

SOY PROTEIN and NATIONAL FOOD POLICY

edited by
F. H. Schwarz

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Soy Protein and National Food Policy

About the Book and Editor

Over the last twenty-five years, a healthy international business has developed in isolated soy protein food ingredients. Today, isolated soy proteins are used primarily as ingredients in processed meat products. They are also used as valuable sources of protein in medical nutritional products and in combination with dairy products around the world.

This book puts into perspective the importance of isolated soy protein food ingredients and their implications for public policy. The contributors examine increasing world demand for meat and meat products and provide case studies of Sweden, China, and Mexico that demonstrate the potential economic value of using isolated soy protein in a macroeconomic context. The contributors also provide methodology for quantifying the profit a country can realize by using isolated soy protein ingredients; show why these ingredients have achieved superiority over other vegetable and "novel" protein sources; and discuss the importance of traditional food product quality in gaining consumer acceptance.

F. H. Schwarz is senior vice president of the Agribusiness Corporation of America in Washington, D.C.

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Foreword

The purpose of this book is to put into perspective the value of soy protein food ingredients and the implications of this value for public policy. The perspective includes considerations of economic value, financial profitability, technology, and consumer acceptance.

Over the last twenty-five years, a very viable international business has developed in soy protein food ingredients, especially isolated soy proteins. These ingredients find their principal use today in processed meat products.

Soy proteins have also found some uses in fortifying grains—especially for malnourished segments of the population. However, fortifying grain products causes the product cost to increase, limiting the business opportunities. Few governments have the funds available to subsidize increased costs. There is also an emerging interest in using isolated soy protein products in combination with dairy products, although dairy subsidies often distort the real economic benefits that can be provided.

Vegetable protein in general and soy proteins in particular were promoted as the answer to malnourishment. Today it is clear that soy proteins' role, especially isolated soy proteins' role, is to mitigate the cost pressure of producing processed meat products.

This business in meat products has occurred for several important reasons. First, as incomes rise, there is an increasing demand for meat and meat products. Second, using isolated soy proteins in meat products lowers their cost and therefore has the potential of lowering their price to the consumer. Third, the meat products utilizing isolated soy proteins have achieved outstanding consumer acceptance as they maintain or improve their traditional sensorial qualities. Fourth, isolated soy protein ingredients and the technology they represent provide both financial value to meat processors and economic value to the countries in which they are used.

The chapters that follow carry out the stated purpose of this volume. Chapter 1, by D. Gale Johnson, presents the issues and conclusions in a policy context. Chapter 2, by J. S. Sarma, describes the increasing demand for meat and meat products and the resulting demand for feedgrains.

Chapters 3, 4, and 5, case studies of Sweden, China, and Mexico by M. Smith, T. Sicular, and G. E. Schuh, present the potential economic value of using isolated soy protein in a macroeconomic context. Chapter 6, by F. H. Schwarz, provides the methodology for quantifying both the financial profitability and the economic profitability to the country in which these isolated soy protein ingredients are used.

Chapter 7, by W. Wolf, shows why soy protein ingredients have achieved technical superiority to other vegetable and "novel" protein sources. Chapter 8, by S. G. Sellers, describes the critical importance of traditional food product quality in achieving consumer acceptance—without which the financial and

economic benefits are not viable. This is particularly important as the intense focus on human needs has often blurred the importance of food acceptance.

It is with deep appreciation that I thank the authors for their effort, insights, and contributions to this volume. We have not always agreed on each point but, as sponsors of this volume and the world's largest producer of isolated soy protein, we are deeply indebted for the careful consideration given in the writing of each chapter. Special thanks goes to Gale Johnson, who chaired the conference at which these papers were presented and discussed, and to Walter Falcon for his many helpful suggestions in guiding the entire project.

If this volume is to contribute to national food policies around the world, it will greatly enhance the international trade in soy proteins. What is needed is simply lower tariffs and greater availability of import licenses and foreign exchange allocations.

The authors have demonstrated the potential value of soy protein food ingredients. Now it is up to governments to permit freer trade so that these food ingredients can earn their markets based on the financial and economic value they offer consumers, food processors, and nations alike.

P. H. Hatfield
President

Protein Technologies International,
a subsidiary of the Ralston Purina Company

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Chapter 1

Policy Implications

*D. Gale Johnson**

* D. Gale Johnson is Professor of Economics, University of Chicago.

