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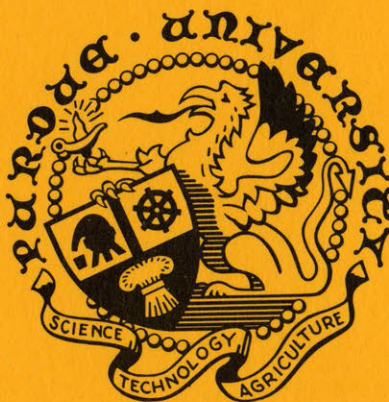
*Agre. outlook*

Feed Industry and Animal Agriculture  
in the Year 2000

Charles E. French

Symposium of the European  
Food Industry

Basle, Switzerland  
October 22-24, 1969



**DEPARTMENT OF AGRICULTURAL ECONOMICS**

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My comments will sacrifice scientific rigor for provocation and breadth of coverage. The 21st century is upon us. Thus, it is becoming fashionable to predict what it may hold, (1, 5, 21, 36, 53)<sup>a/</sup>. Fortunately, 2000 is far enough in the future that my projections will not be remembered at that time. My purposes in this paper are to predict the tone for agriculture in 2000 and to generate some honest thought in so doing.

My predictions undoubtedly will prove to be conservative. Marcus Aurelius made the sage comment, "That which comes ever after conforms to that which has gone before." This tends to bridle most prophets. More important, the persistence of change is disarming. It has a way of amortizing, in advance of the due date, most predictions of traditionally conservative college professors. Some of the interesting and dramatic, technical and social innovations expected in American agriculture in 2000 have been cataloged by our U.S. Department of Agriculture people, (1). My comments will be broader, but those specific USDA predictions are interesting and startling to some people.

My comments, without apology, will involve a lot of judgment - judgment that hopefully came from "studying models of excellence, by learning the art of discrimination, and by building integrity," (2). Hopefully, I will have more than judgment. Establishment of truth has been said to come by one of three sources: common sense, scientific analysis, or Divine Revelation. I hope to be adequate in the first two and will welcome a bit of the third if it comes!

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<sup>a/</sup> Numbers in parentheses denote references in bibliography.

This paper almost defied appropriate circumscription. Finally, I drew myself a picture which shades in the points of my focus. The number of asterisks in the following matrix indicates the relative emphasis I will put in each area. For example, my main emphasis will be on U.S. livestock farmers and U.S. feed manufacturers, (three asterisks); important, but less emphasis will be on U.S. crop farmers, West European crop and livestock farmers, West European feed manufacturers, and U.S. and West European related input suppliers, (two asterisks). I tail off sharply with regard to the rest of the world. To me, animal agriculture is feed and livestock. I will use grain notions often as grains dominate the world production patterns, occupying some 70 percent of the harvested cropland each year. Grains account for an overwhelming share of world food trade, especially if measured on a calorie basis. Direct consumption of grains accounts for 52 percent of man's food energy supply and indirect consumption in the form of meat, milk, eggs, and butter accounts for the remainder, (21).

The focus of my comments:

	<u>U.S.</u>	<u>West Europe</u>	<u>East Europe</u>	<u>Rest of World</u>
<u>Animal Agriculture</u>				
Livestock farmers	***	**	*	*
Crop farmers	**	**	*	*
<u>Feed Industry</u>				
Feed manufacturers	***	**	None	None
Related input supplies	**	**	None	None

Even with this chart I will be careless about specific implications for specific institutions. After all, you should be entitled to some of the fun!

### Two Powerful Trends

Two overpowering influences shape our current century - industrialization and socialization.

Industrialization is accomplished by (a) specializing workers, (b) applying science and technology, (c) substituting equipment for labor, (d) standardizing production, and (e) tending toward large size, (3, p. 2). More recently these characteristics have been interlaced with a scientific organizational scheme built from the products of modern management science, information systems, computers, and feedback notions. Industrialization has been the instrument of growth and growth is the most commonly stated objective of national economies around the globe. Galbraith has defined the process in his The New Industrial State, (31), and Servan-Schreiber, (32), has popularized it in The American Challenge. Both sold a lot of books.

The U.S. food industry has moved a long way toward industrialization. Work by Shaffer, (3; 33, p. 12), of Michigan State University and collaborated by Goldberg of Harvard, (35), gives the following breakdown of who contributes what to the value added in the food industry:

	<u>Percentage Contribution to Value Added in Food Industry</u>
Farming	15
Farm Supply Industry	23
Food Processors and Manufacturers	35
Retailers and Wholesalers	21
Transportation Industry	<u>6</u>
	100



This does not say that farming is relatively unimportant, but if it were not for the overwhelming systems concepts of modern society, it might approach it. Or, put another way, straightline projection of the industrialization trend in U.S. agriculture would predict completion of the last hour of farm work in 1984.

Socialization is not something easy to define or to measure. Yet, we all have some feel for the process. The degree of it in the Western world is often understated. For example, Gordon recently showed that \$45 billion of plants and equipment purchased by the U.S. government for use of private firms since 1940 has never shown up in our nation's capital stock, (4). Socialization has brought de-emphasis of commerce, particularly production. The focus is on groups. The conflict is between the strength, protection, and economies of the group on the one hand and strivings for freedom, rights, and justice by the individual on the other.

Industrialization renders unstuck the conventional institutions. Modern Western competitive notions are not giving the automaticity of former times. Bureaucracy and lack of creativity leave bare economic institutions for social takeover. The problem is not new. Its intensity is. Our great president, Jefferson, understood the issue when he said that one generation could not commit the next to its view of public policy or human destiny.

The processes have a sequential nature definable in U.S. agriculture.

First, we get an injection of engineering, biological, economic and scientific developments which stampede our production processes.

Second, and not far behind, we see innovation in marketing techniques adequate to effect the specialization of production and the system of exchange naturally dictated and needed by an expanding production process.

Third, in areas where the exchange function is most volatile and socially charged, innovations occur in marketing institutions. We saw this in administrative pricing of milk, fruits and vegetables and other products in the late 1920's and 1930's. In that same period, we saw it in the cooperative movement and in the improved credit institutions for agriculture.

Fourth, this type of advance in most historical developments has brought economic and political pressure to alter social institutions. In an exchange-oriented society, we should expect much of this ferment to be around the exchange system. Social institutions lie close to our emotions. It is no accident that we are getting emotional interlacing with our economic problems.

Fifth, export is a natural development of a maturing, progressive, and growing economy. This is export of both produce and ideas. Our production increases coincide happily with a time which finds the world hungering to emerge and grow.

#### The Double Image of the American Farmer

Our farmers are in a dilemma. Recent writings have pointed out that throughout most of history the tiller of the soil and the herder of flocks had no status such as our American farmers have known. Basically, a fortunate coincidence of events created the kind of agriculture that has dominated our nation. One was the Industrial Revolution which gave the farmers the tools and the marketing system to do the job. The second was the Intellectual Enlightenment which prescribed a doctrine distilled from the ancient Jews and Greeks that put emphasis on the individual initiative of the farmer. The third was the discovery of new worlds which gave resources necessary to do this job.

However, recent actions in agriculture have often come with great deviations from the original concept of the free enterprise, small entrepreneurial type of agriculture. The farmer has engulfed himself in much of the commercialism that he sought to evade by his individual approach to commercial agriculture. In a sense, he now lives a double life. He is trying to retain much of the old agrarian status of husbandman, but the ways by which he must operate in the commercial world pull him away from this.

In riding the horns of his dilemma, the farmer sought allies. He found them in his neighbors. He formed cooperatives. He found allies in his government. Our farmers take pride in their independence. Ironically, no group has had greater solicitude from our government than our farmers.

This is a new farmer. His image is less romantic. He is wise, well trained, innovative, and cosmopolitan. He has been homogenized into his society. He cannot extricate himself, even if he wished to do so. Thus, his actions are more interesting and exciting for an economist to predict than were those of his predecessor. Where the artist sees heresy and the sociologist sees retrogression, the economist sees progress.

#### Some Political and Social Assumptions

The economic climate of 2000 Agriculture will be blended delicately with the political and social climate of 2000. Some assumptions about this later climate must be made.

Growing geographic compression of the world's peoples is inevitable. Population control, land development, and space exploration cannot deny a closeness of people that will have important economic implications for 2000 Agriculture.



Continuing world conflict is inevitable. Human wants are insatiable.

Proximity tears away the shroud that has kept two thirds of the world from seeing the fact that they might actively pursue this satisfaction. If we are lucky, we can avoid reprehensible armed conflict. But, this will not ease the level of economic and social conflict. In fact, it may intensify it.

