RECONSIDERATION OF FOOD POLICIES IN KOREA*

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I. Introduction

Rapid industrialization and urbanization (under a series of five-year economic development plans started in 1961) has brought about substantial changes in Korea's industrial structure. The main changes include the increasing income disparity between farm and non-farm sectors and massive out-migration of rural labour into cities. The migration has caused labour shortages in rural areas and thus farm wage rates have been rising rapidly in recent years. The rise in farm wages has, in turn, become a main upward pressure on the cost of farm production.

At the same time, the increase in income level has brought about considerable changes in food consumption patterns. In recent years the consumption of food items for which demand is income elastic such as livestock products, vegetables and fruits has increased rapidly. However, food production has lagged behind food consumption, resulting in considerable decreases in food self-sufficiency ratios. The self-sufficiency ratio of grains, including feed grains, has decreased from 94 per cent in 1965 to about 60 per cent in 1979.

The excess demand has caused a rapid rise in food prices in recent years, placing more pressure on the need for imports of agricultural products. However, agricultural imports have depressed farm prices, thus widening the income disparity between farm and non-farm sectors. Under these circumstances, the food problem facing Korea is concerned with how to meet the rapidly increasing food demand more efficiently with the limited resources available. In order to achieve the important policy objective of increasing the capacity of food production, price support would be essential. High food prices are, however, contrary to the government's

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price stabilization policy to maintain the economy's competitive position in international markets.

As the export sector expands, there has been ever-increasing pressure to import agricultural products whose import prices are considerably lower than those of domestic products. Such imports would definitely lower domestic prices. The resulting low food prices could be detrimental to food security by discouraging production efforts capable of meeting the requirements of domestic markets. Therefore, the macro goal of food security in terms of increased levels of self-sufficiency in food supply and supply of food at low prices through international trade needs to be reconciled by appropriate measures. In other words, more realistic workable strategies need to be designed for the optimal protection of the agricultural sector in Korea.

In this paper, an attempt is made to make a systematic analysis of food situations and related problems in the agricultural sector which may lead to a review of future policy options.

II. Evolution of Food Consumption and Production Patterns

1. Food Consumption Patterns

Food consumption patterns are dependent on a large number of factors such as per capita real income, relative price relationships between foods, knowledge of health implications of individual foods, personal tastes and preferences, social status of individual foods, the availability and cost of processed and convenience foods, and government policies and programs aimed at changing food consumption patterns.

As mentioned earlier, rapid urbanization and industrialization have not only created a large increase in the demand for agricultural products, but also caused substantial shifts in urban food consumption patterns toward higher-quality food.

Grain consumption has been declining slightly since 1970, despite the increasing preference for rice, wheat and soybeans. The main reason has been the substantial decline in the consumption of barley which had been the main staple food next to rice until 1976. As shown in Table 1, per capita consumption of barley decreased from 35 kg in 1976 to 14 kg in 1979. It may be natural that barley consumption tends to decrease as income grows since barley is considered an inferior food compared to rice. However, the rapid decrease in barley consumption is partly attributable to the removal of government regulations imposed on rice and barley consumption.

The Korean government has taken several measures since 1967 to encourage consumers to substitute barley and other grains for rice in their diets. For example, restaurants were required to serve a mixture of 75 per cent rice and 25 per cent barley. They were also required to serve

TABLE 1 TREND OF FOOD CONSUMPTION PER CAPITA PER YEAR, 1960–1979

Unit: kilogram

	1960	1965	1970	1975	1976	1977	1978	1979	1979/1970(%)
Food grains:	167.2	188.8	219.4	207.3	203.5	203.9	201.5	198.8	90.6
Rice	112.7	121.8	136.4	123.6	120.1	126.4	134.7	135.6	99.4
Barley	30.3	36.8	37.3	36.3	34.7	28.5	18.1	14.1	37.8
Wheat	11.3	13.8	26.1	29.5	30.2	30.3	30.5	30.6	117.2
Soybean	5.2	4.4	5.3	6.4	6.4	6.2	7.0	7.2	135.8
Potatoes	2.7	7.3	10.2	7.1	7.2	7.1	6.3	6.3	61.8
Maize	0.8	0.9	1.1	2.4	2.9	3.3	2.8	2.9	263.6
Miscellaneous grains	3.7	3.8	3.0	2.0	2.0	2.1	2.1	2.1	70.0
Vegetables	n.a	42.0	59.9	62.5	68.2	62.5	104.0	122.5	204.5
Fruits	n.a	8.2	10.0	14.0	13.1	15.3	16.2	17.4	174.0
Meats:	3.5	3.5	5.2	6.4	6.8	8.1	10.1	11.4	219.2
Beef	0.5	1.0	1.2	2.0	2.1	2.2	3.1	3.0	250.0
Pork	2.3	2.0	2.6	2.8	3.0	3.9	4.8	6.0	230.8
Chicken	0.7	0.5	1.4	1.6	1.7	2.0	2.2	2.4	171.4
Milk	n.a	0.3	1.4	4.6	5.5	7.0	8.8	9.9	707.1
Eggs	1.8	1.7	4.1	4.5	4.7	5.3	5.6	6.1	148.8
Sea Products	n.a	17.8	17.3	29.9	29.8	29.5	25.9	25.9	149.7

Source: Korea Rural Economics Institute (KREI), *Food Balance Sheets*, 1978 and 1979.

noodles and other non-rice food grains on Wednesdays and Saturdays. Lunches carried by school-children had to contain a similar mixture. Furthermore, all restaurants were required to use a standardized size of bowl, smaller in size compared with traditional bowls, in order to reduce the waste of rice after eating. These restrictions applied primarily to the non-farm population. One estimate indicates that these restrictions were responsible for reducing rice consumption by 20 kg per person per year, which amounted to about 717,200 M/T in 1976.[1] In addition to these restrictions, there was also a regulation that rice be coarse-milled to 7 degrees, not fine-milled to the preferred 9 degrees. Making alcohol from rice was also prohibited.

All these restrictions on rice consumption were removed at the end of 1977, the year in which Korea produced a record 6.0 million M/T of polished rice. Consequently, while the consumption of barley declined, rice consumption increased from 126.4 kg in 1977 to 135.6 kg in 1979. The policy of relatively low rice prices followed in recent years can also be regarded as a factor in the rapid decrease in barley consumption.

Wheat consumption increased rapidly from 11.3 kg in 1960 to 29.5 kg in 1975 and then remained fairly constant. Because of the relatively unfavourable conditions for wheat cultivation in Korea, wheat consump-

[1] H.C. Kriesel, "Reconsideration of Rice Policies," interim paper presented to the National Agricultural Economics Research Institute, Korea, October, 1977.

tion historically was very low compared to barley. In the early 1950s, wheat consumption was about 9 kg, i.e. one-third of that of barley. However, large quantities of U.S. wheat had been shipped into Korea under PL 480 grants-in-aid or loans and the shipments seemed to affect greatly the grain consumption pattern, with wheat gradually replacing barley as the main grain next to rice. In 1977 the consumption of wheat began to exceed that of barley (Table 1).

Soybean consumption has been steadily increasing, as shown in Table 1. The consumption of potatoes and miscellaneous grains has tended to decrease since 1970, mainly as they are inferior crops compared to rice, wheat and soybeans.

However, the consumption of income-elastic foods such as meat, dairy products, fruits and vegetables increased markedly, especially during the 1970s. In the period 1970 to 1979 meat consumption more than doubled, from 5.2 kg per year to 11.4 kg, while milk consumption increased about 7 times from 1.4 kg to 9.9 kg, and egg consumption from 4.1 kg to 6.1 kg (Table 1). In this connection, it should be noted that the requirements of grain for feeding livestock increased almost five times from about 0.6 million tons grain equivalent in 1970 to 2.9 million tons in 1979. The consumption of vegetables also increased by 105 per cent and that of fruits by 74 per cent respectively during the same period.

It may be worth noting that Koreans consumed considerably more meat, eggs and vegetables than the Japanese in the mid-1950s; indeed, they consume almost as much food as the Japanese do at present despite the fact that the per capita income in Korea is currently only one-fifth that of Japan. They consume more grains and vegetables per head and almost as much beef and pork as in Japan.

The nutritional status of Koreans has improved steadily as incomes have increased. The average daily per capita intake rose markedly from 1,943 calories in 1962 to 2,599 calories in 1979. The composition of the diet also changed notably, with the proportion of total calories derived from animal products rising from 4 per cent to 10 per cent during the same period. This figure of 10 per cent in 1979 is compared with 35 per cent in Western Europe, 40 per cent in North America, and 46 per cent in Australia and New Zealand.

The energy intake of 2,599 calories in 1979 exceeded by 399 calories the recommended energy requirement of 2,200 calories,[2] but this excess is probably much less than indicated because the intake is estimated on the basis of available per capita supply including various preparation and handling losses and waste, whereas the requirement is based upon the ingested food intake.