I am not one who has believed or now believes that the world's demand for food will outrun its supply of food during the 20th Century. Thus I do not believe that for the foreseeable future international prices for the major sources of calories, such as grains, vegetable oils and sugar, will increase if such prices are adjusted for inflation. Yet I do support the development of soy protein food ingredients, including isolated soy proteins, and the fullest exploration of their economic feasibility.

Contrary to some widely held views, there has been general improvement in the nutrition and health status of the population of the developing countries. The improvement has not been uniform and it is possible that in some parts of Africa there has been deterioration in the food situation. This has certainly been the case where civil wars and insurrections have prevailed such as in Ethiopia, Sudan and Uganda. But for the area of the world for which there was great concern only a decade ago, namely Asia, there has been significant improvements in nutrition and health.

Table 1 includes data on food production per capita in the major regions of developing countries. In all regions, except Africa, there has been increases in per capita food production, modest in the near East and substantial in the Far East.

But the food available depends upon more than production; trade in food affects how much food is supplied to the domestic market. In the early 1960s Africa was a net exporter of food; at the end of the 1970s Africa was a major importer of food. In 1979-81 Africa imported 16 percent of the calories that it consumed. Consequently, as Table 2 indicates, there was no decline in per capita food supplies even in Africa during the 1960s and 1970s. Since much of the food imports by Africa during the 1979-81 period was provided by aid, it would have been clearly preferable had the increased food supply come from increased domestic agricultural productivity.

But the most striking evidence of improvement in health and nutrition, even in low income African countries, is the data on increases in life expectancy and declines in infant mortality and child death rates between 1960 and 1982. While the available data are subject to error, the data we do have indicate an increase in life expectancy in low income African countries of 7 to 10 years during the period. This is less than in other low income economies. The increase in life expectancy in India was 12 years and for all low income countries other than China and India the increase was about the same as for Africa, namely 8 years.

The declines in infant mortality and child death rates are clearly important indicators of improvement, though it is obvious that much remains to be accomplished. It is perhaps worth noting that in 1900 the infant mortality rate

Table 1

**Estimated Indexes of Food Production Per Capita for Developing Market
Economies By Regions, 1966-85
(1961-65 = 100)**

	Africa	Latin America	Near East ^a	Far East ^a
1966	96	101	101	94
67	98	104	103	97
68	100	103	103	101
69	100	104	103	103
1970	100	106	103	105
71	99	103	103	103
72	95	101	107	97
73	89	101	99	104
74	93	103	105	99
75	93	103	109	106
76	94	108	111	105
77	87	107	105	106
78	88	110	110	113
79	87	111	107	109
1980	87	112	107	110
81	86	113	108	115
82	86	113	108	112
83	80	110	106	118
84	81	110	106	118
85	86	115	112	120

¹Source: FAO, *FAO Production Yearbook*, various issues.

^aThe Near East includes Northern Africa and the Middle East.

^bThe Far East includes South, Southeast and East Asia.

Table 2

**Per Capita Daily Calorie Supply, World and Regions: 1961-63,
1969-71, 1979-81**

Region/Group	Calories per Capita Daily		
	1961-63	1969-71	1979-81
Developed countries	3110	3280	3380
Developed market economies	3080	3260	3370
N. America	3270	3480	3610
W. Europe	3140	3290	3430
Oceania	3190	3280	3150
Other developed	2540	2770	2870
Eastern Europe and U.S.S.R.	3160	3320	3390
Developing countries	2000	2140	2350
Developing market economies	2080	2170	2330
Africa	2130	2180	2260
Latin America	2380	2510	2630
Near East	2290	2410	2840
Far East	1950	2030	2170
Other developing	1950	2190	2310
Asian centrally planned economies	1840	2080	2410
World	2350	2470	2620

Source: Mollett (1985, Table 1, p. 28).

in the United States was 160 per 1000 live births and that in the next 20 years it declined to 80 by 1920. Thus far all low income developing countries both the levels and rate of decline in infant mortality between 1960 and 1980 closely paralleled the U.S. experience in the first two decades of this century.

The data included in Table 3 support the view that low income countries have generally improved their health and nutrition situation in recent decades. But the data also indicate that there is substantial room for further improvement. It is in this context that approaches that will permit lower cost means of improving food and nutrition merit our support.

