

AMERICA'S OBESITY: Conflicting Public Policies, Industrial Economic Development, and Unintended Human Consequences

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■ **Abstract** The chapter reviews the historical development and interactions of U.S. agricultural, economic, nutrition, and development policies relating to the creation of the commercial environment of social, economic, technological, and political factors that favor the development of American obesity.

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INTRODUCTION

America has a pandemic obesity problem. Although a widespread overweight condition is present in all industrial countries, the United States now has the highest occurrence, with estimates of more than one half of its population currently overweight or obese (10, 94). This chapter examines U.S. agricultural and economic

policies and the commercial environment that resulted from these policies during the time the pandemic obesity problem has occurred. The paper is written not from the perspective of the health sciences, but from public policy and business strategy perspectives (78).

Obesity is commonly considered to have multiple causes (5). Much has been written concerning the roles of the current American diet, modern eating behavior, and lack of physical activity in the rise of American's widespread obesity; all are vitally important factors (9, 18, 40). However, there has been relatively little examination of the contribution of agricultural and economic public policies, or the agricultural and food environment resulting from these policies, to this population-wide health crisis (78).

A wider examination of the role of public policies, the development of the American food supply under these policies, and the contribution these policies may be making as a major environmental factor contributing to the growing obesity problem, would appear to be presently needed. This is meant in no manner to diminish the great importance of the psychodynamics of the individual's eating habits and physical activities in obesity prevalence (78).

High levels of overweight and obesity are present in the United States among all age groups and under all socioeconomic conditions (21). Further, this condition has occurred predominantly in recent decades, at an accelerating rate. This all suggests that beyond individual changes in eating behaviors and evolving lifestyles, environmental conditions may also be contributing factors (5).

Currently in the United States, commercial interests supply food that is increasingly more completely prepared, they surround the public with eating opportunities, and they attempt to influence Americans' diet choices and consumption through ever more powerful commercial communications and business strategies (83). Currently, nearly half of Americans' total annual food purchases are for food that is fully prepared and consumed either outside the home or brought into the home for consumption. The percentage of these types of food purchases continues to rise yearly (29), a societal feeding trend that is recognized as favoring increased caloric consumption (see Table 1). Various types of foods and beverages prepared

TABLE 1 Annual U.S. expenditures for food

| Year | Food eaten at home | | Food eaten away from home ^a | | Total billions |
|-------------------|--------------------|---------|--|---------|----------------|
| | Billions | Percent | Billions | Percent | |
| 1990 | \$317 | 56% | \$249 | 44% | \$566 |
| 1995 | \$364 | 54% | \$307 | 46% | \$671 |
| 2000 | \$433 | 53% | \$391 | 47% | \$824 |
| 2005 ^b | \$510 | 51% | \$483 | 49% | \$993 |

^aIncludes both meals and snacks.

^bProjected.

Source: Reference 26a.

TABLE 2 U.S. beverage market

| | Annual beverage sales, in gallons, per capita ^a | | | |
|------------------------------|--|------|------|--------|
| | 1997 | 2000 | 2002 | Growth |
| Carbonated soft drinks | 53.6 | 54.5 | 54.2 | 1.1% |
| Milk ^b | 23.9 | 23.1 | 22.6 | -5.4% |
| Coffee | 21.8 | 22.0 | 22.1 | 1.4% |
| Beer | 22.1 | 22.1 | 21.8 | -1.4% |
| Bottled water | 14.2 | 17.8 | 21.2 | 49% |
| Fruit beverages ^c | 15.0 | 15.2 | 15.0 | 0% |
| Tea | 9.4 | 9.2 | 8.9 | -5.3% |
| Wine | 1.9 | 2.0 | 2.0 | 5.3% |
| Distilled spirits | 1.2 | 1.3 | 1.3 | 8.3% |
| Other ^d | 28.9 | 24.7 | 22.9 | -21% |

^aTotal annual per capita consumption 192 gallons.

^bAll milk consumption.

^cIncludes both fruit juices and juice drinks.

^dIncludes tap water, vegetable juices, powders, and miscellaneous items.

Source: Reference 92a.

outside the home are consumed at ever higher levels, such as many commercially prepared beverages, which today add significant calories to the diets of Americans (see Table 2). As a part of this growing trend of Americans delegating the preparation of their food and beverages to commercial interests, the percentage of total food purchases at restaurants has continued to markedly rise in recent decades (74), a societal trend recognized as also favoring increased caloric consumption (see Table 3) (2).

Over the past half-century, these commercial trends have become more pronounced while at the same time obesity has increased in the United States. However, little conclusive research has been conducted into the manner and degree to which these trends may be related.

TABLE 3 Growth in U.S. restaurant sales

| Restaurant sales as percentage of total retail food sales | |
|---|-----|
| 1950s | 25% |
| 1999 | 44% |
| 2010 ^a | 53% |

^aProjected.

Source: Reference 26a.

When considering obesity from a policy perspective, it is common to confine the discussion mainly to the demand side: nutrition policies (dietary guidance) that advise our citizens concerning proper food consumption (34, 60, 88). This focus on the demand side narrows the policy discussion by failing to consider the important role that supply-side public policies play in the American food chain, from basic agriculture all the way to final consumers. U.S. agricultural, industrial, and economic policies are significant in determining the nature of the food available on our tables and the environmental conditions under which it is presented (78, 79, 81, 84).

Ideally, public policies on both the supply and demand sides should work in tandem toward coordinated or similar objectives (92). The following analysis of supply-side policies—agricultural, industrial, and economic—suggests that just the opposite has occurred, and is still occurring, with implications for Americans' growing obesity problem.

The thesis of this chapter is that the historical occurrence of highly effective public policies for the food supply side—with objectives quite different from promoting public health—as well as the lack of effective policies on the demand side may be among the significant contributing environmental factors in the obesity dilemma in the United States today (78). It is a common (but unfortunate) experience that public policies initially implemented with valid objectives later can undercut needed new policies with far different and often conflicting objectives. In the United States, established and entrenched agricultural and economic public policies now serve as formidable impediments to the success of new public health policies that are needed to address pandemic obesity (79).

Future public policies for preventing further obesity may require significant changes in current supply-side policies in addition to well-recognized needed demand-side changes (population-wide nutritional education, training, and motivation concerning obesity) (81).

HISTORICAL FACTORS

During the nineteenth and twentieth centuries, two significant historical events occurred that influenced the overweight condition of Americans today: the industrialization of the food supply and the accompanying general industrialization of the U.S. economy, and the explosion of nutritional knowledge of the relationship between diet and human health (see Figure 1). Both events—and particularly their timing—are significant when considering today's obesity issue.

Unfortunately for informed public policy making, these significant historical food events did not occur simultaneously (53, 73, 78). A great part of the industrialization of the food supply was completed prior to the advances in nutritional science that led to today's extensive knowledge of diet and health relationships (especially nutrition-related noncommunicable diseases).

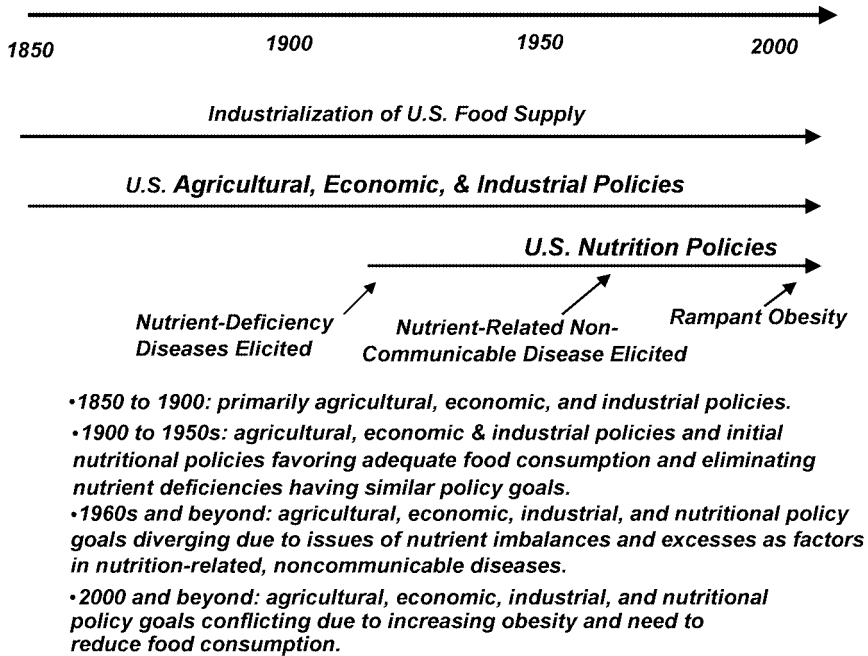


Figure 1 Time lines of public policies influencing the U.S. food supply.

