

Enhancing Human Capital in sub-Saharan Africa in Food Science and Technology through Distance Education

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**A proposal of the International Union of Food Science and Technology
(IUFoST)**

I. INTRODUCTION

The International Union of Food Science and Technology (IUFoST) is committed to alleviating hunger throughout the world. To that end, it has dedicated its energy to provide well-trained workers for the value-added food processing sector. In most societies, on-the-job training is accomplished through seminars and workshops for the professionals employed in these industries. However, for laborers and middle management employees in these industries in developing economies, opportunities for professional training are less readily available. To overcome this shortfall in training opportunities, Dr. Walter Spiess, President of IUFoST 2000-2003, appointed a Task Force to investigate the feasibility of using electronically-assisted distance education to fill the professional training gap in developing economies. Furthermore, because of the shortfall of food availability in Sub-Saharan Africa (SSA), SSA was chosen as the focal point of the evaluation.

This proposal describes (1) the process of evaluating the need for professional training as a contribution to the solution of food availability in SSA, (2) the potential of using electronically-assisted distance education to enhance the qualifications and availability of professionals for the value-added food processing industry in SSA, (3) the selection and development of appropriate learning modules to meet the training needs for the region, and (4) the implementation plans for the project.

II. CHALLENGE

A. CURRENT SITUATION IN SUB-SAHARAN AFRICA

According to a recent analysis of the population and food demand in SSA by the International Food Policy Research Institute (Pinstrup-Andersen et al., 1997), the population of SSA will increase by more than 80% between 1995 and 2020, an absolute population increase of about 425 million people. Obviously such a significant increase in population will require a concomitant increase in food supply. Pinstrup-Andersen et al. (1999) estimated that from 1995 to 2020 SSA would, for example, require an additional 73.1 million metric tons of cereals and 5.75 million metric tons of meat products. These estimates are based not only on the increase in population but also on the fact that there is currently a per capita food supply deficit in the region for both cereals and meat products. Furthermore, they estimated that increases in cereal production in the region will increase by an average of 2.9% per year between 1995 and 2020 through yield improvements (1.7% per year) and expansion of the growing area (1.2% per year). Although this is laudable, the growth in cereal production will not begin to meet the

demand. They estimated that by 2020 the number of malnourished children in SSA will increase from about 25 million in 1995 to about 32 million in 2020, an increase of over 28%.

Although the trend in the prevalence of malnourished children in SSA has decreased from 35% of children in 1970 to about 31% of children in 1995 (Smith and Haddad, 2000), it is clear that without other strategies to enhance the food supply, children and the general population in SSA will suffer major food shortages. Furthermore, Smith and Haddad (2000) estimated that food availability was a major determinant (contributing about 25%) in reducing child malnutrition between 1970 and 1995. Consequently, strategies to enhance food availability are critical to success in preventing malnutrition and fostering food security.

The food production and delivery chain is a complex intersection of several sectors of the economy. The farmer produces raw agricultural commodities. The commodities are purchased by food processors that in turn sell or distribute the product to wholesalers. The wholesalers market the products to retailers who sell the raw or modified agricultural products to consumers. Throughout this chain there are opportunities for product loss through spoilage and spillage. Although there are some studies currently underway to estimate the loss of food commodities and products in the food delivery system, the most definitive study thus far completed was undertaken by the United States National Academy of Sciences (1978). The study, "Post-harvest Food Losses in Developing Countries," reports on studies of food losses in several SSA countries. Losses in rice, maize, wheat, barley, millets, sorghum, legumes and non-grain staples, vegetables, and fruits range from 5 to 60% with most reported in the 15-25% range. Based on these data a reduction of even half these losses would increase food availability by at least 15%.

Obviously post harvest losses will be reduced if there is a value-added post harvest system in the country that properly stabilizes food for the food delivery system. Such a value-added sector is dependent on several factors including a dependable supply of raw agricultural commodities (whether indigenous or imported), an economy that supports investment in hardware and industry, a regulatory system that fosters a fair and competitive market structure, and a well-trained, educated work force. It is this last item, a well-trained and educated work force, which is addressed in this proposal.

B. A Well-Trained and Educated Work Force for the Food Industry

SSA represents a large area capable of producing a wide variety of agricultural commodities. A majority of the current food needs are produced locally with the remainder being imported. Much of the imported foods are fully processed and packaged when they arrive and are inserted immediately into the distribution and marketing systems. One obvious mechanism to enhance the local economy is to convert raw commodities into consumer ready products locally. This enhances the opportunity to process products to local tastes and customs, and to provide jobs leading to economic stability. Some of the products could be exported and this would also generate the much-needed foreign exchange and bring real development to the countries and the region. In this way the developing countries would be able to claim a share in global markets, thereby bringing prosperity to their people.

