

# DEVELOPMENT OF THE AGRICULTURAL FOOD PROCESSING INDUSTRY IN TAIWAN

Tze-Ching Lin  
Food Technology and Processing Section  
Department of Animal Industry  
Council of Agriculture, Executive Yuan  
37 Nan Hai Road, Taipei 106, Taiwan ROC

## ABSTRACT

*Agriculture enhanced both the industrial and economic development of Taiwan. Through the years, however, its contribution to the Taiwanese economy has declined, but it remains a necessary sector as it is closely linked to people's way of life and survival. Thus, the domestic food industry, an extension of agriculture, has continued to create an enormous demand for agricultural products to meet the nutritional requirements of the population. In the face of international free trade, however, only those high-quality and value-added agricultural products could survive the highly competitive world market. Food processing brought added value to farm products, lengthened products' shelf life, and widened their distribution area. With economic development, rising per capita incomes, higher life expectancy, and women's employment rates, the Taiwanese people have been putting more emphasis on the nutritional and health value of the food they eat, in addition to its hygiene and convenience. Hence, the Council of Agriculture (COA), Taiwan's central authority in charge of the island's agriculture, has been working on the framework and strategies to promote the agricultural food processing industry in Taiwan.*

Keywords: Agricultural food processing, value-added agricultural products, processed food industry, agricultural production index

## INTRODUCTION

During the early stages of Taiwan's economic development in the 1960s, agriculture served as the core of the economy, offering inexpensive food, raw materials, foreign exchange capital, a strong labor force, and a market for industrial products. The great contributions made by agriculture to Taiwan's economy enhanced both the industrial and economic development of the island. High production in the agricultural sector before the mid-1960s allowed Taiwan to realize its goal of using agriculture to foster its budding industrial sector. As a result of this orderly economic development, agriculture not only provided Taiwan with agricultural products, but also raised livelihood opportunities and created a better living environment for its people. Thus, in the face of these changes, agricultural development was gradually transformed from an economic to a societal goal. In view of this, despite the fact

that its status in the total economy will probably continue to decline, the importance of agriculture will never be overlooked. No matter how insignificant its role may appear to be in the progress of economic development, agriculture will always remain a necessary sector closely linked to people's way of life, not to mention that humans need food to survive.

The food industry is a very important component of Taiwan agriculture. In the earlier stage of the Taiwanese economy, the processed food industry made use of huge amounts of agricultural products for export, earning considerable foreign exchange to help develop our economy. The rural economy developed prosperously through agricultural products sold to food factories and workers employed in these factories. In recent years, trade liberalization allowed the importation of several food and agricultural products into Taiwan. However, domestic food industries

have continued to create an enormous demand for agricultural products, including contracted crops and seasoning agricultural products.

### FOOD PRODUCTION AND SUPPLY

Taiwan has achieved rapid economic growth since the end of World War II. Between 1952 and 2002, the average annual growth rate of its gross national product (GNP) was 8.3%, and its per capita GNP rose from US\$186 to US\$12,900. During the same period, the annual growth rate of its agriculture sector was 3.1 percent, which was less than that of the industrial and service sectors. Consequently, agricultural production as a percentage of gross domestic product (GDP) fell from 32.2% in 1952 to 1.9 percent in 2002 (Tables 1 and 2).

In 2001, Taiwan had an agricultural population of 3.69 million, or about 16.50% of its total population. Its farming households

totaled around 726,000 with each farm size averaging about 1.1 ha. Of the total employment, agricultural employment (labor force) accounted for 7.5%, of which 15% is around 20-44 years old; 52%, about 45-64 years old; and 32%, above 65 years old. Farm-employed population was 708,000 in 2001, a decrease of 0.3% from 2000 (Table 3). The steady decrease caused the rise of wages for agricultural workers, which in turn accelerated the shift of agricultural production from being labor-intensive to labor-efficient, as opposed to simply intensifying land utilization (COA 2002a).

