
Chapter III

SOCIOECONOMIC FACTORS

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This preliminary analysis calls attention to the likelihood of the emergence, adoption, and relative importance of food marketing technologies and their impact on and interaction with other such technologies, the marketing system, the Nation, and the world. To do this, one must first have identified those socioeconomic factors that may influence, and be influenced by, these technologies. There is a definite relationship between change in the socioeconomic climate and the development and adoption of new technologies. Given socioeconomic conditions may encourage or discourage the development and/or adoption of new technologies, while widespread adoption of technologies may, in turn, alleviate or exacerbate the conditions that influenced their development or adoption.

In order to identify all relevant socioeconomic factors, the Office of Technology Assessment (OTA) staff generated a preliminary list from a review of literature dealing with elements that may be expected to influence our future way of life. Two mail surveys were then conducted to identify those factors most likely to influence food marketing technologies (see appendix B for methodology). The processing and packaging survey included energy, pollution, health, and the supply and demand for food; the survey on distribution included energy, pollution, regulations, consumer attitudes, and the demand and supply for food.

Respondents were asked to comment on them and add others they felt should be included. Most respondents agreed with our list but added information and suggested additional factors. A summary of the socioeconomic factors most frequently mentioned is shown in table 2.

A working group was then formed of specialists in food processing, packaging, and distribution; members represented labor, universities, Government, and consumer groups. The initial list of factors was modified to include the ideas and comments of respondents to the survey and was made available to the working group, which made additional comments on the list.

SCENARIOS FOR THE FUTURE

One objective of the group was to estimate the possible time of development and adoption of the technologies. To this end, two scenarios were presented.

Scenario 1 projects that past and current socioeconomic trends will continue without major shocks into the future. It assumes the

kind of environment one would expect if things evolve much as they have in the past **25** years.

The cost of energy and raw materials will remain about the same relative to other costs, and supplies will remain at the same level. Shortages will be transitory and will not

Table 2.—Socioeconomic Factors Influencing New Technologies as Indicated in Questionnaire Responses

Socioeconomic factors	Processing	Distribution	Total
Energy	49	14	63
Pollution	43	5	48
Demand food ^a	40	9	49
Supply food ^a	41	9	50
Health	44	—	44
Regulations ^c	5	12	17
Consumer attitudes ^c	2	9	11
Raw materials shortages	6	1	7
Prevent spoilage and waste	4	2	6
Changing life patterns, eating, lifestyles		4	7
Nutrition education.. . . .	3	1	4

^aThese socioeconomic factors were in background materials sent in both letters.

^bThis socioeconomic factor was in background material sent with processing letter only.

^cThese socioeconomic factors were in background material sent with the distribution letter. All other factors supplied by respondents. In some instances, respondents did not evaluate our list of socioeconomic factors or add any of their own.

cause major disruptions in the economy. The demand for food will continue at the same rate and prices will not rise drastically. The food supply will remain stable, with new sources adding to conventional production to keep pace with demand. Increased awareness of the relationship between nutrition and health will influence eating habits, which will be reflected in concern about food additives. Regulations will remain essentially unchanged. Lifestyle trends and demographic factors will not undergo drastic changes from current trends. Inflation will continue at 5 percent per year, median family income will rise to \$25,000 by the year 2000, and consumers will enjoy increased disposable income.

Scenario 2 depicts changes in current trends that can be expected to have more influence on the development and adoption of technologies to the year 2000 than those in scenario 1 above.

Energy and raw materials prices will rise, as will our dependence on foreign imports, and supplies will be subject to periodic disruption for political economic, and other reasons. Foreign demand for food will increase, causing domestic food prices to increase. Alternative food forms and sources will be needed to augment food supply. In view of this, consumers, although concerned about health and food safety, will be willing

to accept small risks and to use processed and fabricated foods. Regulations covering the testing and approval of food ingredients, including additives, will change. Food ingredients will be judged on benefits as well as risks. Some lifestyle factors will change, particularly in the area of central food preparation facilities. Inflation will increase at a rate of 7 percent per year, median family income will reach \$21,000 by the year 2000, and consumers will have less disposable income for discretionary use.

Participants in this study felt that scenario 2 was a more accurate forecast of future trends and that it would likely lead to the adoption of more new technologies than would scenario 1.

For a more comprehensive discussion of these two scenarios, the reader may refer to appendix C on procedures for the working group.