In many of these developing economies, the local food manufacturing industry is either owned locally or is part of an international company. In either case, employees familiar with food processing, preservation and packaging are required to deliver safe, nutritious, affordable, and tasty food products to the consumer.

Training the work force for the food processing industry in SSA is accomplished formally through secondary schools, vocational and trade schools, and colleges and universities. Generally, companies will have training opportunities for employees to advance their knowledge and skill levels. Within the 43 countries of SSA there are several universities that offer educational opportunities in food science and technology. Many of these universities are in countries where the primary language is French. Consequently professional development opportunities in these countries should be offered in French.

An analysis of the training needs in food security was undertaken in 1999 by the Southern African Development Community (SADC) (member countries Angola, Botswana, Lesotho, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, and Zimbabwe) (anon., 1999). The survey conducted by the Food Security Training Project (FSTP) examined several factors associated with training needs including sector analysis of the food system, level of skill, mode of training delivery, gender, source of training, duration of training, and cost of training.

Table 1 presents the results of the survey for training needs by sector of the food delivery system and location of jobs in the system (i.e. government, private industry, etc.). The results clearly show that all sectors of the food processing and delivery system require human capacity development. Interestingly, most respondents felt that there was the greatest need for additional training of personnel within the central government. Presumably this reflects the need to enhance the quality of food through regulation and the dominant role that central government plays in food delivery in food deficient countries. Not-for-profit agencies also required considerable work force development. The results of the survey indicated a strong preference for all types of informal training such as on-the-job, mentoring, and informal study tours for senior, mid and junior level employees. Formal training such as internal in-company/agency, non-residential, residential in-country, residential out-of-country, and distance learning was also preferred for all levels of employees. Distance learning was not generally preferred for junior level employees probably because of a lack of study skills and background knowledge. Generally modular programs were preferred for all levels of employees presumably because of less time away from the job. Finally, results indicated that a training budget was available to those responding from governmental agencies (65%), private sector industries (64%), and NGOs and other organizations (61%), and the organizations were willing to pay for training. A lack of suitable courses was cited as a constraint on training. The report summarized the conclusions for the Regional Food Security Training Program (RFSTP) and recommended that RFSTP should concentrate on (1) curriculum development and distribution of appropriate training materials, (2) small business operations in agricultural marketing, processing, storage and transportation, and (3) food safety and hygiene, especially for small businesses.

Table 1: Number of People Needing Training in Food Systems^a

<u>Sector</u>	<u>Market Regulation</u>	<u>Food Storage</u>	<u>Food Transport</u>	<u>Food Processing</u>	<u>Food Safety</u>	<u>Total</u>
Central Government	525	557	373	459	297	2211
Local Government	28	136	14	41	29	248
Private Industry	26	112	101	113	190	542
Not-for- Profit Agency	68	233	59	282	460	1102
Cooperative	10	8	4	16	9	47
Education or <u>Research</u>	<u>30</u>	<u>48</u>	<u>46</u>	<u>55</u>	<u>43</u>	<u>222</u>
Total	687	1094	597	966	1028	4372

^a SADC Training Needs Assessment 1999

To further document the need for training in the food processing sector, in September 2001, a meeting of academic and food industry leaders of SSA met in Durbin, SA to discuss the training, educational opportunities and needs in food science and technology in SSA. The group, the Eastern, Central and Southern Africa Association of Food Science and Technology (ECSAAFoST), identified distance education as a technology that could vastly improve the availability of trained personnel for the value-added food processing sector. They offered their support for an initiative by the International Union of Food Science and Technology (IUFoST) that would make a training program available for current and potential employees of the value-added food processing sector.

C. Previous Activity on Distance Education in Food Science and Technology

One of the first tasks of the IUFoST Distance Education Task Force was to conduct a world-wide survey of courses (for academic credit and continuing professional development) and curricula in food science and technology available via the web or other electronic delivery methods. Surveys were distributed to all adhering bodies of IUFoST, departments of food science and technology chairmen, and selected faculty known to have interest and activity in distance education. The results are accumulated and posted on the IUFoST website (<http://www.iufost.org/DistanceEducation.html>). In summary of those results, most of the available activity originates in the United States, consists of courses for academic credit, and is focused on introductory courses including food law. There are several universities or consortia of universities that offer an MS degree through distance education. Two universities that offer

continuing professional development courses are especially noteworthy. Kansas State University and the University of Guelph have extensive offerings covering the entire field of food science and technology. In addition the Institute of Food Technologists (US) has been developing several continuing professional development courses in food science and technology. IFT staff have some experience in offering these courses to employees of industry. Information derived from the survey will be very helpful in identifying individuals and institutions that can contribute to developing the modules.

