

RESEARCH IN GHANA'S FOOD INDUSTRIES

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A C C R A



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PREFACE

This paper attempts to highlight the need for research and development in large established food companies and focusses attention on the problems in the indigenous sector of the food industry.

It is hoped that this short review would stimulate a meaningful co-operation between research and industrial establishments for the overall developmental growth of the food industry in Ghana.

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I N T R O D U C T I O N

Many of us are witnesses to the rapid growth of food industries in Ghana in recent times. The problems which these industries face or have been facing are not entirely different from those of other industries. The main difference of importance is that industries deal mostly with materials of a biological/food nature, the supply of which is dependent upon natural environmental conditions. Moreover, these materials are subjected to rapid quality deterioration under adverse conditions.

Thus, in the industrial production, preparation, processing, handling and distribution of these materials, methods should be employed to safeguard their quality.

Procurement of good quality raw materials and their careful and judicious preparation; the employment of proven processing techniques during processing; the effective distribution of the products and above all the quality control of the foods so produced should be practised within the confines of a good food processing plant. Not only should goods produced for local consumption be of high quality but also those for overseas markets must meet the standards required by those markets. It is only in this way that confidence in the products of a particular industry can be gained and be maintained.

THE ESTABLISHED COMPANIES

To be able to achieve these aims the (food) industries need intensive and extensive research and development programmes to improve upon, and to inject new ideas and techniques into, their operations.

Research and development can be advantageously related to many aspects of food processing, from production and delivery of raw materials to the utilization and disposal of wastes and residues, and from preparation, processing and packaging of products to storing, selling and delivering to consumers.

The objectives of applied food processing Research and Development include:

1. The production, maintenance and increase of sales, by improving processes, products, and packages; by developing new uses for products; and by developing new products, processes and packages and by testing the acceptability of these products.

2. the elimination of losses and hazards of losses by means of troubleshooting and the development of profitable utilization of surpluses, residues and wastes.
3. the minimization of dependence on raw material which is of inadequate or undependable supply.
4. the increase in profit on invested capital and on unit sales volume by insuring better, more uniform products at lowest possible cost.
5. acting as technical consultants to top management in evaluating proposed new equipment and processes and keeping management informed of developments of potential interest and importance.
6. dealing with governmental agencies, in relation to technical matters including labeling, standards of identity and quality, waste disposal etc.

The necessity, therefore, of Research and Development in a food industry cannot be over-emphasised.

Organization

Many food processors in Ghana, particularly smaller ones, have been depending entirely on government institutions and organizations or "suppliers" for technical information and help. It is no reflection upon valuable services available from these courses, to say that no individual processor, with extensive investments in facilities and markets can now afford to depend entirely upon such outside help. Competition in the industry is becoming keener everyday. Complex technical advances are following one another in rapid succession. Each processor must possess his own Research and Development facility to gather and evaluate pertinent information and apply it advantageously to his specific needs and interests. Each company exists as a result of an idea, and therefore its continued and profitable existence depends upon a continuing flow of constructive ideas.

A Research and Development facility is a planned organisation to keep ideas coming, for having them tested and evaluated, and, if advantageous, put to work in the interest of the processor. Size, type of operation and many other factors will determine what is good for each processor. Variations will therefore result from individual situations. Even the smallest process-

or can enjoy the advantages of research. If sales volumes are unable to support an in-company research staff, there are competent research individuals able to give consulting services. Specialists with long experience may be retained as counsellors or for active research, by companies to secure the benefits of their experience, plus continuing study of current problems and possibilities. Suitable consultants may perform the important insurance function of a research department and save a company from missing the boat on developments involving competitive advantages. Such individuals can serve effectively at nominal cost.

Consultants may also help in organising and staffing an in-company Research and Development department and in evaluating the services of the new department during the early stages of operation.

Companies may also find research and development programmes on their behalf in Research institutions. Since such programmes may involve materials, men and machines, funds allocated should be enough to cover even incidental expenses!

Research and Development Management

The first and most important step in initiating a new Research and Development unit is the selection of an individual to manage it.

A good research manager must possess several qualifications. He must have bold imagination and enthusiasm balanced by canny skepticism and judgment. His imagination must be fertile and inventive with ability to abandon conventional problem - solving methods and think of original solutions.