The remainder of this chapter addresses the socioeconomic factors identified as a result of OTA's selection process. Just as the status of the technologies presented in this report should be updated periodically, so these factors should be reexamined from time to time. This will allow Congress to be alerted to continuations of and deviations from the status of these factors as presented here.

ENERGY AND OTHER RAW MATERIALS

The total food system consumes an estimated 17 percent of the total U.S. energy supply. The marketing sector consumes about 8 percent, the production sector 3 percent, and consumption at home the remaining 6 percent.¹ An increase in the price of energy has a domino effect through the economy—for instance, an increase in the price of energy will cause an increase in the price of steel that will be reflected in the price of canned goods that will in turn be passed on to the consumer.

The cost of energy will be a key factor shaping the development and adoption of food marketing technologies. It is felt that energy costs will continue to rise relatively faster than other costs, and this can be expected to act as an incentive to develop and adopt energy-saving processes throughout the food processing and distribution system as food moves through the marketing channels to the consumer. Many technologies are presently available that have been and will continue to be adopted and used in processing as the price of energy increases. However, in the long run new technologies will have to be developed and used to conserve energy until and unless new sources of energy are available. Packaging is second only to labor as a contributor to food cost, and therefore energy savings as an economic and technical factor must be an important element in assessing a packaging technology.

Because of the interrelationships among socioeconomic factors, trends and regula-

¹According to Energy Consumption in the Food System, processing accounted for 4.4 percent, wholesaling 0.5 percent, retailing 0.8 percent, and transportation 2.1 percent, for a total of almost 8 percent for the marketing system.

tions in one area may work for or against potential energy savings in another. For instance, pollution abatement regulations may be energy-consuming. The convenience foods and individual packaging that consumers demand require more energy than unprocessed foods and larger packages. Some studies suggest that central storage and cooking of foods requires less energy than does home preparation.

Certain raw materials shortages may cause future problems in food marketing, especially in packaging. Plastic packaging materials based on petroleum have increased and will probably continue to increase in price. Other materials that may be in short supply include tin, aluminum, certain hardwoods (for pallets), and other raw materials.

To overcome these expected shortages will require technologies to provide substitute or alternate products at lower prices. Renewable resources may possibly be used to a greater extent than at present. Another possibility is the development of technologies that reduce the need for packaging,

Shortages of energy and to a lesser extent of other raw materials would mean relatively higher prices and would encourage the development of energy-saving technologies. However, the discovery and/or development of alternate energy sources—e. g., solar, geothermal—could dampen the increase in energy costs and adversely affect the development of energy-saving technologies. The positive impact of energy may be felt more in the processing and packaging areas than in distribution, as there appear to be more viable energy-saving technologies available for adoption in processing than in distribution.

POLLUTION

Society seems to agree that our environment should be protected from pollution, but there is no consensus on the extent of pollution control needed or the price that should be paid. Most respondents to the survey felt that pollution control would be an important factor in food processing and packaging but less important in food distribution.

One way of offsetting the cost of pollution control is to convert polluting wastes to useful products. The consensus appears to be that while technologies exist to convert normally polluting waste to both animal and human foods, even more will be developed.

Waste may also be converted to energy and recycled back to the processing operations. Research is needed to determine if hybrid

energy systems would make this feasible. Because of the high initial cost of waste-converting technologies and the need for large-volume processing to make them economical, economic incentives may be needed to promote transporting of wastes to central locations for processing.

New technologies or policies for economic incentives may be needed as well for solid waste management, including beverage containers and all other types of litter control, recycling, and resource recovery operations.

Pollution abatement equipment on transportation vehicles does add to initial cost and in some instances may add to operating costs, but it is felt that food distribution would not be materially affected by pollution abatement requirements.

DEMAND FOR FOOD

World population is expected to double from today's 4.2 billion by the year 2010, and demand for food may be expected to increase accordingly. If the population increase is coupled with rising world income, as has been predicted, the demand would probably increase at a proportionately faster rate. Historically, rising incomes in developing and developed countries have resulted in an increased demand for animal protein and other foods requiring higher inputs of grain and other feedstuffs than vegetable protein, which can be consumed directly.

Domestic demand will reflect population increase, changes in economic climate and social values, and export policy coupled with foreign demand for U.S. farm products. The U.S. population is expected to reach 260 million by the year 2000, and total demand for food will reflect this increase. Some changing economic and social factors—older population with a large number of retired persons, singles maintaining homes, and more working women—have contributed to trends of less time spent on home preparation of meals and perhaps a change in types of food and packaging. However, these factors are not expected to affect total demand for food.