### Indices of agricultural production

In 2002, the agricultural production index was 104.08, an increase of 4.08% over 2001. Looking at the production indices for various categories, it can be observed that crop

Table 1. Major agricultural economic indicators

Agricultural sector	Unit: %	
	1952	2002
Agri. production as % of GDP	32	1.9
Agri. population as % of total population	52	16.5 (as of 2001)
Agri. employment as % of total employment	56	7.5
Agri. exports as % of total exports	92	2.4
Agri. imports as % of total imports	34	6.3
Composition of agricultural production		
Crops	69	43.3
Forestry	7	0.3
Fishery	9	26.4
Livestock	16	30.0

Table 2. Taiwan's GDP by industry (%) (at market prices)

Period	Total		Agriculture	Industry	Service
	(US\$ million)	(%)	(%)	(%)	(%)
1952	1,675	100.0	32.2	19.7	48.1
1961	1,751	100.0	27.4	26.6	46.0
1971	6,592	100.0	13.1	38.9	48.0
1981	48,218	100.0	7.3	45.5	47.2
1990	160,173	100.0	4.2	41.2	54.6
1996	279,611	100.0	3.2	35.7	61.1
2000	309,426	100.0	2.1	32.4	65.5
2001	281,178	100.0	2.0	31.1	67.0
2002	281,508	100.0	1.9	31.0	67.1

Table 3. Farm households, farm population, and farm labor force

Year	Farm households (1,000 households)	% of total households	Farm population (1,000 persons)	% of total population	Farm employment (1,000 persons)	% of total employment
1952	680	45.5	4,260	52.4	1,642	56.1
1960	786	40.5	5,370	49.8	1,742	50.2
1970	880	33.6	6,000	40.9	1,681	36.7
1980	891	23.8	5,390	30.3	1,277	19.5
1990	860	16.9	4,290	21.1	1,064	12.9
1999	787	12.1	3,750	17.0	776	8.3
2000	721	10.8	3,670	16.5	740	7.8
2001	726	10.7	3,690	16.5	708	7.5

Table 4. Indices of agricultural production

Category	2002	2001	Change (%)
General index	104.08	100.00	4.08
Crop products	105.46	100.00	5.46
Forestry products	111.56	100.00	11.56
Fishery products	108.14	100.00	8.14
Livestock products	98.13	100.00	- 1.87

products such as fruits, vegetable, flowers, and rice mostly returned to a normal level after the abnormal weather of the previous year (COA 2002b, c and d). The production index for the crop category consequently rose by 5.46% (Table 4). In the forestry category, the increased output of saw-timber and firewood/bamboo caused the index for forest products to rise by 11.56%. In the fishery sector, an increase in total catch of far sea, offshore, and marine aquaculture attributed to an 8.14% increase in output. In the livestock sector, the reduced output of major livestock such as hogs, cattle, and chickens caused the production index to fall by 1.87% (Table 4).

#### Agricultural production structure

The total agricultural output in Taiwan was valued at NT\$350.5 billion in 2002. Credit for the slightly decreased value of 0.63% over the previous year was mostly attributed to the lowering price of farm outputs, the rebound of crop production, and the increase in foreign product importation as a result of trade liberalization and open market. Of the four

major industries, namely, crop, forestry, fishery, and animal husbandry, crop was the largest category with an output value of NT\$150.9 billion (43.33%); followed by animal husbandry, NT\$105.2 billion (30.0%); and fishery, NT\$92.6 billion (26.4%) (Table 1). Compared with the output value structure of the previous year, animal husbandry's share of total agricultural output grew by 30.0%, crop's share dropped by 5.54%, while fishery's share increased by 2.70 person owing to the rise of inland aquaculture.

The total crop output value was NT\$151.9 billion, a 5.54% decrease over that of the previous year. Fruits accounted for the largest share of crop output with a value of 35.50%, followed by vegetable (23.26%), rice (21.09%), special crops (5.80%), coarse grain (5.3%), and other crops (9%). This breakdown of 2002 crop output figures was roughly the same as that of the previous year (Table 5).