INDUSTRIALIZATION OF THE FOOD SUPPLY

Industrialization of the food supply is a recent and significant event in mankind's long history of obtaining food, occurring only over the last two centuries, and at an accelerating rate during the last half of the twentieth century. Oxford historian Felipe Fernández-Armesto, in his history of food, has depicted the era of industrialization of the food supply as the eighth and most recent stage (others being important developments such as the discovery of cooking, herding, agriculture, and social organization of food activities) in mankind's long historical relationship with food (28).

Arguably, human beings have never before faced such profound changes in the nature of their food supply or in the agents supplying their food as Americans have experienced during the last half of the twentieth century and the beginning of the current century. The unsuccessful acculturation to these profound food changes is evidenced by the present overweight condition and obesity of Americans (18, 21).

Significantly, the industrialization of the food supply and of general society has affected the relationship of people to their diet in two broad ways—first, it has made food more available, and second, it has produced labor-saving technologies that reduce the amount of food people require. The industrialization of the food supply in developed countries has put an end to famine and starvation, food is

generally assured, and food availability and reduced costs allow for recreational eating and drinking (14, 16). With advances in industrialization, processed food is available, ample, varied, and affordable for the first time in history for nearly all citizens in industrial countries (15, 17).

However, along with these great accomplishments have come serious new health problems related to excesses and imbalances in food consumption (e.g., nutrition-related noncommunicable diseases and obesity). Industrialization of society has proven to be a powerful environmental force actually favoring overconsumption of food (9, 10, 21).

Society is now faced with completely new challenges relating to its food supply—the need for (and pleasure in) eating has become a constant long-term health peril because of overconsumption. At a policy level, pandemic obesity can be considered a symptom of the inability of people to self-balance food intake in this new era of plenty. To date, public health policies have had a mixed success in resolving the health-related issues resulting from this new food abundance (21).

Industrialization of a nation gives rise to extensive labor differentiation and a general increase in the population's income. Fewer people are required for food production, allowing others to seek alternate employment. With these changes, food is no longer simply gathered, produced, exchanged, or bartered, but it is sold, thus altering the dynamics of the relationship of people to their food supply (18, 76, 83, 92).

This, in turn, has led in modern times to increasing and changing commercial activities between those producing food and those who are primarily food consumers. Commercialization of the food supply gives a great incentive to those selling food to increase sales by increasing demand. In this historically new commercial process, the food seller's interest and the buyer's interest are increasingly divergent (22) and can result in a conflict between economic and public health policies, as illustrated today by the obesity problem (92).

With these changes accompanying food industrialization and its many benefits, there comes the need to govern commercially related activities affecting food availability, economics, safety, and wholesomeness to protect the interests of a civil society, and more recently, for food-related health reasons (e.g., nutrition-related noncommunicable diseases and pandemic obesity) (22, 58). To date, the latter condition has proven to be particularly difficult to resolve because of a lack of effective public health policies and initiatives. This is an area requiring new thinking and research (84).

A result of industrialization, particularly in the United States, is an apparent association between the extensive, ongoing development of the commercial sector and the rapid rise of obesity in recent decades. This raises the largely unanswered question as to the degree of cause and effect between these two trends in relationship to other important factors known to be involved with the occurrence of obesity (e.g., an individual's diet and physical activity) (76).

In sorting out the degree of cause and effect for societal obesity, other new and unanswered policy questions arise. What are the social responsibilities, rights,

and duties of those responsible for food availability on the supply side (the food sellers) versus the personal responsibilities, rights, and duties of those on the demand side (consumers)? What are the appropriate public health, agricultural, industrial, and economic policies to pursue in achieving balance between these interests? The fast-accelerating rate of American obesity gives new urgency to resolve these issues between current industrial and public health policies (21, 25, 40, 58).

NUTRITION POLICY INFLUENCE ON AMERICAN AGRICULTURAL AND ECONOMIC POLICIES

The twentieth century saw a dramatic rise in the understanding of nutrition, with waves of new and different perceptions of the relationships between diet and health. Throughout the century, as scientists made new discoveries, government policy makers attempted to incorporate the rapidly expanding knowledge of nutrition science into America's health policies. Government policy makers, scattered through different federal agencies [Health and Human Services, U.S. Department of Agriculture (USDA), Food and Drug Administration, Federal Trade Commission] and operating under different—and sometimes conflicting—laws and legal mandates, concentrated mainly on consumer-oriented demand-side initiatives in the form of tactical responses (nutrition advisories, nutrition guidelines, labeling, and information programs to the public) rather than on supply-side initiatives (industry regulation) (20, 34, 36–38, 50, 53, 88).

With this dynamic increase in scientific knowledge and well-intentioned government policy making came unforeseen and changing nutrition policies throughout the century. Significant events included the discovery of nutrient-deficiency diseases from the 1900s to 1950s, closely followed by government nutritional policies aimed at adequate food consumption, and the elimination of nutrient-deficiency diseases (34).

This period was followed in the 1950s to the 1980s by great advances in the understanding of nutrient-related noncommunicable diseases (for example, cardiovascular diseases), which were quickly incorporated into nutrition policies aimed at eliminating imbalances and excesses of certain nutrients in the American diet associated with such diseases (88). Presently, nutrition sciences and policies are shifting to obesity-related issues and emphasizing reduced food consumption (4). The result has been unintended and unforeseen conflicting government directives on food consumption during most of twentieth century (see Figure 1).

Throughout most of the century, agricultural and food industrial sectors were generally resistant to the application of the new nutrition science to governmental policies, but were more concerned about the potential effect on their established food businesses (53). As a result, given the politics involved, government nutrition research funding was predominantly directed to biomedical research, which was very successful and highly productive (53).

However, government funding largely neglected research into effective practical application of this new health information at the population level, thus depriving public policy makers of new information and techniques required for dealing with rising obesity (53). Significantly, agricultural and industrial policies during this period remained largely the same and were strongly pursued. These policies stressed a continued increase in food production and consumption, even as the overweight condition of Americans increased (and continues to do so) (see Figure 1).

Although an analysis of twentieth century public health diet initiatives is not the purpose of this chapter, nevertheless the overall thrust of these policies is potentially a significant factor in examining why agricultural and industrial policies were so successful while diet and health policies were not, especially in relation to obesity. An overall analysis of government nutritional initiatives with regard to rising obesity during the latter part of the twentieth century, and even presently, could identify the government's responses (labeling, guidelines, etc.) as tactical in nature rather than strategic (coordinated policies and programs to reach health objectives) (34, 60).

This absence of a unified governmental strategic response, combined with constantly changing policy objectives depending on largely tactical methods, contributed to the failure of public policies to blunt the rising tide of American obesity (see Figure 1). Further, it failed to act as an effective counterforce to the food industry's ever-stronger strategic initiatives (modern marketing) to motivate continuous increases in food consumption by Americans (9, 18, 53).

In summary, the twentieth century saw both the greatest advances in diet and health knowledge and the greatest changes in the eating behavior of Americans. However, the public policies arising from the former apparently had only limited influence on the long-established agricultural, economic, and industrial public policies. The importance of this disjunction between supply-side and demand-side public policies in the rise in obesity is far from resolved, but it warrants further analysis given the grave health and economic implications of pandemic obesity in the United States.

