Education and Training in Food Science and Technology to Enhance Food Security in Developing Nations

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Introduction

The population of Sub-Saharan Africa has been growing at an average annual rate of 2.7% in 2013 (World Bank, 2013), compared to 0.7% in 2013 for the USA (World Bank, 2015). In 2014, the populations of Nigeria and Niger grew at annual rates of 2.8% and 3.9%, respectively (World Bank, 2015). At the same time, the economies of many African nations have been growing at an annualized rate approaching 4% and urbanization and life expectancy have also been increasing.

These trends have created new pressures, especially for achieving food security, fuelling the need for a more productive, diversified and competitive agri-food sector.

A three-week assignment in Malawi in 2008 provided insight into the challenges routinely being faced by those in the agri-food sector. These include; inadequate education and training, poorly developed local technologies, and an insufficiently trained workforce without the requisite skills in the complexities of modern food processing systems.

Agri-food processors often have a lack of expertise in product development, which may limit their ability to diversify their businesses. Insufficient resources and outdated or unsuitable equipment limit capability to produce quality products in an effective and cost-efficient manner. A poor understanding of process operations can also lead to cases where inappropriate equipment or procedures are used (Mercer, 2009). Similar observations were made during a needs assessment conducted in 2010 to identify opportunities for curriculum redevelopment at Kihonda College in Morogoro, Tanzania (Mercer et al., 2010). In this feature article, Nigeria is used as the basis for illustrating typical situations, as well as trends and actions being taken to address them.

Nigerian Food Industry

Most large-scale food industries in Nigeria are located in the major commercial centres of Ogun State, Lagos, Abuja, Ibadan and Port Harcourt, etc. The companies and the major products manufactured are listed in Table 1.

Table 1: Major food companies in Nigeria and their main products

Company	Main Products
Nestlé Nigeria PLC	Milo, Maggi, Nestlé water, etc.
Cadbury	Bournvita, Tom-Tom, chocolate drinks, etc.
UAC Foods	Ice cream, baked snack products, cookies, etc.
Leventis Nigeria PLC	Bread, snacks, cookies, etc.
Nigeria Breweries PLC	Beer, malt drinks, energy drinks, etc.
Nigeria Bottling Company PLC	Coca Cola, Sprite, Fanta, etc.
Guinness Nigeria PLC	Beer, malt drinks, energy drinks, etc.
Flour Mills of Nigeria	Wheat flour, semolina, sugar, etc.
Dangote Flour Mills PLC	Wheat flour, semolina
Dangote Foods	Juice products, sugar, salt, etc.

Personnel generally receive their training through part-time studies at universities or polytechnics. Most rely on consultants to do in-house training which is organised through their human resources departments and often focussed on senior staff, rather than targeting staff across all aspects of their operation. Only one-quarter of Nigerian food-processing companies provide on-site worker training. This creates a void in the training of workers who cannot afford or access training beyond the very basics required to perform their specific tasks.

Presently there are more graduates of Food Science and Technology programmes in Nigeria, than the food industry is hiring. Many skilled individuals are consequently moving into non-food areas such as banking. With the increasing trend towards automation in the industry, graduate numbers are declining. More casual workers who are non-graduates are being employed and are paid lower wages.

IUFoST Food Science and Safety Professional Development

The International Union of Food Science and Technology (IUFoST) has called upon food scientists internationally to contribute to an on-line knowledge resource centre. Three primary thrust areas have been identified: (1) Food Security, (2) Food Safety, and (3) Education and Training including two active areas which are under development: (1) Core Curriculum in food science and technology and (2) Distance Education. More

information on each of the programmes can be found on the IUFoST website (www.iufost.org/Education-Training (click on Distance Education)).

Institutions that offer food science and technology courses for academic credit
Every five years, since 2003, IUFoST has conducted a survey of academic departments and adhering bodies (i.e., national food science and technology organizations) to identify courses offered by accredited institutions for academic credit. The results can be seen here http://iufost.org/survey-results. Some courses award a certificate or academic degree associated with successful completion of a prescribed curriculum. Most BSc programmes in Food Science and/or Technology presented at the universities in sub-Saharan Africa surveyed meet IFT (US Institute of Food Technologists) or IUFoST guidelines (Minnaar et al., 2013). However, such programmes at universities in urban centres do not necessarily address the needs of those currently employed in the food industry for a number of reasons.

Continuing education
In 2002 IUFoST identified the development of a training programme for food industry workers in Sub-Saharan Africa (SSA) as a major initiative. Although initially targeted to SSA, it is not location-specific and the contents of each module can be tailored to accommodate the specific needs of different regions.

IUFoST training courses are designed to enhance the basic skills of food industry workers through a comprehensive series of distance-assisted courses, covering the fundamentals in:

- Food Safety
- Quality Assurance (including HACCP)
- Food Law and Regulations
- Shelf-life of Foods (including losses)
- Thermal Processing
- Food Dehydration and Drying
- Food Freezing
- Food Chilling
- Food Packaging
- Practical Nutrition
- Minimally Processed Foods

Food science experts mentor small numbers of participants from local food industries using instructional material made available through the IUFoST website. For many of the subject areas, training material is available at the introductory, intermediate and

advanced levels. The main objective is to enhance the level of understanding of food processing or production.