#### Food consumption

The average per capita food supply of Taiwan residents in 2001 included 89.44 kg of cereals (including 50.10 kg of white rice and 33.18 kg

Table 5. Crop output value structure

Year	Output value (NT\$1M)	Percentage of total					
		Rice	Coarse grain	Special crop	Fruit	Vegetable	Others
1998	163,619	21.41	5.85	8.74	35.01	21.75	7.24
1999	170,524	21.57	5.27	7.59	35.41	23.43	6.74
2000	165,214	20.98	5.48	7.93	34.98	23.34	7.30
2001	160,759	20.42	4.58	6.73	36.15	22.87	9.25
2002	151,853	21.09	5.32	5.80	35.50	23.26	9.03
Change, 2002 vs. 2001 (%)	-5.54	-(0.66)	-(0.74)	-(0.92)	-(0.65)	-(0.39)	-(0.22)

Note: ( ) indicates percentage comparisons  
Source: Central Taiwan Office, COA

of wheat flour); 21.6 kg of starchy roots; 25.68 kg of sugar and honey; 24.69 kg of pulses and oilseed; 109.88 kg of vegetables; 134.38 kg of fruits; 76.57 kg of meat; 19 kg of eggs; 35.45 kg of fishery products; 54.37 kg of dairy products; and 23.27 kg of oils and fats. Compared with the 2000 level, apart from slight increases in consumption of wheat flour, consumption of the remaining ten items decreased. The most significant drops were seen in the consumptions of sugar and honey and of fish and seafood, both of which fell in 2001 by more than 10 percent (Table 6).

Taiwan residents' daily per capita intakes of principal nutrients, calculated on the basis of consumption of various types of food, in 2001 were as follows: energy, 2,805 kcal; protein, 92.42 g (including 44.60 g of vegetable protein and 47.83 g of animal protein); and fat, 117.14 g. Compared with the 2000 level, energy, protein, and fat intakes fell by 4.87 percent, 4.43 percent, and 5.27 percent, respectively (Table 6).

A measure of the relative number of calories derived from protein, fat, and carbohydrates (PFC) or the PFC ratio can be used to analyze the structure of the citizens' diets. The ideal PFC ratio is 12: 30: 58. Consumption of principal nutrients was employed to calculate the 2001 Taiwan residents' PFC ratio, which was 13 : 38 : 49. This PFC ratio shows that the Taiwanese diet had too much protein and fat, and too little carbohydrates. Moreover, a dramatic decline in per capita rice consumption occurred over the last half century, from 126 kg in 1952 to 50 kg in 2001 (Table 7).

## UTILIZATION

In the early stage of Taiwan's economic development, agricultural labor was abundant, and the limited cultivated land was utilized very intensively. Since then, the agricultural labor force has declined steadily, with agricultural production gradually shifting from being labor intensive to being capital intensive. Only those high-quality and value-added agricultural products could survive the highly competitive world market. On the other hand, food processing brought added value to farm products, lengthened products' shelf life, and widened their distribution area. Hence, the Council of Agriculture (COA), Taiwan's central authority in charge of the island's agriculture, developed the framework and strategies, following the function of food processing and marketing orientation, to promote the agricultural food processing industry in Taiwan (Fig. 1).

### Mode I

In the early stage of Taiwan's rural food processing industry, most of the farmers processed foods for personal consumption. But the techniques that local farmers had used to preserve their agricultural products were gradually lost because of social structural change. They became an essential part of Taiwan's cultural assets.

From 1976, COA, owing to the surplus produce yields, has begun to promote the Rural Food Processing Project to offset the farmers' economic deficit during the winter season. This project aims to assist farmers to

Table 6. Food consumption

Food type	Year	2001	2000	Change (%)
1. Per capita food supply (kg)				
Cereals		89.44	92.48	- 3.29
White rice		50.10	52.69	- 4.93
Wheat flour		33.18	32.60	1.80
Starchy root		21.60	23.63	- 8.56
Sugar and honey		25.68	28.65	- 10.35
Pulses and oilseed		24.69	26.40	- 6.45
Vegetables		109.88	115.52	- 4.88
Fruits		134.38	136.30	- 1.41
Meat		76.57	79.00	- 3.08
Egg		19.19	19.22	- 0.14
Fish and seafoods		35.45	40.22	- 11.86
Dairy products		54.37	56.04	- 2.97
Oils and fat		23.27	25.06	- 7.13
2. Daily per capita intake of major nutrients				
Energy (kcal)		2,805	2,948	- 4.87
Protein (g)		92.42	96.71	- 4.43
Vegetable protein		44.60	46.13	- 3.32
Animal protein		47.83	50.58	- 5.44
Fat (g)		117.14	123.66	- 5.27

