58

FS 58

The Farm and Food System in Transition:

Reflections and Future Perspectives

James D. Shaffer
Michigan State University

Lawrence W. Libby
University of Florida

Vernon L. Sorenson
Michigan State University

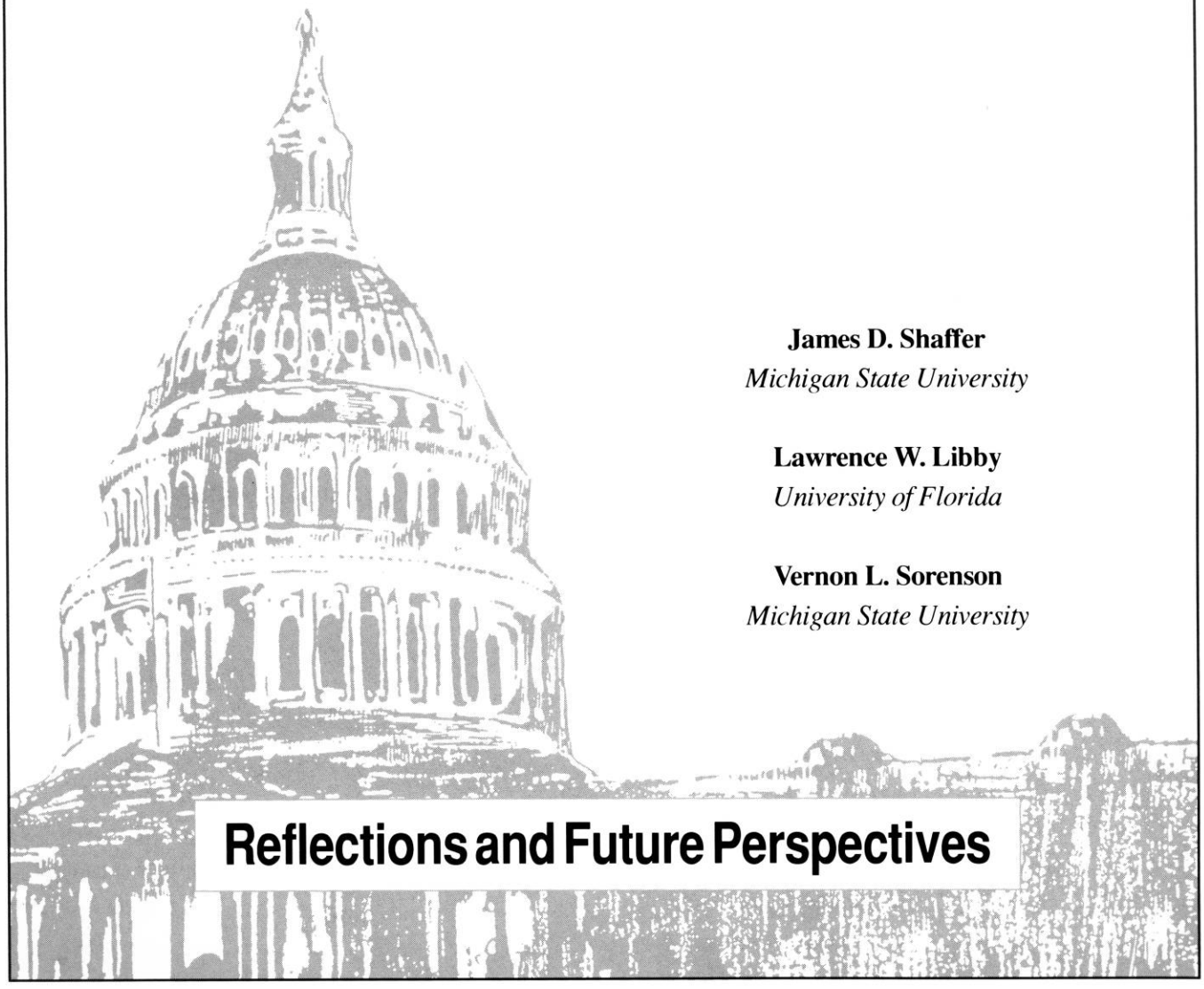
$2.50

COOPERATIVE EXTENSION SERVICE ■ MICHIGAN STATE UNIVERSITY

58

FS 58

The Farm and Food System in Transition:



Reflections and Future Perspectives

James D. Shaffer
Michigan State University

Lawrence W. Libby
University of Florida

Vernon L. Sorenson
Michigan State University

Table of Contents

Preface

This document is the fifty-eighth and final product of this project. The project, as the title implies, was an ambitious undertaking. Our purpose was to develop extension education material to improve the general public's understanding of the food system and emerging policy issues. Our hope was to be futuristic and not simply restate or define issues of the past. We sought to develop the project in terms of issues likely to be important from the time of project planning to the year 2000 and beyond.

As shown in the appended listing of the papers included in the project, this objective was substantially achieved. Papers 1 through 7 deal with overall dimensions of the food system, forces and policies that affect the food system, and the ethics that drive the system. The remaining papers deal with a variety of topics that relate to farm input systems, production agriculture, food markets, resource considerations, and policy questions. The range of topics attests to the complexity of the food system. This system consists of many separate but interrelated parts that are in turn linked to broader social, economic and political forces both domestic and international. The scope of these interactions and links makes it increasingly difficult to formulate programs and policies, both at the firm level and in the public domain, that lead "ex post" to satisfactory outcomes. This suggests a need for those in publicly supported research and education to try to explain emerging conditions and policy options.

This document is in no sense an effort to pull together or summarize the previous 57 papers. It is linked to these papers in that each of the authors gained perspective and insight from the process of organizing the project, reviewing the papers that were developed, and periodically discussing the overall progress and results of the project. This paper is a set of reflections based on this past project activity and our own intellectual proclivities. To this we need to state one exception, namely, the section on technology policy which is a compilation of material from several papers with the bulk of the statement from paper no. 4, "Technology and Productivity Policies For the Future" by Burt Sundquist.

From our perspective the project has been interesting and fun. Above all, we have enjoyed the interchange with the large number of authors and reviewers who participated in the project. We sincerely thank you for your help.

Vernon L. Sorenson

James D. Shaffer

Lawrence W. Libby

Introduction

This paper represents a concluding effort in an undertaking that has involved a large number of agricultural economists in government, in universities, and in business and financial institutions. The purpose of the project has been to develop extension education materials that will lead to improved understanding of the food system and the emerging policy issues. The project was conceived to be futuristic, not simply an effort to restate or redefine issues of the past. The individual papers were directed toward issues likely to be important from now to the year 2000.

In an initial working paper this project was conceptualized as dealing with 4 major questions.

1. What is the food and agricultural system?
2. What do we want from it?
3. What forces and trends will shape the future?
4. Policy for food and agriculture: What is it?

These four questions were used to initiate themes, issues, and appropriate subject matter for the program and to select specific titles for the 57 papers that have been developed by individual authors. This paper will follow the format initiated by these four questions.

Reviews by Dr. Walter J. Armbruster, Farm Foundation, Oak Brook, Illinois and Dr. W. B. Sundquist, Department of Agricultural Economics, University of Minnesota are gratefully acknowledged. This is one of a larger set of resources papers sponsored by the Extension Committee on Policy (ECOP), USDA Extension, Michigan Extension Service, and the various universities and organizations that supported those who have contributed papers and reviews.

WHAT IS THE FOOD AND AGRICULTURAL SYSTEM?

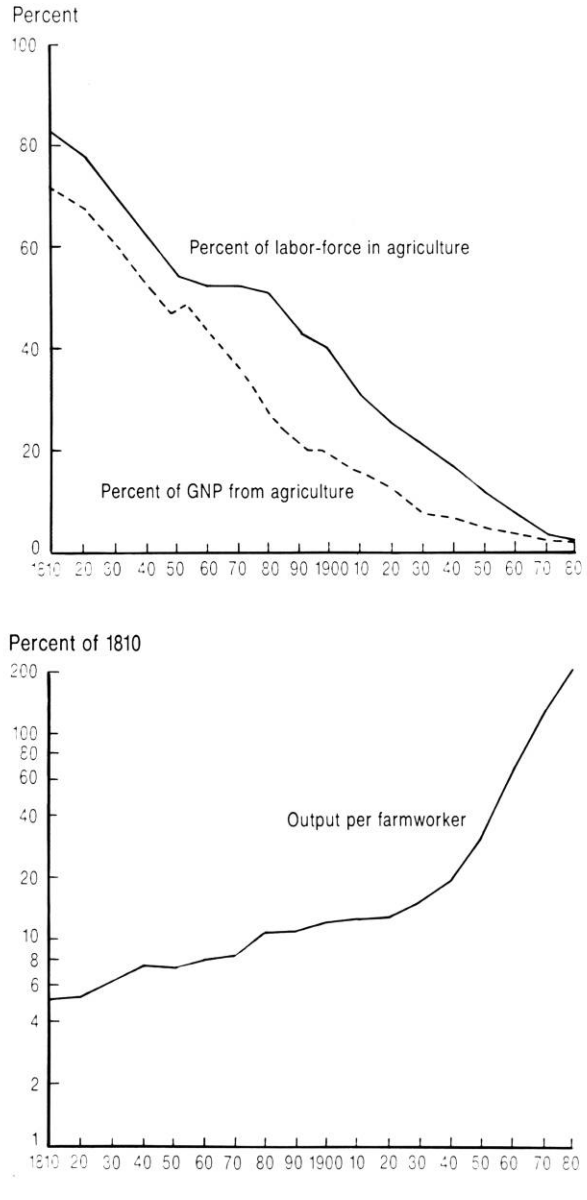
The answer to this question used to be rather straightforward. The system consisted largely of activity on the farm, using mostly farm-produced inputs, including labor and limited amounts of processing, storage and distribution inputs. But agriculture and the food system have now become industrialized.

Specialization has created the need for economic organization to coordinate activities of farming, input, marketing and distribution industries, as well as the total national and world economy. Increased specialization has been accompanied by a number of fundamental changes. One of these is a shift of work from farms to nonfarm firms. Both the percent of the labor force in production agriculture and the percent of GNP it represents have declined steadily since the early 1800s, from a level exceeding 70 percent to less than 5 percent (*Figure 1*). A corollary of this change is that output per farm worker has increased substantially, particularly during the last five decades. Until the 1930s increased output in farming depended almost entirely on increased use of inputs, but since then it has resulted almost entirely from increased productivity without expanding the overall level of inputs used. Dramatic shifts in the mix of inputs have occurred. These changes in the farm sector have been accompanied by significant changes in food processing and distribution. Food and textile manufacturing, which started as small scale businesses, have evolved into large, integrated firms often linked to nonfood industries. Food retailing has evolved from largely small family-owned operations with highly personalized service to large multistore systems based on consumer self service and sophisticated marketing techniques.

These changes have led to changes in vertical links within the system, changed pricing mechanisms, and changes in methods of dealing with risk and uncertainty. As central markets have disappeared for most commodities, an increase in contract and formula pricing has occurred. Larger firms have increasingly sought assured supplies through entering into contracts with farmers and, in some cases, by direct ownership of production. These kinds of formal arrangements range from nil in some areas of production and marketing to virtually 100 percent in others such as the sugar industry. These and other kinds of changes within the production and marketing system as well as changes in effective consumer demand and in the proportion of farm output marketed domestically and internationally, will continue to occur in the future.

Government also plays a significant and changing role in the farm and food system. But policy issues must be viewed in a broad and somewhat undefined perspective. The food system is a conceptual idea referring to that part of the economy involved in producing, processing, and distributing food. Farming is a part of the food system, but farming contributes much more than the production of food for U.S. consumers. A large part of farm output enters international trade, and other parts contribute to nonfood industries. Farmers produce fibers, and inputs to pharmaceuticals, industrial raw materials, leather goods, et cetera. Farming is also an important factor in rural communities; it is reasonable to include this relationship in considering policy issues related to the food system. Other relevant dimensions include such widely diverse areas as antitrust policy, international trade policy, labor policy, monetary policy, transportation policy, and numerous others. The boundaries for discussion of farm and food policy thus are arbitrary. While we have sought to push these boundaries to practical limits in this effort, we have clearly left out important activities and policies affecting the production and distribution of food. To do otherwise would have required the inclusion of virtually all forms of economic policy.

Figure 1 — The Industrialization of Farming.



Source: A. Manchester, ERS, USDA

WHAT DO WE WANT FROM THE SYSTEM?

Any discussion of policy implies a set of objectives or goals to be achieved through the policy process. Policy provides rules of the game which influence performance of the economic system. The following is a brief listing of some of the dimensions of performance considered important in evaluating the farm and food system and in considering policy for that system. The list is not comprehensive nor are the categories mutually exclusive. Some are instrumentally related to other goals, but they are listed because they often are considered desirable or undesirable by participants of the food system.

1. A reliable safe and nutritionally adequate food supply.
2. Equity and fairness in the distribution of benefits and costs of the system and in the distribution of economic and political power that affects the system.
3. Efficiency both in the use of resources within the system and in determining input and product prices.
4. Flexibility in adjusting to changing conditions and achieving improvements in productivity and growth.
5. Maintenance of environmental quality and conservation of resources.
6. Maintenance of satisfactory working conditions for participants in the system and quality of human relationships.
7. Maintenance of quality of community relationships and a contribution to regional, national and international welfare.

These objectives cannot all be met simultaneously. As conflicts among groups involved in the system arise, trade-offs are required. The fundamental task of the political process is to deal with these conflicts and trade-offs to work out an acceptable set of rules. Not only will there be conflicts among objectives, but resulting policy decisions may lead to unintended consequences. Such consequences often affect the interests of people not involved or considered in formulating a given set of policies.

FORCES AND TRENDS THAT AFFECT THE SYSTEM

Various technical, economic, and social phenomena create opportunities, incentives, and boundaries that affect the evolution of the food system and determine policy issues. Some of these have been completely unanticipated. Some have produced shock effects that have reverberated throughout the system with major short- and long-term consequences. Other changes have been gradual trend developments that have required adjustments within the system with both good and bad consequences. These changes have affected all segments of the food system, but they have been particularly important in farming. An overall consequence of these changes is that greatly increased functional specialization and interdependence has occurred, not only within the food system but between the food system and the national and world economy. Increased commercialization of agriculture has resulted in greater use of nonfarm produced inputs and in fluctuating supply and demand balances in domestic and world markets. During the past decade, the food system has been subject to an unprecedented series of changes and disruptions emanating from sources outside of the system. Change can be expected to persist and probably to intensify in the future, and it will need to be considered in future policy formulation. Some of the more important of these phenomena are discussed below.

Globalization of Economic Problems

Nations of the world are becoming increasingly interdependent in many aspects. Trade is only the most obvious of these from the perspective of agriculture and the food system. International monetary links are pervasive; they provide the conduit through which all forms of international economic interdependence occur. Capital flows and international finance have an increasingly important impact on the economies of individual countries. These links also mean that international and domestic economic policies in all countries are interdependent. These interdependencies extend beyond commercial relationships and include, for example, such problems as the international effects of acid rain, the pollution of oceans, and the preservation of animal and fish species. One of the consequences of the internationalization of such problems is that this requires international institutions for solution. Some progress has been made. A U.S./Canadian international joint commission, for example, focuses on water pollution problems of the Great Lakes. Unfortunately many efforts at dealing internationally with problems have not been successful, and some existing institutions are becoming obsolete.

International monetary arrangements have become increasingly difficult and confused. For an extended period following World War II, the conventions of the Brettonwoods agreement functioned effectively. Since the early 1970s when the United States abandoned a fixed exchange rate, international monetary policy has been increasingly ad hoc. Even in the trade area where the General Agreement on Tariffs and Trade (GATT) remains the focal point of international arbitration, effectiveness has been lost. This institution has primarily been a vehicle for dealing with tariff policy among industrial countries. Particularly in agriculture international trade policy has moved out of the tariff realm into unconventional and nontariff barrier issues. Further, large amounts of agricultural trade are with socialist and developing countries. These countries either are not members of the GATT or are committed to state trading. They prefer to deal in a bilateral framework rather than in the multilateral framework of the GATT.

The obsolescence of international institutions that were established largely in the immediate post World War II period and the arrival of numerous problems for which no institutions have been established creates a significant bottleneck in formulating international policy. This condition shows signs of getting worse. Problems that were formerly considered national in scope are increasingly international; they cannot be dealt with by national policy alone. This phenomenon will significantly affect the capacity of nations to deal with future policy problems, including those which affect performance in the farm and food system.

The emergence of an interdependent global food system has created problems that are extremely complex and poorly understood; they can be forecast only with very poor reliability. During the past two decades the world has moved from substantial food surpluses to apparent world food shortages and back to a condition of surpluses and extensive stocks that overhang world markets and depress prices. In 1988 severe drought in the U.S. reversed the situation once again. Throughout each of these phases, even when extensive surpluses exist, large numbers of poor throughout the world remain underfed and malnourished. Many individuals and some countries simply do not have the capacity to translate needs into effective demand and provide an adequate food supply. On the other hand, in many countries both the need and demand have grown rapidly. As a result, trade in agricultural products increased substantially particularly during the decade of the 1970s. This development increased the interdependence among countries. It strengthened the link between agricultural policy and the general economic and trade policies that influences overall economic growth and stability.

The United States benefited greatly from the expansion of agricultural trade during the 1970s, and it suffered serious negative impacts from the decline of the 1980s. The United States can continue to be a major participant in the global food system, but the extent of this role will depend importantly on policies it adopts. Farm policy, in particular, appears to be at a crossroad. If the United States chooses to establish high, rigid price supports as a means of augmenting farm income, protecting inefficient producers, and avoiding structural change, it likely will severely diminish its role in world markets. Alternatively, if the United States adopts policies that recognize the global interdependence of the system and seeks to foster competitive adjustment within agriculture and the food system, its role in world markets can increase.

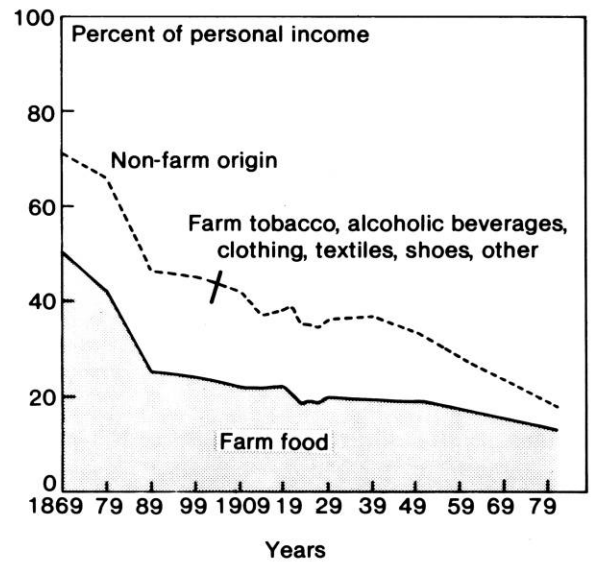
Policymakers need to recognize comparative advantage, which implies expanding exports of some commodities but also expanding imports of others. The United States will then be a positive force in improving the functioning of world markets and in improving the welfare of participants in the food system throughout the world.

Changing Demand and Markets

Market and demand changes have occurred in three major dimensions. One is reflected in changes of consumer tastes, preferences, and buying habits as incomes and working conditions change over time. A second change results from greater participation by American agriculture in world markets. A third significant change is reflected in the increased industrialization and restructuring of both input and commodity markets.

Over time as wealth has increased the proportion of income spent on food has declined sharply (*Figure 2*). This has been accompanied by a shift in the responsiveness of food consumption by consumers both to income changes and to prices changes. In both cases responsiveness to these changes has declined sharply and in the United States and other industrialized countries are very low. This shift has also been accompanied by an

Figure 2 — Consumer Expenditures for Products of Farm and Nonfarm Origin.



Source: A. Manchester, ERS, USDA

increased proportion of services as a component of consumer expenditures. The most recent and dramatic of these shifts is the rapid increase in eating away from the home in fast food outlets and restaurants. The composition of diets has also changed significantly as a result of higher real incomes, changes in lifestyle, concern with nutrition and health, and changes in the form of food products. Total food consumption has changed little, but the consumption of grain and root products has dropped sharply while consumption of vegetable oils and some livestock products has increased. These changes are all a function of the alternatives now available to consumers. Food industry innovations in both products and services and income available to spend on food have created these alternatives. In the decades ahead we should expect further changes both as a result of product innovation and shifts in consumer preferences. The certain lesson from past history is that there will continue to be change.