Growing concern for man's environment will set the tempo of the next 30 years. As Toynbee said, most people have been hungry throughout history. The drive to feed them has probably been our finest global bond for humanity. Yet, a strange emphasis is shifting humanitarians and practitioners alike away from food to the general problem of environment--health, air, water, and esthetics, (55). Let me illustrate the rate of emphasis here with USDA estimates of U.S. land and water resource needs for 2000: (5)

Food needs more than doubled.

Wood products needs about doubled.

Water needs for municipal use doubled--for manufacturing use quadrupled.

Outdoor recreation demand up 300 percent.

Irrigation withdrawals of water up 50 percent.

Land used for homes, schools, and factories up 200 percent.

Land used for reservoirs up 180 percent.

Land used for wildlife refuges up 133 percent.

Land used for transportation up 125 percent.

Declining emphasis on primary production will continue into the 21st century.

Affluent, maturing societies emphasize secondary and tertiary production. Moreover, the basis for distribution of produce is shifting. Production of any kind is not now adequate justification for rewards. Need cries loudly. Traditionally, our Western economic systems concentrated on what, how much, and who. The "who" seems to be getting much more social focus. Economists are scurrying to catch

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up with the sociologists. Agriculture and the extractive industries will be a relatively smaller and smaller factor in increasingly affluent societies.

Improving level of education throughout the world must be assumed.

Education has proved itself in many ways but one of the most convincing to the economist is in terms of lifetime earnings. U.S. studies show sharply increasing earnings from about \$175,000 for those with less than 8 years of elementary education to more than \$300,000 for those with four years of high school, and nearly \$500,000 for those with four years of college. There is room yet for much more. An OECD study in 1957-58 showed these percentages of 15-19 age groups enrolled in school: U.S., 66; France, 31; West Germany, 20; United Kingdom, 18; and Italy, 11. From 1966 to 1975 more Doctor's and Master's degrees will be granted in the U.S. than were granted in the preceding 50 years, (6, pp.55-57).

Woodbury in his book, Let Erma Do It, put this well in terms of education anticipated because of automation: "Education is bound to be greatly affected by automation. People have got to know more and be quicker to catch on in a world where the human hand and brain are shifting their burdens to machines. Everybody will need more education . . . . The change will not be so much a question of material taught as of spirit. For our new world there must be a rediscovery of vigor, the preparation for change, the training for acceptance of opportunity and risk, and the keening for exploration and pioneering. The objective will be to regain some of the spirit of daring that has been lost through the attitude of slavery to machines. Automation itself will, of course, require profound changes in technical education, reaching back into grade school, where its general principles will be taught."

Some Technical Assumptions

The economic climate of 2000 Agriculture must also consider assumptions about technical environment.

The promise of Apollo will broaden the horizon for science and technology. No longer will we ask if we can organize to solve a technical problem in agriculture. The organization skills will be assumed. Whether to tackle the problem or not will depend primarily upon the economic potential for the solution to pay the cost of so organizing.

Social embodiment of science and technology is an accepted part of affluence. Its attainment is a natural extension of national growth objectives. Good food and fiber will be part of that affluence, but only a beginning. Science has had great success dealing with inanimate nature. It promises advances in understanding and controlling vital phenomena. It must, for the most part, yet prove itself outside of this inanimate technical area. But man expects it to do that. For the first time he sees justification for his insatiable wants--science can provide them. Society tends to accept science in the technical area. Logically it must accept it in the social area. But social responsibility must come with the blanket endorsement of the products of science. Dr. P. W. Bridgeman, when awarded the Nobel Prize for physics in 1946, disposed of the scientists' responsibility for the atomic bomb in these words: "If society had not wanted to construct an atomic bomb, it need not have signed the cheque for the two billion dollars which alone made it possible". But, scientists and laymen will give science much elbow room. Speaking of radium in 1905, Pierre Curie said: "I am among those who think, with Nobel, that humanity will obtain more good than evil from new discoveries".

Science is thinking big. Some forecasts of developments before 2000 have been: reliable weather forecasts and regional weather control, translation of languages by computers, production of primitive artificial life, blanket immunization against infectious disease, and the economic production of synthetic protein foods.

Expected in the succeeding quarter century--when children born this year will be only in their fifties--are: direct links between the brain and the computer, chemicals to stimulate the growth of new organs and limbs, drugs to increase the life span, and other drugs to increase intelligence, education by direct recording on the brain, and production of a fifth of the world's food from ocean farming, (7, p.4).

An evolving worldwide agricultural research system promises tremendous acceleration of agricultural research. International research centers jointly financed by Ford and Rockefeller Foundations are providing a new focus for the development of worldwide systems. The four of these are: International Rice Research Institute in the Philippines (IRRI), the International Maize and Wheat Improvement Center in Mexico (CIMMYT), International Center for Tropical Agriculture in Colombia (CIAT), and the International Institute for Tropical Agriculture in Nigeria (IITA), (8). The network is much more, of course. Its basic components are the academic departments and research institutes in the developed countries, the strengthening indigenous institutes in the developing countries, regional institutes in colonial areas, scattered industrial research units, data sources from industry and scattered public agencies, and a growing cadre of evolving agricultural scientists in the developing nations. The scope of this network is promising of a critical mass never before assembled to tackle hunger around the globe, (9,10).

A revolutionary management sophistication rounds out my sketch of the technical assumptions. All will push hard on agriculture. Science has pervaded management for some time, but the notions of cybernation along with systems analysis have crystallized these ideas of science into something which Servan-Schrieber claims is being used by U.S. management to back European industry to the wall. We are not sitting idly by watching this thing in U.S. agriculture either, (11, 12, 13).

Mechanization, automation, and cybernation as ideas form a continuum. However, the philosophical import is with cybernation. This import manifests itself in an admonition of Huxley when he said that the only major vice invented by modern man is the vice of speed. The speed of cybernation terrifies us as it engulfs information and electronifies us as it digests and controls that information.

It has a heavy emphasis on appropriate information. It also has a control aspect - or, if you prefer, an analytical aspect. This aspect has two dimensions. First, is an encompassing or capacious concept, with a discipline of finite mathematics. Calculus had a great reducing and simplifying quality, but finite mathematics encompasses large ideas. Its breadth of conceptualization is a unique advance in science. Second, cybernation has a powerful estimating, dynamic and probabilistic nature. The discipline here comes from both statistics and mathematics. Feedback is the key to this characteristic.



### The Economic Situation for Agriculture

Affluence will abound. This is a key reason for all the talk about national growth. Growth and sustained productivity give affluence. Standards of living are moving up. The developing countries, although at much lower levels, are starting to move their standards up. The U.S. growth rate, as measured in terms of gross national product per capita is increasing at an annual rate of about  $4\frac{1}{2}$  percent. Japan's is at a phenomenal  $12\frac{1}{2}$  percent. The developing nations as a group show a surprising rate of 3 percent--probably the most encouraging humanistic statistic of all time.

U.S. citizens expect good incomes. In two decades the real purchasing power of the average American family went up nearly three fourths.

Unfortunately, it appears that inflation will accompany growth and productivity increases in the Western world. For example, the increase in real family incomes in the U.S. of about 70 percent in purchasing power took actual dollar income increases of  $2\frac{1}{2}$  times. Inflation must be built into most economic forecasts today. It is a political, if not an economic, must.

Of course, income distribution will continue to be a problem, but distribution trends generally favor the market for food and fiber products.

High employment will be sought. Keynesian economics has influenced Western society to push for high-level employment. Also, more people around the globe can raise their hopes and aspirations for a better economic plight. More and more world economies recognize the need for work. Large-scale unemployment in the West is no longer politically feasible. U.S. unemployment approached 10 percent in 1915, 12 percent in 1921, and at least 25 percent in 1933. Since 1941, the highest level has been 6.8 percent.

The notions of efficient work are a part of the industrialized world. It has been said, "To work efficiently, a man needs to substitute the idea of growth for the idea of toil, and to make growth the natural and normal expression of

himself, (14). Employment will be upgraded; U.S. Department of Commerce estimates for 1975 call for the following percentage increases by areas: Service and miscellaneous, 42; government, 39; wholesale and retail trade, 27; finance, insurance and real estate, 23; and manufacturing, 9.

Diets around the world will improve. Three aspects of this food balance problem need examination---future of traditional Western agriculture, agricultural productivity of developing nations, and possible substitute sources for farm-produced foods. Obviously only a superficial analysis of each can be given.

The future of traditional agriculture in the U.S. and West Europe is not overly bright even if we assume little change in supplies from developing nations and only nominal inroads from substitutes and new food sources. In the U.S. we have for several years with government programs kept a continuing over-capacity of 50 to 60 million acres of cropland. This represents 11 to 13 percent of our 460 million tillable acres. In terms of our total annual output, the excess capacity of the agricultural plant is about 6 to 8 percent. Land taken out for industrial uses is about offset by land being brought into production, (15). Domestic demand for food products hopefully will go up about as population increases, 1 to 2 percent annually, (16). Our farmers should have no difficulty in increasing their efficiency by that much. They will keep the pressure on prices and their own incomes.