[2] Weighted average of recommended calories for each age and sex cohort in the population.

The per capita calorie intake from starch foods has remained stable in recent years while calories from non-starch foods have risen significantly. The starch staple ration (percentage of total calories derived from starch foods) has been about 80 per cent since 1975, indicating that the Korean diet is still heavily dependent upon cereals.

The average daily per capita intake of protein increased by 43 per cent over the period 1962–1979 from 53.2 to 76.2 grams. At the same time, the quality of protein also improved, showing that the proportion of protein from animal and marine sources rose from 14.1 per cent in 1962 to 26.5 per cent in 1979. But the figure for 1979 is still far below that of Japan-48.0 per cent in 1978. Until 1974 the average protein intake was below the requirement of 70 grams but this has been exceeded since 1975.

As shown in Table 2, the intake of nutrients such as Ca, Fe and Vitamin B_2 is less than the recommended requirement and, therefore, needs to be expanded.

TABLE 2 COMPARISON OF PER CAPITA INTAKE AND REQUIREMENT FOR VARIOUS NUTRIENTS, 1979

Nutrient	Unit	Intake	Requirement
Energy	Kcal	2,599	2,200
Protein	g	76	70
Ca	g	0.5	0.7
Fe	mg	13	14
Vitamin A	I.U.	2,968	1,800
Vitamin B	mg	2.0	1.0
Vitamin B	mg	1.1	1.3
Niacin	mg	24	16
Vitamin C	mg	122	52

Source: KREI, *Food Balance Sheet*, 1979.

Up to this point, discussion has centred on national average figures for nutritional intake. There appear, however, to be considerable differences in food intake between regions and between income classes. This implies that a considerable proportion of the population may be vulnerable even if the national average figure exceeds requirements, and detailed analyses with disaggregate data are therefore required in order to identify nutritionally vulnerable groups and their nutritional status. However, such a disaggregate analysis is not yet possible because of a lack of available survey data.

Annex Table A-1 shows the proportion of calorie (and protein) intake from different categories of food. Cereals, together with pulses and potatoes, accounted for about 76.2 per cent of total energy intake and 64.9 per cent of protein intake, indicating the importance of grains in the Korean diet. Rice alone contributed about 49 per cent of energy intake and 32 per cent of protein intake. Livestock products contributed 5.2 per

cent of calorie intake and 12.1 per cent of protein. Fishery products are very important sources of protein, accounting for about 15 per cent of total protein intake.

2. Changes in Production Patterns

Agricultural production is primarily directed towards satisfying human demand for food. Korean farmers who are market-oriented have adjusted their agricultural production to the shift in the food consumption pattern. Table 3 shows the changes in the distribution of land area devoted to crops. The proportion of acreage planted with grains has decreased steadily while the proportion for crops such as vegetables, fruits and cash crops has increased rapidly. It is interesting to note that rice acreage increased slightly during the period 1960 to 1979 while all other grains, pulses and potatoes decreased substantially during same period (Annex Table A–2). This is because rice production has been much more profitable than other grain production at prevailing domestic prices and technologies.

TABLE 3 CHANGES IN THE COMPOSITION OF PLANTED AREA, 1960–1979

Unit: 1,000 ha

Year	Planted Area	Grains	Vegetables	Fruits	Industrial Crops	Others
1960	2,801.9	2,486.3	116.6	22.3	81.8	94.9
	(100.0)	(88.7)	(4.2)	(0.8)	(2.9)	(3.4)
1965	3,318.6	2,953.2	149.4	42.5	60.4	113.4
	(100.0)	(89.0)	(4.5)	(1.3)	(1.8)	(3.4)
1970	3,263.9	2,705.6	254.3	60.2	89.2	154.6
	(100.0)	(82.9)	(7.8)	(1.8)	(2.7)	(4.8)
1975	3,143.6	2,531.3	243.5	74.1	108.9	185.8
	(100.0)	(80.5)	(7.7)	(2.4)	(3.5)	(5.9)
1976	3,173.6	2,482.1	281.4	86.6	123.6	199.9
	(100.0)	(78.2)	(8.9)	(2.7)	(3.9)	(6.3)
1977	3,033.2	2,294.3	293.9	94.2	121.6	229.2
	(100.0)	(75.6)	(9.7)	(3.1)	(4.0)	(7.6)
1978	3,001.1	2,286.4	275.7	94.2	121.7	223.1
	(100.0)	(76.2)	(9.2)	(3.1)	(4.1)	(7.4)
1979	2,908.6	2,143.3	338.7	95.7	118.9	212.0
	(100.0)	(73.7)	(11.6)	(3.3)	(4.1)	(7.3)

The number in the parentheses denotes percentage.
Source: MAF, *Yearbook of Agriculture and Fisheries*, 1964, 1968 and 1980.

The total planted area was 2,802,000 hectares in 1960 and reached a record of 3,337,000 hectares in 1969 before declining gradually to 2,909,000 hectares by 1979 (Annex Table A–3). The rate of decrease of total planted area was faster than that of decrease in the cultivated area, resulting in a considerable decrease in the cropping ratio from 147.1 per cent in 1965 to 130.9 per cent in 1979. The main reason for this decrease

in the cropping ratio was the sharp decline in the acreage planted with grains other than rice (Annex Table A–2). Due to its relatively low profitability and the decrease in consumption level, the planted area of barley decreased from 827,000 hectares in 1965 to 473,000 hectares in 1979. Similarly, the acreage for wheat and miscellaneous grains also decreased rapidly.

Although the acreage planted with grains has decreased, the total production of grains has increased steadily due to the considerable growth of yield. The yield per hectare for all grains together with potatoes and pulses increased at an annual rate of 4.2 per cent during the period 1970–79. Notable increases in yield or land productivity can be seen in such crops as rice, pulses and miscellaneous grains (Table 4).

TABLE 4 CHANGES IN YIELDS OF GRAINS, PULSES AND POTATOES, 1959–1979

Unit: Metric ton/hectare

	1959–61 Average	1969–71 Average	1975	1976	1977	1978	1979	Average Annual Growth Rate (%) 1960–70*	1970–78*	1960–78*
Rice	2.87	3.33	3.83	4.29	4.88	4.71	4.51	1.5	4.4	2.8
Barley	1.77	2.20	2.39	2.47	1.58	2.43	3.19	2.2	1.1	1.7
Wheat	2.16	2.31	2.22	2.22	1.68	2.09	3.21	0.7	0.1	0.4
Potatoes	3.19	4.09	5.04	4.90	4.68	5.02	5.28	2.5	2.5	2.5
Pulses	.51	.75	1.07	1.13	1.19	1.13	1.18	3.9	5.7	4.7
Miscellaneous grains	.42	1.02	1.26	1.55	1.81	2.24	3.34	9.3	11.6	10.3
Average	2.06	2.60	3.03	3.30	3.47	3.60	3.78	2.4	4.2	3.2

* Based on three-year average centered on the corresponding year.

Source: MAF, *Yearbook of Agriculture and Fisheries,* 1980.

The value added in agriculture increased at only 4 per cent per year from 1960 to 1979, which is far below the growth rate of about 16 per cent in the manufacturing sector. However, in recent years the growth rate of agriculture has been considerably better than its performance of only 2.5 per cent annually between 1950 and 1960. It was also considerably better than in many other countries. For example, the real annual average growth in agriculture, forestry and fishery production between 1960 and 1970 was 4.5 per cent, and between 1970 and 1978 was 4.0 per cent, in Korea, compared with global averages of only 3.4 and 3.1 per cent in middle-income countries and 1.2 and 1.0 per cent in high-income countries for the same period.[3] The main factors accounting for agricultural growth were an increase in the application of purchased inputs and improved varieties of crops and other technological developments.

[3] The World Bank, *World Development Report,* Washington, September 1980.

The changing commodity structure of agriculture is shown in Table 5. Rice is still the dominant farm product, accounting for about 40 per cent of the total value of agricultural production. The share of cereals other than rice, potatoes and pulses as a group has been declining rapidly since 1965. Fruits and vegatables (excluding potatoes) and livestock and its products, however, are steadily increasing their share in the value of agricultural production: all together they accounted for nearly one-half of the total value of agricultural production in the 1970s, compared with about one quarter in the mid-1960s.

