


PACF

Pan African
Competitiveness
Forum

PROCEEDINGS



**2ND ANNUAL CONFERENCE
OF THE PAN-AFRICAN
COMPETITIVENESS FORUM**

**THEME: Cluster Initiative for African
Economic Development and Sustainability**

15-17 FEBRUARY 2010, ELMINA BEACH HOTEL, GHANA

EDITED BY: ESSEGBEY G.O. KARBO N, & MOHAMMED K.S.



Sida

THE ROLE OF TECHNOLOGY IN ENHANCING COMPETITIVENESS OF LOCAL ENTERPRISES

Wilhemina Quaye and Steven Nketia

ABSTRACT

The Food Research institute (FRI) is mandated by the government of Ghana to conduct applied research, through laboratory and pilot scale investigations, into problems of food processing and preservation, storage, marketing, distribution and utilization in order to assist the local industries to improve on and diversify their operations. Food Research institute has developed a number of food technologies including high quality cassava flour for industrial purposes, weaning foods to combat malnutrition among children, mushroom products and chorkor smoker for fish processing among others. Through training of trainers approach, Food Research has been able to transfer its improved technologies to micro, small and medium scale enterprises and thereby assist in building cluster based initiatives. This paper elaborates on the role of technology in enhancing competitiveness of local enterprises drawing on the experiences of the Food Research Institute and impact on the Ghanaian food industry.

INTRODUCTION

Technology advancement is the key to enhanced competitiveness and sustained growth of local enterprises. It has been established that an important element in improving competitiveness is building domestic capabilities through technological advancement (Richard 2002, Beyene 2002). Competitiveness has been the subject of a number of recent annual reports: UNCTAD's World Investment Report (WIR) 2002, UNIDO's Industrial Development Report 2002/2003, and the Global Competitiveness Reports 1979-2002, published by the World Economic Forum. The World Investment Report 2002 states: "If developing countries are to strengthen competitiveness, they will have to strengthen their capabilities, attract and stimulate activities suited to their endowments (or lack of) and upgrade them over time through technological advancement." Technology is necessary for sharpening competitiveness of local enterprises and strengthening productive capacity, particularly that of small- and medium-sized enterprises (SMEs).

Three stages of competitiveness have been established in the literature namely, catching up, keep up and getting ahead. When countries are catching up, improved technology is needed for problem-solving capabilities that enable firms to improve their productivity and to imitate and adapt products; when countries are keeping up, technological upgrading within the firm and continuous improvements in product quality become crucial in order not to lose recently gained competitive advantages. Finally, when countries are getting ahead, the capability to design and develop new products and processes becomes vital, on the basis of both R&D and continuous innovation efforts. Most developing countries including Ghana are at the catching up stage of competitiveness and therefore technology becomes crucial. The ability to acquire, diffuse and master technologies as well as innovate can be achieved in many ways including clustering (geographic concentrations of interconnected companies or enterprises) and inter-firm cooperation or business linkages (Porter 2000). As reflected in the theme for the conference, cluster initiatives facilitate SMEs' access to mainstream international markets and improve on their networking capabilities and global positioning.

Cluster initiatives draw strengths from endogenous capabilities relating natural and social resource endowment of a particular country for its economic development. As inspired by Castells, the unfortunate thing that should happen to any country or region or individual is to be declared irrelevant in the global marketplace. Comparatively, every country is uniquely endowed with some natural and social resources that need to be tapped through endogenous mechanisms. Cluster initiatives enhance competitiveness of enterprises through deepening and broadening of design, quality control and information related to markets and marketing, and the establishment of linkages to a wider set of technology inputs and actors. Cluster development initiative aims to unite cluster participants into a single platform to design and implement joint actions, create new business opportunities, reduce risk of doing business and capacity building of the enterprises. According to World Bank Report (2009), cluster initiatives are guided with Competitive Reinforcement Plan formulated by local actors. This plan concretely specifies implementation strategies and appropriate actions (projects) that will drive the cluster initiative forward. There are various cluster actors including textiles and garments, wood industry, handicrafts, food processors and technology transfer organization among others in Ghana.