We are exporting about one fifth of our production. We hope to push that up, but our estimated annual increases have been dropping each year. Most sober thought today is that we will do well to hold our absolute levels in the short run. Hopefully we can get slight increases as we move toward 2000.

Recent USDA estimates push projections to 1980 and they see a large wheat surplus and important surpluses for rice, coarse grains, cotton, and oilseeds, (17). Our foreign diplomacy may create some food demand for aid, but it seems unlikely

that the general public will pay the bill for this. It will not help our farmers for them to subsidize it with low food prices.

This is not a bright picture for U.S. agriculture.

I will not try to make a firm appraisal for West Europe. But it appears to us that your production is increasing rapidly compared to consumption needs. Also, current policies will continue that. Surpluses, I understand, exist in soft wheat, dairy products, sugar, and some fruits and vegetables. Without EEC policy changes, more will come. Increased pressure from Eastern Europe seems inevitable, (19,20).

Thus, your commercial agricultural outlook does not appear bright to us either.

The hope of the developing nations has been characterized by the notion "Green Revolution" signifying the dramatic new growth of food in Asia, primarily from new varieties of rice and wheat, (23,24). This hope was summed up recently by U.S. Assistant Secretary of Agriculture, Clarence D. Palmy, who said,

"Crop production also is rising in most of the developing countries, but notably in India, Pakistan, and the Philippines. In these countries, there has been a marked expansion in use of fertilizer and machinery. There has been improvement in irrigation, storage, and transportation. There has been establishment of extension services and production credit. New strains of wheat and rice are making an extremely significant contribution.

"The dwarf wheat developed in Mexico already has spread rather far in Asia. In India and Pakistan, Mexican wheat now covers about 15 to 20 percent of the total wheat acreage. Wheat production in West and South Asia in 1969 may be about 20 percent higher because of the new wheat varieties. Such increases really are a tremendous achievement, especially so for countries that are always walking a nutritional tight-wire.

"However, there are several factors that will probably impede expansion of the new wheat. A substantial part of available irrigated acreage has already been planted to dwarf varieties; farmers lacking reliable irrigation cannot afford the risk of borrowing money for fertilizer and chemicals required to produce the new grain. As production increases, farm prices may fall and the priority given to agriculture by the governments of these countries may lessen. Unless the marketing and distribution facilities are improved, price declines may give farmers much less incentive than at present to adopt the new varieties and produce more with them, (18)."

A more enthusiastic view would be that of L. R. Brown,

"During the earlier era, spanning the two decades from the end of World War II through 1966, the less developed world was characterized by (1) accelerating population growth, (2) a sharp reduction in the area of new land that could be readily brought under cultivation, (3) lagging food production, failing to match population growth in some instances, and (4) increasing dependence on food aid from the United States. During the 1950's food production in the developing countries increased largely as a result of expansion in the cultivated area; but as it became more difficult to bring new land under the plow during the early 1960's, the growth in production slowed perceptibly.

"The new era is characterized by explosive increases in production of principal crops in the larger developing countries of Asia. The 1968 Pakistan wheat harvest was up 37 percent over the previous record, possibly an increase without precedent in any major country. India's wheat crop this year was up 35 percent over the previous record; its total food grain harvest up 12 percent. Ceylon's rice crop has increased 34 percent during the past two years. The Philippines, with two consecutive dramatic gains in its rice crop, has apparently ended half a century of dependence on rice imports.

"Favorable weather has contributed to the record harvests in some countries, such as India, but it is only one factor; these countries are now achieving takeoffs in yield per acre comparable to those achieved in the developed countries during the first half of this century. Increases in per acre wheat yields in Pakistan and India and of rice yields in the Philippines over the past two years may exceed those of the preceding several decades.

"Thus far the most rapid advances have been concentrated in Asia, a region containing more than half the world's people. But countries elsewhere -- Mexico and Latin America and Kenya and the Ivory Coast in Africa -- are also enjoying the fruits of modern agricultural technology. Within the next several years the agricultural revolution will likely spread to most of the less developed world.

"The new era is dynamic, providing new opportunities for farm families, promising to bring into the marketplace literally hundreds of millions who heretofore have eked out a subsistence living, consuming all that they produce. This will broaden the market within individual developing countries, greatly enhancing the prospect for industrial development," (10).

Professor T. W. Schultz of the University of Chicago, cautions about our long-run hopes in this area when he says that our attempts at investments in food production have been beset with four classes of malinvestments, some in this country and some abroad, as follows, "1. We are still committed to publicly-induced over-investment in material forms of capital contributing to agricultural production . . . 2. We persist throughout the agricultural establishment to underinvest in the human forms of capital . . . 3. We still have not developed

a set of successful public policies for investing in agricultural research and technology in poor countries . . . 4. While we have succeeded in putting family planning and birth control on the U.S. foreign aid agenda, we are still a long way from having developed meaningful public policy programs in this area, (22).

On balance, it appears that the potential of the developing nations in affecting world commercial agriculture has become a new ball game since 1966, (54). They will probably give severe competition to the U.S. and West Europe by 2000. For example, the potential in yield increases with new varieties is great, but even with current varieties, FAO countries with highest yields report averages 40 times those in lowest yield countries, (16).

The alternatives to farm production of food are increasing. Also, opportunities to substitute vegetable products for animal products are many. The economic leverage is with the vegetable products. We can do little more than inventory some of these alternate sources and illustrate some of their inroads.

Claims are great for many new threats. Changes in diets would greatly stretch our food supply if we needed to do so. More efficient use of plants has great potential; reportedly we use only about 5 percent of the potential annual energy created for photosynthetic transformation in plants for human food. Higher protein plants such as Purdue's high-lysine corn have great promise. Soybean breeding experiments look promising. Some single-celled chlorophyll-bearing algae of the sea are reported to be more than 160 times as efficient in use of solar energy as a field of corn, (16). Rand Corporation expects fish to be herded like cattle and raised in off-shore pens. Fishing as an industry has been likened to the state of farming by American Indians at the time of the discovery of America, but many new and promising things are happening in this area. It is predicted that kelp, seaweed, plankton, and microscopic sea plants may form underwater farms. The petroleum industry is pushing hard for food from its source materials. The potential is staggering. Technological supports are many, for example, economically

feasible cloud seeding or desalinization could revolutionize irrigation.

Radiation preservation and other techniques stagger the imagination with regard to potential saving in wasted food.

Often the claims in these areas exceed the success. But, animal agriculture cannot afford complacency. U.S. food industries took stock of the inroads of substitute food and fiber items recently and were shocked. In citrus, 30 percent of the national fruit beverage market was partially synthetic. Substitutes had 64 percent of the textile industry on a dollar basis and 43 percent on a volume basis. Nylon had 44 percent of the carpet market. A cotton industry spokesman estimated that the industry had lost one billion dollars to synthetics. Detergents had 80 percent of the soap and detergent market. About 75 percent of the shoes had non-leather soles and 20 percent had non-leather uppers. In the dairy industry two thirds of the butter market had been lost. Coffee whiteners had about one-third of the coffee cream market. Non-dairy whipped toppings had about 60 percent of the whipped cream market. Mellorine had about 5 percent of the frozen dessert market. A dramatic inroad was filled milk. In one state, Arizona, it reportedly had about 8 to 9 percent of the market for products with which it directly competed, (37,38,39,43,61).

Agricultural minorities will increase, but many will maintain important political status. As societies mature, resources move out of agriculture. The resulting minority positions are difficult for farmers to accept. Yet, West Europe and the U.S. are both getting mature agricultural minorities. They are fabricating political alliances with middlemen. They are affiliating widely different kinds of organizations for market power.

The U.S. farmer has lost his uniqueness. He was almost alone among vocational groups in being his own boss. The educational and legislative institutions developed in our country favored him. He had at his disposal an agricultural "establishment". This establishment involved the farm bloc in Congress, the U.S. Department of Agriculture, the general farm organizations, and the Land Grant College System.



Basically, these organizations themselves are shifting and the total position of agriculture has certainly made him at most only slightly unique among American industries, (46). For example, a recent study showed that two thirds of USDA expenditures currently go for programs which are of primary benefit to consumers, businessmen, and the general public, (29).

Around the world there is a growing awareness of the place of agriculture in economic development. Many world leaders seemingly are realizing the importance and potential for agriculture. This national emphasis will help the status of agriculture, generally. I should add, however, that it will also put pressure on existing commercial agricultural societies such as ours.