TABLE 5 SHARES OF VARIOUS COMMODITY GROUPS IN VALUE ADDED OF AGRICULTURAL PRODUCTION, 1961–1979

Unit: percentage

Commodity	1961	1965	1970	1975	1979
Rice	59	39	37	41	39
Other cereals, potatoes, pulses	25	26	18	17	11
Fruits	1	2	3	4	4
Vegetables	4	10	14	15	22
Livestock and its products	5	11	15	11	17
Others	6	12	13	12	7
Total	100	100	100	100	100

Source: Ministry of Agriculture and Fisheries (MAF), *Yearbook of Agriculture and Fisheries.*

The changing volumes of production of various agricultural products are summarized in Annex Table A–4. The total production of grains, potatoes and pulses tended to increase until 1978 due to the increase in yield, although acreage planted with these crops has decreased substantially in recent years. During the period 1970–79, the production of total grains increased at an annual rate of 1.9 per cent which is slightly higher than the population growth rate of 1.7 per cent. Per capita production of major products reached a peak of 228 kg in 1976; it tended to decrease slightly thereafter, mainly due to a decrease in the production of rice, barley and potatoes.

Rice production increased remarkably from 3.9 million tons in 1970 to 6.1 million tons in 1977. This represents an annual growth rate of 4.1 percent which is considerably higher than the population growth rate during the same period. The area devoted to rice production has remained almost the same over the past two decades—around 1.2 million hectares (Annex Table A–2). Thus, the increase in rice production has been achieved primarily by raising yields. The yield of polished rice per hectare increased considerably from 3.3 M/T in 1970 to 4.9 M/T in 1977 (Table 4). However, it has decreased somewhat since 1978, due mainly to damage from diseases, particularly in high-yielding rice varieties.

Barley production, on the other hand, has been declining sharply in recent years in spite of the increase in yield, due mainly to a decrease in

acreage. The unwillingness of farmers to expand barley production is due to its declining profitability. Another factor is the competition in terms of labour between barley and rice, especially at planting and harvesting seasons.

Wheat production has become insignificant, as shown in Annex Table A–4, largely because early-maturing barley varieties are now more suitable for growing in winter between rice crops on paddy. Imports of wheat under PL 480 can also be regarded as one of the main factors contributing to a lower self-sufficiency ratio of wheat.[4]

The production of pulses, including soybeans, increased until 1977 and then tended to decrease thereafter, due mainly to low profitability resulting from the rapid increase in soybean imports.

The growth rates of livestock production are generally much higher than those of grains, as shown in Annex Table A–5. Beef production increased at an annual growth rate of 11 per cent during the 1960s and has, since 1975, slowed down to 6.6 per cent. Pork production, on the other hand, increased at an annual rate of 5 per cent during the 1960s but increased to 11 per cent during the 1970s. During the period 1975–79, chicken production increased at an annual growth rate of 13 per cent and milk about 26 per cent. The rapid increase in milk production was possible because the government imported a large number of dairy cows in order to meet the increasing demand for milk.

III. Food Demand and Supply Situations and their Prospects

One of the most critical problems facing Korea's food sector is, as discussed earlier, the rapid decrease in food self-sufficiency. In this section an attempt is made to analyse the changes in food self-sufficiency, food demand prospects, and the capacity for meeting food requirements.

1. Changes in Food Self-Sufficiency

The concern for self-sufficiency and food security has grown in the past decade or so, especially since the food crisis of 1973. Thus, maintaining food self-sufficiency at a reasonable level has been a major objective of agricultural policy in many Third World countries, as well as in the developed countries. The traditional concept of food self-sufficiency is usually restricted to own (domestic) production for own consumption and this concept thus has focussed only on food supply.

However, the OECD Development Centre's research proposal suggests that food self-sufficiency should be viewed in a broader and more dynamic

[4] Kim, Sang-Gee, 'The Impact of PL 480 Shipments on Prices and Domestic Production," unpublished MS Thesis, the University of Tennessee, Knoxville, Tennessee, 1971.

context.[5] This would mean paying adequate attention to such factors as technology, other factor inputs, and to other policy objectives such as nutrition, food security, and aspects of international trade (balance of payments, foreign exchange, export structure, etc.). In other words, food self-sufficiency should be examined within the framework of overall resource endowment and development strategies.

The measurement of self-sufficiency can be developed for a specific food commodity, group of commodities, and all commodities. The self-sufficiency rate for an individual food commodity can be calculated without much difficulty. However, some difficulties do arise in computing the self-sufficiency rate for groups of commodities or all commodities, mainly due to their heterogeneity.

Food self-sufficiency for all food or for a group of food commodities can be measured in terms of the value of domestic production of food of agricultural origin as a percentage of total supplies. However, this concept is misleading since it does not take account of the feed grains imported for livestock production. Food self-sufficiency can also be measured based on calories, which is a common measurement for all food items. Korea's food self-sufficiency measured in terms of calories has decreased from 85.2 per cent in 1968 to 74.4 per cent in 1979 (Table 6). This means that about 25.6 per cent of energy supplied in 1979 was dependent upon unstable and unpredictable foreign markets and shipments. The per capita supply of energy can be broken down into two components: (i) that which is produced domestically, and (ii) that dependent upon imports, as shown in Table 6. In this case, the proportion of energy produced domestically by using imported raw materials are taken as import-dependent.

TABLE 6 CHANGES IN FOOD SELF-SUFFICIENCY RATES, 1968–78

Year	*Daily Per Capita Supply of Energy*			Food Self-Sufficiency Rate (B/A)
	Total Supply (A)	Domestic Production (B)	Import Dependent	
	Kcal			%
1968	2,276	1,940	336	85.2
1971	2,469	1,873	596	75.9
1974	2,371	1,923	448	81.1
1975	2,390	1,886	504	78.9
1976	2,414	1,939	475	80.3
1977	2,427	1,853	574	76.3
1978	2,533	1,884	649	74.4

Source: Joo, Yong-Jae, *An Analysis of the Demand and Supply of Major Food Commodities* (in Korea), Research Report No. 9, KREI, 1980.

[5] Duncan Miller, *Food Self-Sufficiency: Preliminary Reflections on Concepts and Measurements*, OECD Development Centre, 1979.

Table 7 shows self-sufficiency rates for various food groups. Food commodities such as potatoes, fruits, vegetables and fishery products are nearly 100 per cent self-sufficient while those commodities such as sugar, oil and fats are almost totally dependent upon imports. In 1979 the self-sufficiency ratio for cereals, excluding feed grains, was about 81 per cent and that of pulses about 63 per cent. About 40 per cent of livestock product consumption was estimated to be dependent on imports. In this connection, it should be noted that the imported feed grains were taken into account as raw materials in computing the self-sufficiency rate for livestock products.

TABLE 7 SELF-SUFFICIENCY RATES FOR VARIOUS FOOD GROUPS, 1978

Food Group	Daily Energy Availability per Capital			Food Self-Suffiency Rate (B/A)
	Total (A)	Domestic Production(B)	Import Dependent	
		Kcal		%
Cereals	1,812.6	1,462.6	350.0	80.7
Potatoes	81.6	81.6	0	100.0
Pulses	113.1	71.6	41.5	63.3
Sugar	121.5	0	121.5	0
Nuts	1.8	1.8	0	100.0
Oilseeds	6.5	5.7	0.8	87.7
Vegetables	84.6	83.9	0.7	99.2
Fruits	23.1	23.1	0	100.0
Meat	77.2	49.0	28.2	63.5
Eggs	21.4	14.2	7.2	66.4
Milk	16.5	11.0	5.5	66.7
Fish	60.9	60.9	0	100.0
Seaweed	1.9	1.9	0	100.0
Oils & Fats	109.9	16.5	93.4	15.0
(Vegetable)	55.0	15.8	39.2	28.7
(Animal)	54.0	0.7	54.2	11.3
Total	2,532.6	1,883.8	648.8	74.4

Source: Estimated by KREI from *1978 Food Balance Sheet.*

2. Demand Prospects for Major Food Commodities

The major factors affecting consumption growth will be growth in per capita income and population, demand elasticities and changes in consumer prices. The population growth rate dropped rapidly from 2.18 per cent in 1970 to 1.58 per cent in 1979. Population growth decreased steadily at an annual average rate of about 0.088 per cent points per year during the period 1970 to 1974 and 0.029 per cent points during the period 1974 to 1979.

The Economic Planning Board has projected that the population will grow at a rate of 1.55 per cent during the Fifth Five-Year Economic Development Plan period starting in 1982. For the present demand projection,

the population growth rate was assumed to be 1.64 per cent (although it appears to be slightly over-estimated), which is the average growth rate during the five-year period 1974 to 1979.

Regarding Korea's growth rate in real national income over the 1980s, it is generally accepted that the high growth rate of 11 per cent achieved during the last 16 years could not be maintained for the following reasons.

First, the world economy as a whole has been growing much more slowly in recent years than in the 1960s and early 1970s, and this slow growth is expected to continue, thus providing more pressure for continued protection against imports of manufactured goods from developing countries.[6] This in turn will definitely depress Korea's export growth prospects. Second, oil prices are expected to rise continuously at least through the early 1980s, worsening Korea's terms of trade with the rest of the world since it is entirely dependent on oil imports. With these factors, and the negative income growth performance of 1980, the Economic Planning Board expects a 7 to 8 per cent average growth per annum in real GNP during the Fifth Five-Year Economic Plan period. This would suggest an approximately 6 per cent growth rate in per capita income.