Table 3
Life Expectancy at Birth, Infant Mortality Rates
and Child Death Rate: Africa, 1960 and 1982

Country Group	Life Expectancy at Birth		Infant Mortality Rates (<1)		Child Death Rate (ages 1-4)		GNP PER Capita, 1982 (\$)
	1960	1982	1960	1982	1960	1982	
Africa							
Low income:							
Semi-arid	37	44	203	151	57	34	218
Other	39	49	158	112	37	22	254
Average	38	48	164	117	40	24	249
Middle income:							
Oil importers	41	50	159	111	37	21	670
Oil exporters	39	50	191	113	51	21	889
Sub-Saharan Africa	—	49	170	115	42	23	491
Low-income Economies:							
China	42	67	165	67	26	7	310
India	43	55	165	94	26	11	260
All other	43	51	163	114	—	—	250
Average	42	59	165	87	—	—	280
Middle-income Economics	51	62	126	76	23	10	1,520
Brazil	55	64	118	73	19	8	2,240
Mexico	57	65	91	53	10	4	2,270
Lower-middle income	46	57	144	89	29	13	840
Upper-middle income	56	65	101	58	15	6	2,490
Industrial Market Economies	70	75	29	10	2	—	11,070
Developing Countries by 1982 Per Capita Income:							
Less than \$390	42	59	165	87	27	11	280
Excluding China	42	53	—	—	—	—	—
\$440-\$1,160	50	60	144	89	29	13	840
\$1,680-\$6,840	56	65	101	58	15	6	2,490

Source: World Bank, *World Development Report 1984*.

The chapters that follow subject the possibilities and prospects of isolated soy protein to a series of exhaustive analyses. It is unlikely that any emerging food product has ever had such careful review in terms of how it fits into prospective developments in food supply and demand, or at least none to my knowledge has had such public display of scholarly discussions. As is readily apparent, the chapters that follow vary in terms of the conclusions reached with respect to the economic viability of isolated soy proteins under varying economic conditions. As is made quite clear, both by those who work for Purina and those who work for academic research institutions, the potential contribution that can be made by isolated soy protein varies depending upon the economic circumstances and the policy objectives of various countries. It was because of this openness of the discussion and the knowledge that whatever the results might be, the results would be published that induced me to have a modest role in the evaluation.

It is not my intention in this brief chapter to review the various contributions to this volume. Based upon these papers, I have been asked to review some of the issues and conclusions in a policy context. The primary policy issues are these: First, are isolated soy proteins lower cost in providing nutrition than meat and other animal products? Second, are the products that utilize isolated soy protein capable of obtaining ready acceptance by consumers when there is full freedom of selection? Third, how do the particular economic circumstances of a country and its economic policy objectives influence the economic viability of soy proteins?

These three issues are addressed in the chapters that follow. And it seems to me that they have been addressed in an appropriate manner. Chapter 6 addresses the first question, not so much in terms of providing an answer that has general applicability but by illustrating the appropriate methodology for determining if soy proteins are a potential way of increasing the supply of meat products at lower cost than by increasing the production of meat products. The particular results that are presented are a function of the technical and economic assumptions. The author correctly states: "It must be realized that what follows is only an illustration of how to carry out the analysis. It is not meant to imply that what is shown here as most appropriate is necessarily so in all cases. The ranking of the profitability of the alternative depends upon the technical coefficients, prices and government interventions. Each of these areas varies considerably from country to country and from case to case within countries." The chapter presents a clear and relatively simple approach for comparing the alternatives.

It is novel for an exercise of this kind to show how various distortions resulting from governmental policies may affect the results. Most governments have a variety of taxes and subsidies that are designed to influence the financial viability of an activity within the country. However, these taxes and subsidies confuse the issue of the social or true profitabilities of alternative processes for achieving the same objective. Even when there are relatively modest distortions, as in the examples given, the existence of taxes and subsidies

affect the relatively profitability of different activities from the standpoint of the economy compared to the profitability of a private enterprise that is affected by the taxes and subsidies. The analysis is particularly noteworthy in including the effect of distortions introduced by an overvalued exchange rate. An overvalued currency acts like a subsidy for imports and a tax on exports and thus affects financial comparisons of alternatives that have different mixes of imported inputs or products that may be exported. Comparing the cost estimates given in Table 4 and Table 8 show the effects on true economic costs of a rather modest overvaluation of the foreign exchange rate.

