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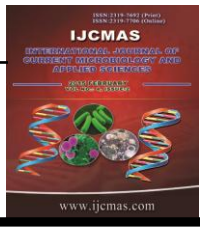

Review Article

Future for Food Technology in Nigeria

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A B S T R A C T

The development of new products, the need to reduce energy consumption, and concerns over the food supply are other reasons for developing new food processing technologies. On the other hand, the emergence of change in certain socioeconomic factors may create a climate that forces or encourages the industry to change, economic incentives to the contrary. An understanding of the issues involved and their expected impacts on society is therefore an important consideration to policy leaders in legislative and policy deliberations. Policy issues arise from either perceived or expected impacts resulting from the adoption of technologies. Impacts may be positive, negative, or a combination of the two; and not all impacts create policy issues. That is, negative impact that are not severe or widespread may not arouse the attention of policymakers, while technologies with primarily favourable impacts may create issues only about whether policies should encourage development and adoption.

Introduction

The food we consume in the next two decades will be determined largely by the interaction of socioeconomic conditions and food technology. Within the next ten years we anticipate changes in foods and eating habits which will reflect nutritional, cultural, and socioeconomic needs.

This paper will focus on some of the conditions and concerns in the coming years as well as certain trends in food technology which are likely to be strengthened in response to such conditions.

Speculation on the future is as old as man. Serious attempt to determine the consequences of Food technology to society are relatively recent. It was not until the mid nineteenth century that formalized speculation about the direction and destination of progress found its way into the literature and scientific thought of that time.

In 1852 Hans Christian Anderson wrote about tourist of the future travelling in steam powered airships. The most famous

nineteenth century 'futurist', the French writer Jules Verne, used science as material for fiction. Verne projected the science of his day into the future, but he envisage that this science would have effected little or no change on the people of that future. Edward Bellamy in his book 'Looking backwards' (1888) was one of the first efforts to reach a world audience. It described whole societies 200 years in the future and changes caused by introduction of certain imagined technologies.

All futurists have that same problem-describing something that does not exist. There is no ''average'' futurist; they are all products of different languages, and different training. Thus each writer's perception of the future is influenced by background as well as benefits.

Not surprising, therefore, there is a wide variety of views, from the club of Rome's rather sober outlook of the world's ability to sustain present growth and prevent a global catastrophe within the next century, to Herman Kahn's more optimistic outlook that Food Technology will be able to supply needed solution to the world's food problems.

There are two futurists' ideas that have particular relevance. The first is that the future should be viewed not as a single future, but many possible ones, and that if enough people agree on a desirable future and work toward that end, this will essentially be the future that will unfold. The second idea is from the French futurist Bertrand de Jouvenel, who stated that to preserve the ability to make choices and not become victims of necessity, public policy leaders should identify emerging situations while they are still manageable and not at the crisis stage.

Although there are many differing conceptions of what the world or Nigeria may be like the year 2020 and beyond, the outlook is in general more optimistic than pessimistic. One accepted method of predicting and understanding possible changes in the world's future is to identify present trends. The following are some of these trends that certain futurist believe will, if continue, make the world different in the future:

- Increasing world political unification and cultural standardization
- Growing affluence with resulting increase in leisure time
- Industrial orientation
- Increase longevity and personal mobility
- Rising educational levels
- Greater emphasis on religion

That these trends if continued into the future, will affect all segments of our lives is not in question; and since the importance of food in our lives cannot be questioned either, it is essential that we be aware of changing conditions that will affect the food sector. It is important to note that Nigerian consumers spent an estimated over One trillion Naira per annum for domestically produced food annually, going by our current population of over 160 million people. Two third of these spending was for food processing. As a result of increase in food expenditure, food process industry take a large share of these expenditure. This is an impetus for food industry to develop and adopt technologies that will help lower food processing costs. The development of new products, the need to reduce energy consumption, and concerns over the food supply are other reasons for developing new food processing technologies. On the other hand, the emergence of change in certain

socioeconomic factors may create a climate that forces or encourages the industry to change, economic incentives to the contrary. An understanding of the issues involved and their expected impacts on society is therefore an important consideration to policy leaders in legislative and policy deliberations.