Under the assumption of a population growth rate of 1.64 per cent, an income growth rate of 6 per cent, and constant price relations, demand projections for various food commodities were made by using income elasticities of demand, as shown in Tables 8 and 9.

Per capita consumption of major food commodities has been projected for 1986, which is the last year of the Fifth Five-Year Economic Development Plan period. Per capita grain consumption is expected to decrease slightly from 199 kg in 1979 to 191 kg in 1986, mainly due to the decrease in the consumption of barley and rice, although the consumption of grains such as wheat, maize and soybeans is expected to increase during the same period. As a result, one may expect the Korean government to try to slow down the rate of decrease in barley consumption as a means of reducing rice consumption below the level estimated in Table 8.

On the other hand, the consumption of income elastic food commodities such as fruits, milk and meat is expected to grow substantially. For example, the consumption of fruits is estimated to increase by 65 per cent and that of meat by 56 per cent during the period from 1979 to 1986. It is interesting to note that beef consumption is likely to increase most rapidly among meats if relative meat prices remain constant. This may be due to the fact that Korean consumers have a strong preference for beef relative to pork and chicken.

Table 9 indicates actual and projected total consumption of major food commodities. This projection, including food and non-food uses, was

[6] The World Bank, *World Development Report*, Washington, September 1980.

TABLE 8 ACTUAL AND PROJECTED PER CAPITA CONSUMPTION OF SELECTED FOOD COMMODITIES, 1979 AND 1986

Unit: Kilogram

Item	Income[a] Elasticity	1979(A)	1986(B)[b]	B/A(%)
Grains & Potatoes	—	198.8	191.3	96.2
Rice	−0.09	135.6	130.1	95.9
Barley	−1.09	14.1	8.8	62.4
Wheat	−0.10	30.6	31.9	104.2
Maize	1.24	2.9	4.8	165.5
Soybean	−0.45	7.2	8.7	120.8
Potatoes	−0.44	6.3	5.2	82.5
Miscellaneous grains	−0.31	2.1	1.8	85.7
Vegetables	—	125.9	145.1	115.3
Fruits		20.9	34.4	164.6
Meats	—	11.4	17.8	156.1
Beef	1.20	3.0	4.9	163.3
Pork	1.08	6.0	9.3	155.0
Chicken	1.06	2.4	3.6	150.0
Eggs	1.03	6.1	9.3	152.5
Milk	3.43	9.9	36.8	371.7

[a] Joo, Yong-Jae, *An Analysis on the Demand and Supply of Major Food Commodities (in Korea)*, Research Report 9, KREI, 1980;
Huh, S.H. "Demand Projections for Meat, Egg and Milk in Korea for 1978–1986 (in Korea)," in *Korea Rural Economics Review*, Vol. 1., No. 3, 1978.

[b] The projection was made on the assumption of a 6 per cent income growth rate per annum based on the 1979 consumption level.

made in order to measure approximately the capacity of Korean agriculture to meet food requirements in relation to its land constraints. The component of non-food uses includes seeds, feed, industrial uses and losses. For conventional purposes, the total consumption of these non-food uses was estimated from food consumption estimates on the assumption that the ratio of food and non-food consumption in 1986 remains the same as in 1979. The estimates of non-food uses so obtained are reasonably close to the Firth Five-Year Development Plan prepared by the Ministry of Agriculture and Fisheries.

By using the above estimate of total consumption, an attempt was made to estimate the planted area required to achieve the target level of self-sufficiency for various crops, as shown in Annex Table A–6. It was assumed that such crops as rice, barley, potatoes, miscellaneous grains, vegetables, and fruits are produced domestically and the remaining items such as wheat, maize and soybeans are maintained at 1979 self-sufficiency levels. In this case, the self-sufficiency rate of grains in 1986 will be around 55 per cent. Under these assumptions, the planted area required for various crops was estimated by dividing the targeted total consumption by the

TABLE 9 ACTUAL AND PROJECTED TOTAL CONSUMPTION OF SELECTED FOOD COMMODITIES, 1979 AND 1986

Unit: 1,000 M/T

Item	1979			1986		
	Food	Nonfood	Total	Food	Nonfood[a]	Total
Grains & Potatoes	7,756	4,902	12,658	8,379	5,767	14,146
Rice	5,099	669	5,768	5,476	502[b]	5,978
Barley	530	351	881	370	245	615
Wheat	1,431	310	1,741	1,670	362	2,032
Maize (excluding feedgrain)	109	354	463	202	658	860
Soybean	271	404	675	366	547	913
Potatoes	237	337	574	219	311	530
Miscellaneous grains	79	26	105	76	25	101
Feedgrains	—	2,451	2,451	—	3,117[c]	3,117
Vegetables	4,735	3,430	8,165	6,107	4,424	10,531
Fruits	786	91	877	1,448	168	1,616
Meats	426	0	426	748	0	748
Beef	113	0	113	206	0	206
Pork	224	0	224	389	0	389
Chicken	89	0	89	153	0	153

[a] Estimated from 1979 non-food uses on the assumption that the ratio of food and non-food uses remains constant as in 1979.

[b] Rice was assumed not to be used for brewing in 1986.

[c] Estimate made by Bureau of Livestock, MAF.

corresponding yield estimated separately. As shown in Annex Table A-6 the total planted area required to achieve the above target food self-sufficiency rates was estimated at 2,491,000 hectares, which is slightly lower than that of 1979. The decrease in the total planted area is mainly due to the decrease in the acreage of barley, which is a winter crop and has no competition from summer crops. The total planted area, excluding barley, in 1986 was estimated to be about 2,254,000 hectares, which is about 152,000 hectares greater than that in 1979. This would imply that all food crops cannot be produced domestically, mainly due to land constraints. In other words, it is hard to maintain the 1979 self-sufficiency rates for crops such as soybeans and maize with the above production targets even if the current arable land remains the same and a considerable increase in land productivity is assumed to be realized. This result suggests that more emphasis should be placed on the increase of arable land and land productivity in order to maintain an adequate level of food self-sufficiency. With such tight land constraints, it is urgently necessary to utilize the scarse land in the most efficient way in order to maximize food production.

VI. Alternative Food Strategies and Their Implications

1. Main Problems Facing the Agricultural Sector

As indicated earlier, in the course of industrialization a rapid structural transformation has been made in the agricultural sector since 1970. In this process, the agricultural sector has been faced with several critical problems such as a drastic decrease in the food self-sufficiency rate and a substantial increase in the income gap getween farm and non-farm sectors. The self-sufficiency rate of grains, including feed grains, has decreased to about 60 per cent in 1979. This implies that about 40 per cent of the people's daily food supply is dependent on foreign markets and shipments. The food self-sufficiency rate is likely to decline further as population and income increase. It has been estimated that the rate is likely to fall below 40 per cent in the near future unless considerable efforts are made to increase domestic food production. Therefore, food security has been a subject of growing interest in Korea as in many other nations, both developed and developing. On the other hand, the income gap between farm and urban households has been increasing since 1976, as shown in Annex Table A–7. In 1979 per capita real farm household income was only 60.1 per cent that of urban households. In this connection it may be noted that there exists seome difficulties in comparing farm and urban household income, due mainly to the differences in sampling procedures. For example, small farms with holdings of less that 0.1 ha, the landless, and agricultural labourers are all excluded in the survey of farm household income. These exclusions lead to a probable over-estimation of farm household income. Moreover, farm household income is a mixed income including return on fixed assets like land, while urban household income is mainly wage earnings. Despite these difficulties in comparing the two income sources, the data indicate a tendency of increasing income disparity between farm and urban households since 1976. Under these considerations, food policy needs to be focused on how to maintain an adequate level of food self-sufficiency and also raise farm income to a level comparable to the non-farm sector.

The goal of food policy is, of course, to maintain a stable food supply at a reasonably low price so that all segments of the population have access to the food they need at any time.

However, there exist some conflicts between producer and consumer prices. While high prices are necessary to provide an incentive to producers to increase food production, the price level required by producers may, in a given situation, lie beyond what the poor section of consumers are able or willing to pay. In other words, low food prices may be beneficial to consumers but will adversely affect farmers' welfare and food production.