The second consideration of importance is a canny profit-sense which scrutinises and studies each new idea until it is validated or exposed as visionary. In selecting a research manager or director it is wise to examine a candidate's past. If his projects have failed to produce profits, it suggests inquiring to determine the cause and whether the fault of omission or commission was his own. Regardless of other qualifications, if unprofitable failures mar a candidate's record, it is doubtful if he is best qualified for a key position in Research and Development.

The third essential of important qualification is experience. For major responsibility in direction and interpretation of food processing research, there is no substitute for experience, Until a man has observed

and compensated for cultural variations in raw materials to produce uniform, high quality products, he cannot dependably evaluate the significance of necessarily limited tests on new processes.

Another qualification of importance for the direction of technical research on food products manufacture is education. Important as this is, it is secondary to qualities discussed above, because a manager or director can hire or retain, a qualified expert in a specialized field to fill gaps in his own skills.

Another qualification of value is ability to work co-operatively with others. Not only must members of the Research staff work well together, but often in co-operation with other departments of the establishment. For this reason a co-operative spirit is essential in every member of a Research staff.

The size and character of the Research staff will vary with the size and character of the operation. When it consists of one man, he should be somewhat of a jack of all trades. As the size increases other specialists are added.

In order to attract Research and Development employees of a desirable caliber, companies with sizable organisations should undertake to effectively establish a company image as a progressive-minded organization by providing their technical employees with access to publications, meetings and organizations reporting technical developments.

They should encourage the publication of material which does not injure the company's interests. They should reward their employees on the basis of ability and accomplishment rather than on any other basis. They should be competitive in salary and fringe benefits and incentive rewards. They should strive to culture and environment favourable to stimulating creativeness and promote a competitive spirit inside their own organization and also with other companies.

In order to keep abreast of current development in physical and biological sciences that are likely to be applied to produce and process development, management should encourage staff scientists and technologists to keep informed on new discoveries and developments in basic scientific knowledge by attending scientific meetings, by checking scientific journals and by reading

pertinent monographs and reviews.

A realistic allocation of Research and Development staff coverage of technical meetings provides a low cost means for keeping abreast of technical advances in fields which affect each processor. In addition, attendance at meetings stimulates individuals to renewed enthusiasm for competing with fellow scientists.

New Product Development

A major function of Research and Development in food processing operations is the development of new products which can contribute to the over-all profitability of an operation.

Factors to be considered in evaluating ideas for new projects should include:

1. feasibility;
2. approach;
3. cost of project;
4. timing;
5. compatibility with company's objectives;
6. facilities required;
7. market potential;
8. estimated investment to capitalise and estimated return;
9. sales promotion required to introduce the new product;
10. effect on balance of the established line and distribution channels;
11. operational hazards involved;
12. waste disposal problems; etc.

Criteria should be set by management in assigning priority to such new ideas and these should be based on

1. urgency;
2. potential tangible benefits;
3. prospects for success; and
4. cost.

Industrial Engineering

The large food processing concerns need the services of industrial engineers. Industrial engineers can provide data and advice to aid in decision making and can undertake planning and control studies for each of mana-

gement's functions, namely planning, organizing, staffing, directing and controlling an enterprise.

Integrated management systems are those in which all functions of the enterprise are identified as to their relative importance, the critical activities in each function are made readily available to management control and plans for the accomplishment of the organization's objective of providing products or services are rationally developed by means of optimizing choices from suitable alternatives.

An essential element of such systems is the provision of communication linkages which provide instantaneous feedback of performance results to management so that control can take place. This requires that performance results which are critical to the enterprise be identified. Integrated management systems therefore require not only rationally designed plans, predictions of performance, controls, but also information or data processing systems which provide needed feedback rapidly and economically.

To improve operations or increase productivity, industrial engineers can assist management with diagnostic methods and productivity improvement programmes.

Such engineers should be members of the Research and Development department of the company.

THE INDIGENOUS INDUSTRIES

Staple foods in Ghana are processed by traditional techniques. Records of how these techniques have been acquired may be difficult to obtain. Nevertheless, the techniques point to definite systems by which agricultural materials are turned into various consumable products. Variations in the techniques might have occurred with the passage of time, although the end products are essentially the same.