U.S. AGRICULTURAL POLICY AND OBESITY

Strong politically backed, long-active government policies have played a pivotal role in shaping American agriculture (12, 14, 30, 35). Successful government agricultural policies have resulted in the availability of relatively inexpensive basic agricultural commodities (grains, meats, fats and oils, and dairy products) to American food-processing industries. In turn, this has lowered food purchase costs for individuals and has created an environment of economical and plentiful daily food (see Figure 2) (43).

Plentiful and inexpensive food shapes Americans' lifestyles today with the likes of fast-food dollar deals, all-you-can-eat restaurants, gigantic packaged soft drinks and sweet treats, as well as supermarkets with 40,000-plus great-tasting foods. American social life, in and out of the home, is often built around eating. Food

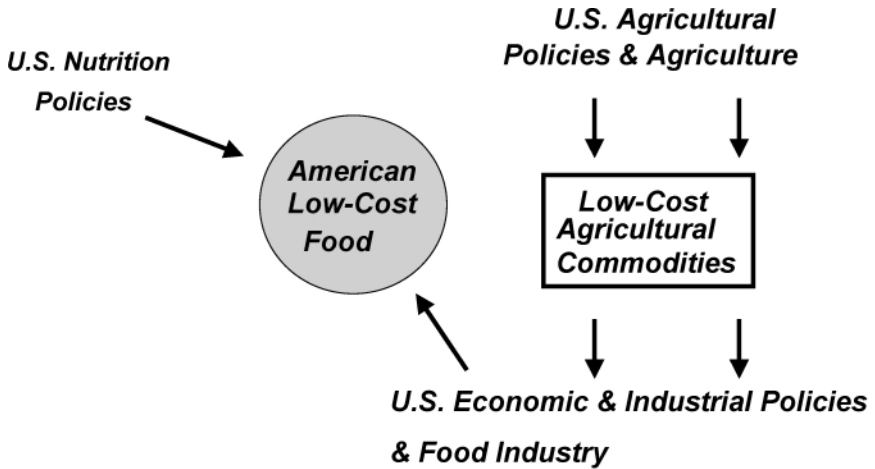


Figure 2 Public policies influencing the U.S. food supply.

economics does little presently to ration plentiful and varied food to Americans, with their food-oriented culture (18).

The food supply chain in America starts with superior agriculture—a key factor in the country's food abundance and affordability. Its agricultural productivity is unparalleled (67). Diverse natural resources (land, climate, and water) are the foundation of this abundance. However, this supply-side achievement is the result of more than natural resources; it is also due to a favorable combination of government policies, agricultural education and research systems, technology, and, not to be forgotten, its industrious and innovative farming sector (12, 35, 63).

Historically, this agricultural bounty was highly desirable as the United States became industrialized and its rapidly growing population increased the need for food. Unfortunately, today this same unchecked food bounty is now believed to be a significant supply-side factor that unintentionally and unexpectedly creates one of the environmental conditions contributing to the country's pandemic obesity.

Overproduction, and the consequent inexpensive foods, is now recognized as an environmental force favoring the occurrence of pandemic obesity. Today, ever more productive U.S. agriculture, supported by unceasing technological innovation, favorable public policies, and the country's comparative advantage in natural resources, are all causal elements to various degrees in creating an environment favoring the occurrence of America's obesity problem—excess food commodity production (6, 30, 41, 78).

U.S. agricultural policies are commonly recognized as pivotal to this food abundance, but they are often overlooked except in broader analyses of environmental factors contributing to obesity (12, 30, 67). Agricultural policies with valid initial objectives (production agriculture) later become open to question due to the environmental conditions the policies create—excess food—and their relationship

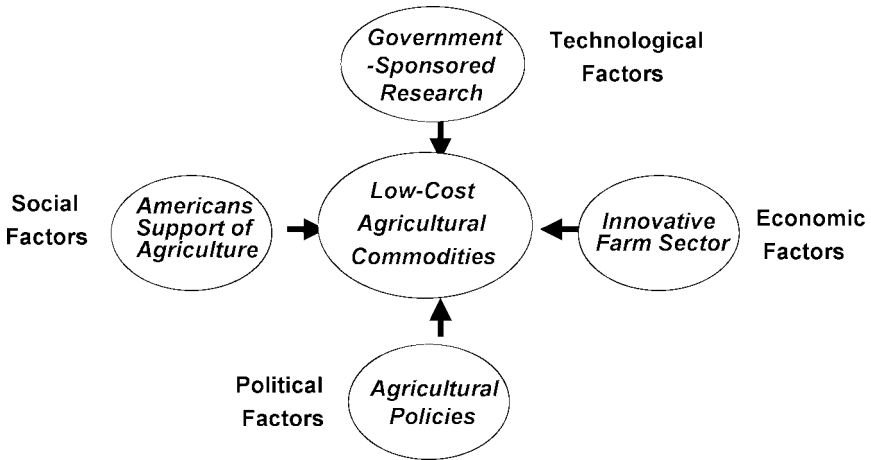


Figure 3 Factors influencing the development of the U.S. agricultural system.

to unintended, unforeseen human outcomes (obesity). The following section examines U.S. agricultural policies as well as social, economic, technological, and political factors (see Figure 3) leading to this ongoing policy disjunction and the factors preventing its correction (6, 39, 41).

UNITED STATES AS AN AGRICULTURAL NATION

The United States is one of the world's leading industrial nations. Consequently, it is often forgotten that agriculture has had an important role throughout America's history. Agriculture is a vital part of the American economy. This ultra-efficient sector supports the world's largest consumer food market today—valued at an estimated \$920 billion in 2003. It offers a vast array of reliable, high-quality, low-cost agricultural commodities for use by the world's largest and most diverse food-processing industries (29).

The United States is also one of the world's largest exporters of agricultural commodities. During the current fiscal year, agricultural products will add \$56 billion to the nation's export sales. Agriculture is not only one of this country's largest businesses; it is a significant cultural and political sector as well (12, 59).

Agriculture is fundamentally different from other American businesses. It requires the favorable interaction of a unique and complex set of environmental conditions (weather, temperature, etc.) with varying degrees of flexibility, and is accompanied by the high risk inherent in all endeavors that depend on nature. This environmental uncertainty and the extreme economic variability of commodity markets present great risks to farmers, which is one of the reasons why agriculture has long been highly favored by supportive public policies (43, 63).

AGRICULTURE: AMERICA'S SPECIAL BUSINESS

To fully understand the paradox of obesity and agricultural policies, one needs to take a brief look at the country's agricultural history. At the nation's founding, America was predominantly an agricultural nation, with 90% of its people depending on agriculture for their livelihood (93). Its founders, many whom had their own large agricultural holdings, greatly valued agriculture and its way of life. Many of these men hoped that the country would remain primarily an agricultural nation (93). This agrarian orthodoxy has fueled agricultural growth and prosperity right up to the present, and it gave rise to a strong, enduring agricultural tradition (the family farm) among many Americans (63).

George Washington, the nation's first president, in his annual message to the U.S. Congress in 1796, stated:

It would not be doubted that with reference either to individual or national welfare, agriculture is of primary importance. . . . Institutions for promoting it grow up, supported by the public purse; and to what object can it be dedicated with greater propriety? (91)

President Washington's remarks were clairvoyant concerning the public purse and the key role it would play in U.S. agriculture. American political culture honors farming and designates agriculture as a special business, resulting in the public's ongoing cultural, political, and financial support, unequaled in either duration or degree by other types of American businesses (32, 33, 43, 51).

AGRICULTURE: THE BUSINESS OF GOVERNMENT

The U.S. federal government has been increasingly involved in agriculture since the Civil War. The U.S. Congress created the Department of Agriculture in 1862. In this same period, it also enacted the Morrill Land-Grant College Act, commonly considered the most important piece of agricultural legislation in American history, which provided for the appropriation of public land for the establishment of agricultural and industrial colleges in each state (30, 35, 41).