This paper particularly elaborates on the role of technology in enhancing competitiveness of local enterprises drawing on the experiences of the Food Research Institute (FRI) and impact on the Ghanaian food industry. The Food Research Institute assists in creation of opportunities for generating and increasing incomes within the micro, small, medium and large-scale food industry. By applied research, the institute has contributed to the nation's food security, foreign exchange earnings from food exports, and application of cost-effective food processing technologies for improved livelihoods and economic development of the country. Experiences shared relate to both cluster initiatives of interconnected micro, small and medium scale enterprises and business linkages with appropriate support services.

Experiences

The Food Research Institute is one of the leading technology development and transfer institutions in Ghana. Its research and development activities involve comprehensive needs assessment, developing tailor-made technologies, pilot scale testing with potential endusers and scaling up through aggressive technology transfer to individual food processors, cluster SMEs, and industries. FRI renders Analytical and Technical Service Support to the food industry and actively involved in entrepreneurial capacity development, cluster initiatives and building business linkages. The Institute Expertise and facilitates are used by budding enterprises in product development, equipment identification and selection. Technologies are developed through effective needs assessments along the food value chain and aim at supporting SMEs organizational, production, processing and business management capacities. Food processing technologies developed by the Institute have been transferred to local entrepreneurs through training and capacity development. Over the years trainings have been conducted in microbiological safety and quality control, training of local entrepreneurs in food product development and food processing. Using training of trainers approach, a number of potential local entrepreneurs have been trained in technologies developed by the institute as presented in Table 1.

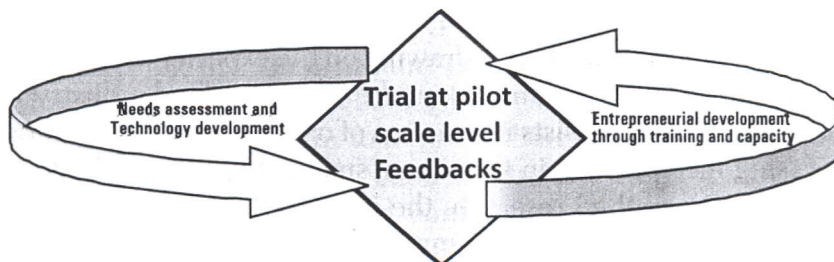


Figure II: Entrepreneurial support through training

Local enterprises improve their competitiveness through technology adoption and in turn give feedbacks for continuous improvement and technological advancement. Below are some of the institute's experiences with food product development and technology transfer, training in food processing, design and construction of food processing equipment and analytical services to the food industry.

Food Product Development and technology transfer

Appropriate technologies have been developed for the production of convenient and shelf-stable foods for both local and domestic markets. These include root and tuber based products such as *fortified gari*, *improved kokonte flour*, *agbelima flour*, and *fufu powders* (yam, plantain and cocoyam). Cereal based convenience foods such as



dehydrated fermented maize meal, high-protein infant weaning foods, composite flours and high legume flours have also been developed. The Food Research Institute has transferred improved food product technologies to a number of local entrepreneurs including Elsa Foods, Praise Export Services, Neat Foods, Gracem Enterprises, Darkrubby Enterprise and Ebenut.

On cluster initiatives, **currently the Food Research Institute is developing incubator centers for training industries into food exports.** The Institute has started some form of Agro Processing Technology Incubation where entrepreneurs are nurtured. SMEs operating in a particular subsector industry are brought together for training on a common platform, exchanging ideas and solving common problems. For example, FRI organizes training for members of mushroom association of Ghana, creating opportunities for cluster operations and improvement in market competitiveness. **In collaboration with GTZ, FRI is extending fruit processing technologies to selected industries. Fruits are processed and packaged for export into the European Markets. Solar and gas-fired cabinet dryers have been constructed for drying of fruits for the export and local market. Entrepreneurs have been trained in fruit and vegetable processing and processing of spices mainly for export.**