In order to solve the above conflicting goals simultaneously, the Korean government has adopted a dual price system for main food grains, namely rice and barley since the early 1970s. However, the system has caused a large grain management deficit, which is a source of inflation since it has been financed through overdrafts from the Central Bank rather than drawn from the national budget. Accordingly, there has been in recent years a strong movement to eliminate this grain account deficit as well as the fertilizer management deficit as a means of curbing inflation. In fact, the real purchase price of rice has tended to decline since 1976. Under these circumstances, a further lowering of the purchase price and a reduction of the amount of the government purchase of rice and barley as a means of eliminating the deficit would definitely depress the production of these grains and farm income, increase foreign exchange needs and eventually reduce the degree of food self-sufficiency. In this connection, it should also be understood that the deficits from the grain and fertilizer management accounts have contributed significantly to the stabilization of food prices by releasing government rice and barley at a low price and by stimulating food production by means of adequate price support and fertilizer subsidies.

At the same time, there has been ever-increasing pressure to import food with low international prices as a means of maintaining an international competitive position of export-oriented industries by stabilizing domestic food prices at low levels. In relation to this, it may be necessary to analyse the implications of food imports on various sectors of the economy.

2. Implications of Food Imports

The argument for importing food is based on the neo-classical theory of comparative advantage. This theory suggests that it is beneficial to acquire food through trade, if a country's comparative advantage is such that it can acquire more food by allocating its resources to producing non-food exports and trade them for imported food.

First of all, it may be worth examining the basic assumptions underlying the comparative advantage theory. The theory assumes full employment and a perfectly competitive market, which are non-existent in the real world. Moreover, farm resources such as labour and land are hardly transferable simultaneously to other more economically-viable industries in the economy. This is particularly true in Korea where farmers have very limited alternative uses for farm land and limited off-farm job opportunities. The theory also assumes constant production functions for a given commodity traded between countries since the theory is based on static equilibrium. However, the efficiency of production may change over time through technical innovation and so the comparative advantage can also be changed over time. Because of its limitations, the argument for

importing food based on this theory may not always be justified.

Since food is one of the basic human needs as a wage good, the import of food will cause substantial impacts on various sectors of the economy. For example, the import of food may contribute to the stabilization of food prices in the short run, but such imports will definitely lower domestic food prices and, in turn, depress farm income and output, and further increase dependency on foreign markets. In Korea's experience, the import of wheat under PL 480 shipments contributed to the alleviation of food shortages after the Korean War but had adverse effects on domestic wheat production.[7] Besides this, it is now generally agreed that the long-run aggregate supply elasticity for agriculture is greater than one, and that unfavorable farm prices have significantly reduced agricultural output and economic growth in many developing countries.[8] The decrease in food production would, in turn, result in a decline in the sale of manufactured goods and indirectly reduce employment and income in urban areas. In this case, stable food prices are no longer a sufficient condition for food security.[9] In rural areas, where the real income of a household is directly affected as a result of fluctuation in its own production, stability of food consumption in a farm household can no longer be achieved merely through domestic price stability.

Heavy reliance on international markets for staple food supplies is also risky because the market is rather small compared with world consumption and production. For example, the volume of rice traded worldwide accounts for only 3–4 per cent of world production, indicating that the trade of rice would be sensitively affected by a small change in output due to weather conditions or an increase of import demand by large grain-consuming countries. Therefore, there is no guarantee that world rice prices will always be lower than those on domestic markets.[10] Moreover, there is also the possibility that the amount of rice required may not be easily purchased when needed, even if willing to pay a high price, especially when the amount of rice available for world trade is small compared with the import demand. Similar, though less dramatic, results can also be envisaged for other food grains such as wheat, maize and soybeans for which the market is wider. In addition, there is also a possibility that food could be used as a political weapon, as was demonstrated by Wallensteen.[11] Thus, because of the uncertainty of food supply and prices in the

[7] Sang-Gee Kim, *op. cit.*, p. 30.

[8] Wills L. Peterson, "International Farm Prices and the Social Cost of Cheap Food Policies," in *American Journal of Agricultural Economics*, Vol. 61, No. 1, February 1979, pp. 12–21.

[9] Hartmut Schneider, *A Review of Selected Issues on Food Production and Distribution*, OECD Development Centre, 1980.

[10] The grain price in Korea in 1973–75 was generally lower than that on the international markets.

international markets, the goal of a high degree of food self-sufficiency for major staples should be one of the prime targets of Korean national planners.

Another constraint on the import of food would be the availability of foreign exchange. The rapid rise in oil prices will create growing pressure on the demand for foreign exchange for importing oil since Korea is entirely dependent on such imports. The import of oil in 1979 accounted for about 16 per cent of total imports. Under the prospects of a continuous rise in oil prices, the high growth achieved during the last decade or so may not be contiuned since Korea's terms of trade with the rest of the world are likely to be worsened. Under these circumstances, agriculture could be taken as a viable import substitution industry.

On the other hand, the increase in the income gap between the farm and non-farm sectors resulting from food imports will also create a series of economic and social problems. In Korea the income gap has accelerated rural—urban migration, casing labour shortages in rural areas. Moreover, the quality of farm labour has also deteriorated because the migrants consisted mostly of young educated men, leaving a higher proportion of the aged and women on the farms. Some may argue that rural-urban migration is a natural phenomenon in the process of industrialization, but this process has been so rapid that farmers have not had time to make the smooth structural adjustments necessary to solve their problems.

The shortage of farm labour has caused farm wage rates to increase substantially, resulting in a considerable increase in food production costs. If the prices of agricultural products do not compensate the rate of increase in farm wages and other input prices, farm income will drop and will, in turn, further accelerate rural-urban migration.

The impact of such a vicious circle could generate escapist attitudes on the part of farmers and have a negative impact on the solidarity of the rural community. Therefore, a certain degree of agricultural protection seems to be inevitable to retain capable young men on the farm and to accelerate a balanced growth of the national economy in the future.

At the same time, the over-population of urban areas due to such migration has also created various social problems such as a shortage of housing and increased unemployment rates in the cities. Furthermore, it has increased marginal costs of social infrastructure such as education, transportation and water facilities. Thus, the development of agriculture and the rural community is essential not only for farmers' welfare but also for preventing such undesirable social and economic disfunctions from increasing in urban areas.

In view of national food security and social equity considerations,

[11] As cited in Duncan Miller, *New Policy Responses to Food Insecurity*, OECD Development Centre, Paris, December 1980, pp. 20–22.

and the accumulated burden of foreign exchange, heavy reliance on importation for food supply would not be desirable in the long term, although food imports are imperative for short-term food security.

In conclusion, food is now too strategic to be left to the uncertainties of comparative advantage. It is, therefore, necessary to pursue a wide range of policies to stimulate domestic food production, to redistribute income, and to conserve foreign exhcnage resources.

3. Alternative Strategies to Increase Food Self-Sufficiency

Food security at the national level must be defined as the ability of the national production, marketing and trade systems to provide all segments of the population with adequate food even at times of adverse production and international market conditions.[12]

In broad terms, the supply of food comes from two major sources: (a) domestic production, and (b) imports from abroad. Heavy dependence on imports for food would not be favorable in the long run, as was discussed earlier, so the main emphasis of food policy in the long term must be the increase of domestic food production. However, it should be noted that a high degree of food self-sufficiency will not be tantamount to a high degree of food security since fluctuations in food production due to weather conditions, for example, may affect much more severely a country relying mostly on domestic supplies than one which imports from a variety of geographical areas. Therefore, the implications of various degrees of food self-suffciency at the national level for major products have to be carefully examined with regard to the geographical pattern of supply.[13] This may imply that food production and procurement need to be diversified in order to minimize the risk of food shortages due to unfavorable weather conditions.

The drive towards greater food self-sufficiency may require reallocation of resource flows within agriculture. However, the resource reallocation needs to coincide with the general goals of employment and income policies-that is, it is necessary to explore closer linkages between agriculture and other sectors of the economy and institutionalize continuous flows of technological innovations in agriculture.

Food production can be increased either by expanding arable land or by improving land productivity. As mentioned earlier, farmland is one of the most constraining factors to increasing food production in Korea. Moreover, it is expected that farmland will be further encroached upon

[12] Alexander H. Sarris, "Grain Imports and Food Security in an Unstable International Market," in *Journal of Development Economics,* Vol. 7, No. 4, 1980.

[13] OECD Development Centre, *Summary Report of a Meeting of Collaborating Research Institutions-Food for All: The Capacity of Developing Countries to Meet Their Food Requirements,* March 1980, p. 6.

in the process of urbanization and industrialization, thus depressing food production capacity. Therefore, workable strategies are needed for new land development, including reclamation and tidal land development, in order to expand or maintain an adequate level of farmland area. According to the survey undertaken by the Office of Rural Development, there are about one million hectares of mountainous area which can be converted into upland or pasture land. In order to maintain or slow down the rate of decrease in farmland, it is necessary to turn part of the mountainous area into arable land or pasture land to the extent that this is economically feasible. Another survey made by the Agricultural Development Corporation indicates that there are approximately half-a-million hectares of tidal land to be developed, as mentioned earlier. As the price of productive land for industry or farming steadily goes up, the development of new land, which was not economically justifiable previously, has now become increasingly feasible. Nevertheless, such programs generally require large initial investment and thus there is a limit to expanding farmland. Therefore, emphasis should also be placed on the increase of land productivity in the short term.