In 1887, the Hatch Act, in combination with the previous act, established the country's land-grant universities and their agricultural experimental stations. This sequence of congressional legislation resulted in the establishment of the country's agricultural education and research system, commonly acknowledged to be the world's leading agricultural research system. By the creation of this government-sponsored system, American agriculture would be supplied with a constant stream of world-class new cutting-edge technologies, allowing it to become ever more efficient and productive in agriculture (30).

American agriculture has continued to be highly favored by government policies, right up to the present. During the period of 1902 to 2000, the U.S. Congress passed more than 70 major federal acts that were highly beneficial to all

production agriculture. These congressional actions have, over time, created a favored agricultural economy within the broader U.S. economy, strongly supported and financed by federal government programs (8, 12, 30, 35).

As outlined in a recent paper on pandemic obesity:

As a result US agriculture developed its own agricultural regime of market institutes and public investment and finance—subsidies, marketing assistance programs, special taxation, a farm credit system, market regulations, commodity programs and trade policies. All of these were highly favorable to US agriculture. It also included a nationally supported rural infrastructure encompassing country roads, drainage systems, flood controls, postal service, as well as technical assistance in the form of market information sources, extension education and assistance, and federally funded world-class production agricultural research. (81)

The overarching objective of the powerful regime described above is to constantly increase agricultural productivity, efficiency, and commodity production. Public policies aimed at furthering these objectives had great social utility for a nation that was rapidly industrializing, accelerating in population growth, and desiring broad security of a food supply at reduced cost for its citizens. American agricultural policies have been successful in meeting these production objectives and should be highly regarded for their accomplishments (23, 30, 41, 43, 63). Only now, as we face the grim reality of pandemic obesity, is there any need to question from a public health perspective this agricultural regime, its political power, and its continuing production goals (81, 84).

Maryland University Professor Bruce Gardner has recently chronicled the history of U.S. agricultural innovation aided by massive government funding programs (subsidies) that have made the United States one of the world's agricultural superpowers. He identifies this as one of the major factors leading to Americans today having such a low-cost, dependable, and plentiful food supply. Professor Gardner and numerous others have noted how fully embedded in the structure of American political affairs is its agricultural regime, and they predict that it will continue to be so in the future (30).

AGRICULTURE'S POLITICAL POWER

During the twentieth century, U.S. agriculture's congressional political power has played a significant role in the continued growth of American production agriculture. No other business sector has equaled the agricultural interests' ongoing bipartisan political power in the U.S. Congress. Its power centers are the agricultural committees in both houses of Congress. These powerful committees, staffed by congressional members from agricultural states, are historically where U.S. food policy is formed and then implemented by the U.S. Congress's control of the public purse.

The political system by which this comes about has been described in the following manner:

A “structural” view of farmers’ political power focuses on a “gold triangle” of members of the committees that authorize legislation and appropriate funds, the executive branch department that administers the programs (USDA) and the lobbyists representing farm interests. (30)

As a result, the U.S. Congress and its agricultural committees have strongly favored, funded, and protected production agriculture. In this mission, the U.S. Congress has been backed by American voters’ support and acceptance of the special business status of farming, and the agricultural sector’s electoral power in predominantly farm states. Under this American agricultural regime, agricultural interests have dominated and directed much of food policy to its production objective—ever greater commodity yields and increased commodity utilization. The ultimate success of these policies can be judged by the results: Per capita U.S. food utilization has increased from 1800 pounds per year in the early 1980s to 2000 pounds per capita presently (90).

U.S. agriculture policies are increasingly questioned on their primary production objectives supported by government subsidies programs. Agricultural policies favoring continuous increases in the production of commodities, irrespective of need or population growth, are increasingly questioned. These policies also face increased questioning, both internationally and domestically, for their large-crop subsidies programs (projected to be \$190 billion over the next decade). However, the long-established political backing of the present agricultural regime to date has prevented significant change (66).

With the rise of pandemic obesity, the established agricultural regime faces a new and difficult challenge. The issue is now public health, not just economic conditions. Any future policy conflicts between agriculture and public health interests will be resolved by the U.S. Congress, guided by voters’ interests and opinions. Public health policy initiatives aimed at reduction or modification of agricultural commodity supplies as part of a strategy to control obesity will meet opposition from the politically powerful agricultural production regime.

The American public, in general, is supportive of agricultural interests and their agendas because they yield a plentiful, dependable, varied, relatively safe, and cheap food supply. The public expects and demands that American agriculture provide these benefits. In 1972, grain prices markedly increased due a combination of large export sales to Russia and poor weather in the grain-growing states, resulting in higher prices at retail for meat, milk, bread, and other staples affected by grain costs. Angry consumers staged public demonstrations against the higher cost of food, including a nationwide meat boycott. At the time, U.S. Agriculture Secretary Earl Butz, under the direction of President Nixon, implemented agricultural policies to reduce the future cost of major commodities; these have been active to the present and successful in their price objectives (59).

Americans enjoy the benefits of the present agricultural regime—consumer food currently requires on average less than 10% of their disposable income—and, as a result, would be resistant to any radical changes in the agricultural system supplying these benefits. The public commonly does not recognize that its inexpensive food entails hidden costs: taxes that they pay to varying degrees to support agricultural programs. In the future, as the public medical costs increase as a result of widespread obesity—supported again largely by taxes—this will further increase the hidden costs of Americans' inexpensive food (71, 72).

Americans understand, in general, that some connection may exist between the marketers of food (food companies and restaurants) and obesity. However, it is questionable whether most of them would see a connection between obesity and agricultural policies, thus making policy changes difficult, if not likely. American agriculture will continue to be more productive under the current agricultural regime and its policies, resulting in continuing low-cost commodities.

Future obesity-targeted public health policy initiatives will probably be required to accommodate the contradiction inherent in the overabundant, inexpensive agricultural commodities. American agricultural interests, collectively as well as on an individual commodity basis, are a part of a vast and powerful environmental force that, together with the food industry, facilitates increasing food consumption for an already overfed American public.

AMERICAN CAPITALISM, THE FOOD INDUSTRY, AND OBESITY

During the last 150 years, the growth, development, and (largely) the business behavior of the food sector can best be understood by considering America's strong economic orientation. America is probably the world's most capitalistic country. French economist Michel Albert writes that American capitalism (versus the more socially oriented European capitalism) is marked by the great priority given to investors' interests and stockholders' profits, with reduced concern over social ramifications (1).

American capitalism stresses open markets predominantly regulated by market conditions rather than by governmental involvement. It is an economic system favoring continuous growth and expanding markets. Under this capitalistic orientation, and in combination with public policies favorable to economic development, American industries—including the food industries—have experienced phenomenal growth over the last 150 years (32, 46, 61, 65).

Under these policies, the food industry has been for decades one of the constant-growth industries of the American economic system. The industry attracts great financial investment, based on the expectations of continuous growth and profitability, which the industry has generally achieved. The food industry has grown and prospered by adhering largely to economic objectives (2, 3).

It needs also to be remembered that until recent times mankind's major food problem was insufficiency; surpluses were unknown (7). An efficient, dependable

food industry was vital to the economic growth of the United States as it became industrialized (the need for a commercial food supply still is vitally important for the nation's modern lifestyles). The growth of the processed-food sector had great social utility both for feeding an increasingly nonagricultural, urban population and for the nation's economic development. The industry, operating under its fundamental economic orientation, grew and prospered by supplying the food required by the country's growing population (45).

During the nineteenth and the majority of the twentieth centuries, the food sector was seen—as were the other economic sectors (manufacturing, transportation, and communications)—as part of the nation's general industrial growth. The same economic and development policies and economic considerations that benefited all other American industries were applied to the food sector (51).

Beyond providing enough food for human subsistence, economic policy makers generally have made no connection between the food industry's business activities and nutritional health issues. The food sector has operated predominantly under general economic and development policies from its inception (and largely still does), reflecting Americans' constantly changing lifestyles rather than following any strong health rationale (2).