A number of problems are encountered in the techniques in use. These include:

1. the time-consuming nature of the processes;
2. the lack of proper hygienic and sanitary practices in their operations;
3. the contamination of the products through unsanitary handling and adverse influences;

4. the low production efficiency generated by uneconomic utilisation of energy sources;
5. the unorganized and scattered nature of the areas of manufacture;
6. the very small-scale of operation;
7. the ineffective utilization of investment capital and lack of profits plough - back systems;
8. improper and ineffective organisation of production schedules;
9. lack of proper recruitment and training of personnel;
10. lack of proper specifications for raw materials and the correct scheduling of their delivery;
11. the rudimentary packaging of products;
12. the lack of suitable machines for processing and for quality control.

In fact these indigenous processing industries need the injection of suitable scientific know-how in every facet of their operations.

Quality control and operations rationalization: In traditional processing

there are no specific procedures by which the quality of the product is controlled. Often, processors hope that the way they manipulate foods in individual operations during their processing would help achieve the desired characteristics acceptable to consumers. In many instances, therefore, absolute reliance is placed on subjective evaluation as a means of assessing quality. However, there is the need for objective appraisal.

For example, quicker and more objective controls are needed to provide checks on incoming agricultural raw materials to free them of such contaminants as pieces of wood, metal or stone chips which are likely to cause damage to machine parts and interfere with efficient operation.

Limitations in machine or equipment design may also make it imperative that specifications are set for in-coming raw materials. In both cases, therefore, subjective and objective assessments are needed.

Objective evaluation is dependent on sensory equipment. To be able to maintain quality levels at all times, rationalization of processing procedures may be necessary. Such rationalization may lead to partial or complete mechanization of operations in a process or of a whole process. Mechanization of operations or of processes can make them more effective, or more efficient, or more economical.

However, it may not improve the quality of the end-product. To be able to achieve this, sampling and testing procedures for measuring quality levels may have to be set up.

The principles involved in mechnaization are engineering ones; however, because of the peculiar structure and properties of food materials as well as their biological and microbiological characteristics, there is the need fo consider biophysical principles in order to relate them to foods. For instance, in the mechanization of fufu production, an operation is required by which the carbohydrate cells of the particular foodstuff can be ruptured to liberate starch. Such an operation may require the services of a machine able to impact sufficient energy to the starch cells to cause their rupture. The way and manner in which this energy is utilized determines to a large extent the characteristics of the end-product.

Generally, it is better to find solutions for total production problems. There is at present the need to provide more effective solutions to such complex interaction systems as are encountered in some of the fermentation processes in the traditional processing of foods. For this, it is necessary that the problems are studied at the interdisciplinary level by teams of specialists whose combined efforts are apt to produce more spectacular results than approaching the same problems from narrow, restricted and individualistic points of view.

More important, is the need to solve specific problems through modification or improvement of systems and processes to provide primarily for a more economic and efficient operation and hence, eventually, provide a rationalized rather than a mechanized system. Indeed, such rationalization will, in the long run, pay richer dividends than complete mechanization. A programme envisioning ultimate sophistication in traditional processing of food is reasonable if considered on a long-term basis. Thus gradual improvement in processes stands a better chance of endurance than large-scale revolutionary changes which are likely to be premature and perhaps without consequence in the long run.

Food Machinery: The multifarious nature of Ghana's indigenous food industry is a good basis upon which to conduct research and development into its machinery needs. The areas of activity of prime importance in machinery needs are:

1. drying and dehydration processes;
2. heat - transfer operations;
3. storage facilities;
4. size - reduction operations

In addition, there is the need to set up an equipment performance evaluation centre for the assessment of locally-designed and constructed equipment and for the testing of imported ones.

Although Ghana is a tropical country with a lot of sunshine, yet absolute reliance cannot be placed on the use of the sun for drying all foodstuffs to attain moisture levels suitable for storage without deterioration. Furthermore, the heat from the sun, and the environmental conditions cannot be controlled. Different dehydrations units may therefore be required to supplement sun-drying or to substitute. Dehydration is obviously a more expensive process than sun-drying yet the dried foods may have more monetary value from dehydration due to improved quality.

Heat-transfer operations such as the boiling of kenkey, the roasting and the frying of plantain, the roast-frying of gari, etc. all need different types of equipment for effective utilization of heat-energy. Simple equipment designs may be needed initially for effective utilization of heat. Improvements in designs may be undertaken as research and development progresses.