Policy issues arise from either perceived or expected impacts resulting from the adoption of technologies. Impacts may be positive, negative, or a combination of the two; and not all impacts create policy issues. That is, negative impact that are not severe or widespread may not arouse the attention of policymakers, while technologies with primarily favourable impacts may create issues only about whether policies should encourage development and adoption.

Priorities for technology assessment

Technology assessment is the systematic identification, analysis, and evaluation of the potential impacts of technology on social, economic, environmental, and political systems, institutions ,and processes. It is concerned particularly with second and third order impacts of technological developments and with unplanned and or unintended consequences, whether beneficial, detrimental, or indeterminate, which may result from the introduction of new technology or from significant changes in the application or level of utilization of existing technologies.

Food technology comprises the activities that take place within the food system from farm gate to the consumer. These include processing, wholesaling, retailing, food service, and transportation.

An effective food processing system should provide an adequate and continuous supply and variety of wholesome, nutritious foods to all consumers at reasonable prices and provide reasonable returns to producers and sellers. While it is simple to state that , assessing performance is complex because cost efficiency is a major governing factor, and yet fulfilling other requirement may increase costs. For example, seeing that food meets safety may add to its cost. In the short run, a technology may increase efficiency and lower cost to the consumer, while in the longer run it could result in structural changes to the industry that could impede competition and result in less-than-reasonable prices for consumers. Any technology that would require a large outlay of capital and therefore drive out smaller firms could lessen competition and increase prices. Likewise, returns to the various segments of the system must be sufficient to attract needed capital and make changes necessary to meet performance standards.

The Food processing system can be broken down logically into two major segments: Processing and Distribution.

Processing technologies are classified into five headings:

- Preservation
- New and improved equipment and processing techniques
- New and modified food products
- New sources of food ingredients
- Packaging

Distribution technologies are classified under four headings:

- Wholesaling
- Transportation
- Retailing and food servicing

- Technologies that cross over the above three in their application and effects

Nutrition and food and food safety are affected by processing and packaging technologies but also affected by technologies in food distribution (wholesaling, retailing, transportation, food service). Many of the distribution technologies are expected to affect industry structure, and in some instances this may affect how firm interact with each other, with other food segments, and with consumers. Capital requirement for many technologies are the prime cause for many of the structural changes that take place.

Many technologies' are adopted to improve productivity and substitute for labour (employment) and these generally will give rise to issues of job loss or labour relocation. The prospects for future increases in energy costs encourage energy saving technologies, so the energy producing industries will be affected.

Most of these high priority technologies are directly concerned with preventing losses in our food system, either through more efficient processing methods or waste reduction in the delivery system, and with producing new foods to substitute the traditional foods. This reflects the concern that between now and year 2020 and beyond our food supply will have to be better managed and more efficiently utilized if Nigeria is to feed herself and have surplus to feed other nations and keep domestic prices at reasonable levels. A comprehensive summary of the seven highest priority for Food Technology is as follows:

Fabricated food

The technologies that are engaged to produce fabricated or engineered foods are considered high priority candidates for assessment because they are already in use (Biotechnology), their impacts have already being felt and their development and use will continue in years ahead. Sales of fabricated foods as far back as 1972 in the United States of America were more than $ 6 billion and are expected to have hit trillion mark by now.

Fabricated foods may be divided into two types-ingredfients (extenders, fillers, emulsifiers) and analogues (substitutes).

The extenders used most widely in meat products today is vegetable protein, usually from soy, in hamburgers or meat loaf. Analogues are substitutes fabricated to resemble a specific traditional food, such as breakfast sausage from vegetable protein or non dairy coffee whitener, cheese whipped toppings or egg substitutes from vegetable oils.

Several advantages have been cited for these products: Lower cost, extended food supply in times of shortages, reduction in energy use, better control of nutrient content, and more efficient utilization of resources. The issues that surface from these foods, however, are already of serious concern to producers, consumers and nutritionists among others.