This highly successful economically oriented regime, from the food industry's beginning and through the twentieth century, resulted by the last half of the past century in an increasing contradiction between established economic policies and rising new health concerns (53). This policy conflict culminated at the start of the present decade in a debate (unresolved to date): What policy adjustments would be necessary to control Americans' increasing obesity problem while retaining the economic viability of the necessary large food-processing sector?

FOOD INDUSTRY DEVELOPMENT UNDER ECONOMIC AND SOCIAL INFLUENCES

In the mid-nineteenth century a food supply revolution began in this country. The American industrial revolution was beginning; people were leaving the farm to work in the new industrial cities; these workers required food, and had wages to pay others to feed them. America needed a commercial food supply (45, 51).

Aided by the nation's increasing consumer market, abundant agricultural commodities, new food-processing technologies, expanding transportation facilities (railroads, then trucking), and new communication systems (telegraph, newspapers, and magazines), the modern American food industry developed. The industry quickly grew, aided by a nascent retail system, new business methods (marketing, branding and advertising), hordes of entrepreneurs backed by ample venture capital, and most importantly, supportive and favorable government economic policies (13).

The industry prospered by supplying large volumes of low-cost, processed food that the American public was hungry for and very willing to buy (24). The industry's development under its primary economic orientation would be further

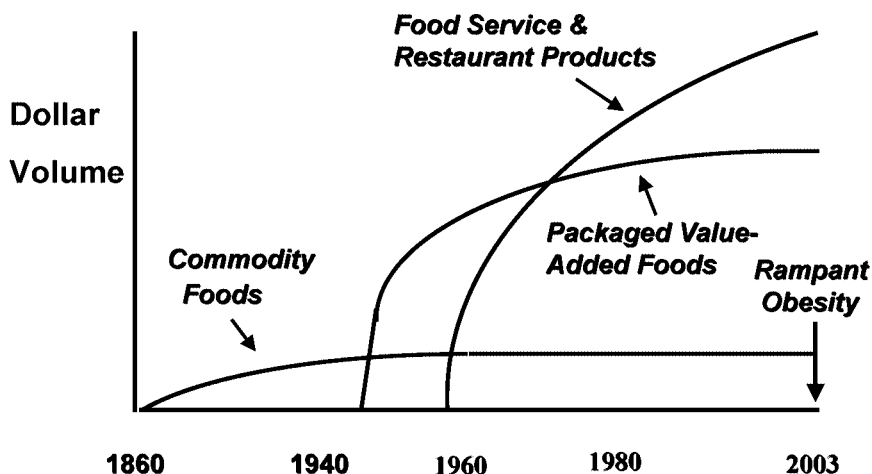


Figure 4 Eras of types of consumer food products growth in the United States.

shaped over time by changing American social trends and evolving consumer food needs (see Figure 4) (83).

The following briefly describes the food industry's product development cycle under these changing social, economic, and technological conditions:

These new food market opportunities (feeding scores of hungry factory workers and city dwellers) attracted entrepreneurs and venture capitalists to the food sector. This started a 150-year-long cycle of food technology innovations that first offered Americans widely available affordable basic food commodities to cook with including, flour, white sugar, meats, canned vegetables and fruits, dairy products. By the 1950s, scores of attractive, convenient consumer foods with "built-in maid service" became popular, such as packaged cereals, bakery products, and cake mixes; frozen fruits, vegetables & TV dinners; instant coffee; bottled soft drinks, and snacks. Recently, the convenience-food revolution has expanded into a multitude of ready-prepared food offerings, including fast foods, take-outs and ready-prepared meals and snacks. (81)

This industrial achievement required great innovation by the food industry. Government policies are notoriously ineffective in producing actual industrial innovation; however, government can foster the necessary economic conditions (public policies, services, and knowledge) to allow entrepreneurs to achieve beneficial innovation. U.S. policies have been extraordinarily successful in creating an economic environment for the food sector's development. Beyond the general support of America's economic policies, the food industry was favored in its growth by specific public policies to encourage innovation in the food sector (such as product and processing research at land-grant universities and USDA laboratories) (89).

Agricultural interests and policies were also supportive because a growing food industry was necessary for the utilization of America's increasing commodities production. As the present size and diversity of the U.S. food industry attests, American economic and development policies have been markedly successful in their objective of encouraging great innovation in the food sector. History shows that the public enthusiastically accepted this cycle of food innovations because of its great utility in their changing lifestyles (14).

As happened with agriculture, without government-sponsored research it is doubtful that the food industry would have reached its current range and sophistication of products or its present industrial structure. Under the nation's agricultural policies, government institutions would supply the necessary food science, and industry would supply the required product innovation for the industry's development (14, 16).

In general throughout its history, the American food industry has been (and still is) highly dependent on government-sponsored research for the basis of its innovation. Food companies historically invest relatively less in research than most other major industries, spending on average the equivalent of only one half to one percent of their sales on research and development (89).

The industry's primary research objectives are new products, processing, packaging, and distribution of food and beverages to encourage consumer purchase (19). The food industry's research efforts historically have been directed largely to applied product development and quality control, not to new industry-resaping innovation. The industry, in general, is not technology driven, but uses technology to accommodate the American public's changing wants and desires in food that accompany their changing lifestyles (16, 84, 89).

Predominantly during the last century, when the food industry developed, Americans chose and bought their food mainly on taste, convenience, and economic motivations rather than for health reasons (Americans still favor these purchase factors) (2, 3, 83). As previously outlined, this historical disjunction between health objectives and industrial objectives could not have been avoided because the knowledge that nutrition science has brought to our understanding of diet and health made a relatively late historical appearance in the development cycle of industry (significantly, only during the past 50 years) (53). During the majority of the course of development of the American food industry in the twentieth century, consumers' food interests, industry objectives, and government economic policies were (and still are) very much aligned (53).

In addition, it is likely that government policy makers (as well as the food industry itself) did not foresee the pandemic obesity that would result from an increasing commercial food supply, nor could they have foreseen the dramatic changes in American lifestyles as the food industry developed (78). As a result, the industry responded and shaped itself predominantly under its marketing philosophy of producing and selling what consumers wanted rather than being concerned with health and nutrition issues affecting consumers (68). This business strategy has been remarkably successful for the sector's growth and consumers' organoleptic

satisfaction; however, it has been of questionable value for Americans' nutritional health.

Like U.S. agricultural policies, the policies under which the food industry operates are not health policies, but economic policies (53). Under these economic conditions, food companies are motivated to continuously increase consumption of their food products under highly competitive business conditions. The food industry, both collectively and in individual companies, has become a vast environmental force facilitating ever-increasing consumption of their food and beverage products (9, 17, 29, 53). The appearance of pandemic obesity and growing public awareness of its health implications have created a potential impediment to the industry's basic business growth strategy (18, 76).

Under the Darwinian economic conditions in which the American food industry has operated, weaker companies are winnowed out on an ongoing basis, resulting in a competitive business environment that requires the surviving companies to become stronger marketers, product innovators, and business practitioners, lest they also succumb to more capable business rivals. This in turn creates a cadre of ever fewer but more capable marketing companies continuously attempting to motivate Americans to buy and consume more of their food and beverage products.

Although individual companies usually market and promote narrow lines of food and beverages products, and thus have limited individual influence on the total American diet, it is the composite influence of the total food industry—in its many formats—that creates a stronger environmental force encouraging Americans' food consumption. This composite industrial economic force, which Yale Professor Kelly Brownell has labeled the toxic environment contributing to American obesity, is of growing interest in evaluating current public policies and their influence on obesity (9, 11).