Basically, the social issues of agriculture are those of attempting to maintain a total involvement in a complicated society. The farmer's problems are becoming increasingly more complicated. Enlightened compromise is the key to his happiness and economic prosperity. He has never been a good compromiser, but he must learn the lesson that enlightened compromise is probably the key to liberality. Among those in the extractive and production areas, where we see generally declining status, he may be the most secure.

Larger farm units will dominate, but small units will not all disappear. Farm size in most areas has been up sharply and numbers down accordingly. The tendency is to forecast a few large units controlling agricultural production. In the U.S., we have roughly 3.0 million farms, about half the number we had 30 years ago. Of the 3.0 million, roughly one third are "big" commercial farms (\$10,000 or more gross sales), one third are "small" commercial farms, and roughly one third are residential farms, (25). "Big" farms have tripled in number in 30 years and "little" farms have dropped to one fourth the number 30 years ago.

Most studies do not show that greater efficiency is the obvious main cause of increasing size. We do have substantial economies of size, but virtually all of the internal economies of size are exhausted for most types of farms when a farm

is big enough to use fully one set of modern equipment. This means a good one- or two-man farm in most regions.

Farm programs have been blamed for the trends. Our programs have favored the larger farms, but evidence is lacking that this has been the major cause of the changes.

The reason may be somewhat more simple. Farmers, like the rest of us, want more income. They now have the capacity to operate on a larger scale. The urge for more income pushes them to move to the larger scale. Yet, the family farm still predominates. If you define a family farm as one that employs less than  $1\frac{1}{2}$  man-years of hired labor, 95 percent of U.S. farms are family farms. The percentage has changed little for many years.

Farmers are diversifying and protecting their units by large part-time involvement, (40). In 1967, the farm population got \$13.0 billion net farm income from farming and \$10.7 billion from nonfarm services. Nonfarm income per farm family more than doubled from 1960 to 1967. Many farm wives work.

The resistance to large operations where individuals lose property rights and opportunities for individual entrepreneurship is still great in the U.S. Both economic and social constraints on wholesale movement to largescale corporation farming exist in the U.S. 2000 will see fewer farms, but it will not see the demise of the U.S. family farm, (26,27).

West European farm organizational changes seem increasingly to resemble those in the U.S. It is difficult to see the probability of the heavy concentration of large farms predicted by programs such as the Mansholt Plan.

Animal agriculture will be emphasized as we move toward 2000. This seems rather sure in the developed countries. Although less sure in the developing countries, it seems probable, (16,18,28). As incomes go up, meat consumption, especially beef, goes up. Most countries have consumption levels that would suggest increases. U.S. consumption of red meats is the world's fifth largest, exceeded

by Uruguay, New Zealand, Argentina and Australia. Our annual consumption is 180 pounds per person compared with 138 pounds in Great Britain, 124 in West Germany and Austria, 71 in the Soviet Union, 67 in Italy, and only 20 in Japan. U.S. poultry meat consumption has been running about 48 pounds, per capita with France, 23 pounds; Great Britain, 20; and Denmark, 9. Japan consumes only 6 pounds. I mention Japan because in five years (1963-68) they increased egg consumption per person from 144 to 214. Such response suggests the dynamics of some of these potential meat and poultry product responses.

The U.S. example may have some relevance in these expectations. More than one third of U.S. food energy and 70 percent of our protein comes from animal products, (16).

L. S. Hardin has emphasized that generalizations about world livestock prospects must be done with care:

"As the population-food gap is narrowed, opportunities to diversify agricultural production may develop. Scavenger production of swine and poultry may increase. Some by-products and cereals may be diverted to commercial production of meat and eggs. Also, expanded cattle production may complement rather than compete with food crop production -- so long as cattle feed from land resources unadapted to food crops. Over 60 percent of the world's agricultural land is non-arable and suited only to grazing, (67, p.248).

"Livestock products are not the food of the poor. Ever increasing numbers of people do not by their presence guarantee an expanding market for meat, milk, eggs, and animal fiber. Even though millions consume protein-deficit diets, nutritional need does not equate with effective demand, (68). Nevertheless, in the developed world, beef among the livestock products enjoys a high income elasticity of demand. Several developing nations, therefore, seek to increase their beef production and exports. Even if nutritionally needful local consumers are bypassed in order to reach an export market, this, because of the multiplier factor, may be a helpful development strategy. In this context beef may be a commodity that is pushed in part for export purposes. Imported industrial inputs acquired with foreign exchange (as from beef exports) have an internal multiplier of as high as four to one according to some estimates, (69). Net foreign exchange is often the key factor. The agricultural strategy of pushing export products even at fairly high development cost is therefore viable -- if reliable, hard currency markets can be penetrated and local production can be sustained at world prices.

"The livestock industry, therefore, becomes a realistic source of derived

demand for by-product or surplus feedstuffs and for the use of labor, capital and otherwise non-productive land. While relatively capital intensive, the livestock industry is labor-consuming and can be built largely with domestic savings and inputs. Foreign exchange requirements to sustain the industry are modest. Livestock farmers have a built-in predisposition to save and accumulate capital in that they tend to grow their herds rather than purchase them.

"Technical research and educational requirements for a successful livestock industry, however, are of major proportions. Such an infrastructure requires public inputs for its creation. While animals in large numbers exist in developing nations, production levels are extremely low. Hence a decision to diversify an agricultural economy by expanding livestock production is a serious one. To mount a program without having (a) tested adapted production technology and (b) some assurance of reliable markets and a system of reaching them is to court failure," (28).

Thus, the focus on livestock will vary from situation to situation, but the economic climate I predict generally favors greater livestock emphasis.

Production and marketing will be more highly coordinated. The increasingly interrelated and coordinated U.S. food and fiber systems termed "agribusiness", by Davis and Goldberg (29) now has domestic annual sales of food of approximately \$100 billion at retail.

K. R. Farrell has indicated the dominance of this as follows:

"In looking to the longer range prospects for agribusiness, an extension of the trends of recent years can be expected. These include: (a) industry adoption of the 'systems orientation' at an increasingly rapid pace; (b) continuously tighter coordination between all levels intervening between the farm production and retail sectors and between the farm production and farm supply sectors; (c) emergence of more efficient and comprehensive information systems, both internal and external to the firm; (d) gradual decrease in the numbers of marketing levels at which prices are determined in 'open markets'; and (e) increased emphasis upon product competition and quality, and tighter product specification and quality control to meet consumer expectations.

"The agribusiness sector of the future likely will have: (a) even fewer firms; (b) larger firms; (c) more contractual arrangements; (d) access to more complete information systems both internal and external to the firm; and (e) an increased span of ownership control across industry lines," (34, pp. 8-9).

P. L. Farris sketches five fundamental characteristics of this complex in the U.S.:

"Gains from Coordination. Economic and technological forces are bringing strong pressures to integrate, in one way or another, the functions and

processes involved in turning out goods and services for the consuming market. Coordination makes more exacting demands on all participants in vertically organized systems and moves decision-making toward one point in the channel, which, in turn, tends to become the single profit center. Any organization alternative which fails to allow efficiency and technological gains from closer coordination to be realized will certainly face serious challenges. But it does not follow that just one organization alternative need be economically superior to all others, nor that it would prevail even if it were.

"Size and organization of Firms with whom Farmers Deal. In many cases the firms which supply farm inputs and those which process and distribute farm products have become not only large but also more vertically and conglomerately integrated, (41). The difference between the industrial organization of nonfarm firms who deal with farmers and that of farmers is often of critical significance. Suppliers and processors may have a substantially wider range of behavioral options open to them than are available to farmers.

"Market Orientation. The modern selling environment in the U.S. is one in which most consumers are busy and have incomes that will buy more than bare necessities for life. Highly processed and conveniently packaged items find increasing acceptance. This setting lends itself to the management of demand by manufacturers and distributors. They are in an advantageous position to anticipate broad changes in consumption patterns, to develop particular products which will fit into general trends in life styles, then to assure that people buy what they produce by using modern advertising and promotion techniques, (31, pp 198-218). Although many nonfood items lend themselves more completely to persuasion, the phenomenon is of growing importance in the food industry.

"Management of demand means that the initiative in modern marketing lies in the hands of those who sell to consumers rather than the consumers themselves. It also means that sellers of raw materials are increasingly dependent upon product policies of purchasers of raw supplies.

"The Farm as a Producer of Raw Material. The undifferentiated raw materials which farmers turn out, to an increasing extent, must be combined with a variety of marketing services before reaching the consumer. This means that decisions about the place and use of farm commodities in further processing and distribution are moving further out of farmers' hands. Where alternative inputs can be procured at lower cost, buyers can be expected to switch to the most economical source, (42). To an increasing extent, the lowest cost source is found outside of agriculture, (43). Farmers can only compete passively, mainly as price takers, unless they can find a way to exert stronger influence on product policies and marketing channels which affect the flow of their commodities into consumption.