Training in high quality cassava flour and Glucose Syrup from Cassava
Food Research Institute has trained Amasa Agro Processing Company, Rodemends Company Ltd producing High Quality Cassava Flour (HQCF) for use by Western Veneer and Lumber Company Ltd in Takoradi, Oti Saw Mills in Sunyani as import substitute. Afrimat is producing the glucose syrup for long Life Confectionary for manufacture of biscuits and sweets. With new products like HQCF, entrepreneurial training package also include business development services specifically aimed at helping small enterprises to overcome market imperfections and lack of competitiveness. Currently there is an on-going project on sustainable and equitable High Quality Cassava Flour value chain in Ghana aimed at improving the livelihoods and incomes of small holder households and stakeholders in micro, small and medium scale enterprises. Smallholder farmers who produce cassava grit are linked to intermediary processors for HQCF production. These intermediary processors are then linked up with plywood, food processing and bakery industries in Ghana by 2011. This project aims at reaching 20,000 smallholder farmers, each producing 0.8 tons of cassava grit annually. In addition, intermediary SMEs will be profitably processing cassava grit into HQCF for plywood, food processing and bakery industries.

Training in Mushroom Cultivation

The Institute has been involved in training and extension activities for the general public, entrepreneurs and individuals on mushroom cultivation and spawn production. Training programmes are conducted at the Institute Pilot Plant to promote the mushroom technology and its consumption in Ghana. Most of the trainees have established small-scale mushroom farming units with spawn provided by the Institute. On-site training programmes have also been conducted for participants in



the Volta, Ashanti, Eastern and Central Regions of Ghana. The Institute has assisted the Christian Rural Aid Network (CRAN) to set up a compost bag unit at Woete in the Volta region. A training programme was organized for personnel of the Mushroom Production and Biodiversity Training Centre (KUM-BIT), Kumasi, on spawn multiplication techniques. Mycelium bank for mushroom production in Ghana has also been established. Spawns for mushroom cultivation are on sale to potential SMEs.

Training in fish processing

Food Research Institute has developed an improved fish smoking equipment (chorkor Smoker) which is currently being used in almost all fishing communities in Ghana. Chorkor smoker technology seeks to improve on the efficiency and effectiveness of fish smoking as well as alleviating health hazards associated with smoking. FRI in collaboration with Women in Agricultural Development, Ghana (WIAD) has trained a lot of women groups in improved fish processing technology.

Design and Construction of Food Processing Equipment

The Engineering Department of FRI has designed and constructed high performance hot air dryers, flour sifters, cassava graters, hammer mills,



and other food processing equipment that have helped various local food processing industries to establish their businesses while saving on imported alternatives to these equipments. FRI food processing equipments are used to produce High quality

convenience foods from root & tuber crops such as cassava, cocoyam, plantain and yam. FRI has Pilot plant facilities for training and upgrading the performance and competitiveness of SMEs in both local and international markets.

Analytical Services

The chemistry and microbiology departments of the Food Research Institute provide accredited services as support to the local food industry to be internationally competitive. FRI offers professional advice on the establishment of food microbiology laboratories including choice of appropriate equipment, planning of analytical programmes and personnel training.

Challenges

As a government organization, the Food Research Institute faces a number of challenges. Some of these challenges are bulleted below;

- Dwindling donor funding for research
- Inadequate financial support for Research and Development by national government
- Lack of financial support for awareness creation on improved technological opportunities
- Lack of societal and institutional linkages connecting technology with development
- Weak partnership with private sector; low capacity of local service providers
- Lack of venture capital for local food industry for technology acquisition; For "High-tech" SMEs, the most important goals are to

promote the development of the private venture capital for R&D uptake (OECD 2000)

- Inadequate local expertise for maintenance of high-level analytical equipment
- Lack of *incentives and institutional frameworks for improving collaborations within networks and clusters*