OBESITY AND THE FOOD INDUSTRY'S CHANGING STRUCTURE

Under the prevailing U.S. economic policies in recent years, the food industry has been extensively restructuring in response to changing marketing conditions (saturated retail food categories and the growing buying power of consolidating supermarket channels) (see Table 4) as well as to companies seeking economic scale advantage. Growth in the average size of consumer food companies is the result not only of rapid industry consolidation (food company mergers occurred at the rate of 350 to 800 per year during the 1990s), but also can be attributed to the organic growth of major companies through the sales of established products and new product innovations (industry-wide new product introductions number in the thousands yearly). This has resulted in not only fewer, but also increasingly larger companies with great ability to influence Americans' food purchases through their consolidated marketing power, often in two to four company market oligopolies

TABLE 4 U.S. retail food consolidation

| Annual sales of five largest supermarket chains | | |
|---|------------------------------------|--|
| | U.S. retail sales (in billions) | Percentage of total U.S. retail sales |
| 1993 | \$74 | 20% |
| 1998 | \$167 | 40% |
| 2003 | \$296 | 58% |

Source: Reference 26a.

as well as single companies dominating significant market shares in various food and beverage categories (42, 77) (see Table 5).

American major food companies lead in virtually every measure of commercial success globally, often with annual consumer sales in the tens of billions of dollars, with single food and beverage companies commanding 20% to 70% of total sales in various food categories (73). In spite of largely saturated markets in all types of processed foods and beverages in recent years, the food industry as a whole continues to grow both in sales and product volumes. This economic paradox of continued growth in spite of apparent market saturation results in the caloric source of much of America's pandemic obesity (9, 18, 53).

Key to their business success and their dietary influence is the attractiveness—the taste, economy, and convenience—of the food products offered to consumers. The food industry excels at determining consumers' appetites, desires, and needs in food products (guided by excellent consumer and motivational research), and then answering these identified market demands at very affordable prices (26, 27, 56, 62, 75, 86, 87). Americans' increasing purchases of the industry's food products attests to the great skill of the food companies in satisfying consumers.

Major food brand and restaurant chain companies excel at well-coordinated product innovation, marketing, and promotion, investing many billions of dollars

TABLE 5 U.S. retail sales of largest food companies

| | 1999 | | 2001 | |
|--|------------------------------|-----------------------------|------------------------------|-----------------------------|
| | Total sales (in billions) | Percentage of U.S. sales | Total sales (in billions) | Percentage of U.S. sales |
| Largest 10 food companies ^a | \$186 | 44% | \$213 | 47% |
| Largest 40 food companies ^a | \$323 | 78% | \$365 | 81% |

^aExcluding food/beverage sales by fast-food establishments, restaurants, or food service subsidiaries or divisions.

Source: Reference 26a.

annually in these sales-generating activities. Also, virtually every global food company today markets its products in the United States, attracted by the growing size of the American food market and the business learning opportunities from its competitive market. Collectively, the American food industry—retail, restaurants, and institutions,—today creates the largest consumer marketing force in food history (2, 3, 29, 73).

Competing in this market are food companies that not only are larger and have greater resources (financial and intellectual), but also are applying increasingly effective product promotion strategies (commonly making use of social and behavioral psychology in their marketing activities) and are operating under the current *laissez faire* public health policies (obesity overlooked) (68, 86, 87).

The measure of the success of American economic policies for the food industry is thus: The American food industry is the largest, most diverse, and most efficient in the world today, having the largest number of global food companies. Seven of the world's ten largest food companies are American (3, 73). The American processed-food industry (all types) supplies a consumer food market that recorded \$824 billion in retail sales in 2000 (food eaten at home \$432 billion, away from home \$392 billion), and is currently projected by the USDA to reach \$1202 billion in sales by 2010 (food at home \$605 billion, away from home \$597 billion) (29).

As a result, the industrial influence on the American diet, particularly during recent decades, is unparalleled. Under current American economic policies, the industrial influence, in its various formats, on what Americans eat is also continuously increasing (8). This is due in part to the expanding types of commercially prepared foods and beverages being offered to Americans (by restaurants, food services, and institutional feeding services), foods that are increasingly fully prepared, often delivered directly, and available around the clock at relatively lower and lower prices (74). This increase in easily available prepared food has occurred while more affluent Americans have become increasingly less physically active (as they work longer hours at their sedentary jobs and professions) and have changed their eating habits from a traditional eating pattern of three meals a day to—increasingly—continuous eating (74).

A leading example of the social eating trends outlined above is the growth in fast-food outlets. Industry data report that Americans currently eat restaurant-prepared food slightly more than 200 times a year on average (both in restaurants and taken out). Fast-food restaurants are currently reported to supply approximately three fourths of these meals (84, 70). This is possible because there is now one fast-food restaurant for every 1000 Americans, up from one per 1400 people in 1990 and one per 2000 people in 1980 (70).

The concentration of fast-food consumption is occurring in larger restaurant chains, with the six largest U.S. fast-food chains reported as having a combined control over 49,198 American outlets (84). Approximately 11.8% of the \$426 billion spent on away-from-home prepared food in 2002 went to these six largest fast-food chains, which spent a combined \$1.68 billion in the same year to advertise their products (48, 84). [The effectiveness of their commercial messages

to potential customers is demonstrated by an industry study for the third quarter of 2003, which showed that 8 fast-food TV commercials were among the top 20 most-remembered (by polled viewers) commercials of all advertised products (85).]

Judging by the American food industry's current size, range of products and services, and business methods, the industry is a significant environmental factor in the daily diets of most Americans. Commercial foods are the caloric source of much of the American diet. The industry's food products represent not only a major, but also an increasing part of Americans' daily diet, and as a result it can be inferred that processed foods of all types are a growing environmental factor in the nation's pandemic obesity (9, 18, 68). This is not to imply a direct causality for obesity, but rather to highlight the powerful environmental force that the food industry in its many forms contributes to many Americans in their negative eating behavior, leading to obesity (76).

The modern food industry's role in the nation's diet, greatly aided by public policies favoring the industry's economic growth, increasingly has become an influence on what, where, and how Americans eat. Estimates by the USDA show in 2000 an average per capita intake of slightly less than 2700 calories per day. This is an increase, on average, of 530 calories per day, or 24.5%, since 1970 (70). Fully prepared purchased food is believed to be a major contributor to this caloric increase in recent years. Food portion sizes at restaurants are believed to have increased substantially in the last three decades; however, the largest increases in portion size are reported for fast-food restaurants (70).

Only now, with the nation's overweight condition affecting more than half of the population, are serious questions being asked about unceasing volume-increasing economic policies under which the industry has developed and currently operates and the potential contribution of these economic policies to pandemic obesity (21).

This raises an important public policy issue for the nation's obesity problem: Given the present industrial structure of the American commercial food supply chain, are new broad structural and strategic responses necessary—or even possible—on the supply side (economic and industrial policies) concurrently with greater efforts on the demand side (American public) to curb obesity?

As with agricultural policies, there is in place an industrial regime in the United States with strong economic and political support favoring continuation of the status quo of current economic policies (53). It must be remembered also that our food is provided by a vast supply chain stretching from the farm to the ultimate consumer, with many nonfood industries supplying necessary goods and services along the way (79). This entire food-related industrial complex has a strongly vested interest in the continuation of the industry's present business growth strategies under existing economic policies. As with agricultural policies, there would be great resistance by industrial interests to any change in current economic policies (53).

Also, with regard to any future supply-side public policies to assist in obesity containment, consumer satisfaction with the industry's products (and the deeply entrenched role of these products in lifestyles of consumers) may be a significant

barrier to any obesity policy initiatives to change or disrupt the current economic-industry agenda (57).

THE FUTURE

Considering the prevalence of the overweight condition today in the United States and its predicted future social and economic costs, obesity can no longer be considered as just the individual's problem, but rather should be seen as a broad population problem requiring attention by government. New public policies and initiatives are likely to be required to contain and solve this ubiquitous American health problem. If so, which policies and public health initiatives (supply side, demand side, or both) will be successful, considering that overweight and obesity are the result of widely varying types of both individual behavior and environmental forces? Which various current agricultural, industrial, and development public policies are significant factors? These questions are complicated by a complex set of interacting and often conflicting social, economic, and political factors.