Source: Statistics Office, COA

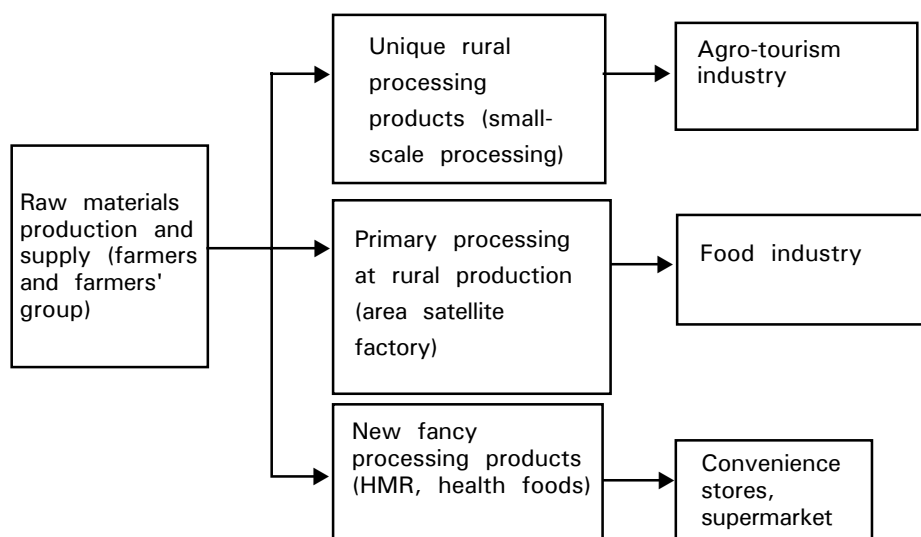


Fig. 1. Framework of strategies to promote the agricultural food processing industry in Taiwan

Table 7. Per capita annual food availability

Year	Polished rice	Wheat flour	Starchy root	Sugar & honey	Pulse & oilseed	Vegetable	Fruit	Meat	Egg	Sea-food	Milk	Oils and fat
1952	126.06	11.33	59.86	9.41	9.86	61.37	16.81	16.82	1.59	15.07	1.17	3.46
1965	132.85	22.33	48.31	10.03	13.56	56.81	21.01	19.21	2.35	27.74	5.30	5.39
1975	130.39	24.21	10.24	18.11	19.01	109.79	55.03	26.98	5.22	35.56	14.98	9.04
1985	80.19	24.96	14.40	25.40	21.87	103.41	111.50	55.75	10.94	35.12	32.91	15.28
1990	65.94	28.65	20.18	27.15	28.98	93.33	131.50	62.89	12.13	47.48	43.92	22.46
1995	59.10	31.88	18.06	24.52	31.71	101.86	137.42	72.76	16.23	38.35	60.62	26.03
1999	54.90	31.66	23.23	25.11	25.81	124.47	148.34	78.09	19.41	43.72	56.72	26.49
2000	54.17	34.28	23.63	28.65	26.40	115.52	136.30	77.81	19.22	40.34	56.08	25.07
2001	50.10	33.18	21.60	25.68	24.69	109.88	134.38	76.57	19.19	35.45	54.37	23.27

Source: Taiwan Food Balance Sheet, COA, Executive Yuan, 2002

utilize the region's surplus in agricultural food processing. It also aims to improve a product's hygiene and packaging, and raise the added value of the final product. Since its inception, the project has supervised over 100 townships, consisting of 300 plus products such as preserved mustard leaves/stems and cucumber as well as dehydrated cabbage, radish, bamboo shoots, mango, longan, and lychee. These tasty unique local processed food products showcased Taiwan's agro-tourism development.