The analysis of human capacity needs in SSA, the current status and availability of continuing professional development material via the web or CDROM, and the objective of IUFoST to foster a world in which food availability is a fundamental right of every human being led to this proposal for a distance education initiative in SSA. It has long been recognized that educational opportunities at tertiary institutions are limited and will be so for some time. This has resulted in enhanced use of distance education. Distance education allows us to bring education to the people, particularly those currently employed, that may not be able to take time to enter formal educational programs. Training-on-the-job has been suggested as one of the pillars leading to the industrialization of Europe after the Second World War. Today, the impact of training-on-the-job should be more significant with the development of Information Technology.

III. Objectives of this Distance Education Initiative

Based on the local assessment of needs in human capacity development for the food processing sector in SSA, this proposal has the following objectives:

1. Develop a consensus on the content of a training program in food science and technology using local SSA faculty and members of IUFoST;
1. Use the membership of the prestigious International Academy of Food Science and Technology as consultants in content identification, module development, and module delivery to participants;
2. Establish a consortium between experts in the subject matter and faculty at SSA universities to develop modules in the selected topics;
3. Develop modules in French and English in food science and technology leading to a training program;
4. Test the training program with current and future employees of the value-added food processing industry in three or four selected countries ;
5. Track the impact of the program by surveying the employers of those who participated in the program;
6. Institutionalize the IUFoST Training Program in Food Science and Technology.

IV. Plan

A. Design of the Training Program

A Task Force on Distance Education was charged to develop a plan to provide educational opportunities through distance education to SSA. The Task Force identified that a training program should consist of at least the following basic modules: (1) food safety, (2) quality assurance including Hazard Analysis and Critical Control Points (HACCP), (3) food laws and regulation, (4) shelf life of foods including food losses, (5) thermal processing, (6) food dehydration, (7) food freezing, and (8) food packaging. The subject areas indicated here are key priority areas and therefore are designed to form the core of the project. The aspects that can be captured here are *“food safety and quality”* and *“reduction of food loss and improved shelf life”*. There is no doubt that these topics are of paramount importance, not only to the developing world, but also internationally. The final decision on the set of specific modules to be developed will be decided by the Training Development Committee, and the final content of each module will be developed by a Module Development Working Group.

B. Development of the Training Program

A Training Development Committee (TDC) will be formed consisting of one member of the IUFoST Distance Education Task Force (IUFoSTDETF), three faculty members of food science and technology departments in universities in SSA, three members of the International Academy of Food Science and Technology (IAFoST) and three regional industry and/or governmental agency representatives. The TDC will be chaired by the project coordinator, a funded staff position of the project. The Training Development Committee (TDC) will have the responsibility to develop consensus on the modules for the training program, appoint the lead developer for each module, and appoint the Module Development Working Group.

C. Module Development for the Training Program

A Module Development Working Group (MDWG) will be appointed for each module. The MDWG will consist of a lead module developer (a person with an international reputation in the subject matter and familiar with electronic-based education), a faculty member from an SSA university, an industry representative from an SSA country, and at least one additional expert in the subject area of the module. The charge to the MDWG is to assist in defining the content of the module, critically review the material developed by the lead module developer, work with producers of distance education material to produce the module in English, assist in testing the module with current or future employees of the SSA food processing industry, and ultimately deliver a complete module to the project coordinator and TDC.

D. Testing the Training Program

The Training Program consisting of the selected modules will be tested by current and potential employees of the value-added food processing sector in at least three selected SSA countries (for example, Botswana, Kenya, South Africa and Zimbabwe). A lead instructor for each DE module will be identified. It is preferable if the lead instructor is the lead module developer. Participants will be selected by host institutions. An in-country mentor for the module will be identified, preferably a staff member at a university or college although an

individual working in industry with an advanced degree (M.S. or Ph.D.) could serve in this capacity. In addition, a volunteer mentoring group will be recruited for each module. The function of the mentoring group is to be available for electronic response to questions raised by the participants. The mentoring group will consist generally of faculty and others with advanced degrees (M.S. and Ph.D.) who are recognized as experts in the subject of the module. The International Academy of Food Science and Technology has volunteered to solicit its members for this purpose.