Advances in the nutritional sciences have provided considerable information on the causes and potential control of obesity at the individual level; however, at the societal level, the investigation of the causes and control of population-wide obesity has only started. Therefore, before embarking on new policy initiatives aimed at solving this societal problem, we should ask to what extent we fully understand the environmental and structural conditions—especially the commercial sector—as contributing factors to today's overweight population. In addition, we should ask whether we presently know the appropriate and effective remedial actions at a policy level to assist in controlling the environment in which this population-wide problem is occurring (47, 76).

At the start of this quest, it might be worthwhile to reconsider the high hopes that the nation shared for Americans' future diet and health upon the passage of the Nutrition Labeling and Education Act in 1990, with its required nutritional labeling of all packaged foods. Only belatedly was it discovered that in their everyday lives most people did not use labels effectively; in addition, there was an extensive change in their diet to non-nutritional-labeled, ready-prepared, ready-to-eat foods.

In addition, there was a lack of government funding for programs to educate the public in the use of the new, complex labeling; this was followed by a decade in which obesity skyrocketed. This, among other recent public health initiatives (the health significance of total-fat-dietary-intake initiatives), should give us pause to evaluate our understanding of the environmental forces contributing to obesity before rushing into new public policies or initiatives without fully understanding their dynamics (69).

Presently, concerned health experts and citizen advocates are calling for societal responses to curb increasing obesity, with tactics such as targeting foods high in fat and sugar for new taxes, rigid controls of commercial communications to children, elimination of certain foods from educational institutions, and increased

interventions in matters of diet and physical activity. Do we have any firm evidence that such tactics alone will work to control obesity? While such tactics may well be part of any eventual societal solution, this chapter questions the success of any such limited tactical initiatives, given that the present powerful agricultural and economic policy regime (outlined above) is still in effect, as opposed to broader strategic and structural approaches to the obesity problem.

Could more progress be made in controlling obesity by initially framing the issue as the conflicting objectives of long-established agricultural, industrial, and economic policies versus needed new health policies requiring resolution at a societal level, prior to deciding on specific remedial actions (25, 76, 78)?

According to recent public opinion studies, the American public is not yet overly concerned about obesity and shows a low level of support for obesity-targeted public policies aimed at the food industry (one exception is with regard to marketing directed at children) (48). Obesity apparently is viewed as resulting mainly from individual behavior rather than as the responsibility of industry (recent public opinion polls report up to 90% of those questioned attributing obesity to individual behavior alone) (57). The introduction of future policies must first overcome the public's ennui concerning governmental involvement with obesity.

We can view the pandemic obesity crisis as it relates to public policies—agricultural and economic—from a historical perspective, seeing the food industry's efforts to feed us as waves of industrial technological innovation initially aimed at feeding (but now overfeeding) us (see Figure 4). As with all important innovations—the automobile, the railroads, and modern communications—a predictable cycle of events will follow.

Initially, society, in the hope of gaining the benefits from any new, untested, technological innovation, allows great latitude (through the absence of controlling or limiting public policies) to those entrepreneurs pursuing its introduction, in the expectation that society may benefit in the future from its commercial success. As the innovation is tested, established, and generally accepted, society's interest (after gaining the direct benefits from the innovation) shifts to the control of any undesirable societal side effects by the introduction of remedial public policies.

The growth and development of the American food industry—initially commodity processed food, later consumer food products, and now ready-prepared foods—over the last century can be visualized as just such an innovation-and-policy cycle. Today, with the food-processing industry fully established and accepted and the nation benefiting from the industry, the undesirable side effects (obesity) need governmental attention through new public policies. With obesity in America today, we are evidently at the inflection point in history, with the strong need to shift from laissez-faire public policies that presently control the food industry's marketing, promotion, and general business activities to an era of new forceful public policies in the interest of dealing with pandemic obesity. Unfortunately, we apparently do not presently have the necessary research-proven policy levers to accomplish this health objective.

Successful future public health policies will require constructively dealing with the strong environmental forces generated by the current U.S. agricultural and economic policies driving overeating as well as the influence of industrialization in general, which favors Americans becoming overweight.

Designing successful public policy for addressing pandemic obesity at a societal level presents daunting new challenges to policy makers: first, devising population-wide policy strategies (presently far from obvious) to control Americans' large appetites in a highly food-oriented society; second, convincing a skeptical public that obesity initiatives are the appropriate role for government (recent public opinion polls show antipathy to this action); and finally, successfully implementing these policies in the daily lives of Americans, whose diverse population is now reaching 300 million! Further, any proposed policies, in order to be seriously considered, need to be acceptable to the majority of Americans culturally, economically, legally, and—most difficult of all—practically (84).

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LITERATURE CITED

1. Albert M. 1993. *Capitalism vs. Capitalism*. New York: Four Walls Eight Windows
2. Baas E, van Battum S, Voorgerbergen M, Zwanenberg A. 1999. *The Fight for Stomach Share*. Utrecht, The Netherlands: Rabobank
3. Baas E, van Battum S, Voorgerbergen M, Zwanenberg A. 1999. *The World Food Markets: Market Trends and Driving Force for International Food Companies*. Utrecht, The Netherlands: Rabobank
4. Big business: the obesity industry. Sept. 27–Oct. 3, 2003. *Economist*, p. 64
5. Booth SL, Sallis JF, Rittenbaugh C, Hill JO, Birch LL, et al. 2001. Environmental and societal factors affect food choice and physical activity: rationale, influences, and leverage points. *Nutr. Rev.* 59:S21–39
6. Bovard J. 1991. *The Farm Fiasco*. San Francisco: Inst. Contemp. Stud.
7. Braudel F. 1979. *The Structures of Everyday Life: Civilization & Capitalism 15th–18th Century*. New York: Harper & Row
8. Briskey EJ, Hays VW, Mitchell RL. 1983. Future approaches for meeting nutritional needs. See Ref. 67, pp. 118–43
9. Brownell KD, Horgen KB. 2004. *Food Fight*. New York: McGraw-Hill
10. Centers for Disease Control and Prevention. 2004. *Trends in Intake of Energy and Macronutrients: United States, 1971–2000*. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5304a3.htm>
11. Coffman WR, Elliot JM. 1983. New directions in the plant and animal sciences. See Ref. 67, pp. 104–17
12. Committee for Economic Development. 1974. *A U.S. Farm Policy for Changing World Food Needs*. New York: Comm. Econ. Dev.
13. Connor JM. 1988. *Food Processing*. Lexington, MA: Lexington Books
14. Connor JM. 1988. Growth of the food processing industries. See Ref. 13, pp. 7–18
15. Connor JM. 1988. Anticipated growth in food processing. See Ref. 13, pp. 67–76
16. Connor JM. 1988. Role of processing in the food system. See Ref. 13, pp. 19–28
17. Connor JM. 1988. Anticipated growth. See Ref. 13, pp. 133–37
18. Critser G. 2003. *Fat Land: How Americans Became the Fattest People in the World*. Boston: Houghton Mifflin