Table 1: Some Technologies developed by Food Research Institute

Technology	Description
Root and Tuber Based Convenience	Use of mechanical chipping/grating techniques fermentation, roasting/solar and mechanical drying to produce high quality convenience foods from root & tuber crops. Improved Gari, Kokonte, Agbelima, Fufu Powder - Yam, Cocoyam, Plantain
Saccharification of Starch	Saccharification of Starch for the manufacture of biscuits, confectionery and other food products. It is mainly used by Small-Scale Businesses; Import substitute for industrial use
High Quality Cassava Flour	Use of mechanical chipping / grating techniques fermentation, roasting/solar and mechanical drying to produce High Quality Cassava Flour. Import substitution. For bakery products, Plywood and Paperboard glue
Cereals/Legume based convenience Foods	i. Fermented Maize Meal Technology ii. High-protein Infant Weaning Food. From Local Materials (FRI-Weaner) iii. Composite Flour High Quality Legume Flours
Walk-In Hot Air Cabinet Dryer	The walk-in hot air cabinet dryer is available in four sizes 56-trays, 84-trays, 100-trays and 140-trays. The dryer uses electrical energy as its source of fuel and has automatic temperature control system and a 24-hour timer to predetermine period of operation.

Snail Meat Preservation	Technology describes a more hygienic, appropriate and low-cost method for the preparation, spicing and solar dehydration snail meat. A second technology developed involved spice extraction and snail meat preparation for the coming of snail meat in brine. For snail meat preservation (solar dehydrated and caned) to offset scarcity of the product during the dry season when snails are scarce.
Chorkor smoker	An improved traditional fish smoking oven designed to make fish smoking very convenient; has a high capacity; smokes fish faster using less fuel and produces good quality smoked fish; adaptable to all species of fish and easy to construct.
Processed Fruits	<ol style="list-style-type: none">i. Desiccated Coconutsii. Bottled Fruit Juices, Drinks & Syrupsiii. Jams, Marmalades & Preserves <p>Thermal Processing for shelf-life extension. For export development and import substitution.</p>
Starter Culture for Food Fermentation	Introduction of some economic micro-organisms to some foods to change their taste, flavour, texture etc. and also to prolong their shelf life. Export / Value addition to traditional Foods
Mushroom Cultivation	Cultivation of different kinds of mushroom, spawn production, Mycelium bank creation
Food Processing Equipment	<ol style="list-style-type: none">i. Dawadawa Dehullerii. Grain Cleanersiii. Sifters
Rice Parboiler	An improved parboiling Vessel which greatly reduces drudgery and also saves energy

Socio-Economic Impacts of Specific FRI Technologies and Programmes on the National Economy

TECHNOLOGY	SOCIO-ECONOMIC IMPACT
<p>Improved Fish Smoking Equipment (Chorkor smoker)</p>	<p>Currently, after dissemination of the technology, the Chorkor Smoker can be found in at least 150 fishing villages in Ghana where its application has helped to reduce postharvest losses significantly. Socio economic and technological evaluation of the Chorkor Smoker has shown that it is much more efficient in terms of capacity and processing time per batch, fuel requirement, labour requirement and quality of finished product. Comparatively low production cost and the higher prices attracted by the product have contributed about 30 percent higher incomes for more than 1500 fish processors in various parts of Ghana. In addition, the adoption of the Chorkor Smoker technology has contributed significantly to increased availability of processed fish, which serves as a major source (70 percent) of animal protein in Ghana. To have a multiple effect of impact of this improved technology on the fishery sub-sector, FRI has collaborated with Women in Agricultural Development, MOFA; the Fisheries Department, MOFA; the University of Ghana, and the National Council on Women and Development for the past 10 - 15 years to train 200 Fisheries Extension officers from Ghana, The Gambia, Kenya, Uganda, Ethiopia, Eritrea, Tanzania, Zambia, Lesotho, Nigeria and Sierra Leone in the design, construction and application of the technology.</p>
<p>Convenient Foods Based On Local Raw Materials</p>	<p>The FRI has developed fufu flours from cassava, plantain, cocoyam and yam, which it produces on a pilot scale, targeting private entrepreneurs to pick the technology. Other flours include: cowpea flour with recipe manual, bambara flour, composite flours, and dehydrated fermented maize meal (an intermediate maize product for preparing porridge, Kenkey and other important maize based staple dishes). These technologies have been transferred to local entrepreneurs such as:</p> <ol style="list-style-type: none"> a. ELSA FOODS Ltd. The company now processes a number of convenience foods including fufu

