependent cancers, like breast cancer and also help reduce the risk of heart disease. Regular consumption of millet is very beneficial for postmenopausal women suffering from signs of cardiovascular disease, like high blood pressure and high cholesterol levels. A high source of fiber, millet is very beneficial against breast cancer in postmenopausal women. Pranati Das (2015) further noted that According to research and recent studies, consumption of millet can help women combat the occurrence of gallstones, as they are a very high source of insoluble fiber. This form of cereal grain is very high in phosphorus content, which plays a vital role in maintaining the cell structure of the human body. The key role of this mineral is that it helps in the formation of the mineral matrix of the bone and is also an essential component of ATP (adenosine tri-phosphate), which is the energy currency of the body. A single cup of millet provides around 24.0% of the body's daily phosphorus requirement. This mineral is a very

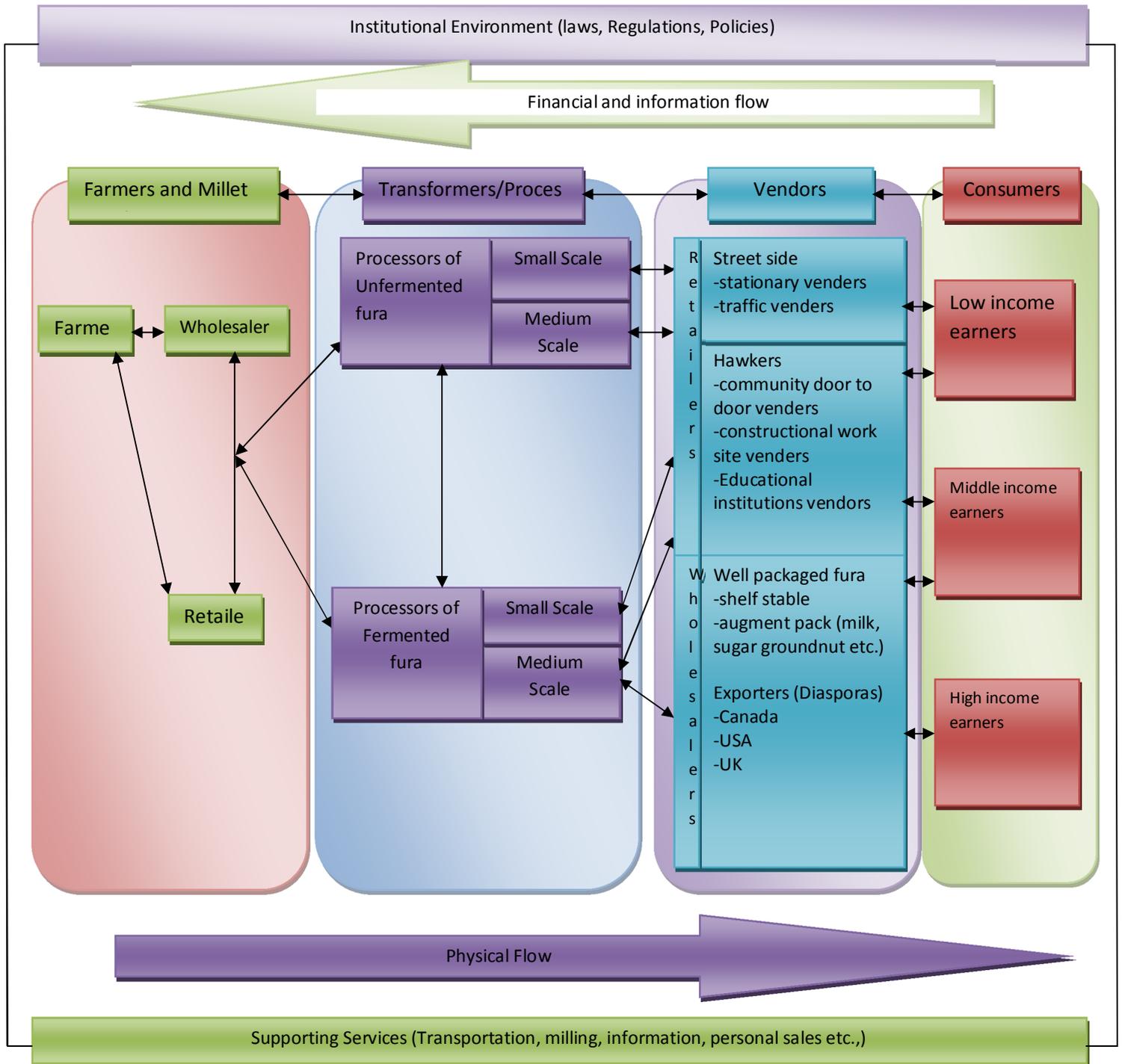
important constituent of nucleic acids, which are the building blocks of genetic code. Recent research has indicated that the regular consumption of millet is associated with reduced risk of type 2 diabetes mellitus. This is mainly due to the fact that whole grains like millet are a rich source of magnesium, which acts as a co-factor in a number of enzymatic reactions in the body, regulating the secretion of glucose and insulin. Magnesium is also beneficial in reducing the frequency of migraine attacks. It is even very useful for people who are suffering from atherosclerosis and diabetic heart disease.