The U.S. policy on food and commodity exports through commercial channels and Government programs as the Food for Peace (P.L. 480) program will determine the availability of U.S. food for export. Our agricultural trade has shown a positive net balance of payments of about \$12 billion for each year from 1974 through 1976 that offset the \$8.5- to \$10-billion deficit in other sectors.² However, even though agricultural trade had a positive net balance of \$10.6 billion in 1977, it was not able to offset huge deficits in oil and other imports for that year.³ It is clear that continued exports of agricultural products to balance the purchase of oil and other imports will exert pressure to raise domestic food prices, especially in years when supplies are limited. Increased demand for food as outlined in both scenarios will have a very positive effect on the development and adoption of technologies in processing and distribution.

²U.S. Department of Agriculture, Economic Research Service, *World Economic Conditions in Relation to Agricultural Trade*, WEC12, August 1977.

³U.S. Department of Agriculture, Economics, Statistics, and Cooperatives Service, *World Agricultural Situation*, WAS16, July 1978.

SUPPLY OF FOOD

Projections by the U.S. Department of Agriculture (USDA) indicate that conventional agriculture will be able to supply domestic needs to the year 2000 and perhaps beyond. This projection assumes average weather conditions and technologies that will keep productivity increases equal to past rates. However, unfavorable weather, a drastic energy shortage, or a leveling off of productivity rates could lower our expected food supply and mean that either additional land would have to be brought into cultivation by 1985 or new technologies would be needed.

A preliminary OTA staff study projects a U.S. surplus of total grains by 1985. World projections indicate a gradual tightening of the supply demand balance from a net surplus in 1978 to a slight deficit by 1985.

It is possible under these projected conditions that food prices could increase and food purchases will be more than the 16.8 percent

of disposable income registered in 1976.' If conventional U.S. agriculture is not able to supply domestic and foreign demand at some acceptable price level, there will be an incentive to develop new unconventional food sources that depend on new technologies. One example might be the substitution of vegetable for animal protein, since the increase in the world demand for beef has been projected to increase 3 percent per year, with supply increasing only 2.5 percent per year. Supply conditions outlined in scenario 2 (conventional agriculture could not supply enough food at reasonable prices) would encourage the development and adoption of processing and distribution technologies.

⁴This statistic is a better indication of change in the cost of food purchases relative to disposable income than it is an actual measure of individual family food expenditures. Families with low incomes or those with large numbers in the family would have to spend a much larger share of disposable income for food than this figure indicates.

FOOD SAFETY AND NUTRITION

Consumers are concerned about the relationship between food and health and are increasingly interested in having more and better information on the nutritional and safety qualities of the foods they consume.

Consumers demand food that is free from harmful additives and from organisms that may cause illness. Some contend that additives may have an adverse effect on health; others contend that additives play an important role in food safety by preventing spoilage and preserving foods beyond their normal life span. Although additional regulations pertaining to food additives should be based on a risk/benefit analysis, determining risk and benefit for many food additives may be extremely difficult. The consensus of those participating in this study was that concern about additives could hinder development of fabricated foods unless criteria and proc-

esses for evaluating additives were modified. Some felt that more concern needs to be given to the naturally occurring organisms causing foodborne illnesses.

The other major concern in this area is the effect of quantity and kinds of food consumed on nutrition. Obesity caused by overconsumption of calories is one of the most serious health problems in the United States, more so than malnutrition or underconsumption of needed nutrients.

Concern about nutrition will likely increase in the years ahead. It would be in the best interest of consumers to increase and improve their habits, knowledge, and attitudes about food and its use through educational programs. This information should be provided in a form that they can incorporate into their daily lives and that clearly conveys the bene-

fits and risks of consuming certain types of food.

The average American has been consuming steadily more fat and less carbohydrates.⁵ Although total per capita consumption of sucrose is not much above that for the late 1920's, the per capita consumption of all sweeteners (natural and artificial) has increased, and there is concern about the large quantities of refined carbohydrates consumed by children and teenagers in soft drinks and snacks.'

'Since 1910, the per capita consumption of fat has increased from 4.5 ounces per day to 5.5, while per capita consumption of carbohydrates has decreased from 17.5 ounces per day to 13.4. However, there has been a small decrease in the consumption of saturated fat from 3.7 ounces per day to 3.3.