	<p>flours, fermented maize meal, weaning foods, etc. for local and export markets.</p> <p>b. EBENUT Ltd benefited from processing technology for desiccated coconut for baked products and other flour confectionery.</p> <p>c. DODO FOODS had technologies transferred for the production of weaning and other high protein foods using locally produced cereals and legumes. COUNTRY FOODS benefited from technologies for the production of dehydrated foods. The company is yet to start production.</p>
<p>Development and Transfer of Food Processing Machinery for Small-Scale Enterprises</p>	<p>Appropriate food processing machinery has been developed and transferred to various enterprises for small-scale food processing. Some of the beneficiary companies are:</p> <p>a. ELSAFOODS Ltd. - Hot air Food drier for the dehydration of various convenience foods</p> <p>b. EBENUT Ltd. - Stainless steel grater and Hot air drier for production of desiccated coconut.</p> <p>c. UNIFEM - Hot air drier processing of root and tuber crops to a Women's group in Cameroon under UNIFEM programme.</p> <p>d. BAMAF INDUSTRIES - Hot air drier for dehydration of spices and mushroom.</p> <p>FLOKANFOODS - Drier for spices</p>
<p>Analytical Services to Industry</p>	<p>A regular and consistent provision of good quality analytical service and advice to industry by the Institute has helped several industries to monitor the quality of their products and guarantee a product of consistent quality to consumers thereby sustaining their business. So far over 90 industries, enterprises etc benefit from our regular analytical services.</p>

<p>Mycotoxin Research</p>	<p>Aflatoxin impact – Health Through the screening of raw and processed foods at the Food Research Institute, data was generated on mycotoxin levels in Ghanaian foods. This study has had a great impact on the Health and Trade sectors of the economy. As a result of the findings, Rotary International carried out a sub-regional awareness campaign programme to sensitise people on the risks of consuming aflatoxin contaminated foods. Over the three years (1999 –2001) that the programme was conducted, about 10 million people in Ghana, Togo and Benin were sensitised and are now aware of the dangers of aflatoxin contaminated foods.</p> <p>Aflatoxin impact - Trade Currently the FRI mycotoxin Laboratory is the only one in the country offering aflatoxin analytical services to exporters of agricultural commodities especially peanuts to the European Union member states. It occasionally serves exporters from neighbouring countries such as Togo and La Cote d'Ivoire. Within the period 2000 – 2003, 513 samples have been analysed for exporters and industrialists, poultry farmers etc.</p>
<p>Glucose Syrup from cassava</p>	<p>The Institute has adapted and fine-tuned a technology for the production of glucose syrup (high maltose syrup) from the High Quality Cassava Flour for use in the manufacture of biscuits, confectionery, soft drinks, frozen fruits and other food products and in the pharmaceutical industry. Hitherto, no industry in Ghana was producing glucose syrup. Meanwhile over 100,000 metric tons of glucose syrup is imported annually into the country for use in various industries. Through the efforts of the Institute four companies are now producing glucose syrup. This is saving the country a huge amount of foreign exchange. Some other benefits include improvement in income levels, employment creation, efficient use of our natural resources, and easy access to an industrial raw material.</p>
<p>Pineapple Research Programme</p>	<p>With the able leadership of FRI scientists, a multidisciplinary team of agricultural researchers, working under the National Agricultural Research Project, assisted pineapple farmers/exporters in Ghana to make a break through in improved cultivation and post-harvest practices aimed at producing a crop, which is competitive in quality and cost and meets export market</p>