Chapter 7 summarizes scores of studies measuring the relative values of various protein food sources. Studies of major scientific institutions are included as well as studies published by researchers in refereed scientific journals. These studies establish that soybean proteins have many desirable characteristics and few limitations in their role as a supplement to meat products. The chapter notes that there are a number of sources of vegetable proteins but soybeans are one of the lower cost sources and has the advantage of already developed technologies for processing. These facts are important in evaluating the viability of isolate soybean protein.

Chapter 8 presents a very interesting analysis of why some new foods or variations of existing food succeed or fail to find ready acceptance by consumers. The authors consider several possible approaches to introducing vegetable proteins—in meats, in baked products and as beverages. There have been successes and failures in each. What seems clear is that if appropriate recognition is given to the various attributes of food products that people evaluate in making their decisions, the probability of acceptance of a product contain isolate soybean protein or similar protein product can be increased to a high level.

Chapter 2 presents a set of projections of meat supply and demand in developing countries to the year 2000. The projections imply an enormous increase in the potential gap between meat consumption and production by the end of the current century. The projections included here are at variance to those made by the Food and Agricultural Organization in *Agriculture: Toward 2000* (AT 2000). In AT 2000 three projections are made of the net trade balance for meat of 90 developing countries. For a projection based on trends from 1961-65 to 1980, the developing countries would have a meat trade export balance of 3 million metric tons. Two other projections are based on detailed analyses of production prospects and demand possibilities reflecting income and population projections show approximate balance in meat trade for the developing countries. The projections in Chapter 2 indicate that desired consumption would exceed trend production by nearly 21 million tons. For comparison, total world trade in meat in 1981 was a little more than 8 million tons.

What is at least as relevant as projections of meat production and demand is what may be expected to be the price trends for meat relative to soybean and

cereals. Recent trends have been diverse. Poultry meat prices have fallen in recent years relative to grain and soybean prices while beef and pork prices have increased relative to the grains and soybeans. If the long run costs of producing bovine and ovine meat increase relative to cereals and soybeans, this should have a positive effect upon the demand for isolated soybean protein. Thus policy analysis should consider prospective price trends of competing products. The price trends could be favorable to the growth of use of soy proteins even if the FAO projections of the trade balance for meats in the developing countries turns out to be reasonably accurate. While neither the FAO nor the IFPRI projections include any adjustment for possible price changes, the increase in total meat production in the developing countries by 2000 could be large enough to result in higher relative costs of production than prevailed in the late 1970s.

Chapters 3, 4 and 5 include interesting case studies of the potential demands for isolated soy protein. The countries differ substantially from each other—Sweden is a high income industrial country, Mexico is a middle income developing country and China is the world's most populous country and one of the poorest ones. In recent years, China has undergone major policy reforms in the agricultural sector and has shifted from being a major importer of grains for nearly two decades to a net exporter in 1985/86.

These studies illustrate a number of the important issues raised in Chapter 6. It appears that the profitability of soy protein in Sweden represents financial and not economic or social profitability. Due to a combination of domestic agricultural and trade policies, meat prices to both consumers and producers are substantially in excess of international market prices and especially so for beef. Thus soy protein may be financially profitable without resulting in a saving of resources for the nation.

The very interesting case study for China indicates that under the conditions that prevailed during the first half of the 1980s the importation of isolated soy protein would have been economical for China. This conclusion rested upon the relative costs of importing corn and the soy protein, the feedgrain:hog conversion ratio and the potential savings of domestic transport and marketing resources through the use of soy protein. By the mid-1980s China had become a modest net exporter of grain, including corn. Thus the corn price that should be used became the realized export price of China's corn and this price is substantially lower—perhaps by a quarter or more—than the import cost. In addition to the shift in China's trade position for corn, the international market price of corn has declined substantially though surely there will be recovery from the low prices prevailing in late 1986.

While the Mexican case study is less detailed than the other two, it indicates several reasons why soy protein may have either financial or economic feasibility. In Mexico the existence of a large number of low income families raises the possibility of undernutrition and emphasizes the desirability of measures that will reduce the cost of an adequate diet. Another feature of the