"Atomistic Structure of Production. Farm producing units continue to be numerous and relatively small. I hasten to recognize the rapid decline in the number of farms in the U.S. and the substantial

increase in the number of those entering large size classes, (44). But the evidence thus far suggests that even if farms in the future are counted in thousands rather than millions the size distribution will not be one in which a significant share of output will be concentrated in only a few large units, (45, pp. 530-545). This characteristic is interrelated with other well-known features of farming which give rise to output irregularity and a persistent tendency toward producing more than can be sold at prices farmers consider acceptable.

"A growing complementary relationship is evolving between economic and political power. This is true even for the traditionally more conservative organizations. Many states have political organizations allied to general farm organizations. These states often have a set of operating cooperatives designed to render economic services. Historically, these two have often been separate. At times, they have been competitive within their states. If farmers are to enhance bargaining power by political power, traditional organizations may need to bring better working relations among these two types of organizations," (27) (See also 63,64).

Cooperatives must be scrutinized for their place in the scheme. They have traditionally been the necessary instrument to obtain public sanction for administrative pricing. Questions arise about the size of cooperatives and the means by which cooperatives should make their needs known to government agencies. As cooperatives gain more strength and effectively seek protection of the government, they will bring themselves under public scrutiny.

A basic reason for being of some cooperatives is to protect the production rights of farmers. In order to have a market for their produce, farmers have at times organized their market. Certain services must be rendered by assuring efficient production units with appropriate marketing functions. If farmer cooperatives do not render such services, integrating units will provide them. To protect their production rights, farmers may again be called upon for new ideas and more effective organizations. Processors and large retail food groups are powerful and have no special reason to hold down margins on food as compared to those on competing products.

Questions will be raised as to how large can a cooperative be. U.S. cooperatives have not typically been large power-oriented institutions. As they develop into



large regional and national agencies specifically for bargaining with control of great supplies, public sanction may be more difficult to acquire. They will be eyed with askance by non-farm oriented legislators and federal agencies. The allowable alliances among large commercial concerns such as regional bargaining agencies undoubtedly will bear social scrutiny.)

Recent U.S. litigation asks, "What are allowable business practices available to cooperatives?" Cooperatives must expect few special privileges. Their business practices must be essentially compatible with those of proprietary agencies. Cooperatives must be willing to give up many of their special privileges if they enter into alliances with organizations that are not bonafide cooperatives. Cooperatives need business alliances with non-cooperatives. Often the advantages here must be weighed against surrender of special privileges beneficial to cooperatives.

Special interests of individual organizations will prohibit strong overall organizations in many mergers or federations. Special interest prompts members to prevent the total organization from becoming stronger than the individual member. Federations may be inadequate to accomplish the necessary strength in a large parent organization. Mergers may be necessary. Both arrangements are being tried and results should be carefully scrutinized.

Issues of equity among individual producers have always plagued growing cooperative organizations. Mergers often result in much larger boards of directors. Executive committees then must be set up to run the business. They must be small enough to operate. Executive committees will wield increasing power. Equity considerations will be an issue since representation, although apparent on a total board, is in effect quite limited by small size of the executive committees.

A large cooperative usually requires giving up individual freedom to gain in group strength. Individual farmers may protect their own freedom before they will sacrifice appropriately for the total group strength. It may become increasingly

difficult, by means of traditional farmer cooperatives, to get organizations large enough to be effective. The individual right was strongly set forth in the original notions and principles of cooperation. The principle of "one man - one vote" will be under severe test.

The whole area of increased coordination is complicated and important. Some fear for our very price system itself, (62). Others see this as the farmers' greatest hour. No doubt exists but what it will continue to grow.

#### Some Specific Questions for Farmers?

Three big questions face farmers generally. Answers may be suggested here or elsewhere in this paper. But these are the priority questions of great uncertainty for farmers in the U.S. and West Europe. Much help is needed in answering them.

How much of the food and fiber will be farm produced? The prophets of gloom that would bury farm based-agriculture under substitutes probably mislead agriculture. However, substitute sources are more than idle threats, (61). Farmers are vulnerable; most have a narrow outlet range. Raw material suppliers with few outlets have an uneasy history.

Commercial agriculture as we know it is a modern phenomena. In fact, its history is so short that one does at times wonder about its future. Entrepreneurship has been its driving force. Farmers see this entrepreneurial lifeblood eroded by most forms of modern agricultural group action and coordination. Agrarian concepts run deep in U.S. roots. Former Assistant Secretary of Agriculture, G. L. Mehren has said, "Throughout our 300-year history, agriculture has been in the forefront of the process of creativity. In the beginning it provided much of the manpower, the spirit, and the capital upon which this nation was founded." (30) The fight for the farm will not be given up lightly.

Our farms are probably solid pillars of Western strength, but the above question is a relevant one for the last one third of this century.

What countries will produce this food and fiber? The United States is the largest exporter of agricultural products in the world and second only to the United Kingdom as an importer. It supplies one fifth of world exports and takes one sixth of the imports. Trade is important to us. The share of exports in total U.S. sales of farm products was (FY-1967): wheat, 56 percent; rice, 67 percent; cotton, 48 percent; tobacco, 34 percent; soybeans, 37 percent; and sorghum, 39 percent, (17).

The U.S. accounted for about 45 percent of the world feedgrain exports in fiscal 1969. Willett of U.S.D.A. reports:

"Coarse grains account for almost half of the world's grain. The LDC's use 65 percent of their coarse grain for food compared to only 6 percent in the developed countries. World output has increased by about one fourth in the past decade and world trade has more than doubled. One tenth of these grains produced is now traded. Corn accounts for most of the increase, but the percentage gain in sorghum has been larger. The United States ships 50 to 60 percent of all coarse grains traded. Argentina, the closest competitor, exports less than 10 percent of the total.

"Expanding productivity abroad is threatening the role of the United States as the world's major supplier of coarse grains. The European Community, the United Kingdom, Denmark, Spain, and Japan are the major markets. The continuing growth of domestic coarse grain production in all these countries, except Japan, dampens trade prospects for grain-producing countries, including the United States, (17, pp.5-6).

"Argentina, Brazil, Mexico, Canada, Australia, Thailand, and the Republic of South Africa are our main competitors for feed grain exports. The production potential of these exporting countries and their dependence on grain sales for export earnings give them strong incentives to strive for continued export expansion. Growth of the livestock and poultry industries in some countries, however, will tend to hold down increases in export availability, (17, pp. 6-7).

"With respect to our agricultural exports, the crucial countries in this grouping are the United Kingdom, Spain, Denmark, and Portugal. It is possible that all four countries, and in particular the United Kingdom and Denmark, may be members of the EC by 1980. We believe that total feedgrain exports to these countries would be somewhat lower under EC membership, partly because of higher producer prices that would lead to increased grain production and lower consumption," (17, p. 15)

"In our projections to 1980 we expect rapid expansion in coarse grain production in Eastern Europe and the Soviet Union, the result of government incentives to expand crop production and increase livestock production. We expect both Eastern Europe and the USSR to be exporters of feed grains. However, these developments will depend largely on the party and government decisions as to economic priorities.

"Japan must depend on outside suppliers of feeds to meet increasing requirements of her livestock industry, because of the very limited land resources available in Japan. Continued economic growth in Japan will lead to further increases in per capita consumption of livestock products, and continuing rise in feed grain requirements. However, Japan's agricultural sector and foreign trade can be greatly influenced by Government action. Food demand is far below the saturation level, and therefore, the Government's food supply strategy can be flexible. Thus, by 1985, Japanese grain imports could more than double those of 1966, but whether they will do so will depend largely on the Japanese government's strategy toward foreign trade and domestic farming. A recent ERS study concludes that Japan's grain imports in 1985 could be as high as 50 million metric tons -- or as low as 19 million tons.

"In supplying Japan's feed imports, we can expect increasing competition from a number of countries including Australia, Thailand, or the Republic of South Africa. First, these countries enjoy a locational advantage. Second, a considerable amount of capital, both domestic and foreign is being invested in Australia and Thailand to promote production of feedgrains. Third, Japan is actively promoting alternate supplies of feedgrains to assure adequate supplies at competitive prices and to develop bilateral trade, (17, pp. 16-17).

"With 11 percent of the world's people and 23 percent of the arable land, the U.S., Canada and Latin America produce 25 percent of the world's wheat, half the corn, barley and other feed grains, 37 percent of the sugar, over half the vegetable oilseeds, 40 percent of the meat and root crops.