The second significant change in demand and markets has been the increased linking of the U.S. food system to world markets. In the early 1970s, sharply reduced production in many parts of the world plus rapid economic growth and expanded demand resulted in greatly increased exports of U.S. agricultural products. Expansion tapered off during the mid 1970s but increased rapidly again during the late 1970s and very early 1980s. This expansion was accompanied by sharp increases in U.S. production of major crops that entered into world markets and a rapid expansion in asset values on American farms. Beginning in 1982, foreign markets shrunk rapidly. The expansion of the 1970s and early 1980s resulted in a new balance in supply and demand that absorbed historical surpluses and created unprecedented prosperity in American agriculture. The consequence of the sharp decline of the 1980s has been, predictably, very much

the opposite. Farm incomes declined sharply, land values dropped to approximately 50 percent of their peak, and unprecedented surpluses returned. Changes in foreign markets have created unprecedented uncertainty in commodity markets and instability in farm income and asset values. They have added a new dimension of complexity to the problem of coordinating production and demand in food markets. This also means that those who develop future farm policy, trade policy, and other policies that affect the food system need to recognize the implications of these policies for future participation in world markets.

A third dimension of market change is reflected in industrial structure. Industrial structure in the United States has been changing since 1776. Underlying motivations related to the greed of man and the search for a domain with economies of size as a catalyst lead to continuing evolution toward larger, more concentrated, and more highly agglomerated business organization. Public policy has waxed and waned over the years in its efforts to counteract this underlying trend. Based on policy developed during the 1930s, large and powerful labor unions developed and have enjoyed strong political support.

These developments were facilitated by dramatic changes in the technologies of production, transportation, communications, and computation. Organization in both farm input industries and in food marketing industries directly reflect these general trends in business and labor organization. Clearly there is a direct impact on performance in the food system, both through its implications for economic power and through the technology and processes that are involved in production and distribution of food.

The underlying forces that have generated these changes can be expected to continue. These include changes in the availability of power sources, shifts in the materials used in production systems, and changes in business organization. Incremental adjustment in many aspects of food production, storage, market communications and other areas will not cease. Additionally, food industries will be affected by potential major breakthroughs such as zero resistant electrical conduction, breakthroughs in biotechnology, and in communications and information systems. An overall impact of these shifts that certainly will continue is further increases in the complexity of coordinating market activity and basic supply and demand. Equilibrium in food markets will continue to be an elusive target.

Changing Technology and Farm Structure

Technology and the resulting increases in productivity are fundamental to improved performance in the food system. Since the 1920s, virtually all increases in output of American agriculture have been based on technology with very little increase in total resource use. Most of this new technology was developed and delivered through public institutions, particularly through the land grant university system and the U.S. Department of Agriculture, though technological improvements emanating from farm input industries have been an integral part of this process. Writers generally classify historical gains in agricultural productivity as coming primarily from three sources: 1) labor saving mechanization, 2) agricultural chemicals (particularly fertilizer, pesticides, and feed additives), and 3) modification in biological systems (particularly through the use of improved crop varieties and animal breeds. These traditional forms of technological improvement may, to a large extent, have run their course. The current level of labor input in crop farming is small; though somewhat higher in animal production, it is also declining in this area. As a result, the potential for further displacement of labor through mechanization is small. It may also be true that in most industrial countries agricultural chemicals have largely been used at least to the extent of their economic potential, if not their physical potential, and that further output increases from this source will also be limited in the future. In fact, concern about environmental impacts may dictate lower use of agricultural chemicals. The most viable of these historical technologies in industrial countries probably is improved crop varieties and animal breeds. In most developing countries, though, all of these methods may still have considerable potential.

For industrial countries two new forms of technological improvement are becoming increasingly important. These are information technology and biotechnology. Information and communications technology is increasingly being used to monitor irrigation systems, livestock feeding systems, and other aspects of farm production. This technology saves resources and increases per unit output. Information and communication technologies have the potential to let farmers use computerized decision models and to monitor and control factors at the production, marketing and financial management levels. Biotechnology is in its early phases of development. Scientists are only on the threshold of genetically engineering new crop varieties, improved disease control techniques, and even totally new farm products. At present, the scope for these new technologies cannot be estimated, but probably it is very large.

Technology in marketing and processing have also been important and likely will continue to be so. Past technology has resulted in such things as improved storage, communication and transportation capability, and new food products. Other effects have also appeared. Tomatoes have become hard, and many additives have been incorporated into the food we eat. Nonetheless, the overall impact of technology has been to generate more capital intensity, lower costs, and often more standardized procedures in producing and distributing food products. Technology has also tended to reduce relative labor inputs and has affected industrial structure in both input and marketing industries.

A corollary to new technology in agriculture has been rapid structural change and increased specialization in the farm sector. These changes have been particularly rapid during the post World War II period, and they appear to be continuing apace at the present time. Technology has permitted farmers to change the mix of inputs used and to substantially increase productivity, both of land and labor. Technology and the capital investment that accompany it have encouraged increased specialization both in crop and livestock production. Agricultural chemicals have reduced the need to rotate crops and diversify while

livestock technology has permitted large scale, mechanized feeding systems and consequent specialization in very large producing units. As a result, agriculture has to some extent adopted mass production processes that long have been a part of the industrial system.

Structural change has created an extremely varied agricultural sector in the United States. Many small farms and a core of relatively large farms produce a high proportion of total U.S. agricultural output. Some farm families earn most of their income from off farm sources while others work full time on the farm. Most farms are owned and controlled by families including those organized as corporations. Increased specialization in the farm sector and the changing structure mean that agriculture can no longer be viewed as a relatively homogeneous set of activities. The interests of grain farmers are not necessarily the same as those of livestock producers, nor do large and small farms always share the same concerns. This diversity means that economic change and policy will affect farmers in different ways. Virtually all dimensions of policy including credit policy, farm income support programs, tax policies, market policies and public research and technology policy differ in their impact on farms with different specializations and of different size. These differences particularly those that have distributional implications need to be considered in forming future farm policy.

POLICY FOR THE FOOD AND AGRICULTURAL SYSTEM

Policy for food and agriculture in the United States has evolved through several phases. Early post colonial economic policy consisted largely of efforts to deal with the United States' role as an exporter of raw materials and an importer of manufactured products. On the import side, the infant industry argument became the foundation of policies that affected the U.S. economy. In the mid-to late 1800s, policy emphasis changed to providing increased opportunities for individuals and to promoting economic development. This emphasis resulted in such important legislation as the Homestead Act and legislation that created the U.S. Department of Agriculture, the Land Grant Colleges, the Experiment Stations, and the Extension Services that followed. Other early policy initiatives included providing various services such as market information, grades and standards and various market system regulatory measures. These early initiatives, though focused on the food and agricultural system, clearly reflected efforts to serve the public interest and improve opportunities for those in agriculture and other parts of the society. They represented social and development policy and not policy aimed at direct support for specific interests or groups.

While these general objectives have retained their importance, a new focus on food and agricultural policy began to emerge following World War I. Low farm prices in the mid and late 1920s caused general economic distress in agriculture and rural communities. In 1929 the government began to absorb some of the surplus agricultural capacity that had developed. In the 1930s, with New Deal legislation, a new era of "farm policy" was established. The philosophy undergirding farm legislation, which for 70 years had been geared to agricultural development, shifted to income support and market stabilization. A new era of government intervention in agricultural markets and farmer decision making was launched. Specific legislation aimed at controlling production and supporting farm prices was developed in the Agricultural Adjustment Act (AAA) of 1933 to protect farmers from the vicissitude of markets and the general economic environment. Although this act was later declared unconstitutional, its major tenants remained unimpaired in subsequent legislation. These policies were supported by agricultural organizations. They were generated and implemented through a close working relationship between the U.S. Department of Agriculture and farm state senators and congressmen. The farm block in Congress, along with the Department of Agriculture, developed and implemented farm policy with little restraint by nonagricultural interests and little concern with broader social and economic goals.

This policy era lasted until the early 1970s, when three significant changes greatly altered the context and process of food and agricultural policy formation. One of these changes was an increased link between U.S. agriculture and the general U.S. economy and between economic policy and the world economy and international policy. The most direct impact of general economic policy occurred through credit markets and interest rates. This occurred in part because of changed organization in agriculture. Farms became much larger, asset values (especially land prices) increased, and farmers required financing beyond the capacity of local banking systems. It occurred in part because of changes (deregulation) in the banking system that provided a more direct link between financial centers and rural lending institutions.

The link to world markets occurred largely as a result of expanded U.S. agricultural exports. During the 1970s, exports as a growth market created prosperity in agriculture, generated optimism, stimulated increased investment, and expanded output. The decline in international markets during the 1980s had a strong opposite impact.

As a result of these changes, the policy that directly impacts food and agriculture expanded beyond those directly aimed at the food and agricultural system. Foreign economic policy, monetary and fiscal policy, development assistance policy, environmental policy, and any other policies that significantly affect the economic and political environment surrounding the food and agricultural system became important.

A second significant change resulted from a restructuring of the political process through which farm and food policy is developed. The increased emphasis on income support through commodity programs that began in the 1930s led to a gradual shifting of political weight to groups with commodity specific interests. As a result, the three-way link between general farm organizations, the U.S. Department of Agriculture, and a single agricultural committee in the House of Representatives and the Senate gave way to a much more complex organization consisting of commodity subcommittees in the Congress and commod-

ity organizations in agriculture. The policy process became highly fragmented. This fragmentation and the power of single interest groups led to a bias toward increased government involvement in agriculture. Each group sought its own ends without concern for overall program costs, and without recognizing trade offs that occur within the agricultural system and between agriculture and other segments of society.

A third change has become important in the past decade and one-half. Concern with the content of food and agricultural policy has widened to new groups. Consumers concerned with health and food safety issues have become active in food policy. Groups interested in world hunger and the problems of United States international relations have also become concerned with the impacts of farm and food policy. Others have become concerned with the impact which industrialized agriculture has on the environment, on soil erosion, and other aspects of the ecology. As a result, the development of farm and food legislation has increased in complexity. Those who participate in the system include a far more diverse set of actors than has been the case in the past. Many groups with widely divergent interests in international affairs, consumer welfare, and resource conservation, both in the general population and in administrative and legislative branches of government, participate in forming farm and food policy.

This has increased the diversity of the issues that pertain to food and agriculture and their interrelationship with one another, as well as with other aspects of domestic and international policy. It places heavy demands on the U.S. policymaking process.

In summary, both the economic and political forces that shape farm and food policy have changed and broadened. Farm and food policy reflects pluralistic views. These divergent interests are adjudicated through the political process to create compromises. These compromises involve trade-offs of private gains and losses and gains and losses imposed on the public at large, or stated differently, on the public interest.

This raises the question of whether policy for food and agriculture can be evaluated in terms of the goods and bads (costs and benefits) that result. Although it cannot be judged in a precise way, some generalizations can be stated. One of these is that if the gains to one group (e.g. producers) exceeds the loss to another, then an overall net benefit has occurred. But this assumes that a given amount of gain or loss (say $10) is of equal importance to individuals in each group. This may not be the case—especially between people at widely different income levels.

Another approach is to establish performance concepts as a basis for evaluating policy outcomes. A set of often used performance concepts for the food system was suggested early on in this paper. These include improving economic efficiency, achieving greater market stability, promoting equity, enhancing productivity and growth, and maintaining environmental quality, satisfactory working conditions, and the quality of community relationships. But applying these ideas to a diverse sector of the economy is not easy. The concepts are not all well defined, and often they do not account for consequences external to the sector. Defining equity, for example, is not straightforward. Equality is often used to mean equity. But a statement of historical vintage that "equality of treatment is equitable only among equals" remains as valid today as when originally uttered.

External effects also can be important. The most accepted concepts of economic and policy analysis is that any given task should be accomplished at the lowest possible cost—or as efficiently as possible. But in food production this has led to extensive use of fertilizer and chemicals in farming and in early machine picking that can result in hard tomatoes and other lower quality produce. In processing it has led to extensive use of additives and other techniques to preserve products, to improve their appearance, and to promote sales. The costs in water pollution and soil erosion that arise from chemical and mechanical farming usually are not counted in defining what is the most efficient way to produce food. When this is the case, private costs of producing food are not the same as the costs to society. But to adequately evaluate public policy, both private gains and losses and the public interest need to be taken into account.

Another approach to evaluation might simply be to accept that whatever policy makes its way through the democratic political process represents the will of society and, thus, is the best policy for the time. This, of course, presumes that the political process works well, or at least acceptably, in measuring and responding to preferences. This assumption is at a minimum questionable. The American political system is fraught with distortions based on the role of lobbyists, PACs and other forces that affect policy decisions and the outcome of elections.

We need to accept that full evaluation of policy outcomes is difficult. Nevertheless, in the remainder of this document, we proceed to discuss four major components of farm and food policy, including evaluative criteria and options for future policy direction. These four areas are (1) policy for the farm sector, (2) market policy, (3) resource and conservation policy, and (4) technology policy.

POLICY FOR THE FARM SECTOR

Policies for the farm sector have three major dimensions: 1) farm price and income policy, 2) agricultural trade policy, and 3) cost subsidies largely related to credit and taxation but also to subsidized water, grazing rights, et cetera in certain areas. Of these, the longest standing and most thoroughly institutionalized are the input subsidies. While policy changes have occurred since their inception, their links to earlier concepts of growth and development of agriculture have insulated them from major political contention and frequent change.

Programs to support farm commodity prices have, since the 1930s, been the centerpiece of policy to improve the economic position of farmers. These programs originated in response to seriously reduced farm income and rural poverty that accompanied the general economic depression of the time. Price and income support programs have continued to the present in response to two perceived characteristics of agriculture: 1) chronic excess production capacity, which results in low farm

income and low returns on resources committed to farming; 2) instability and variability of production, prices and income. These two interrelated problems stem from a set of conditions that are unique to agriculture. One of these is that, for much of recent history, too many resources have been committed to agriculture. This is due in part to an abundance of natural resources. In addition, new technology has been added very rapidly in agriculture to expand productivity both of land and labor. This has resulted in continually declining real cost levels and increased output with a given level of total resources.

During periods of market expansion and optimism, farmers invest in capacity to expand output, often overshooting the amount of production that can be marketed at prices which generate an adequate return. Price supports have provided a powerful and continuing stimulus to overproduction. Once investments are acquired, they tend to be relatively fixed, and production continues at levels that result in commodity prices below production costs. For many agricultural products, production periods are relatively long. Excess capacity will not be felt in the market until two, three, or more years after investments are made. The market consequences of investments are not immediately apparent.

When these conditions are combined with the fact that production decisions are made by many small producers with very imperfect market information and without knowledge of what total production might be, farmers often overproduce individual commodities. Price elasticities of demand are generally very low; thus, only a small excess of production significantly depresses prices. In recent years these inherent problems in agriculture have been exacerbated by volatile interest rates due to changes in monetary-fiscal policy.

U.S. monetary and fiscal policy helped create market swings and, in addition, directly affected production costs in agriculture. During the expansionary periods of the 1970s monetary and fiscal policy created rapid rates of inflation and low real interest rates. Large amounts of money were loaned to farmers to expand output and to buy land. Land prices rose sharply, and many farmers became overcommitted on debt. During the 1980s monetary and fiscal policy changed to sharply reduce inflation and, at the same time, create very high real interest rates. This impacted markets and caused lenders to establish a credit policy based on loan repayment ability rather than on value of farm assets. Farm asset values declined sharply, and many farmers found themselves in an over- leveraged debt position.

Recent Policy Changes

An important question is, has policy for agriculture adapted adequately over time in response to changing environmental conditions and changes within the agricultural sector? An axiom that appears to exist is that changes in policies and institutions occur at a slower pace than the problem they were designed to resolve. At the initiation of the AAA in 1933, farming was structured in more homogeneous units than at present. Government expenditures to support agricultural commodity prices had a widespread impact among large numbers of farmers and rural residents in general. It was assumed that problems in agriculture could be solved through applying farm policies. There was essentially no concern with the role of agriculture in international markets. The United States isolated agriculture from international markets in the 1930s by providing border protection for commodities to which price support programs applied. Following World War II, this perspective was institutionalized internationally through insistence by the United States on exceptions within the GATT for products covered by domestic price support programs. This exception changed international trading rules to permit countries to establish trade barriers on a wide range of farm commodities.

Not until the mid 1950s, with the passage of the Trade Act of 1954, did U.S. policy begin to reflect an interest in expanding U.S. agriculture's involvement in foreign markets. Several mechanisms, including the Foreign Agricultural Service, were established to promote foreign sales of U.S. farm products. In 1965, these mechanisms were followed by a change in commodity price support legislation to initiate a price system whereby farmers would receive a higher price for the domestic proportion of their production and a lower price, assumed to approximate a world price, for production over that amount.

Another change was made in the Agricultural Act of 1973. This act separated the level of price support from the total return guaranteed to farmers by establishing target prices and loan rates with a deficiency payment by government to participating farmers to assure a return equal to the target price. Even with this mechanism, however, loan rates were maintained above a world market clearing level. This was particularly true during the period 1981 to 1985, when it was assumed that strong markets and increasing prices of the 1970s would continue. As a result of changes in macroeconomic policies and the onset of a worldwide recession, this assumption proved to be wrong. Markets began to decline, commodity surpluses increased, and generally depressed conditions settled over American agriculture. The total value of U.S. agricultural exports dropped from approximately $44 billion to about $26 billion. 1985 farm legislation responded to this change by sharply reducing loan levels and providing exceptions that further reduced prices at which American farm products were offered on world markets. In consequence, exports have turned around and begun to increase rather substantially (*Figure 3*).

International negotiations to reduce agricultural protection have been very limited. Agriculture was only minimally included in the first four rounds of post World War II GATT negotiations. It was incorporated only in a very limited way in the fifth round. This action probably fortuitously resulted in the biggest single action taken on agricultural products in the post war period, namely, the agreement by the European Community (EC) not to place any restrictions on soybean imports. In the Kennedy (6th) round, an effort was made to include agriculture but with no major achievements. The Tokyo round, during the last half of the 1970s, was the first where agriculture was significantly included in a general multilateral negotiating framework. Efforts were made to reduce trade barriers to adjust

some of the rules of trade, to explore the use of worldwide international commodity agreements, and to develop special and differential treatment for less developed countries.

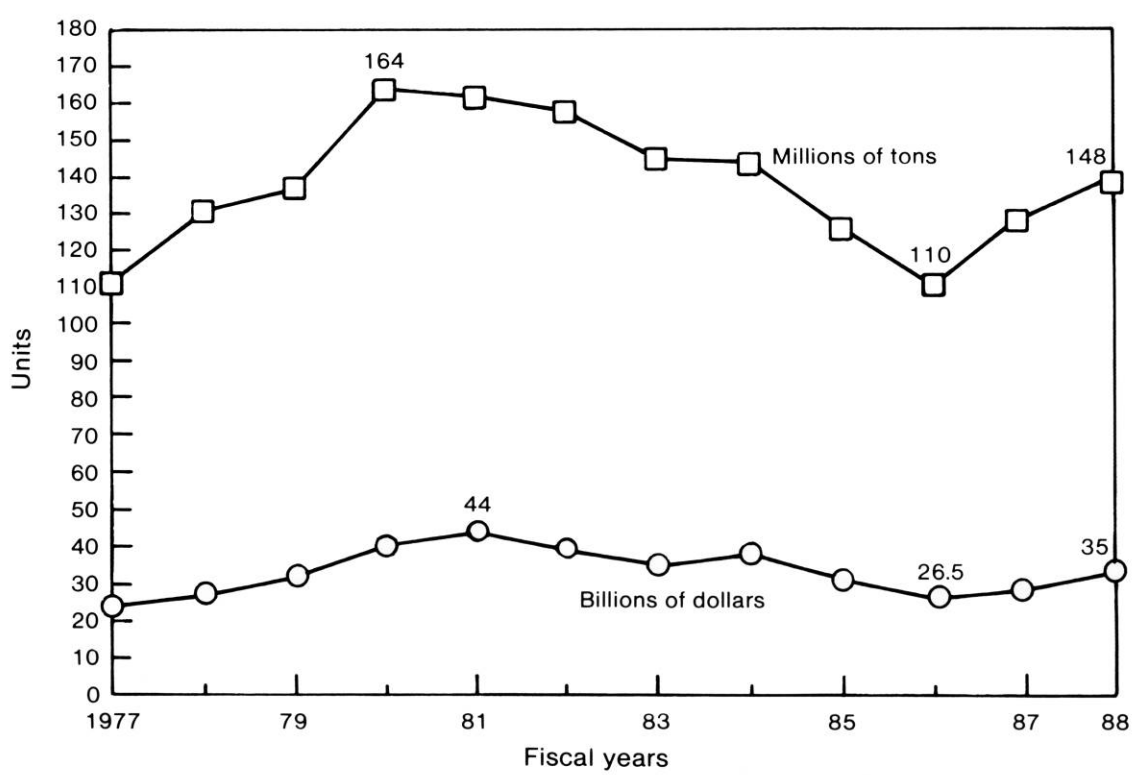
While some progress, or at least change, occurred in each of these areas, real accomplishments measured by almost any standard were limited. This reflects the fact that international policy formation in agriculture is hindered by a number of fundamental problems. One of these is that the role of agriculture differs widely in individual countries. Agricultural structures and cost conditions also vary. Countries also differ in the values and goals that guide domestic farm policy. Food security, stability, self sufficiency, productivity growth, and economic development as well as agricultural fundamentalism play different roles in different nations. A third factor is that there has been a shift in international economic power along with different perceptions of the problem and different trade policy models. The U.S. sought bargaining to reduce trade barriers. The European community sought comprehensive, worldwide international agreements; the LDCs sought special and differential treatment. These are each fundamentally different models for policy formation, and orchestrating these different positions in negotiation proved to be an intricate and difficult task.