For the development of land productivity, it is necessary to provide minimum incentives via adequate price support. However, high producer prices are contradictory to the stabilization of consumer food prices. It should also be noted that policies supporting producer prices benefit larger producers more than smaller farms since the former have a higher share of marketable surplus. Moreover, high producer prices may marginalize even further smaller producers when they are net purchasers of food. Therefore, the increase of food production via price support has some limitation, and emphasis also needs to be placed on increased productivity through land rearrangement, labour-saving practices, improvement of irrigation and storage facilities, and technical improvements.

In order to provide production incentives, it is also essential to restrict food imports to a reasonable level which will not depress domestic food prices and further destroy the production capacity. It might be justified to import staple foods such as rice when its production is short of demand because the shortage will severely affect the nutritional status of the people, particularly that of low-income groups. However, the import of beef, for example, may not be justified, depending on the economic situation of the country.

In 1979 Korea imported about 42,746 tons of beef which accounted for about 38 per cent of total beef consumption. These imports may have contributed to the stabilization of domestic beef prices, but also had various undesirable effects. For example, the low beef prices depressed farm income and domestic beef production. The number of fattening cattle, excluding milking cows, decreased from about 1.6 million head in 1979 to about 1.4 million in 1980, mainly due to low profitability resulting from

beef imports. At the same time, the low beef prices increased beef consumption, thus reducing in relative terms the consumption of substitute meats such as pork and chicken. The decreased consumption further depressed the prices of these meats. The import of beef has been regarded as one of the main factors which brought about a recession in the livestock industry in 1979 and 1980.

Korean consumers have a strong preference for beef over other meats in comparison with neighbouring Asian countries. The Korean's per capita meat consumption in 1979 was 11.3 kg, of wh·ch beef accounts for 3.0 kg. whereas the average Japanese consumed annually 22.5 kg in 1979, of of which 3.4 kg was beef, and the Taiwanese per capita beef consumption was 1.1 kg in 1977, although they eat as much as 35.4 kg of meat per person annually. The reasons for this preference of Korean consumers for beef seem to lie mainly in the cooking methods and eating habits of the population. In Korea meat has been traditionally consumed in the form of soup for which beef is more suitable, and it is regarded to be superior to pork and chicken. Also, cooking methods for pork have not been developed in Korea to the same extent as, for example, in Taiwan which has a high pork consumption.

Furthermore, it may be worth examining who benefits and who suffers from beef imports. Of course, most of the benefits from imports will go to the relatively-high income groups since beef is generally consumed by these groups. On the other hand, it will be most detrimental to small farmers who raise cattle. It should be noted that cattle raising is one of the largest income sources, next to rice, for farmers in Korea. Under these circumstances, it is desirable to restrict the import of luxury foods such as beef as much as possible in order to protect the domestic livestock industry and induce a balanced consumption of animal protein foods.

One of the most important factors in the increase of land productivity is the improvement of research and extension services. It is likely that the returns to an expanded public investment in the development and dissemination of new farm technologies would be very high.[14] When new technologies are introduced to the farm, production functions will shift to the right. It will then lead food prices to fall, all other things being equal. In this case, consumers will benefit from low food prices resulting from technological development. On the other hand, if the rate of decrease in price is lower than the rate of increase in production, farmers will also benefit from such research-induced technical progress.

In this connection, it may be indicated that the financial allocation to research and extension in agriculture has been very low in Korea, ac-

[14] See W. Fished (ed.), *Resource Allocation in Agricultural Research,* University of Minnesota Press, 1971, and J.N. Feerris, et al., *Investment Priorities in the Korean Agricultural Sector,* Korea Agricultural Sector Study Team, 1972.

counting for about only 0.6 per cent agricultural GNP. This, together with the low rate of investment in agricultural infrastructure, could be listed as one of the factors in the low productivity of agriculture in Korea. It is therefore necessary to substantially increase investment in these activities. A nationwide integrated program of research and extension should be undertaken, as well as the provision of modern technical inputs to farmers, to ensure food security via increased food production.

With respect to the adoption of new technology, the size of a farm is a significant constraint, and some adaptive change is therefore required in the prevailing land tenure system in order to realize the potential gain of technology. Productivity increases could be achieved in particular by raising the arable land ownership ceiling above the present 3 hectares, by legalizing land leasing and facilitating contract or group farming, and by reducing the extent of progression of land taxes. With respect to the suggestion of the relaxation of the 3-hectare ceiling, many criticisms may arise because such a provision may accelerate the speculative demand for farmland, causing a decrease in land productivity. Effective measures should therefore be taken to prevent any such speculative demand for farmland.

Recently, the use of chemical fertilizers and pesticides has increased remarkably, causing soil pollution and even deteriorating soil fertility. Low soil fertility can be regarded as one of the main factors which has caused a drastic decrease in rice production in recent years. From the data available, it can be seen that, under unfavorable weather conditions, rice yield from the land with poor soil fertility has decreased more drastically than that from the land with good soil fertility. Therefore, effective measures should be introduced to conserve soil fertility by increasing the application of organic fertilizers like compost and animal manure. Thus, it should be noted that maintaining a linkage between crop enterprise and the livestock industry is essential for improving soil fertility as a means of keeping food production capacity at a high level in the long term.

Another factor which would contribute to increased food production is the retaining of a quality labour force and operators on the farm. This is because the young capable men tend to lose interest in farming occupations, mainly due to poor wages and high risks,[15] limited opportunities for better education and cultural activities, and inadequate rural infrastructure. Minimum incentives are therefore necessary to make farming economically viable. These incentives may include farm price policies not distoring resource allocations on the farm and cautious international trade liberalization policies which do not result in unfairly low prices for domestically-produced farm products which are strategically important. In

[15] By 1981 there was still no crop insurance system but the government has begun to consider its introduction.

addition, it is also necessary to introduce a crop insurance system in order to stabilize farmers' incomes against wide fluctuations in production due to weather conditions.

So far, alternative strategies to increase food production have been discussed. However, food problems cannot be solved merely by achieving a quantitative balance between overall demand and supply. Temporal, spatial and social factors affecting the demand must also be taken into consideration. There may still be large segments of the population whose food supplies are insecure mainly due to an inefficient marketing system or unreasonable food prices, even if the food supply is stable for a nation as a whole.

Another problem relating to food marketing is the existence of wide marketing margins between producer and consumer levels. As shown in Table 10, the margins range from 45 per cent to 111 per cent, depending upon commodities. The reduction of marketing margins could be beneficial not only for consumers but also for producers, and great emphasis needs therefore to be placed on the improvement of the food distribution system.

TABLE 10 MARKETING MARGINS OF MAJOR FARM PRODUCTS BY MARKETING STAGES, 1979

(As % of the price received by farmers)

Classification	Apple	Peach	Chinese Cabbage	Yellow Mellon	Garlic	Red Pepper
Total Margin	61.2	76.6	110.8	87.2	45.1	44.5
Collecting Point	20.7	20.5	29.3	27.5	14.8	13.2
Wholesaling Stage	18.5	23.3	36.8	24.2	16.3	17.1
Retailing Stage	22.0	30.8	44.7	35.5	14.0	14.2

Source: S.H. Kim, *Towards Modernization of Agricultural Marketing System in Korea,* presented at the Seminar on the Agricultural Adaptation Process in Newly Industrialized Countries, 15–20 September, 1980, Seoul, Korea.

It may also be necessary to pay greater attention to the demand aspect from the national point of view relating to health, nutrition and welfare. Food policy should be formed to satisfy an adequate level of nutritional requirements for all, and assure that this is done in the most economical way. Therefore, linking nutritional status to agricultural production should be an established component of a comprehensive food policy.

The consumption of animal-origin food is relatively low in Korea and thus should be increased to a reasonable level. However, excessive intake of livestock products is not desirable in the sense that it will definitely decrease food self-sufficiency. For example, the import of feedgrains has increased about tenfold during the last nine years as the demand for livestock products increased. Conseuqently, the self-sufficiency rate for all grains has decreased from 94 per cent in 1965 to 60 per cent in 1979, and a further substantial decrease is expected, mainly due to the rapid increase

in demand for feedgrains. Furthermore, excessive consumption of livestock products is not recommendable from the health point of view. One research report indicates that a diet based on a small quantity of food of animal origin and cereals, legumes, green vegetables and oils will supply all physiological needs.[16] Therefore, it seems to be desirable to induce a food consumption pattern suitable to the local resource endowment in Korea to maintain an adequate level of food self-sufficiency. While food consumption patterns cannot be changed radically in a short period of time, it may be possible to bring about the desired change through price mechanisms and nutrition education in the long term.