.....  
"With 11 percent of the world's people and only 7 percent of the arable land, the highly-developed, agriculturally-proficient Western European countries have been building up their food production ever since Marshall Plan days. Nearly all have made steady progress, and with their relatively moderate population increase, most have recorded per capita food production gains ranging around 20 percent over the past decade.

.....  
"With 4 percent of the world's people, Africa and West Asia represent some 20 percent of the arable land, but much of it is arid. Food production is on the rise, though whether it can keep up with population through the mid-70's is uncertain. The region is a mix of the world's most passive and aggressive agriculture.

.....  
"With 38 percent of the world's people and 23 percent of the arable land, the free countries of the Far East and Oceania see the land-food population problem coming into critical focus in their part of the globe, and they are striving to meet it.

"With 36 percent of the world's people and 27 percent of the arable land, communism has imposed collective agriculture in Eastern Europe and across the vast Sino-Soviet land mass. The results of state-controlled agriculture have not been good,"(50, pp. 12-13).

I cite these data not so much for significant analysis as to show the acute competitive tone of the U.S. in this area. We expect to stay in the business, but we expect it to get rougher particularly with regard to our friends. Agricultural trade will flow despite sharp protectionism at the major blocks around the world, (58). A recent book, A North American Common Market makes a point (66).

This type of competition will make strange relationships. For example, a recent interesting article showed how the Swiss are helping us develop food trends in our American tourists we send over here, (59, p. 12).

Who will produce the food and fiber is a question we will not answer fully in this conference.

How many farm units will do the job? Much was inferred about this question above. Undoubtedly, farm numbers will be reduced, but the projections in U.S. and Europe based on the one-third century just completed may overstate the proposition. The number remaining in 2000 will in many ways be an issue resolved more by political constraints than by economic constraints.

Some in the U.S. hold views of great concern on this question and take a much stronger position than do I. To emphasize my reasons for putting this priority on this question, I quote parts of two addresses by Professor H. F. Breimyer of the University of Missouri whose judgment I respect on this issue. Also, I commend his fine book, Individual Freedom and the Economic Organization of Agriculture to you, (49):

"Likewise, farm groups are heading in every direction on the compass. One old farm organization begs for federal supply control. Another abhors supply control but itself is a split personality, reaffirming its faith in the old order on the one hand, but pressing for a common bargaining front, commodity by commodity, on the other. A third holds a middle position. A new group wants to unite all farmers in a single bargaining combine. The cooperative movement revives, it too in a double direction-cooperative bargaining and cooperative market integration. One state body wants to integrate all the way forward to retail.

"In the face of this variety, even babel, of voices, it would be easy to say that farmers are hopelessly divided. Perhaps so. But if so, they are divided only in the solution they espouse to meet a common threat. On the nature of the threat they are not so divided; and this I find significant. And, once alarmed enough, farmers could come back together surprisingly fast. They would be like a family that bickers noisily until an outsider seeks to interfere, (47, p. 15)

"Paradoxically, the actual outcome may be not a choice but a combination. If farmers, wedded to independence, fail to choose the second route of defensive cooperation, they may find themselves caught up in a total conversion to agribusiness integration. This could be the outcome because the pressure for more orderliness, more systematic regularity in farm production and marketing is strong and relentless. If U.S. farmers do not accommodate it through their own actions, it will likely be established by means of integrated control.

"When (and if) that happens, the paradox will be complete. Farmers will then have lost their lord-of-the-land place in the scheme of things. Instead, they will be operating under contracts, and as contractees they will discover similarity of constraint and mutuality of interest that they have never acknowledged before. In simpler words, they will be in the same boat and will know it. They will then organize for bargaining," (48, p. 7).

Some Specific Questions for Food Merchants  
and Agricultural Input Suppliers

With regard to the following questions, I strongly imply both here and above that feed industry businessmen who want to be in business in 2000 must give affirmative answers to all six questions. This standard answer does not distract from the fact that they are six priority questions.

Are you geared to service a discriminating consumer? Modern consumers are a diverse lot. One must be careful to select among them. For example, our trade press has been making strong cases for catering to special groups, such as the elderly, (60, p. 1). Another example would be the fact that we say we have basically five different types of U.S. farmers and to generalize about the nature of all farmers is dangerous. First would be the young, committed farmer. Here it is important that this man get control of resources early. Dollars controlled young are worth much more than those accumulated later. He must get turnover of his capital items during his career. Second type would be the young, uncommitted farmer.



We make these fellows think seriously about their choice of going into agriculture. If agriculture wants its fair share of these men, it must make agriculture an attractive place for them. Third type would be the 50 year old and above farmers. Here we should try to get them high technical efficiency and teach them something about having a good life. One of our farmers recently coined the term "lifeshmanship". This they should strive for - not so much for economic affluence. Fourth type would be the older, wealthier, retired ones. Here the emphasis should definitely be on the good life. Fifth type would be the part-time group. This group as indicated above may become more important and will have special needs.

The ultimate consumer of the food industry is powerful and discriminating. Coalitions of farmers and middlemen designed to raise profits or avoid services will meet with resistance. Substitutes do not worry these modern consumers. They are fickle. They are insisting on better information, and they will get it.

Is your business broadly based? In the last decade, agribusiness firms have shifted from being "product-oriented" to "system-oriented", (34). They had thought of themselves as sellers of feed, dairy products, mixes of fertilizer, etc.; but now such a narrow view is unacceptable. The various "systems" span a wide range. The system may be a small feed mix program designed for a man's entire livestock system. On the other hand, it could be a complete system with an electronic record system, financing scheme, bulk program for all inputs, periodic total farm analysis by computer, and household management advice. Feed sales matters may be buried rather inconspicuously in the total. In fact, they may even be a profit-loss item in order to get other high margin sales. The focus of the system, particularly with regard to the merchandising aspects, may vary greatly by countries. For example, U.S. Under Secretary of Agriculture, J. P. Campbell gave a statement recently which has implications for those who include herbicide service in their systems. He said:

"Herbicides are now the largest single category of pesticides used in U.S. agriculture.

"In 1949 herbicides were used on 23 million acres of agricultural land. By 1965 there was a five-fold increase to more than 120 million acres - or about one third of our crop acreage.

"Just in passing, I might point out that Europe uses herbicides on from 80 to 85 percent of its crop acreage,"(65, p. 5).

Studies show that the income elasticity of demand for services is much greater than for food products. As affluence abounds, the industry may need to put greater emphasis on services as contrasted to products. In the case of the "product-oriented" business, it lacked the coordination of the "system". The service of coordination was, in fact, what the customer really wanted. Product considerations often dominate merchandising habits, particularly at the retail level. Little research or deep scrutiny has been given the costs and benefits of different service functions performed. Customers have had little opportunity to differentiate in the services they choose since prices have not represented costs for services rendered.

Opportunities for special services and products exist. Many food firms seem to desire to remain somewhat independent. To perform a special function may be one means of doing this.

Being broadly based also means size. Most of the agricultural input industries in the U.S. are now big. Commercial fertilizer products are in the hands of about 50 companies. Pesticides, petroleum products, rubber, steel and motor vehicles are all in large companies. Farm machinery has 1500 manufacturers, but seven full-line manufacturers sell most of it. The whole petroleum-rubber complex devotes 20 percent of its assets to production of agricultural products and services; motor vehicles, 15 percent; and the chemical industry, 10 percent. This is big business. To compete, you must have systems know-how, a service orientation, and size.

Are you involved with product development and promotion? This is coming to the fore rapidly in the specialized food industries, especially because of conglomerate developments. Conglomerate mergers shroud partisan food interests, such as meat

packing. The effects of large, broadly-directed conglomerates may be greater than those of any other change in structure of the food industries. Decreased emphasis on special food products such as meat, within the predominately "old line" meat packing companies is obvious. Product development emphasis is shifting to high-yielding areas such as petro chemicals, synthetics, and a host of other products handled by the conglomerates. The "we-are-in-the-food-business, not-the-meatpacking-business" attitude removes an historically strong partisan thrust. The diffusion is some greater in cases where the products which are getting the focus are even more remote, such as car rental agencies, movie or TV productions and such non-food items.

No institution is quickly coming to the fore to pick up this torch. The meat interests need partisanism in much the same way as any other industry. Causes for conglomeration are many, but federal U.S. antitrust orders against acquisition within a company's traditional line of commerce have been important. Certain tax advantages have also accrued to the conglomerate. Conglomerates seem here to stay, and partisan feed and animal industry interests must protect the thrust of their specialty. Moreover, it seems doubtful that public research will pick up this thrust.