'Willis A. Gortner, "Nutrition in the United States, 1900 to 1974," *Cancer Research*, Vol. 35, November 1975,

A major concern in nutrition is the formulation of fabricated foods. From a technical standpoint, processed and fabricated foods offer the possibility of better control over nutritional intake. On the other hand, lack of fiber in our diet and excessive consumption of refined carbohydrates by certain age groups has been blamed on increased intake of fabricated drinks and foods. One fear is that increased consumption of fabricated foods may mean decreased intake of vitamins and needed trace minerals. Nutrition education may influence the kinds of food consumed in the future and indirectly, therefore, the technologies needed to produce them.

Workshop participants generally felt that health concerns would have a net positive impact on technological development, particularly in the processing and packaging sector, and that the impacts would be stronger in the processing than the distribution sector.

REGULATIONS

It has been shown many times over that regulations can act to encourage or deter the development and adoption of technologies, and the marketing system is no exception. For example, the recent regulatory controversy surrounding the use of saccharin has spurred research into new alternative sweeteners; bills introduced in State legislatures requiring prices on all items in a retail store have rendered the future of the electronic check-out/Universal Product Code system uncertain at best.

It is alleged that many current transportation regulations discourage the adoption of technologies that would promote efficiency and save energy in the transporting of food. These regulations are administered by a number of Federal and State agencies and cover routes, rates, and equipment size and weight. The Department of Transportation has stated that "Very substantial improvements in fuel economy and overall transportation efficiency can be achieved by moderate increases in truck size and weight by the introduction of a simplified single nationwide size and weight code," which does not exist today.

Other regulations affecting technological development are those on returnable bottles and on building materials and construction. Conflicting regulations by the Occupational Safety and Health Administration and USDA have been cited as detrimental to the full use of new construction technologies and maximum in-plant efficiency.

Regulations have also been a factor in hindering development of many processing technologies. Regulations are interrelated with health concerns, which in turn affect such technologies as fabrication and irradiation of foods. A recent statement by the Food and Drug Administration (FDA) points out that as the technology of fabrication advances and as more fabricated foods resembling traditional foods reach the market, there will be a greater concern over finding ways to assure the nutritional quality of food.'

'Stephen H. McNamara, "Nutrition Regulations by FDA in the Brave New World of Fabricated Foods," speech delivered to the Food and Drug Institute Food Update 1977, Apr. 27, 1977.

Regulations in the processing area will have an overall negative impact on the development and adoption of new marketing tech-

nologies, while in the distribution sector the impact of new regulations will be positive relative to technological development.

CHANGING LIFESTYLES

Data on changes in household and family characteristics give a measure of changing lifestyles. From 1970 to 1977, the number of households increased 17 percent to a total of 74.1 million. Households composed of persons living alone or with nonrelatives increased 49 percent, the greatest increase of any category of households. Persons living alone increased 43 percent, one factor in reducing average household size from an estimated 3.14 persons in 1970 to 2.86 persons in 1977. The most rapidly growing segment of persons living alone is in the 12 to 24 years old age group, and the most rapidly expanding age group is from 18 to 44 years old.⁹

More wives are working, therefore demanding more convenience foods and increasing the amount of food consumed outside the home. "Two-income families are better able to afford these two more expensive types of food.

A recent USDA survey found that persons over 50 eat out less frequently than those under 50 and that the younger group uses fast-food outlets more frequently.¹⁰

It is difficult to assess the overall effect of changing lifestyles on technology because while demographic statistics are measurable

and trends may be extrapolated, attitudes and beliefs are varied and often conflicting and of short duration. They are perhaps the hardest to predict with any degree of accuracy.

Consumers may want more convenience foods but may not like food additives or higher costs (although some convenience foods cost less than their home-prepared counterparts).] Some want home gourmet cooking, yet many consumers prefer to eat out at fast-food outlets. Reacting to fads of unpredictable duration and dealing with what appear to be contradictory trends are among the problems faced by food processors and distributors.

There is no doubt that consumers are better educated and more concerned; they also appear to be more willing to join others in group actions such as cooperative buying clubs and cooperatively owned stores. Since retail stores are consumers' direct contact with the food marketing system, they must have consumer acceptance of or be able to overcome resistance to new retail technologies. Consumers may be more willing to try new foods, but they are also more willing to express their opinions of products and services.