19. D'Alessandro DE. 2001. *Brand Warfare*. New York: McGraw-Hill
20. Davis C, Saltos E. 1999. Dietary recommendations and how they have changed over time. In *America's Eating Habits: Changes & Consequences*, Econ. Res. Serv. 750, pp. 33–50. Washington, DC: USDA
21. Deleted in proof
22. Duffy J. 1990. *The Sanitarians: A History of American Public Health*. Chicago: Univ. Ill. Press
23. Duncan E. 2003. Make it cheaper, and cheaper: How technology pushes down price. A survey of food. *Economist*, Dec. 13, pp. 6–8
24. Duncan E. 2003. Make it convenient: That trends not to mean healthy. A survey of food. *Economist*, Dec. 13, pp. 10–11
25. Duncan E. 2003. Outflanking the enemy: Can government make people thin? A survey of food. *Economist*, Dec. 13, pp. 15–18
26. Ewen S. 1996. In *PR! A Social History of Spin*. New York: Basic Books
- 26a. *Food Institute Annual Industry Review*. 1993–2004. Elmwood Park, NJ: Food Inst.
27. Francese P. 1996. Marketing know-how. *Am. Demogr.* May: 50–52
28. Fernández-Armesto F. 2002. *Near a Thousand Tables: A History of Food*, pp 187–224. New York: Free Press
29. Food expenditures 1992–2010. 2001. *Food Ind. Rev.*, p. 5
30. Gardner BL. 2002. *American Agriculture in the Twentieth Century*. Cambridge, MA: Harvard Univ. Press
31. Deleted in proof
32. Goodwyn L. 1978. *The Populist Moment: A Short History of the Agrarian Revolt in America*. New York: Oxford Univ. Press
33. Hardy RFR. 1983. *The Outlook for Agricultural Research and Technology*. See Ref. 67, pp. 91–103
34. Harper AE. 2000. Recommended dietary allowance and dietary guidance. See Ref. 42a, pp. 1606–21
35. Harris HM Jr, Hite JC, Robinson BH. 1983. Public policy: present and future. See Ref. 67, pp. 70–82
36. Harris RA, Milkis SY. 1980. *The Politics of Regulatory Change*. New York: Oxford Univ. Press
37. Helstosky CF. 2000. The state, health, and nutrition. See Ref. 42a, pp. 1577–84
38. Hoffman JE. 1991. The Food and Drug Administration's administrative procedures. In *Food and Drug Law*, ed. Cooper RM, pp. 1–39. Washington, DC: Food & Drug Law Inst.
39. Hofstadter R. 1955. *The Age of Reform: From Bryan to F.D.R.* New York: Vintage
40. Institute of Medicine. 1995. *Weight the Options: Criteria for Evaluating Weight Management Programs*. Washington, DC: Natl. Acad. Press
41. Johnson DG. 1991. *World Agriculture in Disarray*. New York: St. Martin's. 2nd ed.
42. Kahn BE, McAlister L. 1997. *Grocery Revolution: The New Focus on the Consumer*. Reading, MA: Addison-Wesley
- 42a. Kiple KF, Ornelas KC, eds. *The Cambridge World History of Food*. London: Cambridge Univ. Press
43. Knutson RD, Penn JB, Boehm WT. 1990. *Agricultural & Food Policy*. Englewood Cliffs, NJ: Prentice Hall. 2nd ed.
44. Deleted in proof
45. Koehn NF. 2001. *Brand New*. Cambridge, MA: Harvard Bus. School Press
46. Landes DS. 1998. *The Wealth and Poverty of Nations: Why Some are So Rich and Some So Poor*. New York: Norton
47. Lose weight now? We all know how. Government action alone cannot defeat obesity (editorial). 2004. *Financ. Times*, Feb. 7–8, p. 6
48. McNeal JU. 1992. *Kids as Customers: A Handbook of Marketing to Children*. New York: Lexington Books
49. Megabrand. 2003. AdAge special report. *Advert. Age*, July 21, p. S-2
50. Mojduszka EM. 2000. Food labeling. See Ref. 42a, pp. 1621–28

51. Morison MS, Commager HS, Leuchtenburg WE. 1980. *The Growth of the American Republic*, Vol. 2. New York: Oxford Univ. Press. 11th ed.
52. Deleted in proof
53. Nestle M. 2002. *Food Politics*. Berkley, CA: Univ. Calif. Press
54. Deleted in proof
55. Deleted in proof
56. Nilson TH. 1992. *Value-Added Marketing: Marketing Management for Superior Results*. New York: McGraw-Hill
57. Oliver JE, Lee T. 2004. Public opinion and the politics of America's obesity epidemic. *Am. J. Pol. Sci.* In press
58. Pariza MW. 2000. Food safety and biochemistry. See Ref. 42a, pp. 1662–67
59. Pollan M. 2003. The (agri)cultural contradictions of obesity. *NY Times Mag.*, Oct. 12, p. 41
60. Porter DV, Earl RO, eds. 1990. *Nutrition Labeling: Issues and Directions for the 1990s*. Washington, DC: Natl. Acad. Press
61. Porter ME. 1990. *The Competitive Advantage of Nations*. New York: Free Press/Macmillan
62. Quart A. 2002. *Branded: The Buying and Selling of Teenagers*. Cambridge, MA: Perseus
63. Revel A, Riboud C. 1981. *American Green Power*. Baltimore, MD: Johns Hopkins Univ. Press
64. Deleted in proof
65. Rosenberg N, Birdzell LE. 1986. *How the West Grew Rich: The Transformation of the Industrial World*. New York: Basic Books
66. Robinson BH. 1983. Food and agricultural policy in the twenty-first century. See Ref. 67, pp. 83–88
67. Rosenblum JW, ed. 1983. *Agriculture in the Twenty-First Century*. New York: Wiley
68. Schlereth TJ. 1991. *Victorian America: Transformations in Everyday Life, 1876–1915*. New York: HarperCollins
69. Sims LS. 1998. *The Politics of Fat*. Armonk, NY: Sharpe
70. Sloan AE. 2003. What, when, and where Americans eat. *Food Technol.* 57(8):48–66
71. Sturm R. 2002. The effects of obesity, smoking and drinking on medical problems and costs. *Health Aff.* 21(2):245–53
72. Taxpayers foot more than half of obesity-related medical bills. 2004. *Wall Street J.*, Jan. 23, p. D-2
73. Tillotson JE. 2002. *Food Policy Options: Preventing and Controlling Nutrition Related Non-Communicable Diseases*. Washington, DC: WHO/World Bank
74. Tillotson JE. 2002. Our ready-prepared ready-to-eat nation. *Nutr. Today* 37(1):36–38
75. Tillotson JE. 2002. Food brands: friend or foe? *Nutr. Today* 37(2):78–80
76. Tillotson JE. 2002. We're fat, getting fatter! What is the food industry's role? *Nutr. Today* 37(3):136–38
77. Tillotson JE. 2002. What does the future hold for American food companies? *Nutr. Today* 37(5):192–94
78. Tillotson JE. 2003. Pandemic obesity: unintended policy consequences. *Nutr. Today* 38(4):116–19
79. Tillotson JE. 2003. Pandemic obesity: agriculture's cheap food policy is a bad bargain. *Nutr. Today* 38(3):186–90
80. Deleted in proof
81. Tillotson JE. 2003. Pandemic obesity: Is it time for change in economic development policies affecting the food industry? *Nutr. Today* 38:6:242–46
82. Deleted in proof
83. Tillotson JE. 2003. Convenience food. In *Encyclopedia of Food Sciences and Nutrition*, ed. B Caballem, L Trugo, F Pinglass, pp. 1616–22. Kent, UK: Elsevier. 2nd ed.
84. Tillotson JE. 2004. Pandemic obesity: What is the solution? *Nutr. Today* 39(1):6–9
85. Top spots: fast-feeders top Q3 charts. 2003. *Advert. Age*, Oct. 27, p. 12
86. Tybout AM, Carpenter GS. 2001.

Financial Times Mastering Marketing. Essex, UK: Pearson Educ.

87. Torsten HN. 1992. *Value-Added Marketing*. New York: McGraw-Hill
88. Ullrich HD. 1992. *The SNE Story: 25 Years of Advancing Nutrition Education*. Berkeley, CA: Nutr. Commun. Assoc.
89. U.S. Congress, Office of Technology Assessment. 1986. *Technology, Public Policy, and the Changing Structure of American Agriculture*. OTA-F-285. Washington, DC: GPO
90. Deleted in proof
- 90a. U.S. Department of Health and Human Services. 2001. *The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity*. Washington, DC: GPO
91. Wanlass WL. 1920. The United States Department of Agriculture. *John Hopkins Univ. Stud. Hist. Polit. Sci.* 38:12–31
92. Weidenbaum ML. 1989. *Business, Government and the Public*. Englewood Cliffs, NJ: Prentice Hall. 4th ed.
- 92a. What people drink. 2004 (Jan.). *Food Proc.* Jan.: 36
93. Wood GS. 2002. *The American Revolution: A History*. New York: Modern Library
94. World Health Organization. 1998. *Obesity: Preventing and Managing the Global Epidemic*. Geneva: WHO

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