Traditional university courses use a “Knowledge-Based Education and Training” (KBET) approach. The main thrust is structured learning using core textbooks that stress theoretical principles and what might be considered as being intellectual activities designed to promote critical and independent thought. This is more appropriate than using a “Competency-Based Education and Training” approach. Participants are assessed on their ability to apply the basic concepts to their everyday lives and working environment. Cause-and-effect relationships are emphasized to illustrate the results of various actions on the product leaving a process.

The first pilot courses began in 2009 and dealt with food dehydration and drying at both the introductory and intermediate levels (Mercer and Lund, 2011). The alpha test of the materials was conducted in Ethiopia, Kenya, Nigeria, South Africa and Mauritius with ten participants and seven mentors. Later, it expanded to include Nigeria, with a number of mentors from other countries indicating an interest in participation. Preparation of the material recognised that many food industry workers have not completed high school and that most are unable to attend college because of a need to remain in full-time employment. A survey of Food Science and Technology curricula in African universities indicates that there is insufficient non-degree extension training, and nutrition education is significantly lacking (Minnaar et al., 2013).

In Nigeria, approximately 70% of the participants are female. About 60% hold a B.Sc. degree or a Higher National Diploma, 30% have an Ordinary National Diploma, and the remaining 10% are secondary-school graduates: around 50% have some form of industrial experience. There is a particular focus on female entrepreneurs. An emphasis on developing self-confidence, negotiation and marketing techniques through ‘learning by doing’ has proven very effective in developing female entrepreneurs in the Tanzanian food industry (Spiess et al., 2013).

These numbers are interesting. The original intent of the IUFoST programme was to provide basic training to entry-level workers. However, individuals with university degrees are taking these courses to enhance their employability potential. “Food Safety” is currently the most popular topic.

Most participants in the Introductory Dehydration and Drying Module felt that the instructional information was excellent and that the assignments were very clear. One attribute of the training module that stood out was the appropriateness of the level at which the assignments were directed. Most importantly, all participants considered that

the information presented was very useful to them. They also valued the inputs of the mentors as they progressed through the course modules.

Although IUFoST does not offer courses for academic credit, a “Certificate of Completion” is presented to those who complete the training modules (see Figure 1). While the number of participants in the training modules offered to date was small, the success of the pilot offerings is encouraging. This has strengthened the resolve of IUFoST to offer similar course on a worldwide scale to anyone seeking education and training support for food industry workers.

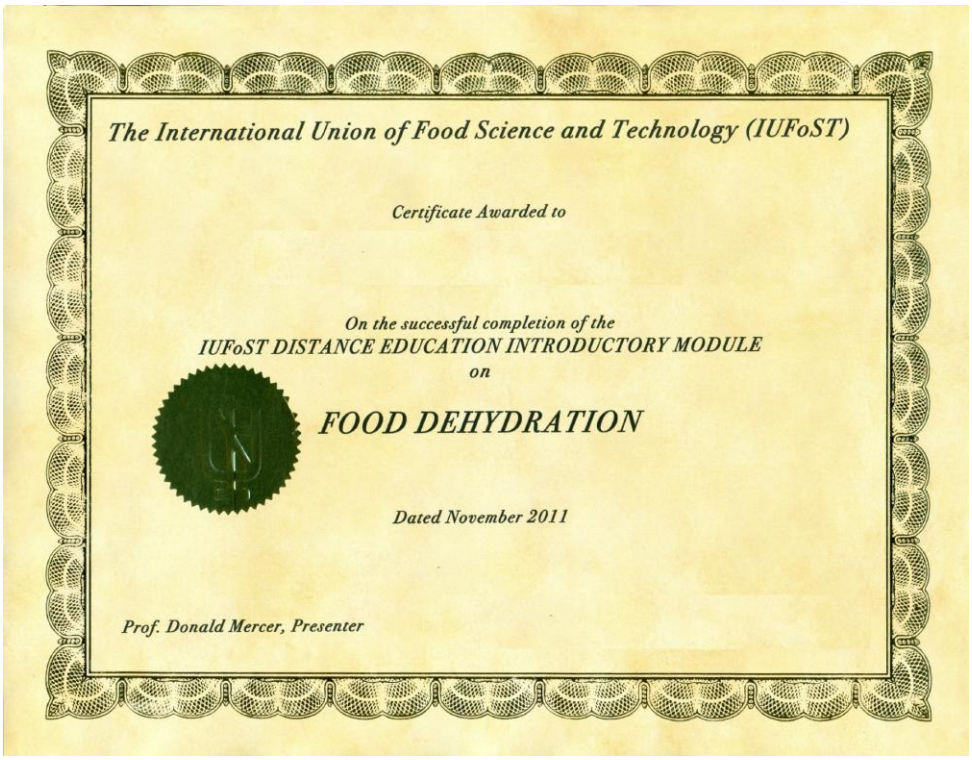

Figure 1: Certificate of Completion from an early pilot course offering.

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