Value chain of Millet for the indigenous production of fura



The existing value chain of millet for the agro-processing of fura is very simple with the use of indigenous processing methods to obtain small to medium scale production levels that gives low productivity, small margins of profit, simple revenue streams.

Value chain of Millet for the proposed technology infused production of fura



The technology intervention along the value chain of fura takes care of almost all the proposition of consumers from 'farm to fork' if all actors were to comply to value addition towards green growth. Farmers will harvest towards increase premium of raw material, vendors can pre-processing to obtain cleaner raw material for increase margin, transformers can introduce starter culture controlled fermentation to reduce processing time, energy input, safe and hygienic, well packaged value added product proposed by consumers for increase price through different revenue streams. The consumer will have his/her proposed fura available, convenient and safe. The technology intervention will help families a lot since all processors engaged in both the indigenous way of processing and the potential large scale way of processing are women.

The following summarizes the structure of the millet value-chain in some parts of West Africa and is adopted from the USAID study (Mamadou 2010):

- Value chain actors have limited market incentives—generally as a result of governments' inadequate policies control of input markets and food aid programs—to invest in commercial millet production, large scale processing, and supply chain management practices.
- Growth in millet processed products, although currently a small percentage of total consumption or sales of millet has the greatest potential to transform the value chain and infuse inter-relations between actors with incentives for long-term, win-win cooperation.
- Unstable policy environment, notably the unofficial restrictions on cross-border trade in cereals that are a component of governments' policies of self-sufficiency in food security items, prevents a more efficient and vibrant flow of information and cereals between surplus and deficit areas as they occur across the West Africa region.
- Weak organizational capacity among producers and other value chain actors limits the potential for improving trade relationships beyond being based on price-based, bulk sales to more transparent, cooperative long-term trade relations.
- High transport and logistics costs due to corruption and roadway checkpoint delays.

The millet which is the basis for staple food in rural households in most West African countries can be a viable alternative to rice wheat and sorghum for urban consumers. But a number of constraints limits its competitiveness and impede the development of millet value chains. Like most semi-developed value chains, millet exhibit weak processing and packing activities while market is beset by large seasonal price variations that can be daunting and imputable to large variations in supply, quality availability and lack of storage. However, there is ample room for improving marketing using new information technologies.

Conclusion and policy recommendations

Millet is one of the most critically important food security crops in Africa. Ghana consumption rate is 117,955 MT (5years average) the fifteenth in the world. The crop can grow well in the areas with less than 350mm annual rainfall & with temperatures 25 to 35 degree Celsius, as stated by Pranati Das, (2015). The crop adaptability to light soils and lower rainfall make them highly suitable when other crops

are not feasible. Millet can act as the primary food source envisaged for food security. The study shows clearly that there is the need to infuse technology along the value chain of millet to better productivity, improve profit, and introduce safe, healthy processing methods to obtain the desired well augmented packed proposed fura. Since all processors are female gender advocacy will be necessary. Yet owing to policy neglect (much of it due to bias toward commodities for exports or toward urban consumer's needs) such as maize and rice and the resulting lack of incentives by actors in the value chain, but millet crops are typically grown with little or no inputs and so produce low yields, compounded by lower fertility soils. Consequently, these crops remain largely subsistence crops with limited surplus to market and lower market penetration compared to maize or rice. Some of the key constraints along the value chain pointed to specific recommendations to rebuild this critical staple food value chains.

A coherent millet policy and investment programme must target the following priorities:

- (i) Create the required market, price and credit incentives needed to increase adoption of improved technologies by farmers to improve yields and premium grains for agro-industry;
- (ii) Promote higher marketable surplus by subsidizing investments in producer-run storage facilities to improve marketing and introduce supply and price risk-management schemes;
- (iii) Provide subsidized credit and investments for small- and medium-sized agro-processing units through public-private partnerships in agro-processing mills (which use millet in animal feed, as well as processed and semi-processed food and beverage products);
- (iv) Encourage demand for millet food products by strengthening food quality control measures and supporting improved quality packaging through subsidized investments;
- (v) Support the emergence of strong and market-oriented producer organizations for millet by funding training and capacity building based on need, and by subsidizing investments in storage and encouraging public-private partnerships involving producer organizations, finance institutions, and agro-processors.

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