The Present Setting

So the question arises as to where the United States now stands on farm and agricultural trade policy and what criteria is used to measure that position. Farmers and politicians, as well as some economic analysts, often state that the 1985 farm bill is working. The criteria for this conclusion is that agricultural exports and farm incomes have both increased substantially during the past couple of years. The extent of overall improvement in agriculture is shown in Table 1. Net farm income has moved from a low of $12.7 billion in 1983 to $46.3 billion in 1987. The negative aspect of this picture, however, is that much of this improvement resulted from major increases in government expenditures on farm commodity programs (*Figure 4*). In addition to these expenditures, approximately $8 billion annually in credit guarantees and subsidies are committed to expanding of U.S. agricultural exports. Thus the total cost of government associated with these changes reached a peak of approximately $34 billion in 1986. While these costs have declined and are expected to continue lower in future years, it nonetheless appears that major government outlays likely will be made to support farm prices and to expand agricultural exports at least through the duration of the current farm bill.

In assessing these outlays, two situations need to be brought into question. One results from the changed structure of agricul-

Figure 3—U.S. Agricultural Exports.



Source: ERS, USDA Outlook Reports

ture and its implication for how these benefits are distributed within the farm sector. Farmers participate in program benefits in relationship to their size and the amount of program commodities they produce. Of the present 2.2 million farmers, 71 percent or approximately 1.6 million produce less than 40,000 dollars annually of product and participate only marginally in farm program benefits. These are mostly individuals who are employed off the farm in professional, factory, and other types of work, and who do not depend on agriculture as their main source of livelihood. Most program benefits are paid to the other 600,000 farmers, and benefits increase sharply with farm size. The distribution of government payments in 1987 by farm size is shown in Figure 5. The question of how farm program benefits are distributed within agriculture is significant and is far different from that which existed in the 1930s when the basic format of todays' commodity programs were originated.

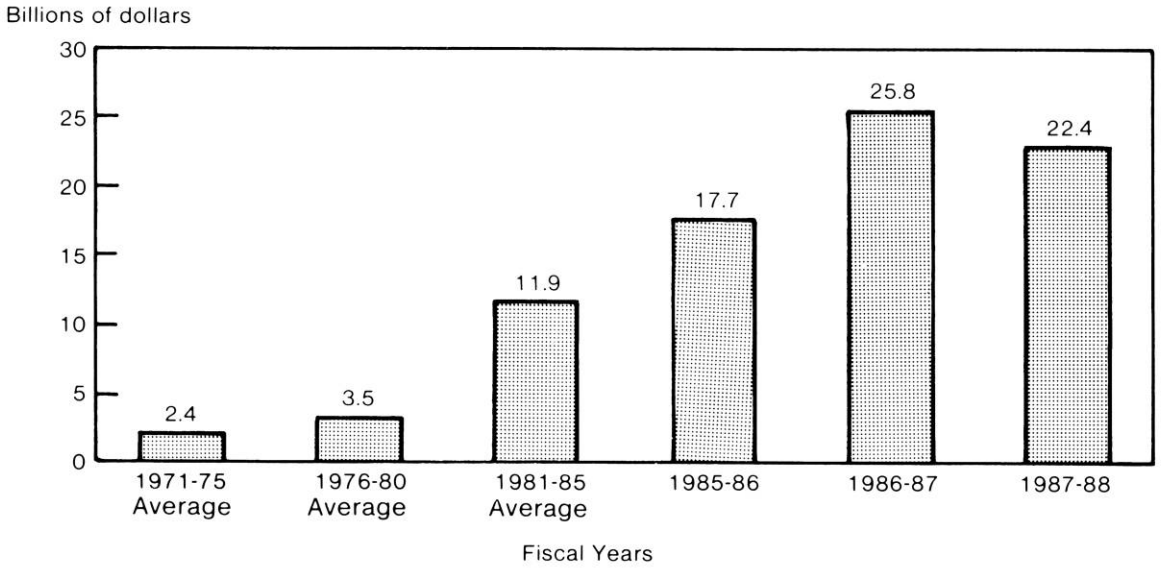
Another equity question arises in terms of the level of income of those who are classified as farmers relative to the U.S. population in total. If nonfarm income of farmers is added to farm net income, total income for 2.2 million families is approximately $93 billion in 1987 (*Table 1*). This represents an average exceeding $40,000 per family, well above average U.S. family income. This means that farm programs are creating substantial income transfers to a class of people where the criteria of need does not exist. Taxes to support these transfers, in part, come from those who are less well off.

Table 1—Farm Income and Expense Statistics.

	CALENDAR YEAR						
	1981	1982	1983	1984	1985	1986	1987
	$ BILLION						
Farm receipts	144.1	147.1	141.1	146.8	149.2	140.2	143.7
Direct gov't payments	1.9	3.5	9.3	8.4	7.7	11.8	16.7
Cash expenses	113.2	112.8	113.5	116.6	110.2	100.6	103.3
Total expenses	139.4	140.0	140.4	142.7	134.0	122.3	123.5
Net cash income	32.8	37.8	36.9	38.7	46.6	51.4	57.1
Net farm income	26.9	23.5	12.7	32.2	32.3	37.5	46.3
Off farm income	35.8	36.4	37.0	38.9	42.6	44.6	46.8

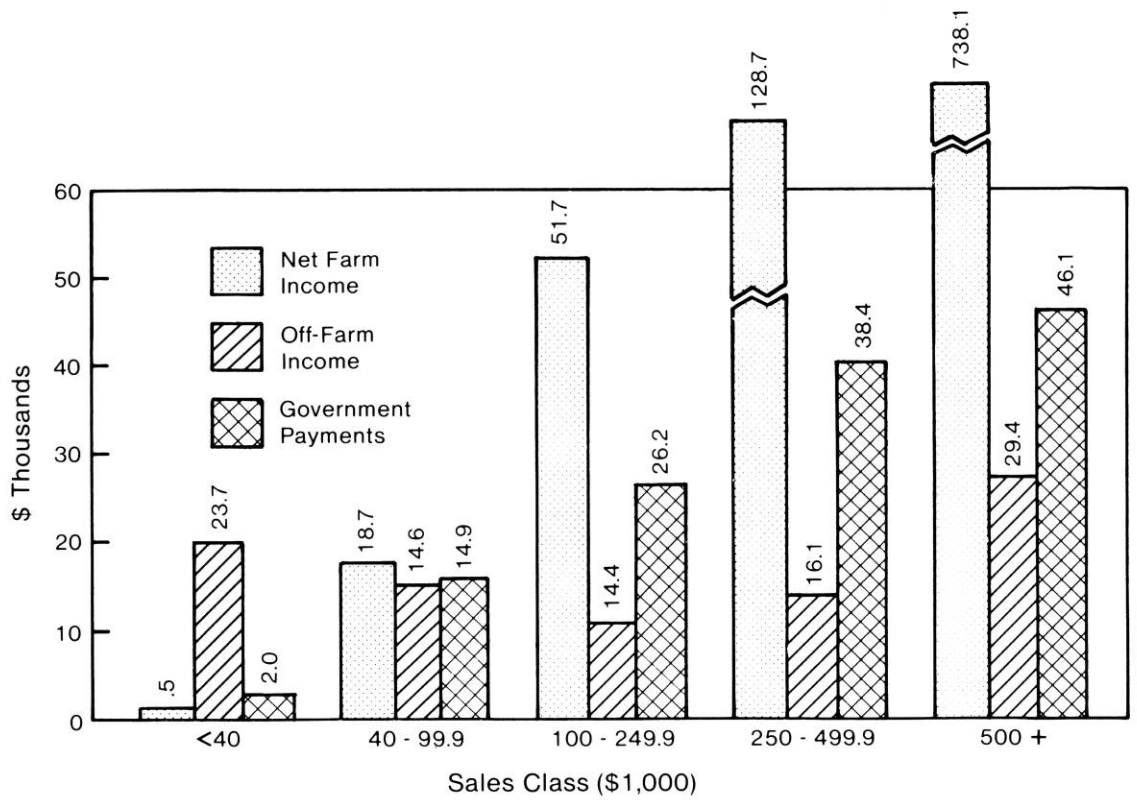
Source: ERS, USDA Agricultural Outlook, November 1988.

Figure 4 — Net Outlays for U.S. Farm Programs.



Source: ERS, USDA Outlook Reports

Figure 5 — Net Farm Income before Inventory Adjustment, Off-Farm Income, and Direct Government Payments per Agricultural Operation by Value of Sales Class, 1987.



Source: USDA, ERS, ECIFS7-1 Economic Indicators of the Farm Sector, National Financial Summary, 1987.

Current Policy Proposals

In recent years a number of proposals have been put forth to change farm programs. The present administration supports continued reduction in the level of government support for agriculture through lower target prices. Another proposal supported by a number of groups and politicians suggests that farm income can be stabilized only through higher prices supported by much more stringent acreage controls. International cooperation among governments would also be required to stabilize market shares and sales in world markets. This approach could reduce government outlays, but it also would result in increased food prices and a shift of the support burden to consumers. A third approach is that all government payments to farmers should be decoupled from the amount of commodity they produce. Direct income payments would be made to farmers related to a historical production base, but these income payments would be phased out over a period of time. Thereafter government would not be involved in directly supporting farm commodity prices or farm income. This approach would be costly to government in early years but its costs would decline over time. It likely would cause significant structural adjustment in agriculture and would require that all U.S. commodity groups seek to be competitive in domestic and world markets.

The most active aspect of U.S. policy formation stems from the fact that reduced support for agriculture has been incorporated into the (Uruguay) round of trade negotiations now underway among nations. An initial proposal by the United States, supported in varying degrees by other major exporting nations, is that countries agree to eliminate agricultural subsidies and import barriers that effect trade. This position was strongly resisted by major importing countries and negotiations have evolved to an effort to achieve a substantial reduction - though not necessarily a complete elimination - of agricultural subsidies and trade barriers.

Significant change, however, will not be easy to achieve for a number of reasons.

1. Policies of the recent past have created distorted patterns of agricultural production. Excess resources in food production are large in some countries.
2. Very large costs of adjustment will be imposed on some segments of world agriculture as a consequence of the kind of change implied. Further, the costs will fall heaviest on

small farmers least able to absorb them and will be heavily concentrated in certain countries.

3. Countries continue to place varying degrees of emphasis on different objectives in formulating their domestic and international agriculture and food policies. To expect Japan to eliminate all policies aimed at food security, for example, in order to prevent interference with international markets, is simply unrealistic. Equally, to expect less developed countries to subjugate their agricultural development planning and food security entirely to international markets is unrealistic.
4. The political systems in most countries, after many years of building vested interests through protective agricultural policies, will have great difficulty in absorbing this kind of a change.
5. There are many problems of definition, measurement, determining impacts and calculating reciprocity that will have to be overcome.

The initial U.S. objective in these negotiations was to move from one extreme position to another. This original position has now been replaced by an effort to seek a realistic balance between domestic and international policy. Such a position recognizes that certain legitimate domestic policy interests exist, but at the same time it seeks to eliminate excessive production and market distortions.

It is important to note that the U.S. proposal places no restrictions on the level of protection given to agriculture, provided this protection does not interfere with production or trade. Despite this, any effort to reduce protection that interferes with trade implies a reduction in agricultural protection from that which exists in present policy in most industrial countries. Where a balance might be achieved is difficult to say. On a worldwide basis, however, food and its adequacy, both in its economic and political dimensions, will continue to be a policy concern of all governments. Even if issues of income support and farm policy can be overcome in the negotiations, it is unlikely that most governments will leave the question of food and its adequacy entirely to the market.

Future Policy For The Farm Sector

Historical developments and current perspective suggest that a range of analytical questions and issues need to be addressed in developing future policy for the farm sector. Some of the more cogent are as follows:

1.What is the income problem? A clear definition is important. USDA data (Table 1) shows that on average farm families enjoy a relatively good income. A farm income problem in the sense that it existed in the 1930s, when farm price and income support programs were instituted, does not exist. There is, of course, a difference between a farm income problem and an income problem being faced by an individual farmer due to historical investment decisions or for other reasons. Two points need to be noted about the level of income that farmers enjoy. One is that half of that income comes from nonfarm sources. Nonfarm income is important to farm families in all size ranges, including the very large commercial farm, but is particularly important to the 71 percent of census classified farms with gross sales of $40,000 or less.

The second point to be noted is that, of the income from farming, an increasing amount in recent years is represented by government payments and government budget outlays. Further, since these government payments are concentrated in certain commodities, particularly the major field crops, the proportion of income from government payments in some commodities is very high. This means that market returns to farming are unsatisfactory even though the income position of farm families in aggregate is relatively strong. The problem of increasing net income from farming and of adjusting supply to demand at prices that will provide an adequate return from the market to resources used in agriculture remains.

2. Market adjustment: Can policies be instituted that will help achieve better long-run and short-term adjustment between effective demand and available supply? Price and income support programs have sought to achieve this balance through acreage control programs. In general, these control programs have not been fully effective. It can be argued, on the other hand, that the guaranteed prices have stimulated increased production by causing farmers to expand other inputs to offset reduced acreage. Other factors have been involved. Tax laws and programs subsidizing interest rates or making more money available to agriculture also exacerbate the overproduction problem. Special agricultural income tax rules, including the use of cash accounting, the immediate deductibility of some expenses of a capital nature, and capital gains treatment for income from assets whose costs may have been deducted as a current expense, all tend to stimulate investment and increase agricultural production. Credit subsidies have also been important, particularly those that exist through the FmHA. These subsidies also affect farm structure in that they permit some farmers who could not otherwise stay in agriculture to expand or maintain their production.

Creating a better demand/supply balance, reducing both short-term variability, and solving the chronic overinvestment problem are the primary challenges for the farm sector. At various times, the United States has sought to reduce resources in agriculture by removing whole farms from production. A recent buyout of dairy cows has reduced productive capacity in that industry. It has often been suggested that the continuous flow of new technology into agriculture is the main cause of overproduction and that this flow should be reduced. This, however, is not a logical approach from the perspective of maintaining productivity, growth and sustaining U.S. agriculture's competitive position in world markets.

A question that needs to be raised is whether and to what extent can either the short term or long term adjustment problem be solved within agriculture. Solution to the long term problem suggests that additional farmers will need to leave agriculture and that market forces be allowed to reduce the commitment of land and other resources to farm production. The recurrent problem of excess supplies, particularly in some commodities, raises the question of whether some form of farmer collective

action can be instituted to facilitate the planning of production and the management of marketing in order to match supply with demand. From the perspective of government action, the joint questions of production being stimulated both by guaranteed price and income supports and subsidized inputs need to be addressed.

3. Price supports and income subsidies: Some groups advocate high price supports and severe production controls. Because neither domestic nor international demand for farm products would decrease very much in the short run with higher prices, this approach could generate an increase in farm income. However, in the long run, stringent production controls and the attendant increased government management in agriculture would lead to severe problems. High price support levels also would, over time, erode U.S. agriculture's international competitive position and would require increasingly severe production restraints. Lower price supports at a level that would prevent disaster on reasonably sized, efficiently operated, adequately financed family farms would provide American agriculture's most competitive position in international markets. These supports would still remain consistent with maintaining a healthy, growth oriented agriculture. This level of support would not provide an adequate income to over-leveraged farmers or to small, high-cost producers who depend on agriculture.

If low price support levels are chosen, however, the question is to what extent, if any, should these be supplemented by direct income payments. To what extent will taxpayers be willing to support large-scale payments to agriculture in the form of deficiency payments and set-aside programs? Objections have arisen over large payments to individual farmers such as several million dollars to individual producers in the dairy buyout program. Taxpayers are recognizing that large farmers, many of whom are in good financial shape and have substantial farm earnings, are collecting large amounts of direct government payments.

Two major options have been suggested for change. One is that income payments should be targeted only to individuals and groups most in need, such as small and medium-sized family farms. Another is that payments should be unrelated to agricultural production, and that a program be adopted with a predetermined, say ten year phase-out period, for government direct commodity support. In any event, a question needs to be raised. Can we justify levying taxes for massive government transfers to farmers whose average income substantially exceeds the national average?

4. Trade issues and export expansion: The aspect of agricultural policy that perhaps is the most complex is the international trade of agricultural products. Agricultural protectionism and domestic farm policy are closely linked. Trade restrictions are placed on commodities to compliment and protect domestic price and income support programs. Restrictions vary widely among countries, but they are rarely accompanied by any efforts to improve productivity or farm structure or otherwise adapt agriculture to achieve a competitive status in international markets. These restrictions result in excessive international conflict. They have particularly devastating effects on developing countries whose growth is central to future expansion of U.S. agricultural exports. History shows that the world community loses with a protectionist policy. It suggests that continued, strong efforts be made to reduce trade barriers and to allow an improved international balance in agricultural production and resource use.

But trade distorting measures are not exclusive to countries that seek and implement import protection. U.S. budget commitment to export enhancement approximates 8 billion dollars per year. A recent study mandated by the U.S. Congress stated that these expenditures are relatively cost-ineffective and that they have not had a major impact on U.S. farmers' income. Interest subsidies and other direct actions to stimulate exports tend to be offset by countervailing action by other countries. Further, in this kind of a competitive game, the United States, with its more private export system, is at a strategic disadvantage vis-a-vis the European community with its exports tender system and government market control. It is also at a disadvantage against other competing exporters with centralized marketing boards that can develop long-term arrangements and otherwise directly manage export programs.

Two overall focuses become central to U.S. efforts to improve international agricultural markets. One is continued effort to develop mutual reductions in agricultural trade barriers as is currently underway in the Uruguay Round trade negotiations. The other is to seek a more rational approach in U.S. general economic policy to deal with the domestic federal budget deficit and the related overall trade deficit. Recent declines in interest rates have benefited agriculture. Declines in the value of the dollar also have helped make U.S. exports more competitive. Nevertheless, much more is needed. Perhaps the single biggest danger to the future of U.S. agriculture is the federal budget deficit and its resulting effect on the trade deficit and exchange rates. When deficits have been brought under control and the resulting adjustment in exchange rates have occurred, American agriculture will better be able to assume its appropriate role as an efficient producer for domestic and international markets. Fundamental policy changes that permit reduced agricultural trade barriers and that strengthen the overall U.S. economic position in world markets are needed to deal with international problems in agriculture.

5. Aid to developing countries: Another component involved in expanding U.S. agriculture's markets is aid to less developed countries. Growth in developing countries is central to U.S. agriculture's market expansion. U.S. aid programs have three major purposes: 1. humanitarian assistance to improve the lot in life of families in poor countries, 2. assistance to improve economic growth rates in low income countries and, 3. support for our political interests in various parts of the world. The second objective, that of increasing economic growth in poor countries, has the most substantial impact on U.S. farm product markets. Even in situations where this results in increased competition in the short-run, aid which contributes to long-run economic growth and expands food demand will far outweigh

the short-run competitive impact and will result in permanently expanded export markets. This presents a problem in defending aid programs that provides long term benefit through expanded export markets for U.S. agriculture in light of increasing concern with possible short term competitive impacts that might occur in a limited number of situations.