	<p>requirements. Pineapple production per annum rose from 9,800 metric tones in 1992 to 25,000 metric tones in 1996. As a non-traditional export commodity, pineapples earned a total of US\$5,629,761.85 in 1995. The current success of pineapple export as an income earner to the Country owes a lot to the efforts of the FRI.</p>
<p>Alleviation of Iodine Deficiency Disorders in Ghana (IDD)</p>	<p>A nationwide survey estimated that 33% of the then 110 Districts of Ghana had serious IDD problems. Traces of the problem were also detected in 67% of the remaining Districts. Severe iodine deficiency places children at the risk of cretinism, stunted growth, idiocy and goitre. In pregnant women, severe IDD causes spontaneous abortion and still births. As a collaborating institution under the National Salt Iodation Programme, the FRI was charged with the training of salt producers in Ghana. A total of 70 staff from 44 salt producers (some representing associations) were trained by FRI in iodation of salt. Today, iodated salt is consumed all over the country and the FRI under its Salt Iodation Programme continues to train salt [producers at the village level. It is hoped that in a few years the problem of IDDs will be eliminated in Ghana.</p>
<p>Soybean Utilization for Good Health</p>	<p>Soybean cultivation in Ghana started a few years back when the Ministry of Food and Agriculture initiated a programme to promote it as a priority crop both for household consumption and as an industrial crop because of its very good nutrient content.</p> <p>A. RECIPES</p> <p>In a collaborative work with the Women in Agricultural Development (WIAD) and the Crop Services Department of MOFA, a number of recipes were developed by FRI for the utilization of soybean in various dishes. Some of this information was used to prepare an extension manual which is currently used by the Front Line Staff of MOFA in their extension work.</p> <p>b. Improved Health for Farming Communities</p> <p>A pilot project targeted 50 households in two farming communities at Asutsuare and Korle-Manchie, where soybean cultivation had been integrated into their farming activities. Various recipes were introduced to the communities and the following impact was observed:</p> <ul style="list-style-type: none"> • Improved health and nutritional status with significant reduction in the incidence of nutrition – related diseases; • Improved productivity as more healthy hands are available for farming and other productive activities;

	Infant food formulations introduced by the project have contributed to import substitution.
Mushroom Cultivation for Income-generation and Improved Diets	The Mushroom Project organizes training workshops on Cultivation of edible mushrooms. So far about 4,500 farmers, extension officers, church groups, NGOs and the general public have been trained. The long-term objective of the project is to introduce techniques for the cultivation and processing of local and exotic mushrooms for domestic and export markets. Fresh and dried mushrooms are currently sold in major supermarkets and open-air grocery outlets in Accra. To mobilize producers for the enhancement of their operations for the export market, a National Mushroom Growers Association has been formed with FRI staff as key players. About 35 growers produced 25 Metric Tonnes of mushroom worth ₵10 million in 1997 and every year the figure increases significantly.

REFERENCES

- Beyene Asmelash (2002)** Enhancing the competitiveness and Productivity of small and medium scale enterprises(SMEs) in Africa. An Analysis of differential Roles of National Governments through Improved Support Services. *Africa Development*, 27(3):130-156
- OECD (2000)** Conference for ministers responsible for SMEs and industry Ministers. Bologna, Italy, 14-15 June, 2000.
- Porter ME (2000)** Location, Competition, and Economic Development:Local Clusters in a global economy. *Economic Development Quarterly*, 14(1):15-34
- Richard, F. (2002):** "The UNIDO Industrial Development Scoreboard", UN Commission on Science and Technology: Panel on Indicators of Technology Development, UNCTAD. "Clusters For Competitiveness: A Practical Guide & Policy Implications for Developing Cluster Initiatives" International Trade Department." World Bank. 2009.
- UNCTAD (2002):** World Investment Report 2002: Transnational Corporations and Export Competitiveness, United Nations publication, sales no. E.02.II.D.4, New York and Geneva
- UNIDO (2002):** Industrial Development Report 2002/2003, Vienna: UNIDO.