As a result of these, fabricated foods make use of a number of additives and unconventional ingredients, about which official standards and regulations are frequently incomplete or in disagreement, many persons worry that those who consume these products are been adequately protected. Others, however, believe that these regulations overly restrict the development and acceptance of what may be a viable solution to the problem of maintaining an adequate, dependable and nutritious food supply.

Nutritionist and others are concerned about the effect the consumption fabricated food may have on overall nutrient intake. While the use of vegetable protein as a meat extender or analogue may be one way of providing an in expensive source of protein. On the other hand these technologies will afford the opportunity to supply specially formulated foods that will meet the dietary needs or improve the nutrient intake of selected target population.

The other issue that should be considered are adequate labelling and resource use. How should these foods be labelled to properly identify ingredients, at the same time not putting a barrier to consumers' acceptability? If the use of these foods become more widespread, how will it affect agricultural production sector, particularly the meat, poultry and dairy producers.

An assessment of these technologies must study the issue that will arise in the areas of food safety, nutrition, regulations, labelling and resource use.

Food sanitation and distribution

Preventing the adulteration of food is of concern throughout the food system. Since the problem of maintaining adequate sanitation is a serious one in the distribution system, particularly with the virtual non existence of the rail roads and our poor state of roads, this area emerges as a high priority for assessment.

Contamination of food and food products during haulage has two major causes: The vehicles are not cleaned adequately and may be infested with pests, chemicals and microorganisms, or vehicles used to transport foods might have been previously used in conveying toxic chemicals, residues of which remain.

Several solutions to this problem are possible. When in place our rail roads must be equip with tracking devise to monitor carriages used in conveying toxicants, special refrigerated vehicles must be dedicated to haulage of food systems especially perishable ones. Also a method of detecting contaminants in haulage vehicles and rail cars is essential. More thorough cleaning techniques must be developed for the haulage systems.

Examples of possible technologies that have been suggested earlier and which should be considered for assessment are:

1. Freight vehicles designed specifically for food products that will be more resistant to contamination and infestation
2. Equipment and procedures for decontaminating freight cars. This would include trained inspectors operating with specific guidelines relative to food safety.
3. Freight vehicles specifically designed for food use and a system that will keep track of the ''dedicated'' fleet and schedule the vehicles efficiently. This must include an effective mean of enforcement to maintain the integrity of the system.

A major policy issue in this area is funding the development of these technologies. At present, the development of our defunct rail roads appear unable to secure the capital needed to initiate and maintain such a system. Serious attention should be given by the Government to the desirability of policies that will help us to achieve this lofty goals.

An assessment to this area should also determine if this system is needed and feasible, whether it should be encourage through regulation, voluntary cooperatin, or some type of incentive arrangement.

Retortable pouch

The technology that produces the retortable pouch has been adopted in the developed world. Adoption of this technology and use is expected to have strong impacts and far reaching consequences in Food Technology, particularly in the areas of energy, food storage, transportation and environment. Owing to these expected impact, retortable pouch technology ranks high on the priority list for assessment.

The pouch is a multilayer, adhesively bonded package that will withstand thermoprocessing temperatures and that combines many advantages of the metal can and the plastic boil-in-th-bag. The quality of food processed by this method is said to be superior to that of foods retorted in conventional cans, and taste tests indicate that it may approach that of frozen foods.

Energy savings are possible in its processing because of shorter cooking times at lower temperatures. However, while the pouch itself would appear to offer savings in energy use, these savings can only be confirmed by a thorough analysis of different systems that are or might be used commercially.

Savings of as much as 50 percent (pouch versus can) may be projected in the area of transportation owing to improved product-to-package weight ratio. One question that must be answered, however, is the relative durability of the pouch for transportation purposes. Retortable pouch now in use are protected by an outer protective package which limits the potential savings.

When the technology becomes widespread, issues to be addressed will include loss of revenue to producers of metal cans, and industries producing raw materials, displacement and relocation of large segments of labour force and possible considering loss of jobs.

Environmental impacts of this technology may be considerable, in both a positive and a negative sense. The pouches are not recyclable, as compared to cans and most bottles, which would negate some of the initial energy and raw materials savings. However, retortable pouches can be used as fuels, therefore even without recycling, most of the energy initially expended in their manufacture could be reclaimed, while at the same time minimizing solid waste problems .It is essential that these problems be recognized, and expected negative consequences be thoroughly assessed as food industry adopts this new packaging technologies.