In order to increase food self-sufficiency with limited land resources,

TABLE 11 SUPPLY COSTS OF SELECTED FOOD COMMODITIES IN TERMS OF NUTRIENTS, 1979

Food Item	Energy Production Per Hectare	Supply Cost Per Ton	Energy Content Per Ton	Protein Content Per Ton	Cost Per 1,000 Kcal	Cost Per 100 gr. of Protein
	'000 Kcal	'000 Won	'000 Kcal	Kg	Won	Won
Grains & Potatoes						
Rice	15,334	311	3,400	65	91	478
Barley	10,718	237	3,360	104	70	229
Wheat	8,750	205	2,726	69	75	297
Maize	15,984	223	3,490	91	64	245
Soybean	5,010	563	4,040	366	139	154
Other Pulses	3,079	645	3,110	200	207	323
Potato	7,162	102	677	23	151	443
Sweet Potato	27,316	40	1,206	10	33	400
Miscellaneous grains	3,477	735	3,190	120	230	613
Livestock Products						
Beef	—	3,279	2,610	180	1,256	1,822
Pork	—	1,294	3,170	145	408	892
Chicken	—	646	1,260	207	513	312
Eggs	—	629	1,424	113	442	557
Milk	—	208	690	38	301	547
Sea Products						
Sea Products	—	201	674	116	298	173
Shells	—	280	259	48	1,081	583

Source: Joo, Y.J., et. al., "A Linear Programming Model for the Supply and Demand Planning for Food," in *Korea Rural Economics Review*, Vol. 4, No. 2, 1981.

[16] FAO, *Food and Nutrition Strategies in National Development*, 1976, p. 34. The specific requirement for animal foods is to supply vitamin B-12. If the needs for vitamin B-12 were met by means of food processes involving selected bacterial or mould systems, there would be no mandatory requirement for foods of animal origin. However, animal products are good sources of a variety of essential vitamins and minerals, as well as protein and fat, and nutritional adequacy is more easily achieved if the diet includes at least small amounts of these foods.

great emphasis should be placed on the production of crops with high yield potential and nutritional value. For example, rice has been a basic staple food, accounting for about 50 per cent of energy intake, and is also regarded as one of the preferred grains of Koreans. As shown in Table 11, the energy productivity of rice is one of the highest next to the sweet potato. It is for this reason that the Korean government has placed great emphasis on achieving self-sufficiency in rice. However, rice production has lagged behind consumption, resulting in considerable imports in recent years. Under these circumstances, continuous efforts should be made to increase rice production through adequate production support systems and technical improvements including new rice varieties with high resistance to diseases and cold temperatures. At the same time, it is also desirable to restrict the consumption of rice by increasing barley consumption. For this, effective measures should be taken to develop processing techniques or cooking methods for barley in order to diversify its uses and broaden consumer acceptance. It is also necessary to maintain adequate relative prices between rice and barley in order to induce substitution of barley for rice.

As the demand for livestock products increases, the demand for feedgrains is expected to increase steadily, causing a considerable decrease in the food self-sufficiency rate. It may be desirable therefore to control the consumption of liverstock products at a reasonable level by expanding the supply of fish or soybeans which are low-cost protein foods compared to livestock products, as shown in Table 11. It is also necessary to increase the production of roughage on the paddy field during the winter season (after the rice is harvested) and to upgrade the efficiency in animal feeding methods as a means of reducing the demand for feedgrains.

It may be argued that it is cheaper to import meat directly rather than import tremendous amounts of feedgrains, but this is not desirable as it will depress farmers' incomes substantially since the livestock industry has become a more important source of farm income as the demand for livestock products increases. This argument is reinforced by the fact that there is a limit to increasing farm income from food grains such as rice and barley due to physical production constraints; there is also a limit to price supports for these grains. Off-farm income could be an alternative source of farm household income, but only in the long term since tremendous investment in rural infrastructure and rural industrialization is required in order to increase off-farm job opportunities. It is interesting to note that the proportion of off-farm income to farm household income increased only 7.1 percentage points over ten years (from 24.2 per cent in 1970 to 31.3 per cent in 1979).

One study indicates that Korea has a comparative advantage for the production of livestock products, except beef.[17] Therefore, it is recommendable to produce part of the meat supply domestically by importing feed-

grains rather than importing the final products. However, some amount of beef imports seems inevitable since Korea has a limited capacity of beef production.

Vegetables and fruits are perishable, bulky compared to their value, and have high transportation costs. It is generally recognized, therefore, that domestic production of these products has definite advantages over importation. However, the production of these crops has been very unstable because of weather fluctuations and over-reaction of the producers to price movements. More efforts should thus be made to stabilize the prices of these crops by stabilizing the supply. For this it may be necessary to develop an agricultural outlook system and induce regional specialization in these crops.

The demand for soybeans, wheat and maize is expected to increase substantially as the population and incomes increase. On the other hand, the domestic production of these grains is extremely limited, due to land constraints and relatively low yields. Consequently, a great effort needs to be made to increase land productivity for these grains through high-yielding varieties and improved cultivation practices. In any case, it is desirable to maintain and strengthen a minimum production level for long-term food security purposes.

In recent years, Korea has imported more than 5 million tons of grain annually. These grain imports are expected to increase further as the demand for livestock products and soybeans increases. Thus, it is also essential to develop a grain-importing system including institutional arrangements in order to secure more stable imports at more stable prices. For this, it is urgently required that the government or private agents participate more actively in international grain markets and obtain information on the grain market situation as quickly as possible. Since more than 90 per cent of grain imports have come from the United States, it may also be desirable to diversify the sources of imports in order to avoid the risks which may result from the concentration of grain imports from one particular country. Furthermore, it is important to adjust the selling price of imported grains in such a way that disincentive effects on the domestic grain sector are avoided. At the same time, the gains obtained from selling imported grains need to be reinvested in the agricultural sector in order to improve its productivity.

Finally, it is generally known that a considerable proportion of food is lost in the process of distribution from producer to final consumers. Consequently, great emphasis should be placed on the improvement of post-harvest techniques such as milling, storage and transporation, in order to increase the effective supply of food by minimizing losses.

[17] Huh, Shin-Haeng, *A Study on Comparative Advantage for Livestock Products in Korea*, Korea Rural Economics Institute. 1980.

IV. Concluding Remarks

The rapid growth of the Korean economy since the mid-1960s has transformed the agricultural sector significantly. As a consequence of the high economic growth in the industrial sector, the agricultural sector has suffered from such problems as decreasing food self-sufficiency and widening income disparity between farm and non-farm sectors.

Pressure to increase food imports based on the comparative advantage theory has to be seen against this background. However, careful analyses of the international grain markets suggest that food is now too strategic for Korea to be left largely to the uncertainties of international trade in a politico-economic world context which refuses an international division of labour in accordance with the comparative advantage theory. Therefore, increased food production and higher efficiency in that sector should be taken as prime objectives of economic policies, particularly in a country like Korea which has about one-third of the population engaged in agriculture. In other words, the role of agriculture as a basic industry, though declining in relative importance, should not be neglected in the process of industrialization.

In order to maintain an adequate level of food self-sufficiency and also reduce the income gap between the farm and non-farm sectors, it is essential to maintain adequate price supports and stabilization. Also, it is imperative to make greater efforts to improve agricultural productivity in order to upgrade the welfare of the whole population.

In this connection, it should be noted that the relatively-low agricultural productivity in Korea is mainly due to low investment in this sector. It is, therefore, urgently necessary to substantially increase investment in agricultural infrastructure to ensure improved productivity.

Effective measures to increase off-farm income should also be taken in order to raise farm household income to a level comparable to the non-farm sector. However, long-term measures to increase agricultural productivity through structural change and technical innovation, and to expand non-farm job opportunities, have to be accompanied by adequate price support policies for some time to come. In other words, it is desirable to gradually adjust the level of price support, depending on the increase of agricultural productivity and off-farm income in the economic situation prevalent in Korea.

In conclusion, the authors believe that adequate protection of agriculture resulting in a high degree of self-sufficiency in strategically-important foods is essential in order to ensure food security and achieve balanced economic and social development in Korea.

TABLE A-1 PER CAPITA DAILY SUPPLY OF CALORIES AND PROTEIN BY FOOD GROUPS, 1979

Food	Energy Kcal	Proportion %	Protein g	Proportion %
Cereals	1,804.5	69.4	38.7	50.8
Rice	1,266.6	48.7	24.2	31.8
Barley	134.7	5.2	4.2	5.5
Wheat	320.9	12.3	8.1	10.6
Pulses	114.7	4.4	10.0	13.1
Potatoes	62.8	2.4	0.8	1.0
Sugar	141.7	5.5	0.0	0.0
Vegetables	113.3	4.4	5.8	7.6
Fruits	23.8	0.9	0.2	0.3
Livestock Products	134.7	5.2	9.2	12.1
Fishery Products	65.4	2.5	11.2	14.7
Others	137.8	5.3	0.3	0.4
Total	2,598.7	100.0	76.2	100.0

Source: KREI, *Food Balance Sheet,* 1979.