Are you staffed with a modern management team? Some industrialization ideas were discussed above. The secret is in the type of people you have, how they are organized, and how well informed they are. Modern management insists on all these elements. Management takes a professional twist these days in what Galbraith calls the "technostructure". System is an important word, although not new. Napoleon is to have said, "When I want to close off one matter, I push in its file and pull out another. I never get them mixed up, and they never bother nor fatigue me." (51). System and program are key notions today.

Maneuverability seems to be the basic need of modern management. It must be versatile and quick.

Marketing institutions must turn themselves to a much more external basis for management decisions than has been true in the past. In many respects, automation

in its broad social and economic consequences brings a difficult time for agricultural middlemen. The competitive structure lies in inter-industry relations. The eyes of askance are on retailers or their buying representatives. Cooperatives are girding their loins. Middlemen are in a rather serious squeeze. Intra-industry competition may be the most intense ever, especially in retail selling. Many middlemen are trying one of five courses of action. Few are coming off well. These courses of action are: A) Becoming more efficient. This tends to take the form of tremendously large plants. Many of these are going to have to have great growth with mortality of many other plants if they are to become economic units. B) Integrating. This is to reap some of the monopoly gains of others. It is rough for one monopolist to take gains from another. Great fights will see who wins. C) Diversifying. This is to try to get out of a squeeze in their specialized areas. This is being forced on many by government decree that they cease growth within their own traditionally specialized areas. They must diversify to grow. D) Going for increased social relief. If they do not go directly for government assistance, they go for laws to sanction some type of guaranteed margin which they impose jointly among themselves. E) Seeking greater market power. Here they hope to gain a greater part of the total market pie by improved market power. They are looking for the weakest link in the power structure. They may find it in the farm bargaining alliances.

Do you consider yourself a potential architect for new institution building?

Institutional changes have been slow to evolve in many instances. The time seems right for rather drastic innovations. It has recently been said that new means of coordination may be produced through trial and error by private firms working within the existing institutional framework, or they may require public action. However, it was pointed out that, in either case, social invention and innovation are necessary. Centuries have been required for development of coordinating devices such as the limited liability corporation, the insurance firm, and the commodity futures market. The rapid pace of today may require much faster development of institutional devices

capable of flexible application. Service and systems-oriented agribusiness firms may well be the ones in a position to effect such development. The cost of such development may be high. However, to relax and let someone else design the institution may extract a much higher cost.

The whole financing package and its relationships to this modern agribusiness may have high payoff. Hopkin of the University of Illinois (26) and Herring of the University of Wageningen, the Netherlands (52) have just this summer independently addressed themselves to this issue. Their views are somewhat collaborative. A big payoff probably lies here.

Can you operate under social constraint? Society insists upon certain sanctions on industry. Rather obvious ones have been written into our constitutional documents. A smaller world will see attempts to codify and standardize these constraints, (56). Maybe we are ready for a management science specifically for running a business under the government's eye.

It appears that Western society wants a mixture of socialism and free industry. It will not be all social. The old Danish proverb says, "When the mayor is a baker, the breads are always small." Yet, it will have strong social notions. Our Admiral Rickover is outspoken, and on one occasion he said, "How to make technology most useful to ourselves and our society, yet prevent it from controlling our lives -- that is the problem. The problem is aggravated by the bureaucratization of American life, itself largely a result of technology. We must devise ways to limit the power of the giants now controlling nearly every aspect of American life. The founders of our nation established no safeguards against this kind of power, simply because it did not exist in their day." You will operate under social constraint. To do so will take thought, preparation, and a fair amount of patience.

A Summary Comment

Agriculture has a great heritage. It is resilient. It is deep in the economic fiber of Western society. Also, it is in the heart of the West. Agriculture will be with us in 2000 - changed, improved, but vibrant and exciting. I look forward to being part of it.

Animal agriculture will prosper. This will come because we can afford affluent living in more of the world, not because production economics favors animal agriculture. Substitute food sources will keep the pressure on. The beef steak and pork loin will be eaten in 2000. I look forward to eating them.

The feed industries will be a vital link in the 2000 forage-grain-livestock complex. This industry will change greatly - much broader, less production-based, and much more sophisticated in the way it is managed.

Society will have difficulty in keeping appropriate incentive for the industry. This will be difficult because society desires to constrain the industry. Sol Linowitz, Xerox Corporation, put it bluntly when he said, "The heart of the problem is...how to stay awake on a full stomach!"

Each of us has the responsibility to stay progressive and alert. Adversities will occur. But adversities may be opportunities. A biographer said of Goldsmith: "Given all his time free from bailiffs and taskmasters, it is to be doubted whether he would ever have written anything of note whatever." We in agriculture have a charge - a charge that probably differs little from that of everyone else. This has been put best by William James, the philosopher: "The great use of a life is to spend it for something that will outlast it," (57).

### Bibliography

- 1) Freeman, Orville L., "Agriculture/2000," Series of six addresses, USDA, 1967.
- 2) The Royal Bank of Canada Monthly Letter, Vol. 49, No. 8, August 1968, Montreal.
- 3) Shaffer, James D., "The Scientific Industrialization of the U.S. Food and Fiber Sector - Some Implications for Economic Research," Proceedings: A Seminar on Better Economic Research on the U.S. Food and Fiber Industry, Economic Research Service, U.S.D.A., February 1969, pp. 2-7.
- 4) Gordon, Robert J., "\$45 Billion of U.S. Private Investment Has Been Mislaid," The American Economic Review, Vol. LIX, No. 3, June 1969, pp. 221-238.
- 5) Freeman, Orville L., "Resources in Action - Agriculture/2000," Miscellaneous U.S.D.A. publication, June 1967.
- 6) 200 Million Americans, U. S. Department of Commerce, Bureau of the Census, November 1967.
- 7) The Royal Bank of Canada Monthly Letter, Vol. 49, No. 5, May 1968, Montreal.
- 8) Q & A On Agriculture, Science, and the Developing World, Rockefeller and Ford Foundations, October 1968.
- 9) Schuh, G. Edward, "Some Notes on a Proposed Program in International Agricultural Economics," Unpublished Seminar Paper, Purdue University, 1968.
- 10) Brown, Lester R., "A New Era in World Agriculture," Presented at Senator Frank Carlson Symposium on World Population and Food Supply, Kansas State University, Manhattan, Kansas, December 3, 1968, USDA No. 3773-68.
- 11) French, Charles E., "Manpower Requirements for a Mechanized Agriculture," Speeches Presented at the Cornell Conference on the Impact of Mechanization, Automation, and Cybernation on Modern Agriculture, December 11-12, 1967, Cornell University, Ithaca, N.Y., pp. 63-72.
- 12) French, Charles E., "Use of Digital Computers in Agriculture," The Voice of America Forum Lectures, Agriculture Series No. 18.

- 13) French, Charles E., "The Managerial Factor and Research on Decision Making in Agricultural Marketing Firms," Chapter 17, Marketing and Economic Development, Readings in Agribusiness Research, University of Nebraska Press, Lincoln, Edited by Clarence J. Miller, pp. 316-330.
- 14) The Royal Bank of Canada Monthly Letter, Vol. 50, No. 7, July 1969, Montreal
- 15) Bottum, J. Carroll, "What are the Farm Program Alternatives?" Economic and Marketing Information for Indiana Farmers, Purdue University, Lafayette, Indiana, November 29, 1968.
- 16) Daly, R. F., "World Hunger and U.S. Food Supplies," ERS, USDA, Presented before the Idaho Annual Health Conference, Inc., Sun Valley, Idaho, May 24, 1966.
- 17) Willett, Joseph W., "Looking at Our International Agricultural Trade in the Future," U.S.D.A., ERS, Foreign Regional Analysis Division, Paper presented at Workshop on Development of an International Program in Agricultural Economics, Purdue University, September 3, 1969.
- 18) Palmby, Clarence D., "The World Feed Situation in the Seventies," Paper presented at Third National Feed Production School, Kansas City, Missouri, May 27, 1969, U.S.D.A. No. 1668-69.
- 19) Neetz, Roger E., "Soviet Agricultural Policy: Past, Present, and Future; Its Impact on the American Soybean Farmer," U.S.D.A., ERS, Foreign Regional Analysis Div., Paper presented to the National Association of Soybean Processors, Minneapolis, Minnesota, August 4, 1968.
- 20) Indices of Agricultural Production in Eastern Europe and the Soviet Union, 1950-68, U.S.D.A., ERS, Foreign No. 273.
- 21) Brown, Lester R., "The Man-Land-Food Relationship, 1935-2000," U.S.D.A., ERS, Washington, D. C. 20250, Talk to California Hay, Grain, and Feed Dealers Association, Los Angeles, California, April 3, 1964.