6. Structure, process, and the potential for change: It is clear that the political economy of agricultural policy is diverse, complex and contentious. It is also apparent that policies do not change to keep pace with the problems and conditions they were designed to address. The United States, and for that matter most other industrial countries, maintain policies that were designed to fit far different conditions of the 1930s or in some cases, the immediate post World War II period.

The political economy of agricultural policy is part of a broader framework that is constantly changing, sometimes gradually and sometimes abruptly. Within this economy, political and economic phenomena are interwoven strands, often very closely interwoven. While societal goals tend to be reflected in policy, vested interests that often overshadow concern with the broader public interest usually bring pressure to bear on this policy. The present dynamics of agricultural policy are the product of a long tail of historical events and perceptions of what policy goals ought to be. One way to look at these dynamics is to distinguish between two levels of analysis: structure and process. Structure refers to the longer-term political and economic determinants of the incentives and constraints within which actors operate. Process refers to the short term behavior of actors within a given set of institutions, assumptions and expectations. Process, at any point in time, is influenced by how economic realities, institutions and values have evolved over time to influence the incentives and constraints within which current policy is formulated. Policies can seek marginal change or they can seek fundamental systemic change. When, for example, we say farm policies change slowly, this implies marginalism. Recent United States efforts in international negotiations have been aimed at a more fundamental, systemic change in agricultural trade and farm policy. While this approach has set a new direction, the extent to which actual change will occur is still undetermined. Nonetheless, moving in the direction of reducing massive distortions in agriculture created by government policy, even if only slowly, appears appropriate.

MARKET POLICY IN THE FOOD SYSTEM

In the modern industrial food system literally thousands of people contribute to the production and distribution of a single loaf of bread and to each of the other thousands of food products delivered to consumers each day. Market policy in the food system is about how all this activity is coordinated. The coordination takes place across markets and within organizations, always within rules established by government and custom.

Coordination involves matching supply with demand at each stage of production and distribution. The economic problem is to organize in such a way that consumers articulate their preferences effectively and producers have incentives to match supply with demand at prices consistent with the costs of production. The problem is greatly complicated by the fact that decisions influencing future production are made prior to the time when the products of these investments will be sold. The future is uncertain in general, and the future demand for products and future commodity prices of inputs are particularly uncertain.

This formulation of the problem directs attention to a number of interrelated institutional and economic issues involved in forming food market policy. In the discussion which follows, these are organized around five major topics. A first section deals with formulating and articulating preferences. A second section discusses sources of information and the problem of individual versus collective choice. The third section deals with achieving market discipline through competition and regulation. The fourth section discusses institutional forms that effect market coordination while a fifth section deals with entitlements and property rights and how their distribution affects outcomes in the food system.

Preference Articulation

In our system of political economy we express preferences through a combination of market and political processes. Preferences for goods and services are most immediately expressed in markets through buying and selling. However, the market may not be an effective mechanism for articulating preferences for some particular goods and services; political processes or government is required. But preferences articulated through markets always reflect the rules of the economic game which are established through political processes.

Both market and political processes have serious flaws as mechanisms for articulating preferences. Market transactions frequently have consequences which are not taken into account by the parties to these transactions. Where the benefits produced are not captured by producers of a good or service, too little of that good or service is likely to be produced. Similarly, where costs are imposed on others, too much of a good or service may be produced. Information is a significant problem. For the market to work effectively buyers must know what they are buying and what the alternatives are; sellers must know what buyers will want and be willing to pay for. Some goods and services, if produced, can be utilized by additional users without adding to the costs. And markets may not be disciplined; thus incentives to supply products demanded at the lowest possible cost are lacking.

The political process also has major problems as a mechanism for articulating preferences. It is difficult to transmit preference information to policymakers. Transactions costs are high. Many conflicts of interest must be resolved. Individuals and groups have very different levels of influence in the process.

A reasonable general principle to follow would seem to be to use the market as the mechanism for articulating preferences to the extent feasible and limit the political mechanism to areas where the market fails. This leaves great room for policy debate. The extent of government participation in the economy has been

the central ideological issue in food policy in the past. General beliefs about the role of government and markets will likely be a major factor influencing food and agricultural policy in the future. Much of the discussion of policy which follows involves judgements of the relative effectiveness of markets and government as mechanisms for articulating preferences.

Information and Choice

A number of food system policy issues involve information and individual versus collective choice. We briefly discuss a few of these which we believe will be important issues in the future.

Food Safety and Nutrition

Almost all citizens would agree that the availability of an adequate supply of safe food meeting the nutritional requirements of the population is one of the most important goals for the food system. However, the role of the government in assuring or promoting food safety and adequate nutrition is controversial.

In the modern food system, various chemicals and technologies modify foods as they are produced, preserved, and distributed. Some envisage radical transformations in the foods we eat and in the food system, based on the application of existing and still developing food technologies. These technologies include synthetic flavors and colors, chemical preservatives, preservation by irradiation, plant and animal growth regulators, pesticides, herbicides, and many others. Thousands of chemical compounds may enter the food chain by design or accident. These technologies bring us many benefits and promise many more. But what risks do they involve, and what are the appropriate policies to deal with these risks?

The two policy extremes are "let the buyer beware," (which assumes that the buyers can be adequately informed and are responsible for their actions), and "the government is responsible for assuring that food is safe."

In practice the U.S. follows both these extremes and variations in between. Under the Delaney clause, a class of food additives which may cause cancer are prohibited with a zero tolerance. In this case, policymakers do not consider the fact that some consumers would be willing to trade off a small risk of cancer to obtain a lower price or other product characteristic. At the same time no prohibitions are placed on the use of food additives such as fat or salt which may contribute to heart disease.

Both market and political processes have major problems in providing consumers information to deal with food safety and nutrition. It is not technically or economically feasible for individual consumers to evaluate the consequences of ingesting the great variety of chemical compounds potentially available. Even with strict labeling rules, it is not possible to even identify all of the compounds in most foods. And consumers are unequipped to assess the consequences of most of these compounds even if they were identified.

The government also faces very difficult information problems in developing and implementing food safety and nutrition policy. Great uncertainty exists about the relationships between particular chemical compounds and the health of those who ingest them. Of 60,000 or so compounds which could enter the food system, only a few have been tested. For many of those which have been scientifically evaluated significant uncertainty remains about the consequences of their use. For example, small quantities of a pesticide residue may indicate no hazard for most people but this residue may be unsafe if large amounts are accumulated in the body. Short-run consequences may be absent but long-run exposure may be hazardous for people who have had a particular illness. Or more likely, the long run consequences are unknown.

Another serious information problem is that of determining preferences in trade-offs between risks and costs. It is very difficult to articulate such preferences through the political process. Few people vote for a legislator because of his or her stand on such trade-offs. Some general legislative guidelines must be given based upon legislators' general beliefs about benefits and costs of regulation, constituent beliefs, and their ideological positions on the proper role of government. The decisions must then be left with technical specialists and officials, with provisions for hearings to allow interested citizens to provide information about both consequences and preferences. Important policy issues, then, include the design of the policy guidelines, agency procedures and effectiveness in generating information about risks and benefits and citizen preferences. These guidelines and the agency organization promise to be major issues in the future as technology develops both new compounds, means of testing their presence in foods, and their possible connection to health.

Almost everyone agrees that government has a role in protecting buyers from harmful substances added to food, and that producers and consumers should not suffer from arbitrary actions of government regulation. A major issue remains in regard to the role which government has in protecting citizens against their own actions. We require labels on cigarettes warning of possible harmful effects of smoking and prohibit advertising cigarettes on television. We have laws prohibiting the sale and use of some drugs such as cocaine, resulting in high prices of the drugs, large profits to suppliers, corruption, and intimidation of government officials. We tried prohibiting alcohol and gave it up. These are all agricultural products, and they are important in American consumption patterns.

A number of uncertainties exist about the relationship between diet and health. Strong evidence exists relating diet to cancer and heart diseases. What role should the government take in promoting more healthful diets? Should it provide information, prohibit advertising of some foods, require warning labels on manufactured foods which may be detrimental to health, or even prohibit the sale of some foods? Should foods likely to be harmful be subsidized through farm programs, should they be discriminated against through taxation, or should there be no interference by government?

The notion that the government has a very limited role in protecting individuals from the consequences of their own behavior may be changed as the government becomes more involved in paying for health care. The cost of medicare, the proposed broader federal health insurance plans, and privately

provided health insurance are all greatly influenced by the dietary patterns of participants. Thus it is not just the user who is influenced by the consumption choices. If a smoker knows the habit contributes to cancer and emphysema, should he be eligible for the same benefits from health insurance as the nonsmoker? How about those who do not control their intake of fat and salt? In the interest of reducing costs of health services, should the government be more active in promoting improved diets or influencing the content of manufactured foods?

These are not trivial issues. The future food system and its performance will be greatly influenced by the policies on food safety and nutrition. Food safety, quality assurance, and reliable measures have been major functions of the USDA and by far the largest part of the budgets of the state departments of agriculture.

Grades, Standards, and Labels

The saying goes that a rose by any other name is still a rose. But names create images, convey information, and influence the value of products. Grades are "short hand" representing a set of product characteristics. They have generally been used to facilitate trade by reducing transaction costs and improving the reliability of contracts. Standards establish criteria for certain product identification. A product identified as a meat pie, for example, must contain a minimum percentage of meat. Label regulations relate to identifying the contents of the product or package.

New technologies for testing and identifying characteristics, greatly improved communications and data processing technologies, the potential for many new products, mass merchandising, and global trading in agricultural products challenge the current system of grades, standards, and labels, and the regulatory role of government.

It should be possible to trade on the basis of more specific commodity characteristics than the generalized grades currently in use. This would better coordinate supply with demand. Since quality images are important, poor quality of a product may influence the market for a product not only of the specific lots of poor quality but of the product as a class. It is argued that the delivery of grain not meeting the standards of foreign buyers reduces the value of U.S. grain in the international market. Growers of some fruits and vegetables argue that quality standards are needed to build the image of their commodity. They seek to enforce the standards through marketing orders. Health conscious consumers and consumer interest groups are demanding more informative labeling. The specifics of the label influence demand for products and the value of these products.

Advertising and Merchandising

Large amounts of money are spent to advertise and promote food products and agricultural inputs. Again, technologies to produce new products and communication and data processing technologies may change the role of government in providing and regulating information that influences choices.

It is generally agreed that basic, truthful, informative advertising is desirable and that blatantly false advertising which might be taken seriously should be prohibited. Issues arise from large expenditures for advertising and merchandising which may have a negative effect on health, reduce competition, or increase costs without a benefit. For example, should the government regulate advertising of breakfast cereals which contain large quantities of sugar when these ads are aimed at children, as in Saturday morning television? Should the government be concerned with alleged waste of resources from competitive advertising and merchandising? Should the government facilitate collective agreements to reduce advertising and promotion practices which increase food costs, as has been alleged for trading stamps and coupons? Should the government be concerned with advertising and merchandising which leads to the lessening of the number of competitors? Should the government be concerned that the decisions of a few merchandising managers can greatly influence what consumers purchase and what products are profitable to produce?

A special issue arises over the role of the government in generic advertising of agricultural products. The government plays two roles. It provides the mechanism for assessing producers of a commodity so that they can collectively contribute to an organization for advertising and other promotion. This is done through special commodity legislation and through state and federal marketing orders. The U.S. government and some states also provide funding for agricultural product promotion, both domestic and foreign. One argument for public support has been that advertising and merchandising by private firms emphasizes branded products, which are mostly highly processed, and that these firms spend very little on promoting fresh products. To the extent that highly processed products are of less inherent value or less nutritious, the expenditure of public funds may benefit consumers. The major criticism of grower sponsored generic advertising is that comprehensive research proving it to be profitable to the producers paying the bill is in short supply. Such research is difficult and expensive.

Market Information

An efficient market requires informed participants. Particularly important for allocating already produced commodities is information about prices and quantities. Changes in communications and data processing technologies would seem to improve the possibility of achieving transparent markets. However, changes in market structure and channels, partly related to technology, have resulted in many of the transactions within the food system being beyond easy observation. Market news provided by government reporters from central markets is now possible for only a very small part of the value of traded agricultural commodities. Market news seems to have the characteristics of a service that would be underproduced by private market participants because of the difficulty of excluding other users who do not participate in the cost of developing the information. Nonetheless, considerable market information is supplied by private firms.

One issue is the ownership of market information. Should private firms be legally obligated to report transactions in the interest of achieving an efficient market? What should be the government's role in collecting and distributing market informa-

tion for the food system? Does government have a role in regulating private information services?

Research and Extension

The concept of a public system of agricultural research and extension developed when a large part of the nation's population lived on farms. Research produced knowledge applicable to agriculture. The translation of this knowledge into directly useable farming practices and its delivery to a large group of independent entrepreneurs on farms and in other agricultural industries contributed to the food system's transition. Strong incentives for farmers to adopt technologies to increase output and for firms to sell these technologies also led to transition. Now a question arises, How appropriate is this system of research and extension for the modern food system?

A number of studies have shown that investing in knowledge in the food system and applying this knowledge has a very respectable ratio of benefits to costs. These studies most likely underestimate how much knowledge contributes to the productivity of the system. This contribution becomes clear when the modern food system is compared to systems which did not or do not apply modern technological, management, and institutional knowledge. The current policy question is not about the value of producing and distributing knowledge; it is about organizing its production and distribution and the incidence of the benefits and costs of its application.

Where the benefits of investment in producing and distributing of knowledge can be captured, it is likely to be privately produced. Research on new varieties of hybrid corn is an example. The investment can be protected because the seed will not reproduce itself. Research and extension dealing with techniques for improved conservation tillage methods is less likely to be privately produced since it is difficult to exclude users. However, large farmers are willing and able to pay for consultants to reduce the costs of acquiring useful information. Thus at least part of the extension service could presumably be privatized. There is, however, an argument in favor of public investment in knowledge that increases productivity even if it can be profitably produced by private firms. The benefits, it is argued, will flow to the taxpayers in the form of better or cheaper products.

Research and extension dealing with food safety, impacts of actions on environmental quality, and the consequences of alternative policies are among areas of research that are very important to future welfare. However, they have characteristics which require public funding or other public intervention to create the incentives to develop at socially desirable levels. It would be possible, for example, to require firms to provide research proving all their products safe and to evaluate all the environmental consequences of their activity. They could also be required to advertise the research findings. This would privatize these functions. Some of this is current practice. The extent to which these functions should be privatized will be an important future issue. What is clear is that a dynamic, scientific, industrial food system requires very substantial research and extension to keep the system productive and safe at the same time.

One of the problems with public enterprises is that they create special interest groups interested in their funding. The employees of such organizations and those receiving special benefits from them have strong incentives to influence legislators in the organization's favor. Taxpayers are a dispersed group. While they have a general aversion to taxes, they seldom find it worth their time to express their preferences about funding specific functions. In the case of technical research it would, of course, be particularly difficult to form an informed opinion on which to base a political position.

Competition and Regulation

A basic proposition of a private enterprise system is that competition will discipline the system. The idea is that in order to stay in business a firm must produce goods that buyers want at prices reflecting the costs of production. Otherwise there is a competitor who will. Temporary profits may accrue to the innovative, but competitors will quickly follow, forcing market prices to the costs of production. If there are too few buyers or sellers, and entry and exit from the business is expensive and risky, the firms will have some discretion over their prices and costs.

The American food system has changed from a system where most of the tasks of food production and distribution took place on small farms to a system where almost all of the value added in the food system is done by nonfarm firms, many of which are very large. An important area of policy revolves around the question—How effectively does competition discipline the various industries of our modern food system?

At least two classes of policies need to be considered. The first are policies which promote competition and prohibit conduct which lessens competition. The second are direct regulations of business practices. These regulations are intended to mitigate the consequences of market structures and conduct which are not consistent with performance expected from competitive markets.

This is not to suggest that efficiency is the only criteria for judging market performance. Equity, worker safety, worker dignity, and many other goals are important. Such goals will not necessarily be promoted by competitive markets. However, in this section, we are looking at the important, but narrow, question of the how effectively competition promotes efficiency.

Few suggest that the ideal market structure is a large number of very small firms in all industries. Economies of size are well recognized. Some argue that very large firms are essential in order to get the large long term investments required to exploit the potentials of modern technology. In some cases, economies of size may be sufficient to result in a monopoly to achieve the lowest cost production. In the case where economies lead to one or a few large firms, the question becomes how to regulate their behavior rather than how to promote atomistic competition.

Input Industries

As we have been arguing, the modern food system is highly industrialized. Inputs to the system come from most of the

industries of the economy. We will briefly comment on only a few of the more important.

Purchased energy is a very important input to all other industries of the food system. The price of oil is significantly influenced by the OPEC cartel, the very large multinational corporations and government agencies which buy and sell oil. The OPEC cartel is unstable but can be expected to continue to influence the price of oil. The oil companies engaged in processing and distributing of oil products are large enough and operate in sufficiently concentrated markets that they have some control over their prices and costs. Retailing of oil products to farmers appears to be competitive, in part because of the extensive participation by farmer cooperatives and the general ease of entry. Electric power and distribution of natural gas are not competitive industries although other sources of energy influence their prices. They are basically regulated monopolies.

The chemical industry, a major food input industry, has characteristics very similar to oil processing and distribution. Some chemicals are highly differentiated by function and brand and have very little competition. Some are protected by patents, which may promote innovation, but also restricts competition.

Transportation, another major input, is a complicated story. Transportation services were, for many years, regulated. The regulation was not designed to promote competition. Many rates were set by regulators and even by industry officials with the sanction of the regulating agency. In recent years, much of the regulation dealing with price and public service obligation has been eliminated. The evidence is that rates have come down in areas with large volume which have attracted competitors. The nature of competition for railroads and pipelines is somewhat different than for trucking and airlines. Trucks and barges compete with railroads but may not be very effective competitors for some commodities and areas of the country. Many firms are not served by multiple railroads. There has been some trend toward industry concentration, and without policies to promote competition, it would be expected that mergers will be pursued and that this will soften competition. One of the issues has been the acceptability of mergers involving several modes of transportation.

Machinery and equipment inputs to the food system are for the most part manufactured by very large firms. Very significant trends have appeared in these industries. Only a few years ago U.S. firms dominated the U.S. and many international markets for these products, but competition has changed radically. The relevant market for judging competition in these industries is worldwide. The discipline of competition is evident in the adjustments made in U.S. industries in the face of rising international competition. At the same time there appears to be a trend toward very large international firms in these industries. The nature of competition which will evolve is not clear. In the case of farm equipment, some international specialization appears to be developing. For example, small tractors are built in Japan, medium-sized in West Germany, and large ones in the U.S. Worldwide concentration in producing specific types of equipment may become the rule in these industries. Competitive discipline will then depend on the threat of entry by large firms producing similar lines of equipment and will be greatly influenced by trade policies. Protection from foreign imports is protection from the discipline of competition in an internationally segmented production system.

Containers and packages are a major input in the food system. It is not at all uncommon for the cost of the package to exceed the cost of the raw product in consumer foods. The paper, sheet steel, basic plastics, aluminum, and glass industries are generally characterized by very large firms and substantial concentration. Containers are fabricated by a mixture of large and smaller firms. Competitive discipline is provided by the actual and potential entry of food manufacturing firms.

Advertising and promotion are also important inputs. Manufactured foods, tobacco, and beverages are among the most highly advertised products in the American economy. This influences the nature of competition and food system costs. Advertising expenditures, for example, will often exceed the profits of food retailers. The two major media for food system advertising are newspapers and television. National television is a concentrated industry, although cable is creating more competition. Competition among local newspapers is almost a thing of the past in the great majority of American cities. Competition clearly affects advertising rates. The business merger of the two Detroit papers resulted in the announcement of advertising rate increases even before the merger was official.

Financial Markets

Credit is particularly important in the food system and especially in farming. Farming uses a large amount of capital relative to labor when compared to other industries in the U.S. economy. The interest rate and the availability of credit not only influences costs in the food system, but they are critical in determining entry and exit from farming and other food system industries.