TABLE A-2 CHANGES IN THE SHARE OF AREAS PLANTED WITH GRAINS, PULSES POTATOES, 1960-1979

Year	Total	Rice	Barley	Wheat	Potatoes	Pulses	Miscel-leneous Grains
				1,000 ha			
1960	2,486.3	1,121.1	641.4	75.9	107.0	318.8	222.1
	(100.0)	(45.1)*	(25.8)	(3.1)	(4.3)	(12.8)	(8.9)
1965	2,953.2	1,228.1	827.0	92.9	212.6	365.4	227.2
	(100.0)	(41.6)	(28.0)	(3.1)	(7.2)	(12.4)	(7.7)
1970	2,705.6	1,203.3	730.3	96.7	180.4	365.2	129.7
	(100.0)	(44.5)	(27.0)	(3.6)	(6.7)	(13.5)	(4.7)
1975	2,531.3	1,218.0	711.0	43.7	146.3	332.7	79.6
	(100.0)	(48.1)	(28.1)	(1.7)	(5.8)	(13.1)	(3.2)
1976	2,482.1	1,214.9	711.0	36.7	136.1	312.4	71.0
	(100.0)	(48.9)	(28.6)	(1.5)	(5.5)	(12.6)	(2.9)
1977	2,294.3	1,230.0	515.6	26.5	127.3	326.5	68.4
	(100.0)	(53.6)	(22.5)	(1.2)	(5.5)	(14.2)	(3.0)
1978	2,286.4	1,229.7	554.4	17.1	112.6	313.8	58.8
	(100.0)	(53.8)	(24.3)	(0.7)	(4.9)	(13.7)	(2.6)
1979	2,143.3	1,233.2	473.3	13.1	94.8	276.8	52.1
	(100.0)	(57.5)	(22.1)	(0.6)	(4.4)	(12.9)	(2.5)

* The figure in parentheses denotes percentage.

Source: MAF, *Yearbook of Agriculture and Fisheries,* 1980.

TABLE A–3 TREND OF CULTIVATED LAND, TOTAL PLANTED AREA AND CROPPING RATIOS, 1960–1979

Year	Area of Cultivated Land			Total Planted Area	Cropping Ratio (%)
	Total	Paddy	Upland		
			1,000 ha		
1960	2,024.8	1,206.3	818.5	2,801.9	138.4
1965	2,256.4	1,286.2	970.2	3,318.6	147.1
1970	2,297.5	1,273.0	1,024.5	3,263.9	142.1
1975	2,239.7	1,276.6	963.1	3,143.6	140.4
1976	2,238.2	1,290.0	948.2	3,173.6	141.7
1977	2,231.2	1,303.2	928.0	3,033.2	135.5
1978	2,221.9	1,312.0	909.9	3,001.1	134.5
1979	2,207.1	1,311.0	896.1	2,908.6	130.9

Source: Ministry of Agriculture and Fisheries, *Yearbook of Agriculture and Fisheries*, 1980.

TABLE A–4 CHANGES IN PRODUCTION OF GRAINS, PULSES AND POTATOES, 1959–1979

Unit: 1,000 M/T

	1959–61	1969–71						Average Annual Growth Rate(%)		
	Average	Average	1975	1976	1977	1978	1979	1960–70*	1970–78	1960–78
Rice	3,219.5	4,009.1	4,669.1	5,215.0	6,005.6	5,797.1	5,564.8	2.2	4.7	3.3
Barley	1,135.1	1,588.9	1,699.9	1,759.4	813.6	1,348.0	1,508.2	3.4	−3.2	0.4
Wheat	164.7	213.0	96.9	81.6	44.7	35.7	42.0	2.6	−18.4	−7.3
Potatoes	336.2	756.1	737.6	666.6	595.2	565.3	501.0	8.4	−3.8	2.8
Pulses	166.2	270.8	356.9	352.4	389.9	354.5	326.1	5.0	3.5	4.3
Others	107.3	134.1	101.4	109.0	120.9	127.2	170.1	2.3	0.5	1.5
Total	5,219.0	6,972.0	7,661.8	8,184.0	7,969.9	8,227.8	8,112.2	3.1	1.9	2.6
Per Capita Production(Kg)	205.0	216.7	217.2	228.2	218.7	222.3	215.7	0.6	0.1	0.4

* Estimates based on three-year average centered on the corresponding year.
Source: NAF, *Yearbook of Agriculture and Fisheries*, 1980.

TABLE A–5 TRENDS OF PRODUCTION FOR MAJOR LIVESTOCK PRODUCTS, 1960–1979

Unit: 1,000 M/T

	1960–62	1969–71							Average Annual Growth Rate* (%)		
	Average	Average	1974	1975	1976	1977	1978	1979	1961–70	1070–78	1975–78
Beef	14.4	36.7	51.5	70.3	74.6	77.4	74.3	86.5	11.0	10.1	6.6
Pork	52.0	79.8	95.4	186.7	113.6	146.3	171.6	218.7	4.9	10.6	10.7
Chicken	17.4	45.8	53.3	55.6	60.9	73.1	82.2	89.7	11.4	7.5	13.0
Milk	1.2	49.0	126.9	162.4	20.7	262.4	329.0	380.7	51.0	26.6	25.7

* Estimate based on three-year average centered on the corresponding year.
Source: Ministry of Agriculture and Fisheries

TABLE A-6 PROJECTION OF PLANTED AREA REQUIRED FOR VARIOUS FOOD CROPS, 1986

Crop	1986 Total Demand Projected	Self-Sufficiency Rate[a]	Domestic Production (A)	Average Yield for 1980 Year[b]	1986 Projected Yield[c]	1986 Planted Area Required	1979 Planted Area
	'000M/T	%	'000M/T	Kg/10a	Kg/10a	'000 ha	'000ha
Cereals	14,146	55.2	7,804	—	—	1,972	2,143
Rice	5,978	100.0	5,978	456	492	1,215	1,233
Barley	615	100.0	615	262	259	237	473
Wheat	2,032	2.4	49	220	333	15	13
Maize	3,977	3.4	135	277	472	29	32
Soybeans	913	43.4	396	117	144	275	207
Potatoes	530	100.0	530	496	503	105	95
Miscellaneous grains	101	100.0	101	95	105	96	90
Vegetables	10,531	100.0	10.531	2.167	2,670	394	339
Fruits	1,616	100.0	1,616	801	1,296	125	96
Total						2,491	2,575

a) Rice, barley, potatoes, miscellaneous grains, vegetables and fruits are assumed to be produced domestically and grains such as wheat, maize and soybean are assumed to maintain self-sufficiency rates at 1979 level.

b) Average Yield of 3 years from 1975 to 1979 excluding the two extreme years of the lowest and the highest.

c) Yield projection made by MAF for Fifth Five-Year Plan.

TABLE A-7 CHANGES IN FARM AND URBAN HOUSEHOLD INCOMES, 1970–1979

Unit: 1,000 Won

Year	Nominal Income			Real Income*.					
	Per Household			Per Household			Per Capita		
	Rural (A)	Urban (B)	A/B	Rural (C)	Urban (D)	C/D	Rural (E)	Urban (F)	E/F
			%			%			%
1970	255.8	381.2	67.1	580.0	776.4	74.7	98.0	145.4	67.4
1971	356.4	451.9	78.9	715.7	811.3	88.2	122.8	153.7	79.9
1972	429.4	517.4	83.0	761.3	831.8	91.5	133.3	157.8	84.5
1973	480.7	550.2	87.4	780.4	857.0	91.1	136.4	163.2	83.6
1974	674.5	644.5	104.7	833.7	807.6	103.2	147.3	155.0	95.0
1975	872.9	859.3	101.6	872.9	859.3	101.6	155.0	166.9	92.9
1976	1,156.3	1,151.8	100.4	925.8	999.0	92.7	167.1	197.8	84.5
1977	1,432.8	1,405.1	102.0	980.0	1,106.3	88.6	177.5	232.4	76.4
1978	1,884.2	1,916.3	98.3	991.2	1,318.9	75.2	184.2	281.8	65.4
1979	2,227.5	2,629.6	84.7	1,030.3	1,529.7	67.4	198.1	329.7	60.1

* Farm household incomes are deflated by the corresponding price index paid by farmers and urban household incomes by the retail price index.

Source: MAF, *Report on the Results of Farm Household Economy Survey*, 1980.
EPB, *Annual Report on the Family Income and Expenditure Survey*, 1979.