- 22) Schultz, Theodore W., "What Ails World Agriculture?" Published in Bulletin of the Atomic Scientists, January 1968, Hutchison Distinguished Service Professor, Department of Economics, University of Chicago.
- 23) Wharton, Jr., Clifton R., "The Green Revolution, Cornucopia or Pandora's Box?" Foreign Affairs, Vol. 47, No. 3, 58 East 68th St., New York, N.Y. 10021.
- 24) The Impact of New Grain Varieties in Asia, U.S.D.A., ERS, Foreign No. 275, Washington, D. C. 20250, July 1969.
- 25) Upchurch, M. L., "Dynamics of Commercial Agriculture," Talk to Annual Agricultural Outlook Conference, Washington, D. C., February 18, 1969, U.S.D.A., ERS.
- 26) Hopkin, John A., "The Challenge of Financing Modern Agriculture," Presented to American Feed Manufacturers Association, Inc., LaSalle Hotel, Chicago, Illinois, September 25, 1969. Professor of Agricultural Finance, University of Illinois, Urbana.
- 27) Farris, Paul L., "Alternative Coordination Policies for Commercial Agriculture," Presented at National Agricultural Policy Conference, Williamsburg, Virginia, September 11, 1969. Professor, Department of Agricultural Economics, Purdue University, Lafayette, Indiana 47907.
- 28) Hardin, Lowell S., "Later-Generation Agricultural Development Problems," Conference on Agricultural Development, Bellagio, Italy, April 23-25, 1969. Ford Foundation, 320 E. 43rd St., New York, N.Y. 10017.
- 29) Mehren, George L., "The Role of Government - Yesterday, Today, and Tomorrow," USDA No. 3216-64, Washington, D. C. 20250.
- 30) Mehren, George L., "Agriculture - A Creative Industry," U.S.D.A. No. 2138-67, Washington, D. C. 20250.
- 31) Galbraith, J. K., The New Industrial State, Boston: Houghton Mifflin Co., 1967.

- 32) Servan-Schreiber, J.-J., The American Challenge, Atheneum, New York, N.Y., 1968.
- 33) Shaffer, James D., "A Working Paper Concerning Publicly Supported Economic Research in Agricultural Marketing; Part I - On the Nature and Significance of Marketing Research," U.S.D.A., ERS, Washington, D. C. 20250.
- 34) Farrell, Kenneth R., "A Look Ahead for the Agribusiness Industries," National Agricultural Outlook Conference, Washington, D. C., February 18, 1969, USDA, ERS.
- 35) Goldberg, R. A., Agribusiness Coordination: A Systems Approach to the Wheat, Soybean, and Florida Orange Economies, Division of Research, Graduate School of Business, Harvard University, Boston, Massachusetts, 1968, pp. 12 and 22.
- 36) Hardin, Clifford M., Overcoming World Hunger, The American Assembly, Columbia University, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.
- 37) Synthetics & Substitutes for Agricultural Commodities, University of Florida, Institute of Food and Agricultural Sciences, Gainesville, Florida, Pub. 1, May 1966.
- 38) Speeches Presented at the Cornell Conference on New Foods, Flavors and Analogs, Cornell University, Ithaca, New York, April 24-25, 1967.
- 39) Proceedings of Seventh National Symposium on Dairy Market Development, "Adjustment to Imitation Dairy Products," Published by Market Research Department, American Dairy Association, 20 N. Wacker Dr., Chicago, Illinois, October 16-17, 1967.
- 40) Morris, W. H. M., "Part-Time Farming in the Midwest," Unpublished paper, Purdue University, Lafayette, Indiana 47907.
- 41) Food from Farmer to Consumer, National Commission on Food Marketing (Washington: U.S. Government Printing Office, 1966).

- 42) Moore, Hugh L. and Gorham Hussey, "Economic Implications of Market Orientation," Journal of Farm Economics, Vol. 47, No. 2, May 1965.
- 43) Synthetics and Substitutes for Agricultural Products - A Compendium, Miscellaneous Publication No. 1141, U.S.D.A., ERS, April 1969.
- 44) Parity Returns Positions of Farmers, Report to the Congress of the United States Pursuant to Section 705 of the Food and Agriculture Act of 1965 by the U.S. Department of Agriculture, 90th Congress, 1st Session, Senate Document No. 44, August 10, 1967.
- 45) Nikolitch, Radoje, "Family-Operated Farms: Their Compatibility with Technological Advance," American Journal of Agricultural Economics, Vol. 51, No. 3, pp. 530-545.
- 46) Bonnen, James T., "Evaluation of Traditional Roles of Agricultural Institutions," Department of Agricultural Economics, Michigan State University, East Lansing, Michigan.
- 47) Breimyer, Harold F., "Man, Markets and the American Dream," Talk before the 13th Annual Research Conference of Charles Pfizer and Company, Chicago, Illinois, May 9, 1965, U.S.D.A., Consumer Marketing Service, Washington, D. C. 20250.
- 48) Breimyer, Harold F., "The Struggle for Market Power in Agriculture," University of Missouri, Columbia, Missouri, Foundation for American Agriculture, November 28, 1967.
- 49) Breimyer, Harold F., Individual Freedom and the Economic Organization of Agriculture, University of Illinois Press, Urbana, Illinois, 1965.
- 50) The Quiet Revolution, A Call for Action in World Agriculture, International Minerals & Chemical Corporation, Skokie, Illinois, 1965.
- 51) The Royal Bank of Canada Monthly Letter, Vol. 49, No. 7, July 1968, Montreal.

- 52) Horring, J., "Alternative Methods of Financing Agricultural Investments," Presented at Economic Commission for Europe Committee on Agricultural Problems, 7th Session, 1-5, September 1969, Item 6 of the Provisional Agenda. Professor, University of Wageningen, The Netherlands.
- 53) Daly, Rex F., "The Future of Food and Farming," Director, Economic & Statistical Analysis Division, ERS, U.S.D.A., Washington, D. C. 20250.
- 54) "The Struggle to End Hunger," Time Essay, August 12, 1966.
- 55) McCracken, R. J., "Impact of Man's Activity on the Agricultural Environment," Special Issue of Agricultural Policy Review, Vol. 9, No. 1, 1969, pp. 6-7.
- 56) Brandow, G. E., "The Food Industry and the Public Interest," Abstract of Lecture Presented as the J. S. McLean Visiting Professor Lecture, March 28, 1967, Department of Agricultural Economics, University of Guelph, Guelph, Ontario, Canada, Publication No. AE 67/8.
- 57) The Royal Bank of Canada Monthly Letter, Vol. 49, No. 4, April 1968, Montreal.
- 58) "Press Conference of Georges Pompidou, President of the French Republic, at the Elysee Palace, July 10, 1969, No. 1270 (Ambassade de France, Service de Presse et d'Information, 972 Fifth Avenue, New York, N.Y. 10021).
- 59) Trick, Alan W., "Swiss Tourist Business Gives Advertising Boost to American Foods," Foreign Agriculture, Foreign Agriculture Service, U.S.D.A., Washington, D.C. 20250, Vol. VII, No. 37, September 15, 1969. U.S. Agricultural Attache, Bern.
- 60) "Foods Specially Made for Elderly Persons Coming on the Market" article in The Wall Street Journal, September 29, 1969, Vol. XLIX No. 244, Midwest Ed.

- 61) "Meatless 'Meats'" article in The Wall Street Journal, October 2, 1969, Vol XLIX No. 247, Midwest Edition.
- 62) Kohls, R. L., "Major Issues in Food Marketing in The Years Ahead," Presented as the J.S. McLean Visiting Professor Lecture at the University of Guelph, Published by the Dept. of Agricultural Economics, Ontario Agricultural College, University of Guelph, Publication No. AE/65-66/8, March 1966.
- 63) The Food Marketing Industries-- Recent and Prospective Structural Changes, Economic Research Service, ERS-295, U. S. Department of Agriculture, May 1966.
- 64) Marketing Farm Products - Recent Developments and Outlook, Marketing Economics Division, Economic Research Service, ERS 263, U. S. Department of Agriculture, 1965.
- 65) Campbell, J. Phil, Address before the National Agricultural Chemicals Association, White Sulphur Springs, West Virginia, September 1969, U. S. Department of Agriculture Publication No. 2861-69.
- 66) A North American Common Market, 1969 The Iowa State University Press, Ames, Iowa, U.S.A., First Edition, 1969. Standard Book Number: 8138-1164-3. Library of Congress Catalog Card Number: 69-18483.
- 67) President's Science Advisory Committee, "The World Food Problem," Volume II The White House, Washington, D.C., May, 1967, p.248.
- 68) Hardin, Lowell S., "Economic and Marketing Factors in Animal Production," Proceedings, Second World Conference on Animal Production, University of Maryland, 1968.
- 69) Berry, Albert. Private estimates based upon current research at the National University, Bogota, Colombia, March, 1969.