Major changes are taking place in the organization of financial markets. Competition in financial markets has a significant impact on interest rates and financial services to different borrowers, but it is not the most important factor in determining rates: monetary and fiscal policy of the U.S. and other major industrial countries is. The role of international banking and multinational corporations in determining the supply of various currencies, and thus rates, is not clear. We do know that huge quantities of money and credit flow among money markets daily. The participants in this activity include mostly very large firms and central banks. Small differences in expected rates of return appear to move large amounts of money, which indicates worldwide competition in these markets. The internationalization of capital markets reduces the capacity of a single government to manage its own money supply.

The trend in credit retailing is also mixed. Barriers to concentration have been reduced, leading to a number of very large firms engaged in lending money. At the same time, many new firms have entered the market. The banks of the farm credit system, which operate as credit retailing farmer owned cooperatives, have had difficulty competing. This would ordinarily indicate a high level of competition in these markets. However,

the system was greatly stressed by unexpected changes in farm asset values and interest rates; therefore, it may not be a good yardstick for competitive performance.

As to the future of world monetary systems and the way they will deal with huge budget deficits, trade deficits, and the creation of credit, we declare befuddlement along with everyone else, noting simply that the performance of the food system will be profoundly influenced by the way it works out.

Food Wholesaling and Retailing

Food retailing is divided between the suppliers of groceries for home consumption and prepared foods for away from home, including institutional consumption. Estimates are that expenditures for food and related services away from home are about 40 percent of the total.

The trend is toward much larger firms in the restaurant industry. The familiar national restaurant chains are very large organizations. Many of the chain restaurants are franchise systems; thus the parent firm is more like a wholesaler than owner. One of the competitive issues is the extent of control the franchising firm has over the purchase of supplies by the owners of the individual stores. It appears that the major barrier to entry is the ubiquitous presence of major fast food chains with their well-advertised products of consistent quality occupying strategic locations. In the process of penetrating the hundreds of local markets, these chains created competition and displaced many independent operators. The question for the future is how competitive will these firms be as the industry matures? It is clear these large firms now influence what we eat and the size of the market for some specific agricultural products. To date, we do not have evidence that they exercise monopsony power in raw product markets.

The trend in grocery retailing is toward larger stores but not toward higher levels of concentration at the national level. The major national retail chains are integrated retail-wholesale organizations with some integration into food processing. Large stores have cost advantages and offer consumers greater variety. One of the significant economies to size within a particular market is in advertising and merchandising. Economies to size in chain operations appear to be in procurement and wholesaling. Some strategic advantages may arise from the possibility of managing prices in different markets, either to enter a market or to ward off new competitors.

The relevant market in food retailing is local. In a number of local markets, consumers have a limited number of supermarkets to chose from. There is evidence of higher prices in more concentrated markets. Even where competition is limited in a local market, the potential entry of a competitor imposes limits on prices and profits. There seems to be a tendency for costs to increase the longer a retailer is in business. This attracts new entrants, often with a different level of service and amenities. The current development of box or warehouse stores is an example. Also as firms are in business for longer times, wage rates, benefits, and work rules tend to increase. If a new firm can come into a market with a new, significantly lower cost labor agreement, it may be able to replace an established firm, even given the frequent barrier to entry arising from advertising. This has happened in food retailing, and it is likely to continue to be a factor in competition.

An important factor in the competitiveness of independent retailers and small chains is the competition in wholesaling. Competition in wholesaling is enhanced by the wholesale organizations owned by groups of independent retailers. These are retailer owned cooperatives. In competing with the integrated chains and the retailer cooperatives, some of the independent wholesalers behave very much like the retailer owned wholesalers, providing a variety of services to their clients.

Perhaps the most important competition is that among suppliers for shelf space in retail outlets. The importance of the level of concentration in the wholesale function is that a relatively small number of buyers, in combination with large retail merchandisers, have a great influence on what products are presented to consumers. Some food manufacturers and processors go to great lengths to get products on the shelves. One of the major incentives for brand promotions is to pressure buyers to stock the items. Tactics to reach the shelves include consumer coupons and providing tie in advertising and services to the retailer as well as up-front payments just for the opportunity of getting on the shelf. Suppliers may provide incentives not only to get their products into the store but also to keep competitors products out.

About 90 percent of the foods and beverages we purchase are processed to some degree. The number of food manufacturing firms declined from about 42,000 to about 17,000 from 1947 to 1987. About 700 of these firms have 100 or more employees and account for about 80 percent of the value added in this industry. The 100 largest food manufacturing firms account for more than half of industry sales. Food manufacturing can usefully be divided into processing for other manufacturers and for the away-from-home market, products sold under private label (largely retailer brands), and manufacturers' branded products. The 100 largest food processors generally specialize in producing for their own brand. These firms spend large amounts of money promoting branded products. In 1982 the 100 largest food manufacturers did 92 percent of the total industry media advertising. Sales concentration has been increasing in the manufacturers' branded product part of the industry, much more than in the other parts of the industry. Brand advertising and promotion appear to be the major barriers to entry. Exit is also inhibited by the investments in promotion because these investments have limited salvage value. It is estimated that at least 25 percent of manufactured food products are sold as differentiated branded products in oligopolistic markets. In these markets prices are estimated to be 6 to 10 percent higher than they would have been in more competitive markets with undifferentiated products.

In most of the private-label, generic, and unbranded markets there are many competing firms, and this competition provides effective discipline. There are strong incentives to keep costs down. A good deal of food processing is done by farmer owned cooperatives. As a competitive yardstick, these firms provide

evidence of the low profits in much of the food processing industry.

Meat packing is a special case. In the 1920s meat packing was highly concentrated, and a court case resulted in increasing competition in the industry. Nonetheless, a few firms retained significant market power. In the 1970s the industry was restructured. A major technological development in the form of boxed beef, combined with significantly lower wages and cost reducing labor practices, resulted in the rise of a new kind of packer and the demise or restructuring of the old line beef processors. Now there is concern that the industry may be dominated by two or three of these packers. There are some indications that pork packing may follow the pattern for beef. These new packers are units of large multinational conglomerate corporations.

Many of the largest firms in the food system are conglomerates. These large corporations have units which produce products in many lines and serve many markets. An example is the International Telephone and Telegraph Corporation, which is a large food manufacturer. The growth of the large conglomerate firms has come largely from mergers. Two major questions arise about the large conglomerate. First, what economic benefits or costs result from this type of organization? For example, did the ownership of Iowa Beef Packers by Occidental Oil contribute to the performance of the beef packing firm? The second question is, How does such ownership influence competition? The large conglomerate has the potential to exercise competitive strategies which tend to restrict competition in the long run. These include the possibility of selling below cost in selected markets, supporting the losses from other lines of business and expecting to recoup the losses from higher prices later on, providing very large initial advertising, possible economies and advantage in advertising and promotion with retailers in battling for shelf space, and the possibility for reciprocity and competitive forbearance. The latter possibility arises from the many possibilities of agreements conglomerates have to buy different lines of products from each other. A conglomerate can offer soft competition in one line of products in exchange for soft competition in another line.

Farming

While there is much discussion about the decline of the number of farms, there are very few commodities where the individual farmer or farmer controlled cooperatives have any influence on the terms of trade in purchased input or product markets. In fact competition has been so relentless that commodity prices frequently fall below the cost of their production, assuming market wage and interest rates. Farmers have sought assistance from the government to mitigate the consequences of relentless competition combined with a steady stream of technological innovation. The farm programs are one form of this assistance, and they are discussed extensively in another part of this paper. Farmer-owned cooperatives and marketing orders are organizations intended to give farmers some measure of market power.

The Capper-Volstead Act exempts farmers from most antitrust restrictions in forming farmer owned commodity marketing cooperatives as long as the cooperative does not manage to unduly enhance prices. Secretarys of Agriculture are charged with implementing the Act. None has found a cooperative which he believed unduly enhanced prices. Bargaining cooperatives attempt to influence terms of trade and have had some success. However, since they have very limited capacity to control total production, they have limited market power. Their practical objective is to counteract power on the other side of the market to achieve prices close to what they would be in a well informed competitive market. Several marketing cooperatives have developed branded products and provided their member with good market outlets. The purchasing cooperatives have provided a competitive force in input markets and captured some of the economies of scale for their members. In general, the evidence is that farmer cooperatives have contributed to the competitive performance of markets and have not unduly enhanced prices. Even so, attempts have been made to have the Capper Volstead Act repealed or modified. Attempts to strengthen farmer bargaining cooperatives by giving them some capacity to manage supplies through legislation facilitating full participation membership have been unsuccessful.

Marketing orders have also been authorized to give growers of selected fruits and vegetables and milk some measure of control over their markets. The fruit and vegetable orders provide a mechanism for collecting funds to support product promotion and research. They also provide some collective control over quality of marketed products. There is very limited capacity to enhance prices through control of quantities marketed in different markets. Control of production is not authorized. The authorizing legislation states a goal to achieve orderly markets leading to parity prices, but it does not authorize the means to achieve the goal.

Milk marketing orders provide dairy farmers with some influence over the prices processors pay for milk. Elaborate procedures have evolved to determine the formula for prices which processors are required to pay. Since, again, the orders do not permit control of production but do provide for regulation to prevent undue price enhancement, the market influence is limited. The extent of influence of the orders alone is difficult to judge since most farmers selling in "order" markets are represented by marketing cooperatives as well. In addition, the government has provided price supports. All this together does not describe a competitive market.

Both cooperatives and marketing orders need to be considered for their potential as mechanisms to improve economic coordination under conditions of uncertainty. This will be discussed in a subsequent section.

Labor Markets

A very large share of the costs in the food system consists of wages and salaries. The estimate for the U.S. economy is over 80 percent. It would not be much different for the U.S. food system. Other components are rents, interest and profits. Wages, salaries and labor productivity are by far the most important determinants of food prices.

What is the nature of competition in labor markets? What determines wages and labor costs? A number of factors are involved. Perhaps least important is the minimum wage. Some benefits and costs are dictated for some types of employers—social security tax, and overtime pay, for example. While unions represent only about one-fifth of U.S. workers, they significantly influence wages and work rules. Union wages are about 40 percent higher than those of unorganized workers. This may be due to other conditions, because many unorganized workers of similar skills, especially working for large firms, are as well or better paid than union workers. However this means that union workers and some others receive wages much higher than the lower end of the wage distribution. One reason some unorganized workers receive wages comparable to those paid to union members may be that paying below union standard will create an incentive for workers to organize.

Wages have a sociological aspect as well. There are more or less standard notions about the relationship between wages of different skilled trade workers. Most of the skills used on a job are learned on the job. Co-workers help to train new workers. If employees were continuously replaced whenever a lower wage worker was willing to join a firm, the quality of on-the-job training would be greatly diminished. Also, in most firms, productivity depends upon willingness to work and to work with other people. Acceptable wages, even wages above the expected standard, may be profitable for the firm. Their effect on morale and willingness to cooperate can improve productivity.

Particularly important in determining wages and salaries is what the employing firm is able to pay. This depends upon two things: the nature of competition facing the firm and the firm's cost of production compared to its competitors. Employees who work for a very progressive firm which has high earnings can expect to share in the earnings. And employees in industries operating in concentrated markets can expect to share in the benefits of slack competition. For example the automobile manufacturing and the steel industry have wages much higher than average manufacturing and manufacturing has wages much higher than the service industries. Two people in the same town both doing the same kind of work (sweeping floors for example), one working for Deer and Company and the other for a small food processor producing unbranded products, may receive vastly different wages. The structure of the two industries is very different.

If the food system is divided between those industries consisting of many small firms facing tough persistent competition and those consisting of a few large firms which have escaped the full discipline of the market, you will find wages, salaries, and labor costs higher for the latter. Higher costs are passed on to consumers. The higher costs and earnings of the firms in less competitive industries increase costs and reduce the demand for the firms in the more competitive industries.

There is a general notion that in search of profits each firm will employ workers as long as the value of the expected product of the worker exceeds the cost of employing the worker. Because of competition, the wage will be forced to the level necessary to get the last worker hired. What seems to be more descriptive is that many factors influence wage rates and that firms will decide how many workers can be profitably employed at the established wage and salary scale. Thus, in this view, labor market competition does not set wages and salaries, but the established wages and salaries determine how many workers will be employed in the various industries.

Salaries of the management group in a corporation are also influenced by the fact that ownership and control of most large firms is separated. Management, not the stockholders, control. And management largely influences management salaries. Since in large firms it is generally impossible to attribute contributions to output or profits to individual efforts, the salaries will be determined by some other means. Again the competitiveness of the markets in which the firm operates will affect what there is to divide among the managers, the workers, and stockholders.

Policy on Competition

Competition policy is concerned with the whole economy. Only a few laws deal specifically and exclusively with competition in the food system. However, the industrialized food system is influenced by the performance of every major industry in the economy.

As a nation we have ambivalent positions on competition. Almost everyone favors competition in the abstract but will avoid its consequences if possible. There is a general impression that large firms are large because of better performance. Some schools of thought believe very large firms are essential to organize capital-intensive industries operating under real world conditions of uncertainty. Some believe that the market is the proper test for firm size, and that government is not capable of applying regulation in a manner which would improve performance.

A large number of competing small firms in all markets is not a practical goal. There are significant economies of scale and advantages in larger firms. For example, research and development are important, and very small firms are unable to invest in research and development. But very large firms in highly concentrated markets are not noted for innovation and general progressiveness. The discipline of market competition is clearly very important. The policy problem is to determine the desirable and acceptable limits to the escape from that discipline and then to design and enforce laws consistent with these limits.

Economic Coordination

The above discussion of competition focused on the relationships among firms selling the same products. Economic coordination involves relationships in the sequence of activities in production and distribution. Competition and coordination cannot be separated. Competition affects the incentive firms have to search for and implement effective coordination. Firm size is influenced by the benefits and costs of coordination within a firm in contrast to buying the input or services from another firm. Market concentration may arise from the incentive management has to reduce the uncertainties of the competitive market.

Spot Markets

In the modern food system thousands of technically separable activities are coordinated within firms or between firms through markets. For the purposes of this discussion, it is necessary to divide markets into those dealing with already produced goods and those dealing in promises to deliver a good or service in the future: spot markets and forward contract markets.

Transparent, competitive spot markets are effective in directing already produced goods to those who are willing to pay the most for them. Prices are determined by the interaction of buyers and sellers, based upon supplies brought to the market and the demands of the buyers in that market. Both supply and demand may be influenced by expectations of future supply and demand. But spot markets are not effective in coordinating investments needed for producing goods. Last year's prices are not a reliable indicator of next year's prices. And the spot market does not convey information about the potential demand for characteristics which are not offered in the market.

Integration

The spot market is particularly ineffective in coordinating the production of inputs for future stages of production. Consider the coordination problems of a farm machinery manufacturer. A line of equipment requires hundreds of parts. Many of these parts are uniquely suited to a particular machine. No firm is going to produce these parts and simply offer them for sale in a market. So the choice faced by the machinery manufacturer is to produce the parts within the firm or engage other firms to provide the parts according to specifications.

The advantages to buying the parts rather than producing them follow from two conditions. There many be significant economies of scale in producing a related set of parts which could not be captured by producing the part inside the firm. This could include both expensive investments in production facilities and specialized knowledge. A supply firm may therefore be able to produce the parts at a lower price because it can spread these costs over products for a number of buyers. A second reason why an outside supplier may produce the good at lower costs is because the outside managers are likely to work under stronger incentives than the manager of a unit within the firm. The outside managers are more likely to benefit directly from good performance; it is easier to evaluate their performance, and they are more subject to the discipline of competition from alternative suppliers. This is especially true if the supplying firm is smaller and more specialized. In addition, if the supplying firms are smaller and younger, they are likely to have lower labor costs.

A drawback to using outside suppliers is the difficulty of contracting effectively. The transactions costs may be high. It is very difficult to anticipate all the contingencies which are important in implementing a contract. For example, what happens if there is a strike or a fire or inflation or a change in demand? An especially difficult situation is one in which assets are required which have little or no alternative use.

The more technically complex the food system becomes, the more technically separable activities will be and the greater the requirements for coordination. And the more industrialized the system becomes, the larger and more specialized are the investments required. With large investments which can pay off only over a long period of time come strong incentives to avoid the uncertainties of the spot market.

Contracts

Contracts are used extensively in the food system to help coordinate supply with demand for individual firms. For example, most vegetables for processing, almost all broilers, and sugar beets, some hogs, cattle, mint and many other commodities are produced under contract between processors and growers. Some of these contracts include agreements to supply and use particular inputs, for example, feed and technical assistance for broilers and seeds for vegetables. While these are useful for firm to firm coordination, they appear to be ineffective in matching the industrywide supply with demand. In many cases transparent or open markets in contracts are missing, the contracts being negotiated by private agreement. And the contracts are frequently very incomplete, difficult to enforce, and short in duration.

Other examples of contracting in the food system include the franchise agreements between a franchisor and individual restaurants, agreements between processors and restaurant chains, between transport firms and shippers, and between food manufacturers and retail stores dealing with promotion and shelf space, to cite only a few.

Coordination between individual firms is important to the performance of the food system. When the uncertainty of the spot market is unacceptable, contracting and integration through ownership are alternatives. In general it appears that, where contracts can be designed and enforced to meet the needs of both parties, economic performance is likely to be promoted by contracting systems rather than by integration. Thus policies contributing to the development of contractual arrangements and the enforcement of contingent contracts would be prudent. At the same time, policies prohibiting vertical integration may preclude opportunities to improve economic performance. Vertical integration may, however, become a problem when the integrating firm is very large and has escaped the discipline of the market.

Cooperatives

Cooperatives are an important form of economic organization in the food system. Cooperatives have been perceived either as organizations to enhance competition (the competitive yard stick) or as organizations to achieve market power. It may be that their more important potential function is coordination. Here the question is, Does the cooperative do a better job of coordinating relationships between two separable activities than other independent firms or than that which occurs in an integrated firm? The potential advantage of the cooperative compared with integration by ownership is that the strong incentives of independent ownership and supervision are maintained. Integrated firms encounter problems of bureaucracy. A potential advantage of cooperative organization in contrast to open market transactions lies in the potential to negotiate reliable long-term agreements. These agreements may be explicit contracts between an individ-

ual member and the cooperative, as in the case of contracting a year in advance for the delivery of a specific quantity and formula of fertilizer. Or the agreements may be implied in the membership agreement, as in the case of a processing cooperative's commitment to process its members' raw product. An independent firm could reject the product.

This view of the cooperative form of organization has important policy implications because it emphasizes the role of the cooperative in improving coordination and efficiency rather than it's role as an institution for gaining market power.

Commodity and Industrywide Coordination

Individual transactions within firms and between firms can provide effective coordination of supply with demand at the firm level but fail to provide effective coordination at the commodity or industry level. This problem arises because of the uncertainty and difficulty in planning production to meet future demand. Firms make mistakes based on inaccurate expectations about the future or faulty decision rules. The coordination problem has an important time dimension. An industry may overinvest or underinvest in long-run productive capacity. For example, the farm equipment industry over invested in the capacity to build tractors. Or an industry may overproduce or underproduce for a particular time period. Overinvestment and overproduction is indicated when the value of the products produced is less than the value of the resources used to produce them. Under production occurs when additional resources used in production would have returned more than the value of those resources. While there are many issues related to how resources should be valued, we simply start with the general idea that reducing the extent of over- or underproduction, based upon this definition, is a desirable goal.

Coordination and Public Policy

Policy is concerned with two major problems in market coordination. 1. What should government do, if anything, to reduce the mistakes which lead to serious mismatches of supply and demand? 2. What, if anything, should government do to mitigate the consequences of serious failures in industry coordination?

The potential sources of error in production planning are many. Among the more important are uncertainty about the future demand for the firm's products. This divides into uncertainty about industrywide demand and uncertainty about supplies and prices of competitive products. Another potential source of error is uncertainty about the prices, availability, and input-output relationships of inputs which are not already purchased or under contract. Many factors, of course, contribute to these uncertainties. Uncertainty about inflation and exchange rates, for example, add to the uncertainty of both product demand and input costs.

All industries of the food system have problems coordinating capacity and production with demand. However, the problems of small firms in highly competitive markets and large firms in oligopolistic markets differ. Firms which have escaped the full discipline of the market are better able to control aspects of their economic environment, thus reducing these uncertainties. These firms as a group adjust to declining demand by reducing output more than by reducing prices. Competitive firms have no choice. They adjust to market prices over which they have no control.