Electronic checkout

Electronic checkout systems are already in use in super markets and supprettes all over the country. There is every indication, however, that the development and use of this technologies will continue to expand, with economic and social consequences for retailers, consumers, labour, and the telecommunications sector. As a result of these impacts and the emotions they have aroused, electronic check out technologies must among those areas considered high priority for assessment.

At the moment two popular electronic systems are used. The first is an electronic cash register, which may be self-contained or tied to a central store computer. It relies on individual price marked items and manual entry into the register. The second system, which has received the most

publicity and generated the most opposition from consumers, is tied to a central computer and uses a scanner that reads the Universal product Code (UPC) currently printed on a number of packages. This system, like the first, has the potential to improve merchandising decisions resulting from better inventory control, improve labour scheduling, less need for storage space, more thorough analysis of sales, increase product movement, and better use of shelf space.

In addition, the UPC scanner system eliminated the need to mark prices on individual packages, since this information will be stored in the central computer and transmitted to the terminal when the UPC is read. It this elimination of pricing that has created most of the public opposition to this system.

Opponents claim that the lack of pricing deprives consumers of information they need to make rational purchase decisions and to secure proper charges. Proponents believe that this is outweighed by the many economic benefits that may accrue from the use of this system, stressing that this would probably result in lower food prices.

An assessment should consider the impacts of many elements of this technology. What particular components of the system generates savings, and how much of the savings are cash savings due to increase productivity of labour versus secondary savings from better management of inventory, pricing policies and so on? How much of these savings would be passed on to the consumer? If this is indeed a problem, are there alternative solutions? How would widespread implementation of this system affect the industrial structure and competition, given the high initial capital required to install per store. If individual pricing were required by law, would this deter the growth of high volume, low price discount stores that might offer substantial savings to consumers?

The adoption of this technology would cause a relocation of labour. How would this affect the millions of food store employees and labour in related industry? Increased use of electronic check out may involve increase use of electronic funds transfer. What will be the impact on individual privacy and liability for losses and errors in the system?

Technologies to reduce food losses

Approximately 70 percent of all food produced for human consumption is lost annually in Nigeria. Technologies that reduce the extent of these losses can help substantially to increase the food supply available from existing resources is important as the world pressure on food increases. Such technologies include those that will help in reducing waste in packaging and transportation in food technology system and also reduce losses due to pilferage and general lack of security control.

Waste resulting from mechanical harvesting might be reduced by improved harvesting technologies. Waste resulting from spoilage and bruising in transportation might be reduced by using such alternatives as bulk packing on the field for short distance delivery to stores or by educating consumers to the benefits of damaged , and equally nutritious, produce. In addition, technologies are needed to reduce the food loss at the retail level to damage in handling and pilferage.

The first part of an assessment of loss prevention technologies should determine the extent of loss in the food processing

chain, when it occurs, and what technologies are available to reduce this loss. Another area to be considered is the potential for utilizing produce that does not meet grade standards as a result of the out of size range or blemish, what consumer objections would have to be overcome to accomplish this, and whether it would be economically feasible. Technologies to reduce losses at retail, such as the electronic checkout for better inventory control should be considered and better designed locking system for rail wagons and road transport trucks to reduce losses during transportation.

Elecronic food shopping

These technologies are not likely to be widely adopted as the electronic checkout systems, but their gradual evolution would have significant impacts on the food system; hence the high priority accorded them for assessment.

Three electronic food shopping system are considered: Warehouse-to-door system, automated mini markets, and mobile food markets. These technologies apply primarily to large metropolitan areas and the special distribution needs of rural areas.

Possible advantages of ordering and delivering directly from warehouse to the consumer include savings in time to the consumers and savings in transportation costs, fuel use, convenience, and possibly safety, to the consumers (particularly the elderly). An assessment should analyse these technologies to determine whether they can indeed provide the same services at retail stores at less costs. Automated mini markets, a convenience store where most items are dispensed automatically, as well as the warehouse–to-door system, would be dependent to a certain extent on some type of credit, probably electronic funds transfer which would be card activated. Both systems would be dependent therefore, on the development and use of electronic funds transfer technology. Mobile markets would move products into certain areas on a schedule basis. Tests indicate that this is a high cost operation, but this cost may decrease if the operation were to become widespread.