There is little doubt that under certain conditions changing lifestyles will affect the development and adoption of technology in the years ahead. Changing lifestyles will probably have a small but positive effect on the development and adoption of food marketing technologies, especially under scenario 1 and particularly in the processing and packaging sectors under both scenarios. This

⁹Department of Commerce, Bureau of the Census, Population Characteristics, Households and Family by Type: March 1977, Series P-20, No. 313, September 1977.

¹⁰One recent study estimates a 10-percent annual growth rate in away-from-home eating establishments between 1976 and 1981, which compares to a 13-percent annual growth rate between 1971 and 1976. See William C. Hale, "Rationalization of the U.S. Food Service Market and Opportunities for Supply Industries," paper presented to American Paper Institute, Tissue Division, Oct. 17, 1977.

¹¹Alden D. Manchester, *Eating Out*, National Food Situation, Economic Research Service, USDA, September 1977.

¹²Larry G. Traub, *Convenience Foods-1975*, Cost Update, Family Economic Review, USDA, Agricultural Research Service.

may reflect, in part, the visible changes in processing and packaging that have taken

place to produce the many convenience foods now available.

INDUSTRY STRUCTURE

Structure as used here refers to the size of firms, market shares, and the way firms in an industry are linked together.

It is difficult to characterize the food industry as a whole, since it encompasses everything from giant to small firms. The four largest food processors had about 8 percent of sales in 1975, and the eight largest had about 13 percent. In 1976, the four largest chainstores had about 19 percent of the chainstore and independent grocery store sales (excluding convenience stores), and the eight largest about 27 percent. The trend over the years has been toward fewer and larger firms, and consumers and Government have expressed concern about the dominant market share of the large food chains in some geographical areas. This trend may become even stronger if "superstores, retail foodstores that also sell a large volume of non-food items, are successful.

While the number of wholesalers has remained steady, considerable change has

taken place in the nature of wholesaling since 1960. Most large chains operate their own warehouse facilities and have integrated the wholesaling and retailing functions. In some areas, however, some chainstores have found it advantageous to discontinue their wholesale operations and have nonchain wholesalers supply their operations. Wholesalers have affiliated with their customers either in voluntary arrangements or as cooperatives, and wholesalers and distributors are becoming fewer and larger.

Participants in this study felt that industry structure would have a net positive impact on the adoption of technologies (although less on the distribution technologies under scenario 2). Since many technologies in this area require large capital investments and large volumes to operate economically, smaller firms may find it difficult to make such investments and compete effectively with the large firms.

OTHER INSTITUTIONS

Individual concerns may be expressed through acts that over time become institutionalized.

One such institution is organized labor, whose principal concern is with the adoption of technologies that threaten to reduce the number of jobs available or to change job status. The degree of concern and possible opposition depends on the severity of job loss or relocation, the union's ability to gain support for its view, or the relative strength of the unions versus the industry involved. This may or may not, therefore, act as a deterrent to the development and adoption of certain technologies. In addition, union contracts act

as a major impetus to wage increases, which tend to rise as prices increase; this can be expected to impact on the marketing of food as well as on other segments of the economy.

Other institutions that may influence technologies are those that come about through the organization of individual concerns—e.g., consumer groups—that may themselves exert influence on other groups or may influence local, State, and Federal institutions to work in their behalf. There is no doubt that such groups can have an effect, directly or indirectly, on the types of technologies that may be developed or introduced into the marketing system and the extent to which they are accepted and used.

FOOD WASTE

Approximately one-fifth of all food produced in the United States is never consumed.¹² It is wasted. This waste occurs throughout the production and marketing chain and may result from poor methods of harvesting, damage during transportation, inefficient utilization in processing, or spoilage. Spoilage leading not to total waste but to deterioration in quality may be caused by poor methods of preservation, rough handling, improper storage and temperature controls, or damage from insects, disease, and rodents. Significant amounts of food may be wasted at point of service in schools and

other institutions, restaurants, and in the home.

Reducing this wastage should be of concern to all those involved in setting policy in the food sector, and interest in this area should stimulate new technologies in harvesting, waste conversion, and reduction of spoilage in the marketing channels.

Increasing the amount and quality of food that ultimately reaches the consumer in proportion to the amount produced can have the beneficial effect of decreasing the energy used in both processing and transportation, reducing pollution through conversion of now-polluting wastes, and increasing the nutrient intake and therefore raising the nutritional status of Americans.

¹²U. S. Congress, General Accounting Office, Food Waste: An Opportunity to Improve Resource Use, CED-77-118, September 1977,