Designing policy or institutions to reduce coordination errors or to mitigate their consequences is complicated by the difficulty of identifying causes of the symptoms and the possible undesirable, unintended consequences of possible remedies.

Take a simple example. Suppose you do a careful analysis of the market and costs for a restaurant on one of four corners of a rural intersection. Based upon the information you invest your life savings in the building, equipment, training of staff, and advertising for the optimum-sized restaurant for that location. The restaurant is just large enough to return revenue sufficient to meet all costs plus a normal profit. Suppose I come along and see your successful enterprise and decide to build a restaurant of comparable capacity across the street. The result is that each of us get half the business, which is not enough to meet the variable costs and maintain sufficient quality to attract return customers. The value of the fixed assets of both businesses drops to their salvage value and both firms file for bankruptcy. I made a mistake and I suffered. Since the mistake was avoidable, most people would not be concerned that I suffer the consequences of the mistake. But what about you? You performed well and suffered from my mistake. In fact you suffered more than if I had burned you out, in which case you would have received insurance. You may wonder why it is illegal for me to destroy your life savings by some acts and not by others.

It might be argued that you made a mistake by not taking into account that I might come along and make the mistake. Economic activity would surely be restricted by a decision rule such as "Never invest where a competitor's mistakes can ruin you." Perhaps there should be insurance for such events. Such insurance has obvious difficulties, but it could probably be administered with some subsidy. The county commission might pass a zoning ordinance specifying that a business could not be placed in an area unless it provided data which would prove the business was viable and would not inadvertently cause damage to other businesses. One restaurant in the area is better than none, and two empty buildings are an eye sore and a public nuisance. The insurance idea mitigates the consequences while the zoning is intended to avoid the mistake in the first place. They have different effects on resource use.

Suppose that rather than making a mistake I knew that I would drive you to bankruptcy and did it because I did not like you. Suppose I have other sources of income and have an objective to establish a chain of restaurants and intend to destroy the competition in the interest of long run monopolistic profit. This is illegal. Finally, suppose I believe I have a better concept for the restaurant than you do. I believe I can provide better meals and service at a lower price and am willing to test my belief in the market in competition with you. We may still both go bankrupt. Should the zoning board, assuming its existence, treat this situation differently than the others?

This example involves a simple case of a very small market. In the real world the relevant market ranges from the four corners of an intersection to the entire world. The policy issues are more complex with many more actors, but the practical and ethical issues raised in the example remain relevant. Our restaurant case is not an abstract example, a fact attested to by the frequent failures of restaurants and other small businesses due to decisions leading to overcapacity. Other examples from the food system include excess capacity problems in farming, overinvestment in grain elevators, the continuing cycles in broiler production, shifts in capacity and supplies of fertilizer unrelated to demand, periodic shortages and surpluses of transportation equipment, and excess capacity in fruit and vegetable processing.

A number of institutions have evolved or been proposed as means to either reduce the extent of industry coordination mistakes or to mitigate their consequences. We turn to a brief discussion of some of those with particular relevance to the food system.

Matching supply with demand in farm commodities has been a particularly difficult problem and has received a good deal of policy attention. Some consider it to be the farm problem. The problem in farming is more complex than in many of the other industries because of the importance of the weather and other factors which add uncertainty to the level and quality of production. When General Motors plans to build 2000 cars it can expect with a high degree of certainty to get the 2000 cars to market. Not so for many farm crops. The second difference is the structure of the industry. Large numbers of farmers make production decisions. These decisions have to be made well in advance of marketing, and it is very difficult or expensive to stop the process after it is started. Again, General Motors can observe the total number of cars on the market on a nearly daily basis and can adjust the number of cars built each day if necessary.

A study of the annual variation in the quantity produced of more than 70 farm commodities indicated that on the average the yield (mostly because of weather) accounted for only about 30 percent of the variation while production decisions accounted for most of the difference. Variation in farm commodity production also creates coordination problems for farm supply and product processors. They have to adjust to an uncertain supply and demand based on the weather, farmer production decisions, and government policy.

Government Commodity Programs

Farm commodity programs are discussed extensively in another section of the paper. Note here only that these programs attempt to address the coordination issue in at least six ways: 1. They provide some incentives to reduce production by not utilizing some existing capacity. 2. They buy out some existing capacity. 3. They attempt to expand demand by subsidizing some sales and promotion. 4. They provide some incentives to limit marketings. 5. They attempt to even out supplies with some participation in storage. 6. They attempt to mitigate the consequences of collective industry and commodity production mistakes through price and income-support payments. To a large extent, these programs focus on relieving the consequences of overcapacity rather than avoiding it. Here we discuss other approaches.

Information

Since the coordination problem arises largely from the lack of information, it is often assumed that information can solve the problem. However, it is not possible to generate all of the information required, and the ordinary methods of generating information may produce unreliable results. Nonetheless, public and private programs to generate and distribute information about intentions to produce (the intentions to plant reports), production in process (the crop production forecasts), inventories, prices, and marketings can contribute to planning. Information on investments in capacity—existing levels, committed levels and intentions would also be useful, but it is seldom available. Forecasters also attempt to provide information about the future. These range from fortune tellers to elaborate econometric models. All have their limitations.

Aside from the fundamental uncertainty of the future, information programs are limited because of the uncertain reliability of the information collected. The possessors of bits of information may have incentives to refuse to report, to bias the information, or to change behavior and thus the basis for the information.

Several policy issues arise. Should a firm be required to report this kind of information? Is it a proper role of government to provide this service or should it be private? Information has unique characteristics which may result in its under-production. Should the government regulate private information to avoid misleading reports? Should trade associations or firms in concentrated industries be permitted to generate information which could contribute to collusive behavior? An unbiased information system is very useful in maintaining a cartel. For example, is there a way to allow the small group of firms which determine broiler production to generate information collectively which would be useful for planning production without providing the basis for supply restricting monopolistic profits? One proposal for collective planning of crop production is to have several iterations of intentions to plant with a legal commitment to actually plant what the grower reported as the final iteration. This would ensure much more reliable and useful information than ordinary intentions to plant.

Futures Markets

Futures markets trade in contracts promising delivery and purchase of units of a standardized product. There is no intention that the product will actually be delivered; almost all contracts are settled by a contract transaction before expiration. The number of commodities traded on futures markets has exploded. Included are a number of major storable farm crops, minerals, oil, interest rates, currency, and stock indexes. The futures market is a mechanism to reduce the risks of future price changes. What is necessary is a group of speculators who will bet on future prices by buying and selling contracts. This makes it possible for people who intend to sell a commodity similar to that of the contract to reduce the risk of price uncertainty by selling a contract today and then buying it back when they sell

the commodity. One intending to buy a commodity in the future would do the opposite. The success of the hedge will depend on what happens to the difference between the cash and contract prices. In any case, in order for the market to work, speculators must be attracted. This will happen only if they expect a profit. Their profit and the transactions costs represent the cost of the price insurance.

It may be that the futures market also provides useful information about the prices to be expected in the future. Futures prices summarize beliefs of those who participate in the market. It is generally a forecast of limited accuracy except as the expiration date approaches. The length of the contracts, the specification of the contract commodity, and the scope of coverage limits the use of this method of insuring against price risks. The contribution to improved coordination is valuable but limited. The major benefit is to mitigate the consequences of short-run production decisions made in an uncertain environment.

Options Markets

The options market provides an opportunity to reduce future price risk by buying the option to sell a commodity at a prescribed, designated price as of a particular date. This makes it possible for the buyer of the option to lock in a minimum price without committing to sell and thus foregoing the opportunity to sell at a higher price. The possibility to fix a minimum price has planning value. Again it is essentially buying price insurance and a premium must be paid. Neither options or the futures market are used much by farmers. The futures market is used more by large processors and traders who do not wish to speculate on price.

Crop and Revenue Insurance

Crop insurance protects against yield uncertainty. It has problems of moral hazard, of establishing reliable actuarial information in order to set rates, and of generally high transactions costs. The moral hazard refers to the fact that buyers of the insurance have a better idea of the individual risks than the seller, so that those with the highest risk are most likely to buy the insurance. This will raise the average cost of the insurance and discourage additional lower risk farmers from buying the insurance. The other aspect of moral hazard is that having the insurance may discourage some covered farmers from preventing yield losses, especially as the expected yield falls near the payoff level. Crop insurance is underwritten by the government. Its purchase has sometimes been made a condition for participation in specific commodity support programs, and it has been proposed as an alternative to government disaster drought relief.

Revenue insurance is a proposal to combine yield and price insurance on the basis that producers are interested in protecting their assets and incomes and not just insuring either yields or prices. This is particularly relevant, since for many commodities prices are low when yields are high and vice versa. It is conceivable that the insurance agency could hedge the price risk on the futures markets and develop adequate information and rules to make revenue insurance feasible. Government participation would be necessary to develop this insurance and, most likely, to underwrite it and to cover some administrative costs. Its value could then be tested in the market. Some of the revenue risk insurance function included in the farm commodity programs could be at least partially privatized. Again, as an insurance, it has a cost, and it mitigates the consequences of uncertainty rather than dealing with the underlying cause.

Marketing Orders

The authorizing legislation for federal marketing orders identifies orderly marketing as a primary goal of such orders. Presumably orderly marketing, which the legislators failed to define, is similar to our notion of effective coordination. A marketing order is proposed at the initiative of a group of growers and must be authorized by the Secretary of Agriculture and approved by a vote of those growers who would be covered by the order. The order legislation identifies the possible functions an order can include. The selection, specific design, and administration is left to the representatives of the growers, always within the limits authorized by the law and the approval of the Secretary of Agriculture. This is the mechanism for a small do-it-yourself farm program.

Fruit and vegetable orders have several features particularly relevant to this discussion. Market flow regulations control the amount of a crop which is marketed during particular periods. This is used mostly in citrus. It is intended to even out the quantities getting to particular markets to avoid gluts and shortages and the related price variations. The specific mechanism is to regulate the quantities individual handlers can ship. The order may also declare a shipping holiday if a market is glutted. The orders provide for three methods of managing volume marketed under the order. Producer marketing allotments restrict the total amount which can be sold based on allotments related to past sales. Such a provision is likely to create an entry barrier since new growers must obtain an allotment. Market allocation programs provide for dividing marketings between two or more markets in order to raise the average price. Reserve pools are intended to set aside part of a large crop, with the intention of selling the stored product following a small crop and increasing the average price by more than enough to pay the cost of storage. There are circumstances where the reserve pool will be profitable to the group, yet the storage would not take place by individual firms because of risks related to the behavior of others in the market.

Each of these programs provides some potential to improve the match between quantities marketed and demand for the segment of the industry covered by the order. Those opposed to such provisions argue that they provide the potential for initially gaining monopolistic profits and, since production cannot be controlled, eventually eroding the profits. This occurs because of increased production in response to the higher prices and the subsequent effects on profits of disposing of the excess. This critical story assumes that the managers of the order do not understand the important economic relationships involved and would thus mismanage the order. There have been suggestions that marketing orders be authorized for all farm commodities to replace at least some of the commodity programs and as a means

of dealing with the continuing problem of failing to coordinate supply with demand. While the order provisions could provide commodity groups some capacity to improve the coordination of marketings with demand, these programs have serious limitations as a means of consistently matching production with demand at appropriate prices. Authorized orders do not permit national coverage. However, many of the relevant markets are at least national, if not international, and they do not allow control of production or of investment in capacity.

Marketing orders with the authorization to manage production, to manage investment in new capacity, and to include the relevant market would have authority to challenge the commodity programs as appropriate means to deal with the farm problem of the future. Even so, some additional program would be required to deal with the adjustment to the current excess capacity.

A basic policy question is, Would the grower elected directors of the potentially powerful commodity marketing orders have the wisdom and the will to use the authorization to achieve effective coordination and not use them in pursuit of monopsonistic profits? Or, perhaps more appropriately, can the policy be designed and implemented in such a way that this objective is achieved within reasonable expectations?

Forward Contract Markets

A more radical proposal is to institutionalize systems of forward contract markets, replacing many of the existing modes of coordination for particular subsectors of the food system. The concept is simple; the design and implementation would be complex. The basic concept is to require that all transactions between firms in a particular production distribution sequence be based upon contracts. These contracts would be made with the expectation of delivery and the contract transactions would be made in open, transparent markets.

Start with the transactions between hog producers and processors. The rule would be that hogs for processing could only be bought and sold across the national, computerized market in contracts. Contracts for each lot of hogs would be settled prior to breeding. Various longer term contracts would be permitted according to the interest of the participants. The contract would specify the number of hogs, the weight, and other relevant characteristics, the price and other significant terms of trade. In addition there would be more or less standard contingency clauses, such as discounts for failure to meet the weight specifications, and a basic agreement for negotiation and ultimately arbitration to deal with contingencies not included in the contract. The hog producer could plan to produce only the number of hogs which the market will take at a price agreed to before investing in the inputs which vary from the time of the contract. The packer could plan his operation to handle the hogs on order in the most efficient manner. He would order the hogs with the characteristics he believes maximize his profits. The packer would not fear that his competitor would undercut his product prices based upon the contract commitment because the terms of all contracts would be determined in competitive transparent markets. A problem with a partial contract system is that the uncontracted portion of the input (hogs in this case) can be very volatile. This leads to volatility in the product market as well and creates incentives to avoid complete contract commitments. Many hogs are now traded under contract, but packers are reluctant to contract more than about 40 percent of expected requirements.

The full participation contract market system has the major advantage of generating the information needed to effectively coordinate supply with demand and then assuring that decisions will be made consistent with the information. The producer will not have to guess what the price will be on market day or be concerned that other producers will make mistakes leading to prices below acceptable levels. And the prices and quantities are determined by those in the best position to make the judgements. Producers' offers are based on knowledge of their costs. Processors bid based upon their knowledge of their costs and assessment of the market for their products. They possess added knowledge of the price their competitors paid for last lots of hogs purchased and the quantities purchased. This is a commodity-wide planning system without a central planner. All production and purchase decisions are freely made by the individual firms, save one. They must trade across the market in future contracts.

This approach to the coordination problem is designed to avoid mistakes, to reduce the fundamental uncertainty, not simply to mitigate the consequences of the industry production mistakes. If the hog producer is concerned with the possibility that his costs of production will change after he accepts a contract, he can lock in his cost with contracts for corn and other inputs. Corn can also be traded in a full participation contract market. Similarly the packer can contract sales to retailers and restaurants. A comprehensive full participation contract market system would be one where a major part of the production distribution sequence is included under interlocking contracts.

The communication and data processing technology to efficiently operate such markets has only recently been developed. Existing programs are both expensive, and they fail to solve the basic coordination problems. There is a clear trend toward contractual arrangements and new markets in exotic contracts designed to reduce uncertainty or to insure against it. Some policy questions arise. What kind of coordination institutions for the food system are likely to evolve from this set of circumstances? What role, if any, should government play in developing and implementing contract systems in the continuing transition of the food system?

The Credit System

Overinvestment in production capacity in some areas of the food system is obvious. Underinvestment in other areas is likely but less obvious. Many observers have noted that the credit system contributed to the overcapacity problem by financing many investments which were redundant even before they were made. No one believes that the lending agencies can predict the future. But is there a basis for charging them with more responsibility for the consequences of the aggregate results of their lending decisions? More specifically, is there a policy which would generate more complete information on investments in

capacity and the probable consequences of additional investments in order to guide lenders decisions? This question is especially relevant for the Farm Credit System. Could this system take responsibility for collecting and analyzing information for investment in new capacity and for developing lending decision rules which would better serve its members? The federal government is heavily involved in the financing and regulation of the system. What role should the government take in regulating the flow of credit for the purpose of expanding capacity? Should the government facilitate loans to expand dairy production at the same time it is spending large quantities of taxpayers' money to buy other farmers out of the business or in storing unwanted production? And how wise is lending money at below-market rates to farmers for the purpose of entering farming, as is the case with some state programs, given the excess capacity problem? Coordinating government programs is also a problem. The propensity to make unsound loans and thus contribute to inappropriate capacity may be increased by the policy to bail out failing banks. Would loan decisions improve if lending agencies suffered more of the consequences of their decisions?

Entitlements and Property as Policy Issues

A child dies from starvation and a farmer receives a million dollars to stop producing milk. Dogs are eaten in some poor countries while they are fed better in the U.S. than most children in Mali. The ex-president of a large food processing firm receives a two million dollar bonus to retire after the firm is purchased by a conglomerate while an unemployed single mother of two is denied food stamps because she has an $11,000 equity in a small house. One worker receives $10 an hour for watching a machine package breakfast food, and another receives the equivalent of a dollar a day cutting sugar cane by hand in 100 degrees heat. The Federal Reserve Board takes action which increases interest rates resulting in farm and business bankruptcies, and a zoning decision increases the value of a piece of land by a million dollars. These are observations of the consequences of the current system of entitlements and property rights distribution.

The articulation of preferences, the discipline of the market, the matching of supply and demand refer to economic processes. The way these processes play out with the evolution of the economy depends very much on the rules of entitlement and property. To a large extent, that is what politics and policy are about.

Preferences are relevant in the market only to the extent they are translated into demand by the ability to pay. The content of demand is a function of the level and distribution of income and wealth, which are a function of entitlements and property rights. The costs in the production opportunity set are a function of property rights. A cost represents someones' right to exchange a good or service or to withhold it. Cost to a buyer is income to the seller. Income distribution, the content of demand, and the costs of production evolve from economic transactions among participants based on the rights of each participant. Literally thousands of laws, administrative rules, customs, conventions, standard operating procedures, and beliefs define the legitimate claims to economic benefits.

In our democratic society, beliefs about legitimate claims to economic benefits may be the most important determinants of both economic policy and economic performance. Such beliefs lend support to the rights of participants which determine rewards from economic transactions and are also translated into political support for the explicit payments from government entitlement programs. The indirect benefits, those mediated through the market, are more subtle but very much more important.

Benefits according to contribution are believed proper for both ethical and pragmatic reasons. That is, we believe that a person deserves to be rewarded according to contribution. We also believe that compensation according to contribution will create incentives to increase the production of the goods and services desired by society. This properly raises questions about the measurement of contribution and the effectiveness of the distribution of rewards as incentives for production of the desired goods and services. The previous discussion of competition and coordination was concerned with these issues.

In addition, there are beliefs about legitimate claims according to status: children, the aged, and some classes of disadvantaged, for example. These claims may be considered deserved as contributions to the future of the society, as charity, or perhaps as an expression of political power.

If contribution is to be the basis of entitlements to a share of output, we must first ask as to the sources of the productivity of the economy. It seems clear that the major source of productivity is not how hard individuals work but lies rather in the knowledge embedded in the system, that is the knowledge contained in the technology, the institutions, and the training of people. Knowledge is the critical and limiting factor of production. At the same time knowledge without application contributes nothing to output. Human effort remains an essential complementary input with knowledge. This leaves the fundamental question of the rights to output attributable to the inherited knowledge of the economic system.

The great productivity of the modern U.S. food system and the U.S. economy provide wide scope for discretion in rules of entitlement. The technical and economic revolution contributing to continued potential for economic growth promises to continue. This will lead to more policy choices. Almost every public policy has distributional consequences. Beliefs about legitimate claims to output can be expected to change and to become more important in the politics of the future.

Consider only a few of the entitlement issues likely to become more important in the future:

1. Adequate food as a right of all. We have accepted the belief that food should be available for all children and deserving disadvantaged. The issue is one of the level of support and the criteria for eligibility. Does our belief in this right reach out to those in other countries? To the able bodied adult male? To the noncontributing derelict? Many of those eligible for food stamps fail to obtain them. What are the

rights to adequate food for children of parents who do not attend to their needs? Should children be provided food at school?