Many tropical fruits and vegetables abound in Ghana. But the amount of these food crops and their processed products, in wholesome form which is distributed and marketed is so small because of poor methods of storage and improperly controlled processing techniques.

Proper storage of fruits and vegetables begins at the point of harvest or concentration. In Ghana, the manual harvesting of over-ripe fruits and vegetables, their packaging in traditional basket containers, and their subsequent transportation to distribution centres are so inefficient that a high percentage of these produce crack, are fractured, bruised or crushed. There are no definite and proper storage centres at points of harvest of fruits and vegetables at the moment in Ghana, except open sheds and household kitchens.

Most harvested fruits and vegetables are therefore quickly distributed to semi-rural and urban centres where markets exist but where suitable storage facilities are also absent. With the prevalence of high humidity and high temperatures coupled with poor handling, these foods start to deteriorate rapidly.

Studies are needed in the storage characteristics of these fruits and vegetables with the prime aim of developing suitable, simple but effective storage systems at points of production and of consumption.

Raw materials often occur in sizes that are too large to be used and, therefore, they must be reduced in size. The reduction in size is brought about by mechanical means without change in chemical properties of the material, and uniformity in size and shape of the individual particles of the end products are usually desired but seldom attained.

Such operations as cutting fruits and vegetables, for canning or drying, grating of cassava for starch or tapioca, milling of maize for dough, are all size-reduction. There are size-reduction equipment for maize and a few for cassava tuber, but none for other crops. Research and development in this direction are therefore needed.

GHANA'S FOOD RESEARCH INSTITUTE

In the realization of the tremendous research and development needs of the budding food industry in Ghana that the government established the Food Research Institute in 1963, with the aim of conducting applied research in the storage, processing, preservation and marketing of foods and to contribute towards the development of the food industries in Ghana. The institute acquired a legal status in 1965.

Since its inception, the Food Research Institute has:

1. carried out economic appraisals of existing food industries,
2. advised on costings, profitability and problems of marketing and distribution;
3. developed new products and improved upon old processes and equipment,
4. carried out services for the industry and the public on food analysis and quality control;
5. compiled and standardized local food recipes;
6. collected and analysed material on local food production and food consumption patterns;

7. produced a food composition table for use in nutrition extension, catering and in planning food policies.

Unlike Food Research Institutes in other parts of the world, which concern themselves with a few food items or specific subject matter areas in food science and technology, the Ghana Food Research Institute was conceived as a comprehensive food research organisation to cover in its research programmes, the entire food field. This was and is still inevitable due to the fact that lack of resources and the desire to cater for everyone's needs put on a pressure from which few research institutes in Ghana can escape thus making them multiple research organizations in which limited resources are eventually spread thin. In this context, therefore, the Institute carries out research and development programmes in

1. fruits, vegetables, cereals and cereal products, oil and oil seeds roots and tubers;
2. Meat, fish, sea foods, milk and dairy products;
3. Spieces, salt, condiments, sugar, confectionary;
4. Beverages, distillery and brewery products;

CONCLUSION

The short analysis of Research and development needs in Ghana shows clearly the tremendous work entailed therein.

The Ghana government, the Food Research Institute, and the food industries must make concerted efforts to bring about fruitful Research and Development to aid in the industrialization programme of the country.

It is only in this way that the many types of agricultural and fish produce from the Operation Feed Yourself programme can be preserved, processed, stored and distributed and marketed for the benefit of all and sundry.

R E F E R E N C E S

1. Anon. 1969 FRI Information Brochure
No 1 Pub. FRI. GHANA.

2. Heid, J.L. 1963 Research and Development.
In Food Processing Operations. Their management,
machines, materials and methods. Vol.1 by Joslyn, M.A. et
Heid, J.L. pub. The AVI pub. Co Inc.
Westport, Connecticut.

3. Lartey, B.L. 1968 Mechanization of traditional food
processing in Ghana In Proc. of 2nd Seminar of Food
Science and Technology in Ghana. pub. FRI. Ghana.

4. Lartey, B.L. 1969 Storing and Processing of food crops
in Ghana.

Paper read at symp. on agric mech. in Ghana at University
of Ghana, Legon pp.8.