## **Mode II**

The agricultural food processing industry is considered the lower-end industry of agriculture. This industry can add value to agricultural products, thus enhancing their production. In the early days, pineapple, mushroom, and asparagus were all exported in cans. The canning materials were supplied by contract cultivation. Later on, it was replaced by free purchase. After our membership to the World Trade Organization (WTO), we had to establish new supply systems to be more competitive. We recruited agricultural production cooperative societies and farmers' associations to set up specialized satellite factories. These factories produced and packed products according to the food factories' requirements and delivered the semi-finished products directly to production lines. In doing so, the factories reduced the labor and equipment cost for storage, washing, and pre-processing. Today, some of the cooperative societies also produce freshly cut vegetables and fruits for institutional users.

In recent years, some of the cooperative societies have changed from supplying the market with fresh vegetables and fruits into freshly cut ones. Their customers include the army, large enterprises, hospitals, and schools. The quality, quantity, variety and cost of the supply can also become more stable this way. The COA plans to use the CAS Certification System to further upgrade the system and possibly supply the fresh food market with cold salad and freshly cut fruits.

## **Mode III**

With economic development, rising per capita incomes, higher life expectancy, and women's employment rates, the Taiwanese people are putting more emphasis on the nutritional and health value of the food they eat, in addition to its hygiene and convenience. Hence, the COA is working toward this direction.

Chinese food is already quite famous worldwide, thanks to the wisdom and craftsmanship of our ancestors. Our food is also an essential part of our precious cultural assets. Twenty years ago, COA took note of this and began to develop it into frozen forms. Yet, in the process, we had difficulties in preserving the product's original flavor. Together with food science experts, Chinese cuisine specialists, and food industry technicians, we have been trying to upgrade all the techniques concerning material pretreatment, transportation, industrial production, original flavor preservation, packaging, even temperature, safety, and hygiene. Our goal is to bring more varieties and the convenience of Chinese food to the tables of people worldwide.

In order to prevent hypertension, elevated blood glucose, hyperlipidemia, and compromised immune condition, brought by modern-style living, people are paying more attention to consuming a balanced diet and taking health supplements. The National Science Council (NSC) set up a Health Food Inter-Departments Integration and Promotion Subcommittee to administer the annual scientific research cooperation projects of NSC, Health Administration, and COA.

The promotion of Chinese and health foods has been based not only on the research of the techniques, but also a lot on the integration with the marketing channels, meaning, the cooperation among agriculture, food industry, and business sectors. It had to be market-oriented to start with. The promotion of 18 rice desserts was a very good example. The 7-Eleven franchise, using its modernized marketing method, took the lead in integrating farmers, satellite factories, and food industry manufacturers, creating a NT\$5 billion annual market.

## TECHNOLOGICAL NEEDS FOR FUTURE DEVELOPMENT

Faced with a growing competition in free-trade markets, Taiwan has to phase out its passive protection of its agriculture and make its production more consumer market-oriented. Taiwan should do everything possible to enhance its competitiveness in farm production and expand its overseas market. The food processing industry can add value to farm products, making agriculture industrialized and commercialized, transforming it from a primary industry to a secondary and/or tertiary one, and helping farmers to gain profits not only from the land, but also from the outputs of post-harvest technology. This can ensure farmers a steady income from a commodity's production to its marketing.

Strengthened research and development in agricultural food processing industry also become more important. The COA projects now focus on developing unique points of difference such as tasty local foods that are

different from imported ones. Moreover, special interest is placed on blending Chinese cuisine and herb medicine and developing functional foods, cooked and ready-to-eat frozen foods, among other things, to create the market niche for boosting the value of agricultural products.

## REFERENCES

- Council of Agriculture. 2002a. Agricultural production statistics abstract of the Republic of China. COA, Executive Yuan, Taiwan ROC.
- Council of Agriculture. 2002b. Annual agricultural reports. COA, Executive Yuan, Taiwan ROC (in Chinese).
- Council of Agriculture. 2002c. Agricultural statistics yearbook, 2002. COA, Executive Yuan, Taiwan ROC.
- Council of Agriculture. 2002d. Basic agricultural statistics. COA, Executive Yuan, Taiwan ROC.