2. Animal rights has become an important issue. The issue is, of course, not the rights of animals but the preferences of citizens for the kind of world they live in. The treatment of animals in laboratory experiments and in the production of food is offensive to some people. It has been reported that animal rights generate more letters to Congress than any other food system issue. Some animal production practices considered standard in the U.S. are prohibited in some other countries. Even without legislation, the beliefs about animal rights affects the supply and demand for food. For example, some people do not eat meat because they oppose the idea that another creature should give up life for them. This position is held by a large number of the Hindu faith. It has been argued that the Hindu position originated from the concern for equity in a poor country facing population pressure on the food supply. The belief assures a much larger supply of food to the poor since the wealthy do not bid for the grain to feed livestock.
3. Minimum wage, organization of workers, and working conditions will likely become more important in the future food system. Some of the poorest paid workers in the economy are employed in the food system. Are workers employed in farm field work or by small processors and restaurants entitled to a higher wage as a government defined right? What rights to organize and what protection from risk from harm in the work place is their right? For most people, the answer will depend upon their beliefs about the relationship between returns from the market and contributions.
4. New technology will continue to create new policy issues. The right to compensation for the consequences of adopting a technological process, or the right to stop its adoption, or the right to require assessment of the consequences of developing a particular technology is likely to become a more contentious issue. Since the beginning of the industrial revolution, groups have attempted to stop adoption of technology believed to threaten their livelihood or way of life. The future issue is more likely to center on the distribution of the benefits.
5. The right to compensation for some of the negative consequences of government actions also appears to be an area of greater future importance. Already some workers receive compensation for loss of employment due to a few specific cases of imports. Changes in policy on trade, the budget deficit, and interest rates has major consequences for wages, employment, and business failures. Are the rights of the losers properly specified and protected?
6. Farm price and income programs entitle a small group of farmers and land owners to large payments from the government. These entitlement programs are discussed in detail in another section. Similarly, the rights to natural resources and the policies intended to protect the environment are property rights issues which significantly affect the distribution of income and wealth.

RESOURCE AND CONSERVATION POLICY

This section seeks to establish the broad policy context for public actions that affect the role of resources in the food system and to suggest priority items on the emerging agenda in this area. Those compelling natural policy issues demand the attention of researchers, educators, and policymakers at every level.

Natural Resources and the Food System

Natural resources are inputs, outputs, and a residuals "sink" for the U.S. food and fiber system. The resource links for that system are diverse and complex. Virtually no system function is without natural resource consequences. All levels of government design policies to resolve competitors' conflicts for the valuable attributes of resources in those roles.

The best understood resource links involve converting of soil, water, air and nutrients into food and fiber products within a viable structural medium. Plant growth and its conversion to energy for animal growth are acknowledged natural resource aspects of the food system. Large bodies of clean water yield fish species, with proper management. Oil and gas resources fuel the production and marketing systems. The value of natural resources in those roles is derived from value of the final product. But natural resources also are valued for direct use or as a key part of the setting within which various services are consumed. Certain combinations create habitat for wildlife that may be photographed, viewed, or hunted for food or sport. Wetlands provide essential breeding grounds for fish and birds; they provide critical hydrologic services to maintain supplies of clean ground and surface waters for various uses in the food system. Major regions of the U.S. are resource-defined—the Great Plains, Great Lakes States, Sun Belt, Pacific Northwest, defining production potentials as well as living environment for the people of the food and fiber system.

Land, water, and air also collect the residuals of food and fiber production. Future resource use patterns and policies will be influenced by the effects of that food system on resource quality, effects that may render those resources useless for human contact.

Policy Responses

Rights to resources are granted and denied through public policies at all levels. Use patterns evolve in competition among permitted users.

Local

By both tradition and law governments closest to competitors for resources have been primarily responsible for the rules that influence physical patterns of location. Participants in the food and fiber system—farmers, loggers, processors, transporters, workers, consumers — are directly affected by those rules. Land use planning and regulation, waste disposal, and the creation of

industrial parks or agricultural districts are essentially local programs and policies with occasional guidance and funding from higher levels. Food and fiber production are generally more land intensive than other economic activities. Zoning regulations and various incentive programs often seek to alter the terms of trade in favor of keeping resources in food production. Importantly, the particular set of rules that emerges locally depends on the mix of political views within the community. And that mix is changing rapidly. With fewer full time farmers and more nonfarm rural residents, local land and water use policies will reflect the preferences of nonfarmers. Ironically those policies may call for "protecting" more farmland than farmers are interested in working. Farmers often are not enthusiastic about "preserving" farmland by removing nonfarm competitors for those lands. Water, on the other hand, is often allocated away from agriculture as the nonfarm population increases.

State

Broader patterns of resource use are established at the state level. The water management system of Florida, for example, establishes the state-wide context within which the food and fiber system competes with homeowners and shopping centers for the scarce supply of clean water. The Florida "green belt" program requires local governments to tax farmland for its value in agriculture, not for its potential value for development. Farmers retain the option to sell, however, while one of the costs of waiting is kept under control by state policy. There are state-wide efforts to locate suitable solid waste disposal sites, usually in rural areas that are part of the food and fiber system. Erosion abatement, surface water protection, and forest management programs are administered at the state level.

Some states have designed policies to protect or enhance aspects of the food and fiber industries as economic development strategies. Michigan has targeted food processing and forest products for special policy attention, to increase state income from these industries. The greatest potential is for activities that add value to the basic product, not production itself.

National

Reducing soil erosion has been a national public purpose since the 1930s. Technical assistance and various incentives are offered to encourage farmers to protect the broad public stake in fertile farmland. While states may have their own erosion abatement programs, a prevailing national concern extends beyond the sum of state efforts. Programs have been largely voluntary for the farmer, available but not required. Additions to farm legislation in 1985 added a more mandatory tone—farmers must protect soil or lose eligibility for various "income enhancing" USDA programs. While there is much debate among professionals about whether soil conservation is a valid national purpose when food is in surplus, the American people consistently support conservation programs. The "general public" (whoever that is) believes that public action should be taken to encourage, or even to assure, good land stewardship by farmers.

Other national policies which affect natural resource links to the food system include managing of public lands for timber, recreation, grazing and energy development; managing of offshore mineral reserves; rural development initiatives; coastal and Great Lakes fisheries investments; and water development projects of various kinds. With nearly one-third of the surface area of continental United States in federal hands, public actions to increase timber harvest, expand recreation opportunity, raise grazing fees for open range, reduce coal and other mineral development, or establish fish harvest limitations will have profound effects on the global markets for those products or services. Since federal holdings are concentrated in western states, so too are the impacts of federal action. A decision to lease oil drilling rights in the Gulf of Mexico near the Florida Keys or in the rich fisheries of the North Atlantic would influence the cost of operating the food system and could also affect the mix of products from that system. There is pressure to eliminate the federal subsidy of water for farmers through Bureau of Reclamation development projects, particularly when that water increases output of "program crops" that are also targeted for expensive supply control programs.

Environmental programs to protect the quality of the nation's ground and surface waters are largely federal though they rely on state implementation. Pesticide regulations, safety testing of biotechnology innovations, and various protections for farm workers limit the options available to food system managers. Federal policies clarify the broad public interest in the resource quality aspects of the U.S. food system.

International

Certain natural resource problems can only be handled on an international level. These problems persist because it is difficult to transcend national boundaries when those who gain and those who lose from the problem or its solution are in different countries. Even if we *know* the magnitude and consequence of acid rain, getting the United States and Canada to agree on mitigating action has been nearly impossible, at least until recently. The United States is the source; Canada has been feeling much of the pain. Now that lakes are dying in the Adirondacks and northern Maine, action seems more likely. Scandinavian leaders have demanded that German and British policymakers act to reduce the concentration of acidic compounds from industrial centers. Crops and forests are damaged by acid rain, imposing real impact on the food system.

Policies designed to reduce emissions must alter the incentives facing industry managers. One of the ironies here is that earlier "tall stack" policies designed to improve air quality near the plant have exacerbated the problem miles away, often in another country. Regulatory approaches entail a high enforcement cost. Marketable pollution permits have been proposed, but if the decision to pollute is not influenced by costs imposed on people many miles away, that approach seems hopeless. There are obvious distributional or equity considerations with any policy option. Food system participants, generally removed from large industrial centers, are in the "damaged" column, without control over the cause. Actions to shift away from high sulfur coal to cleaner fuels could increase the cost of electrical energy and perhaps raise the price of petroleum based agricultural chemicals. The transportation system supporting coal trans-

port is important to agriculture as well. When U.S. produced acid rain reduces crop yields in Canada, U.S. farmers may gain in some insidious way. International natural resource connections do exist for the U.S. food system. American farmers, processors, and marketers do have a stake in international policies affecting this problem.

Control of the boundary waters can influence location and character of the U.S. food system. Great Lakes fisheries are important food and income sources. Uncontrolled Canadian oil exploration on the floor of Lake Ontario could affect availability of clean water for apple processing in northern New York state. European fishing fleets may reduce the catch for New England fishermen in the Georgian Banks. International law and policy are involved.

Global warming is perhaps the least understood yet most frightening natural resource/food system problem of coming decades. International policies are clearly needed.

All governmental levels are involved in policies linking resources and food. Allocating authority among those levels is a function of tradition, political acceptability, and the physical or biological boundaries of the problem. There can be no doubt, however, that the U.S. food system is affected by these policies. Thus natural resource problems and solutions are an integral part of U.S. food policy.

The Emerging Agenda

The policy agenda for the food and fiber system in the U.S. is changing dramatically—that is the point of departure for this publication set. Farm legislation, once the acknowledged province of agriculturists and the "farm states," is increasingly pushed and prodded by those whose interests had been considered peripheral. Natural resource issues are now in the mainstream, part of food policy rather than separate from it. Identified here are those issues that will be demanding the attention of food system specialists in the future. The list is not complete, but it contains the most important ones. These are predictions, not prescriptions.

Agricultural Responsibility

The farm and food system is a major part of the U.S. economy. Farmers have always been the "good guys," "the salt of the earth," guardians of all that is right in the American way. No one questions the importance of food to the individual or to society — unlike the importance of some of the "heavier" industries. Farmers and other participants in the food system have long enjoyed a reservoir of good will with American voters and taxpayers. But that reservoir is being depleted or at least more broadly shared. We are rapidly moving to an era of agricultural responsibility, where farmers and others will be asked to account for those actions that cause problems for others. Much of the reason is the obvious change in demographics. There are fewer farmers and more of everybody else. Rural populations are primarily nonfarmers, thus small rural governments that create zoning ordinances or nuisance laws are largely run by nonfarmers. Farms are increasingly surrounded by nonfarm residences, by hospitals, schools and shopping centers. The proximity of modern farming ensures greater scrutiny. Much of that proximity may be attributed to farmer decisions to sell selected acres for top dollar development.

Another reason for the coming age of responsibility has to do with the size and technological complexity of farms today. There seems to be less intrinsic virtue in high-tech agriculture than there is in the good old family farm. The fact that many of these advanced farms are family owned and operated has little to do with perceptions of impersonal food factories and large corporations.

The consequence of the shifting politics of food will be more insistent demands for socially responsible action by farm operators. No longer can farmers sell the position that other users of natural resources or other occupiers of the rural countryside must yield to the primacy of food production. That's not to say that farming and other parts of the food system are out of favor or unwanted—only that they must accept that the use of resources carries a responsibility to acknowledge the rights of others.

Recent changes to soil conservation policy signal the new era. Since the 1930s, farmers have considered soil conserving measures on a take it or leave it basis. Conservation compliance measures in the 1985 Farm and Food Security Act up the ante by requiring that farmers protect soil quality as a condition of their eligibility for credit and other income support programs of USDA. With the Soil Conservation Service placing higher priority on the off-site water quality consequences of erosion, farmers can expect restrictions there as well.

Groundwater use and contamination represent the next most significant area of responsibility for future farmers and other parts of the food system. The sandy flats of southwest Florida are experiencing unprecedented urban growth while major citrus producers are expanding their groves. Both require large amounts of water. The state's water management districts have authority to deny pumping permits. Eventually, agriculture must get in line. Farmer despoliation of groundwater is already an issue in Iowa, Michigan, New York and elsewhere. Pesticide and fertilizer limits result.

Protecting wetlands and endangered species habitat has long been considered by some in agriculture to be the ultimate in rampant, undisciplined good intentions. Yet farmers must join others in avoiding those actions that destroy or compromise natural systems that are valued by the American people. Support for those fragile systems is not defined solely by proximity; it is nationwide.

While in the 1960s and early 1970s preferential tax assessment was the prevailing technique for retaining farmland in urbanizing areas, more direct approaches may be tried in the future. The "social bribery" approach to farmland preservation places all discretion with the landowner with little compliance required. Future policy will place greater emphasis on controlling growth and on social responsibility of the landowner.

Other examples could be cited but need not be. All parts of the food system will be called upon to bear an appropriate part of the responsibility for sharing the resource base of this country. Increasingly agricultural leaders and others in business, govern-

ment and academia recognize this responsibility and are responding. Others especially outside of agriculture are trying to resist change in a losing cause.

Global Warming

A greenhouse is an agricultural implement, yet the term has taken on new meaning in recent years. Increasing concentrations of waste gases from fossil fuel consumption—carbon dioxide, methane, nitrous oxide/chloroflourocarbons and ozone — are apparently increasing a greenhouse-like effect on surface temperatures. Some of that warming is essential to life; too much could dramatically alter the location and composition of the U.S. food system. There is scientific doubt of the magnitude or even the existence of consistent increased warming, though casual evidence has caught the attention of environmental and resource policy groups. The American Forestry Association has launched a major campaign to encourage tree planting as a converter of CO_2 to oxygen. With higher concentrations of CO_2, come higher rates of photosynthesis, lower rates of water transpiration, and more efficient plant growth.

Consequences of a significant and sustained global warming trend would include rising sea levels as polar ice is melted. Impact on port cities, lowland states and countries, and many island nations would be devastating. Warming may affect wind direction and force, further affecting coastal areas. It is likely that extreme weather events— storms, drought, heat waves — would become more frequent and intense. There would certainly be shifts in production patterns as previously colder areas acquired new production options. Regional comparative advantage would be materially realigned. Forest species are particularly sensitive to climate. People would be redistributed as well, though the pattern is difficult to predict. Northern regions considered inhospitable might gain in popularity while the Sun Belt would lose some of its special appeal. With greater plant growth efficiency, there could be significant productivity increases, though productivity declines could occur in some areas where climatic change is adverse.

The key to avoiding greater greenhouse warming is global reduction in use of fossil fuels. Several policy participants have called for a worldwide "Law of the Atmosphere" equivalent to the current "Law of the Sea." Policies designed to encourage a shift to other fuels would meet opposition from those whose livelihood is linked to fossil fuels. They would also be opposed by those with high discount rate on the possibility of future problems as compared to near term advantages of continued economic growth. With little scientific consensus on the matter, major changes in production technologies to avoid warming would be difficult to accomplish. The issue is solidly on the emerging agenda for natural resource/food system links.

Sustainable Production Systems

Phases and concepts come and go in the farm policy process. They acquire and lose meaning as different groups adopt a concept for whatever value it may have. "Low input, sustainable agriculture" is such a concept for the late 1980s and 1990s. To some the notion represents a departure from high-tech farming that has for so long been exploring the boundaries of size and scale economics. It is a return to simpler times when farmers returned organic matter to the land, paid more attention to the quality of each acre, and relied less on chemical fertilizers and pesticides. It is also a reaction to environmental damage and human risk from heavy use of chemicals on farmland. To others it is organic farming pure and simple, with all of the inherent goodness that the term implies. Others use the idea to suggest a path toward improved incomes for operators of small farms and a way out of rural poverty. Farmers are encouraged to spend less on purchased inputs, reduce scale, and live within their means. Still others use the phrase to characterize a national policy shift away from overproduction and expensive income-support programs of the late '70s and early '80s, a shift toward emphasis on the virtue of individual effort and stewardship. It is all of these and more. It is an important idea that will shape rural policy in the years ahead. Even without precise definition, and acknowledging significant disagreement over the real meaning of "sustainability," a loose coalition of policy interests will continue.

The significance of this evolving interest in low input, sustainable agriculture (LISA) for the U.S. farm and food system has several interrelated components. First, the LISA concept has assured political access to farm policy debates for a diverse set of interest groups that care about organic farming, rural poverty, and land and water quality. U.S. Senators and Congresspeople are listening, their staffs are drafting bills, hearings are being held. The "bigger is better" folks are having a harder time on Capitol Hill. At least they now have company. Changes in research priorities through the federal agricultural research establishment are already apparent. Effort and attention are being targeted on this set of issues in order to seek defensible scientific basis for the idea. Even economists are involved, analyzing the firm level consequences of these shifts in technology. Other social scientists are interested in the community and family implications of change. Second, the concept reinforces the "age of responsibility" in agriculture discussed above. Impacts of high tech farming and processing on the environment and on the quality of food produced are open for discussion. Third, the dilemma of constant, demoralizing rural poverty is back on the agenda, only partly attributable to LISA, but reinforced by the political mix involved. Rural people left behind by continuing consolidation of farm production have a stake in small scale, limited purchased input production systems. They also have a stake in research and extension programs that focus on economic options for areas that have phased out of large scale production. Finally, attention to low input systems could alter the distribution of farming across the country. No one believes that the basic trends of farm consolidation will stop, but there may be modest retrograde adjustments in areas thought lost to farming. Overall impact on production will be slight, but part-time farming on small low capital units will likely increase in some areas.

States Rights in Public Land

A fairly specialized item on the food system agenda deserves brief mention. The federal government manages one-third of the land west of the Mississippi River. Several states are 90 percent federally owned. Most of this territory is unproductive, remote

land that nobody wants. But some is forest or rangeland that represents important income potential for ranchers and other rural people in the region. Production goals sanctioned in Washington may make little sense for westerners. Some of them argue for greater timber harvest, less wilderness reservation, better management of range and access at lower fees. There is a prevailing sense in much of western U.S. that easterners simply don't understand the needs of the west and should turn over management of those resources to people who live there. Of course, substantial federal investments in water supply, recreation and timber have created business opportunity and communities where none existed before. But westerners will continue to demand a stronger say in future decisions. Those claims have received sympathetic hearing in Washington in the 1980s. These demands will intensify in coming years.

Impacts for the U.S. food and fiber system are not immediately obvious. There may be greater harvesting of old growth timber, some perhaps from previously unforested areas. There may be more mining on federal lands, producing local income. Better range could support more cattle at lower private costs, increasing output from that sector.

Role for the Land Grants — Reworking the Social Contract

Land grant universities are under pressure, no question about it. From within, there is tension between those who want to study familiar problems and those seeking greater academic respectability through more "scholarly" work. For some reason, relevance, and scholarship are seen as mutually exclusive. Outside pressure on the system questions the continuing utility of the agricultural academic establishment, created with the Morrill and Hatch Acts in the late 1800s and Smith-Lever Act of 1914. Formula research funding has already been compromised with greater attention to competitive grants. The real question is whether the scientists and educators who work within the land grant system can adjust to the changing needs of non-metro America of the 1990s. The mission of the land grants is sound —to bring knowledge to the service of society. It's just that society's needs are changing rapidly, as are the needs of the U.S. food and fiber system. The problem solving mission of the land grants makes as much sense now as it did 100 years ago, but the problems themselves have obviously changed and will continue to do so. If the academic establishment can't respond, can't exploit or encourage changes in scientific priorities, can't reconcile timely problem-solving with academic excellence, then it will not survive and it should not. Our bet is that it will.

The U.S. food and fiber system of coming decades will need science as much as it has in the past. Land grant universities represent a significant stock of human capital. Response to issues discussed above, in a global food and fiber economy, requires continued investment in the physical, biological and social sciences that define land grant universities. Failure to invest would be an unfortunate waste of that human resource already in place. The natural resource/food system links discussed here constitute much of the evolving challenge for the land grant system.

TECHNOLOGY POLICY

Technology has made the U.S. farm and food system one of the most productive in the world. During the mechanical era of 1920-1950 farmers made the transition from horsepower to mechanical power. Mechanization increased the productive capacity of agriculture and greatly reduced the need for labor resources. The chemical era of 1950-1980 further increased agricultural productivity by increasing the farmer's ability to control pests and disease and by increasing the use of chemical fertilizer. Now in the 1980s the farm and food system is being propelled by a new technological thrust—that of biotechnology and information technology. In this new era, scientists are beginning to genetically engineer new crop varieties and even new farm products. Simultaneously information technologies have the potential to let farmers use computerized decision models, telecommunications, and monitoring and control technologies to make more effective decisions about production, marketing and financial management. The effect of this new technological era on agricultural productivity may be more profound than either the mechanical or chemical eras. These technological changes have the potential to significantly affect both the structure of agriculture and that of public and private institutions related to it.

Productivity gains and the movement to scientific industrialization of food production and distribution greatly improve real per capita income for the society as a whole. Productivity gains, however, involve changes and adjustments that affect people; existing skills and capital become obsolete and lose value. The gains and costs from change that occur often are not equitably distributed. The policy problem in an industrial democracy is to promote productivity increases while at the same time mitigating adverse consequences from changes that alter the level and distribution of incomes, wages, and relative prices.