The TDC in consultation with the SSA mentors will determine the order of presentation of the modules. A general rule is that one week will be allowed to complete one hour of instruction. It is possible that two or more modules could be available to a participant simultaneously. Each participant will be tested either in person or using electronic technology on each module to assure mastery of the subject material.

The mechanism of delivering the modules will depend on the participant's access to communication equipment. It is anticipated that most of the instruction will occur via the Internet and through CD ROM technology. The participant is expected to interact directly with the in-country mentor and to access the volunteer mentor group through the Internet or via fax.

To ultimately maximize the utility of the training modules, it will be necessary to translate the modules into French and possibly Portuguese. For this purpose, faculty in departments of food science and technology where instruction is carried out primarily in those languages will be asked to solicit assistance from food science students in translating the text of the modules into the appropriate language. This concept has been presented to several university professors who teach in French and the concept was very well received.

E. Evaluation of the Project

The project will have a project evaluator (PE). The function of the PE is to monitor progress on the project and evaluate the final product of the training program. Evaluation of the final product will be carried out using the modules through one cycle of application to current or potential employees of the SSA food processing industry in selected countries such as Botswana, Kenya, South Africa, and Zimbabwe. A report will be submitted by the PE to the project coordinator that includes evaluation of the modules by participants. Modules that are found to be ineffective (either in content or delivery) will be returned to the MDWG for correction and changes. Long-term evaluation of the training program will be assessed by surveys of the employers of the participants one year after completion of the training program.

F. Timetable

It is anticipated that the modules will be available approximately one year after securing funding for the project. The International Academy of Food Science and Technology and ECSAAFoST support the project. The second year of the project will be field-testing the training program in selected SSA countries such as Botswana, Kenya, South Africa and Zimbabwe according to the Plan. Finally, evaluation of the project will follow within approximately 2.5 years of the initiation of the project.

G. Sustainability of the project

For long term sustainability, companies would pay tuition for their employees to take the modules and eventually end up with a certificate from the in-country university, possibly endorsed by IUFoST. The local "professor" would be paid a modest stipend for mentoring the student(s). In the meantime the university will solicit various entities (national government, computer manufactures, foreign assistance programs, etc.) for support of computers and Internet connections. Sufficient funds will be required so that continued upgrading of the material could occur, although the first modules are very basic and would be in service for a considerable time. Ultimately there could be the development of modules for academic credit as well. Additional grant funds would be sought for some of those activities.

V. Funding

The University of Guelph and Kansas State University both have extensive libraries of training material in food science and technology already available on the web and through CD-ROM technology. They have agreed to make their material available on a *pro bono* basis for development of the learning modules with the understanding that as the program grows beyond the demonstration phase there will be negotiations for some reimbursement for use of their original materials. Furthermore, the University of Guelph will make available a project coordinator at 75% time with vast experience in developing training modules in food science and technology. The project will fund the appropriate share of his salary for the duration of the project.

Use of the educational material already available from UoGuelph and KSU will greatly reduce the cost of producing the learning modules. It is anticipated that development of the specific modules beyond what is available will cost approximately \$20,000US (\$2500US per module). Expenses include purchasing at least two video cameras for use by the SSA module development participants from SSA countries so that video of actual processing conditions in SSA countries can be used in the modules.

To recruit Module Development Team Leaders and SSA university collaborators, an honorarium of \$500US per program hour for the lead module developer and \$50 per program hour for the SSA university collaborator is budgeted. Final preparation of the module will be done at the UoGuelph or KSU. It is anticipated that the average length of a module will be 8 hours of instruction. Consequently, 8 modules will require support for development of 64 program hours at a cost of \$550US per program hour resulting in a total cost of \$35200US.

For testing the modules, the lead instructor of a module will receive an honorarium of \$100 per program hour. The SSA university collaborator in each country will receive \$5 per program hour per participant. Total cost based on 10 participants at four locations is \$19200US (\$6,400US for the lead instructor and \$12800US for the in-country collaborators).

The project will have a project evaluator. This individual will receive an honorarium of \$1,000US.

ESTIMATED BUDGET

Project Leader	\$150000US
Development of Modules	35200
Presentation of Training Program	19200
Evaluator Honorarium	1000
TOTAL	\$205400US

VI. References

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VII. Appendices

A. Report on the Role of DE in Workforce Preparation in the Food Processing Industry of Sub-Saharan Africa by ECSAAFoST

B. Support letters

1. International Union of Food Science and Technology (IUFoST) Alan Mortimer, President
2. International Academy of Food Science and Technology (IAFoST)- Malcolm Borne, President
3. The Eastern, Central and Southern African Association of Food Science and Technology (ECSAAFoST)– Tony Mutukumira

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