The main advantage of all three systems is that they will make foods available in the urban and rural areas, where such services may be at its lowest ebb. The apparent disadvantage is with the remote ordering or with a smaller amount of food from which to choose, the consumer would therefore face a limited selection and some instances would not be able to examine certain foods, particularly fresh produce, before purchase.

All these technologies should be examined in relation to alternative systems such as industry cooperatives programmes for improving stores in the urban cities, consumer cooperatives, and direct marketing by farmers in rural areas. Providing all types of food delivery services in all locations may be too costly. However, an assessment should consider providing as much choice as possible to consumers regardless of location.

Returnable and recyclable containers

Technologies for recyclable containers, returnable cans and bottles, and other refillable containers have a high probability of being an important part of our future, and the impacts of adoption will be widespread. These technologies have developed because of the socio-economic pressure, and the pressure will in all events continue to build up for new solutions through technology to the problems of conserving natural resources and reducing the expense of keeping our environment free of pollution from

discarded containers. This is an instance of socio-economic pressure creating demand that established the high priority given to these technologies for assessment.

Returnable and recyclable containers are being produced today, and many communities in the urban cities have set up collection points for cans, bottles, water sachets, and other recyclable products. The public must be interested in the concept of recycling, even if the specific technologies or systems used now may not have met with their approval.

These technologies fall into three categories: recyclable beverage containers, returnable and recyclable food containers, and the general concept of recycling applied to all food products. The issues, however, are generally the same for all and fall into areas of economics and the most efficient resource utilization.

In some instances, returnable may add to the cost of distribution and handling of the product, from my own experience in the brewing industry it could cost 5 percent more per bottle, but whether this cost would be passed on to the consumers, is the choice of the food industry. Included in this issue is the high initial capital cost of converting production lines in bottling plants to handle returnables. An assessment should evaluate policies for overcoming such capital problems.

Delivery problems may also result from a widespread conversion to a returnable bottles. This may give rise to new products that do not depend on bottles (such as powders to be mixed with carbonated water at home)

Recovery and recycling from food containers may be one method of extending our natural resources. Various technologies for collection and processing of these materials could be initiated, for instance with large, central, high technology for separating recyclable metal, glass and other materials from refuse relative to separation by consumers of these materials before the refuse enters the recycling system. There may be no one system applicable for every situation, but people may have to make a choice of whether they wish to participate by paying for a centrally located or industry based system with taxes or fees or whether they would prefer to lower the cost by participating directly as what obtains in the developed world. We shall get there one day.

Technologies needing more research

Research is needed to further develop many technologies identified in this paper that are not now in adoptable state. The following list is not in priority order and does not include those technologies selected for high priority assessment that would more clearly specify needs for more research.

The listing of these technologies should not imply that they are being advocated, but rather that they are currently not developed to the point of adoption, or that not enough research has been conducted to be able to assess their potentials.

The food processing and distribution technologies needing further research are:

1. More efficient utilization of water in processing
2. Development of containers or rail cars for better food quality preservation.
3. Central cutting and packing of meat
4. Solar energy technology in processing

5. Meals-on-wheels and other delivery of complete meal to the home
6. New analytical instrumentation and processes for detecting ingredients in foods
7. Moisture reduction processes

Conclusion

There is a high possibility that these technologies will play an extensive role in revolutionizing our food processing system by the year 2020. This early warning signals for decision makers to allow them to plan for the long term consequences of these technological applications in food Technology. Decision makers now have an advanced opportunity to examine the many ways in which these technologies will affect agricultural production, food manufacturers, and processors, food retailers and peoples' lives. Further analysis that would help to balance judgements about the positive and negative consequences of these technologies and should explore the physical, biological, chemical, economic, social, and political impacts and the parties that will be affected when these technologies are applied on a national scale

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