Technology and Economic Growth

There are two kinds of economic growth: Quantitative growth is experienced in most areas of the world based on more employment, more equipment and more resources and more output; qualitative growth is based on more output per unit of input and more income per capita. It is this latter kind of growth and productivity which is of prime interest for the future of the U.S. farm and food system. Almost all of the future increases in agricultural production must come through qualitative growth - from higher yields and increased production per unit of input.

New, more efficient technologies for primary farm production and food manufacturing and distribution stem from both fundamental and applied research. The knowledge evolving from public institutions is readily available to all potential users. Private businesses utilize both public knowledge and the results of their own research in developing products and processes. This

interface of the public and the private sector help to secure an efficient, competitive farm and food system.

Publicly funded agricultural research is heavily concentrated on program areas which protect, conserve, and manage resources and which produce and protect crops and animals. These two major program areas receive about three-fourths of all the public expenditures on farm and food system research done by the USDA and state experiment stations. Such research is heavily concentrated in the biological sciences and related applied technology areas. In contrast, private sector R & D is concentrated in the physical sciences and engineering. These private research efforts tend to be about equally divided between farm inputs and food processing and marketing.

One set of issues involves the mix of private and public research. Accumulative public decisions seem to place greater reliance on private research and private finance, even when the research is done in public universities and mixed with public policy. This raises the question of how these trends will effect the supply of basic research, the training of future scientists, the choice of subject matter, and the methods of communicating knowledge. Private farm input and food processing firms are primarily profit oriented. They engage in R & D with proprietary goals aimed at achieving short run benefits through reduced processing and/or marketing costs or developing new products or processes that can be patented or otherwise kept private. Their educational and promotional activities are primarily designed to produce and sell sophisticated products or product packages.

Viewed from a societal perspective, there obviously is a clear and continuing need for public research that recognizes and deals with the longer run consequences of technology. These questions range from the broader questions of the greenhouse effect, the impact of technology on the ozone layer, the impact on water quality, both surface and groundwater, and other areas of general concern. There also is a need for longer term, nonprofit oriented research to assess internal adjustment questions within agriculture. Agricultural policymakers, for example, have tried to achieve a delicate balance between the need for continued improvement in agricultural productivity and the problems of adjusting to overproduction. This task will not be made any easier if genetic engineering significantly affects technology. Changes in plant tolerances for environmental conditions and disease control could greatly alter productivity and regional production patterns. These and other factors can greatly affect the incomes and the asset values of farmers and agribusiness people. In short, important new policy decisions must be made. These decisions will affect the pace and the content of agricultural productivity and the distribution of its costs and benefits.

Policy Issues

The merits of technical change and productivity growth are apparent. Other things being equal, productivity growth is desirable. But creating technology to achieve this growth is a problem, and so is the managing of new technology so as to maximize its benefits while minimizing its disadvantages. Thus one can identify two broad categories of technology policy issues as those relating to (a) the inducing of new technologies and (b) the curbing or modifying of adverse effects from technologies which are developed.

Technology Inducement

Most new technology now requires research inputs from both the basic and the applied sciences. And the public research institutions and the private industrial laboratories both need to contribute to the production of new technology for the future farm and food system. But how should these R & D priorities be set and how should the ensuing investments be financed? Who should pay the bill? Even now, though most farming sector productivity gains are the result of past effective R & D efforts, the real investment in federal research for food and agriculture is declining. How can this decline be reversed? What economic incentives for generating additional private sector R & D will be appropriate? How will public (and private) interests be protected in the granting of such incentives? What kind of public sector-private sector institutional arrangements should be fostered to develop new technology? How does one ensure, for example, that the basic scientific work which permits the development of new applied technologies gets done? These several latter questions imply an important broader question. How do we draw together the resources and capabilities of the private sector, the research universities, and the government to deliver the technologies necessary to provide adequate future productivity growth?

These several issues of inducing new technology focus mainly on three key mechanisms of public policy:

1. establishing constructive mechanisms for joint public-private sector planning of R & D priorities and conduct of R & D work,
2. providing funding and other support services for public sector research, including private sector funding for research universities, and
3. granting proprietary rights and tax benefits to private sector firms (the latter including technology users).

In some areas, current public-private sector relationships for R & D are somewhat in disarray and are mainly of an adversary nature. This suggests a need for constructive joint planning of R & D needs, priorities and opportunities, and the appropriate roles in producing of new technologies. The broad range of emerging public interests described earlier should be represented in the process, particularly at the stage of identifying technology needs and priorities. Communication and planning are necessary at both the national level, where much of the public research funding originates, and at the state and regional levels where much of the R & D actually occurs. Such a developmental strategy should capitalize on the interests, capabilities, and comparative advantages of both private sector firms and public sector institutions. For example, the comparative advantage of the USDA/State Agricultural Experiment Station System lies in its extensive and widely dispersed research base (both professional staff and facilities), its extensive feedback system (particularly with producers), and its training capabilities (particularly at the graduate level). The comparative advantage of the private sector centers on its unique profit incentives and its vast capa-

bilities to develop applied technologies and to market the resulting products.

Both new and tested mechanisms need to be utilized in funding public sector research for the future farm and food system. Traditional federal research agencies need expanded funding support. And both the traditional federal formula funding for the Agricultural Experiment Stations and a strong competitive grants program should be integral parts of the future system. In addition, key regulatory agencies need funding support for evaluative (technology testing) research. Within the State Agricultural Experiment Station and research university system, new mechanisms are needed to expand private sector funding support. For producers of commodities benefiting from expanded export markets, research funding from commodity checkoff monies probably should be expanded. In addition, a broad range of joint public-private research ventures needs to be explored. In these joint ventures, the allocation of patent rights and royalties becomes an important consideration.

The process of granting proprietary and quasi-monopoly rights to businesses for new technology by patents, copyrights, and other licensing mechanisms will undoubtedly be an area of active future public policy. So will issues relative to investment tax credits and other tax exemptions or write-offs. In both areas, public policy must be based on an evaluation of trade-offs. But two principles should be of overriding public concern. First, the granting of proprietary rights should not be permitted to excessively slow the broad availability of productive new technology or to allow franchise holders to excessively exploit new income streams. In short, excessive monopoly powers should not be granted to technology developers. Second, tax benefits to technology users should generally be granted only for those technologies which have been determined not to have broad-based adverse effects. Though the latter principle is difficult to implement, some significant improvement over past (highly nonselective) policies is possible.

Curbing Adverse Effects

Three general types of policies can be used to curb the adverse effects of new technologies once they are developed. Some specific technologies must be regulated or constrained to protect human or environmental health. In other cases, appropriate adjustment (compensation) for those groups adversely affected represents the most feasible policy. A third component of policy to curb adverse effects of technology to assure timely and accurate information to all who might be directly affected by a new technology.

Regulatory Constraints

Among the mechanisms available here are statutory prohibitions against technology use (such as banning of certain pesticides and food additives), extensive testing requirements (again, most common for pesticides and food additives), regulation by licensing, pollution abatement requirements, fair trade practices, and others. Such regulatory constraints can, however, discourage developing and/or implementing beneficial new technologies by greatly increasing development costs or by curtailing profitable market uses. Arriving at appropriate trade-offs between adequate human and environmental protection on the one hand, and foregone potential productivity benefits on the other, will generate numerous issues for future policy attention. Historically, federal government regulation of industrial structure (principally excessive monopoly exploitation through industry concentration) has been rather ineffective, whether the need for it has stemmed from technology or from other causes. New technology will raise new issues of concentration and control, particularly when private sector firms hold proprietary rights to the manufacture and sale of this technology. So will the application of this technology by farm and food firms if it generates additional size economies. It is not too early to begin the debate about how such issues of concentration and control will be dealt with in the future arena of public policy.

Adjustment (Compensation) Mechanisms

Much opposition to new technology clearly results directly from a lack of appropriate adjustment policies. The mechanization-labor displacement issue falls directly into this category. Here it is generally agreed that the first line of policy defense against the impact of labor displacement is to ensure an economy in which productivity is growing and employment is expanding. This certainly was the economic salvation for many of the several million farm operators and workers who left agriculture between 1940 and 1980. It worked much less well, however, for the minimum-skill hired workers displaced from agricultural employment by mechanization. The second line of defense is providing adequate severance pay, unemployment compensation, and employee retraining programs. Historically, the latter group of adjustment programs have been very inadequate within the farm and food system. Although such programs must generally be publicly funded, where the technological causes of labor displacement can be adequately ascertained, a portion of the adjustment cost can reasonably be charged to the franchise holders of the new technology.

In addition to workers, numerous firms in the farm and food system and some communities, school systems, and other institutions have been adversely impacted by some new technologies. Unfortunately, the welfare effects of technical change do not readily lend themselves to economic analysis. Targeted compensation programs can deal with only the most obvious and flagrant cases of adverse technological impacts. Most others must be dealt with primarily by more general forms of social welfare, education, training, and aid to businesses.

One of several useful compensation mechanisms is that of "pollution fees," which requires the users of polluting technologies to pay for the public costs of waste treatment or pollution cleanup. Still another useful policy mechanism is that of charging "user fees" to help pay for the installation of new technology. Transportation facilities are a case in point. Because of the "public goods" nature of many infrastructure components, new technology can only be provided by public sector action. Yet some part of the cost for this infrastructure should be allocated to its private sector beneficiaries.

Technology Information

Finally in the technology policy arena is the question of the provision of timely and accurate information on new technology for all participants in the farm and food system. As technologies become more sophisticated, particularly for the emerging biotechnologies, and with the expectation of increased patenting and other actions to protect the proprietary rights of private technology developers, there could be an increasing need for the smaller firms in the farm and food system to have effective information access in order to remain competitive. Although many of the emerging biotechnologies appear largely scale neutral in their application, the costs of acquiring technical and managerial information could exclude many smaller firms from realizing the full benefits of some of these innovations. What role should the public sector (including the land grant universities) play in providing such information access? And what, if any, new and/or existing organizational and institutional arrangements for technology transfer might be appropriate?

A Current Perspective

Clearly the U.S. farm and food system is now a high technology enterprise. The cost of research to maintain this existing technology will increase in the future, and even more new technology will be required to provide for needed future growth in productivity. Effective public policies are needed to induce the development of this new technology. Publicly funded research and proprietary rights for business firms are key inducement mechanisms. Technology targeted tax benefits are another. But not all new technology should be permitted to survive. Human and environmental health need to be protected. This requires legally prohibiting the use of some technologies and regulating others. In those cases where adverse technological impact can be assessed, adjustment or compensation policies can be effective mechanisms for transferring benefits from gainers to losers. Where welfare effects cannot be adequately assessed, more general adjustment policies and programs are needed to correct for adverse effects. Finally, there is increasing evidence that the future technology requirement for a "world class" farm and food system will be high. And our heavy reliance on export markets requires a cost-effective and competitive system. The constructive cooperation of government, the research universities, and private business will be required to deliver this cost-effective technology. Yet the voice of the general public (producers, consumers, and environmentalists) must also be sought out and heard as we determine future productivity and technology policies.

EPILOGUE

The basic dimensions of the farm and food system and the subject of concern in this project are stated in the first paragraph of the first of the fifty-seven papers developed in the publication series. The author states:

> *The farm and food system is one of the largest sectors in the U.S. economy. Centering on farming, it reaches backward through a chain of farm supply stores, tractor dealers, and fertilizer distributors to farm input manufacturing plants and phosphate mines. Extending forward through the chain are all the activities that move food and fiber from the farm to the dinner table or the clothes closet. On the food side, processing, transportation, and distribution are major parts of the system and all of these activities require inputs from other sectors of the economy, ranging from tin cans to paper bags to salt. On the other side are all the activities which link the cotton boll or the sheep's fleece to the fabric, clothing, or other material we buy.*

This statement outlines a system composed of a wide range of specialized functions that require integration among farming, input, marketing and distribution industries as well as between the total national and world economy. Within this broad framework, a wide variety of technical, economic and social phenomena affects the evolution of the system and determines policy issues.

The system has been subject to many changes in recent decades. An overall consequence of these changes is that greatly increased functional specialization and interdependence has occurred, not only within the food system but between the food system and the national and world economy. Increased commercialization of agriculture has resulted in greater use of nonfarm produced inputs and in changing supply and demand balances in domestic and world markets. This trend can be expected to persist and probably intensify in the future, and it will need to be considered in future policy formulation.

This increased specialization and interdependence has also led to increasing conflict. Domestically, conflicts arise because links within the food and agricultural system are such that change which benefits one group often will lead to costs or losses to other groups. At the international level, interdependence in agricultural markets has resulted in extensive conflict among trading nations. This reflects efforts to protect domestic markets and achieve domestic goals at the expense of trading partners. These conflicts, both at the domestic and international level, are central to the problem of formulating effective policy for the farm and food system.

Policy must be developed with the full recognition of increasing interdependency between the farm and the food system and the domestic macro economic environment, increased links to world markets, increased concern with environmental and resource impacts, and a greater interaction with policies that affect these other areas. This has increased the complexity of the issues that pertain to food and agriculture and their interrelationship with one another as well as with other aspects of domestic and

international policy. It places heavy demands on the U.S. and world policymaking process.

Farm and food policy reflects pluralistic views. These divergent interests are adjudicated through the political process to create compromises. These compromises involve tradeoffs of private gains and losses and gains and losses imposed on the public at large, or stated differently, the public interest.

The period from the mid-1960s to the mid-1980s can be looked back upon as one of the most eventful and dynamic periods in the history of the development of the U.S. and world economies and of change in the farm and food system. It is too early yet to fully appraise the events of this period and the forces that shaped them with the detached view of historical evaluation. It is clear that many new problems and dimensions have been injected into farm and food policy when viewed either from an economic or a political perspective. The policies that have developed during this period will be subject in the future to change and displacement, but if there is one continuing lesson from experience, it is that agriculture and food policy evolves slowly. Abrupt changes rarely occur. A continuing thread that runs through the evolution of farm and food policy, notwithstanding numerous inconsistencies and contradictions, is that the programs of the past and present become the foundation for the programs of the future.

It has not been our objective, either in this paper or in the previous fifty-seven papers in the project, to prescribe what policies are most desirable and should be pursued in the future. We hope, however, that a contribution has been made by elaborating conditions and options that might be useful information to those whose responsibility it is to help formulate public policy both for the food system and other areas. In a democratic society, this includes all individuals capable of absorbing and evaluating information and of making their views known to those with direct responsibility for charting the course of public and private actions.

The Farm and Food System in Transition: List of Papers

1. *The Farm and Food System: Major Characteristics and Trends*, Alden C. Manchester
2. *What Forces Shape the Farm and Food System?*, B.F. Stanton
3. *Farm and Food Policy—An Overview*, Ronald D. Knutson
4. *Technology and Productivity Policies For the Future*, W. Burt Sundquist
5. *Food for People and Profit: Ethics and Capitalism*, Luther Tweeten
6. *Food for People and Profit: Ethics and Capitalism—An Alternative Interpretation*, Harold F. Breimyer
7. *Monetary and Fiscal Policy Connections to Agriculture*, Dean W. Hughes and Marvin Duncan
8. *Changing Attitudes Toward Animal Welfare and Animal Rights: The Meaning for the U.S. Food System*, Harold D. Guither and Stanley E. Curtis
9. *International Food Policy and the Future of the Farm and Food System*, Vernon L. Sorenson
10. *Financing Agriculture in the Future*, John R. Brake
11. *The Future of Farm Price and Income—Support Programs*, A.L. Frederick and R.G.F. Spitze
12. *Farm Product Assembly Markets in the Future Farm and Food System*, Dennis Henderson
13. *Domestic Food and Nutrition Programs: Sorting out the Policy Issues*, James D. Shaffer and Judith I. Stallman
14. *The Role of Milk Marketing Orders*, Robert D. Boynton and Andrew M. Novakovic
15. *Genetic Engineering in the Future of the Farm and Food System in the U.S.*, L.J. Butler and A. Allan Schmid
16. *The USDA—Land Grant University System in Transition*, Wayne D. Rasmussen and R.J. Hildreth
17. *The Farm Structure of the Future: Trends and Issues*, Norbert A. Dorow
18. *Commodity Futures Markets and Food System Performance*, Raymond M. Leuthold and Gerald R. Campbell
19. *Fruit and Vegetable Marketing Orders*, Walter J. Armbruster and Edward V. Jesse
20. *The Global Food System and the Future U.S. Farm and Food System*, T. Kelley White
21. *Trade and the U.S. Food and Fiber System*, Jimmye S. Hillman
22. *Natural Resources and the Food System: An Overview*, Lawrence W. Libby
23. *Soil Conservation Policy for the Future*, Sandra S. Batie
24. *Research and the Development for the Future Farm and Food System*, B.R. Eddleman
25. *Taxes and Future Food and Fiber System Structure and Performance*, Michael Boehlje
26. *The Changing Politics of the Farm and Food System*, B.L. Flinchbaugh and Mark A. Edelman
27. *The Future of Farmer Cooperatives*, Randall E. Torgerson and Gene Ingalsbe
28. *Retail Cooperatives in the Food System*, Ronald W. Cotterill
29. *Multinational Firms in the World Food Marketing System*, John M. Connor
30. *Standardized Shipping Packages: Their Role in Improving Food System Performance*, Charles W. Abdalla and John C. Bouma
31. *Merchandising: Its Role in Food System Coordination and Performance*, Larry G. Hamm and Charles R. Handy
32. *Future Uses of Fossil Energy in the Food System*, Otto C. Doering III
33. *Regenerative Agriculture: Beyond Organic and Sustainable Food Production*, J. Patrick Madden

34. *Foreign Ownership of U.S. Farmland: What Does It Mean?*, J. Peter Debraal

35. *Wildlife and Agriculture: A Case of Interdependence*, George M. Johnston

36. *Food Safety Issues for the Eighties: Their Implications for Agriculture*, Clark R. Burbee and Carol S. Kramer

37. *The Environmental Connection*, James S. Shortle and Donald J. Epp

38. *Exchange Rates and Agricultural Trade*, Maury E. Bredahl and William H. Meyers

39. *Exchange Rates and the International Monetary System*, Walter Enders

40. *Forward Contract Markets: Can They Improve Coordination of Food Supply and Demand?*, Daniel E. Kauffman and James D. Shaffer

41. *Technical Proficiency in Food Processing*, W. Smith Greig

42. *Food Retailing and Wholesaling: Trends in Competition*, Bruce W. Marion

    Food Retailing and Wholesaling: Trends in Competition—Another View, William T. Boehm

43. *Food Manufacturing in the Farm and Food System*, John M. Connor and Bruce W. Marion

44. *Large Conglomerate Corporations in the Food System*, Willard F. Mueller

45. *Concentration Policy for the Farm and Food System*, Paul L. Farris

46. *Changing Relationships Between Farm and Community*, Ronald C. Powers and Daryl J. Hobbs

47. *The Implications of Climate Change for 21st Century Agriculture*, Wayne L. Decker

48. *Food, Fisheries, and Aquaculture: Systems in Transition*, John P. Nichols

49. *The Potential Role of Insurance in U.S. Agricultural Policy*, David Trechter

50. *The Changing Role of Government in the Farm and Food System*, Jerry R. Skees

51. *Technological Change and the Future of the Farm and Food System*, Michael J. Phillips

52. *Getting Work Done: Labor Issues in the Food and Fiber System*, Howard R. Rosenberg

53. *Water Policy and Our Nation's Farmers*, Roy R. Carriker and L. Tim Wallace

54. *Transportation Policy and the Farm and Food System*, Marc A. Johnson and Kenneth L. Casavant

55. *Separating Land Ownership and Farm Operation*, Robert F. Boxley

56. *Credit Assistance Options for Agriculture*, David Trechter, Ronald Meekhof and David Freshwater

57. *Land Policy and the U.S. Food System*, Lawrence W. Libby and James D. Caudill

58. *Reflections and Future Perspectives*, James D. Schaffer, Lawrence W. Libby, and Vernon L. Sorenson

---

 Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, J. Ray Gillespie, interim director, Cooperative Extension Service, Michigan State University, E. Lansing, MI 48824. Price for this document is: $2.50. 2P-1.5M-12:89-TCM-SP

Published by the Cooperative Extension Service, Michigan State University, East Lansing, Michigan