

CHAPTER IV

RICE PRODUCTION AND RICE MILLING INDUSTRY IN THAILAND AND TAIWAN

This chapter focuses on the background of rice production and the rice milling industry in Thailand and Taiwan, including factors such as rice growing area, rice production, supply and utilization of rice, marketing channels, number and characteristics of rice mills, milling process and milling technology. According to difference of world position and the economy, also geographic locations and fundamental economic information of both countries are explained.

4.1 Description of the study areas

4.1.1 Thailand geographic location

Thailand is located in Southeast Asia covering a geographical area of nearly 514,000 square kilometers, between 5°30' N to 21° N latitude and 97°30' E to 105° 30' E longitude. It shares its border with Burma on the west and northwest, Laos on the east and northeast, Cambodia on the southeast, and Malaysia on the south. It experiences tropical climate with long hours of sunshine and high humidity. There are three seasons, which are hot from March to June, rainy from July to October, and cool from November to February. The average temperature range varies from 20°C to 37°C. The geographic location and climatic conditions provide the opportunity to

successfully cultivate a wide range of tropical and semi-tropical agricultural crops. (International Rice Research Institute (IRRI), 2001)

Agriculture is considered as the Thai economy's largest and most important sector in terms of food self sufficiency and employment. Of the 61,230,874 population as of 1999, 62% depend on agriculture for livelihood. The GDP real growth rate is reported as 4% with GDP per capita \$6,700 (CIA, 2001). The share of GDP by services, industries and agriculture accounts for 47%, 39% and 12% respectively. Although economic growth in nonagricultural sectors has greatly reduced the relative importance of agricultural exports, agriculture still continues to be an important sector.



Figure 4.1 Geographic maps of Thailand and Taiwan

4.1.2 Taiwan geographic location

Taiwan is situated in Eastern Asia between 21°53' N and 25°18' N latitude and 120°01' E and 121°59' E longitude, straddling the Tropic of Cancer. It is 394 km long and 144 km broad at its widest point, covering an area of 36,000 square kilometer. It consists of islands bordering the East China Sea, Philippine Sea, South China Sea, and Taiwan Strait, north of the Philippines, off the Southeastern coast of China (Government Information Office (GIO), Taiwan, 2001).

As two-thirds of Taiwan comprises of mountains or slope land, farming is done mainly in the remaining 29% of the total area. It experiences a subtropical climate characterized by high temperatures and heavy rainfall. These conditions are appropriate for agriculture, but also favor growth of insect pests and diseases. Frequent typhoons in summer and autumn are a menace for farming as they destroy crops.

With a population of 22,191,087 Taiwan recorded a GDP-real growth rate of 5.5% and GDP-per capita of \$16,000 in 1999 (GIO, 2001). Similar to Thailand, service contributes 64% to Taiwan's GDP, followed by industries and agriculture with 33% and 3% share in GDP respectively. Although the contribution of the agriculture sector to employment, gross domestic production, and export value declined, it continues to be at the root of Taiwan's economy, which cannot be slighted. This is not because it provides food, but it acts as a force for social stability in the country. About 800,000 households engage in agriculture with an average land holding of just one hectare (6.25 rai) which is too small for efficient agricultural production. The government has recently attempted to get farmers to enlarge their lands to increase productivity and gain economies of scale. Although only about one quarter of

Taiwan's land area is arable, virtually all farm land is intensely cultivated, with some area suitable for two and even three crops a year. Taiwan's major crops are rice, sugarcane, fruit and vegetables.

4.2 Rice production

4.2.1 Extent and production in Thailand

Rice is the most important crop in Thailand. Even though it is declining in relative importance, it still occupies over half of the total cultivated land. There are two rice-growing seasons in Thailand. The main crop or locally name "wet season crop" is cultivated during June to August and harvested during October to January. The second or dry season crop begins between February and is harvested during April to June. The production from first crop and second crop accounts for 18 million tons and 4 million tons respectively. Total areas cultivated with rice over the last decade have increased by 4.09%, from 61.9 million rais in 1990 to 64.4 million rais in 1999 (6.25 rais = 1 hectare). Of the total rice area, about one-third is irrigated rice, while the remaining represents rainfed rice. Rice production is spread throughout the country's six major regions (Food market exchange, 2001):

- Upper northern: This region concentrates on glutinous rice cultivation, although land is also dedicated to growing other varieties of rice.
- Lower northern: The second largest rice production region, which is suitable for growing many varieties of rice, including white rice and jasmine rice.
- Central plain: Thailand's largest rice production area resides in the central plain, where rice production continues all year round, through each of the

3 possible production cycles in a year. The central plain benefits from massive irrigation systems and a reservoir of enriched land parcels. Rice produced in the central plain is targeted for export.

- Upper northeastern and lower northeastern: These regions are well known for cultivating both glutinous and fragrant rice. However, due to unpredictable climate, droughts and floods, the upper and lower northeastern regions are only suitable for single crop production.
- Southern: It represents the smallest rice growing area of the country. In this region, rice is mostly grown on a small scale and only for regional consumption

Rapid production increase was recorded over the last decade. An increase of 40.59% over 10 years or 4.06% per year from 17.2 million tons to 24.2 million tons during 1990 to 1999 was recorded. The average yield increased from 313 kg/rai to 388 kg/rai or 2.4% per year at the same period.

Table 4.1 Planted area, total production, and average yield of wet season rice and dry season rice in Thailand during 1990/91 – 1999/2000

Year	Planted area (1,000 rais)		Total production (1,000 tons)		Average yield (kg/rai)	
	Wet season	dry season	wet season	dry season	wet season	dry season
1990/91	58,205	3,705	14,902	2291	290	618
1991/92	55,177	4,494	17,518	2282	336	658
1992/93	56,295	4,158	17,302	2615	325	646
1993/94	56,153	3,098	16,483	1964	330	652
1994/95	56,373	4,304	18,161	2950	350	694
1995/96	57,407	5,946	17,729	4287	347	726
1996/97	57,291	6,437	17,782	4550	345	717
1997/98	56,958	7,231	18,789	4791	342	677
1998/99	56,240	6,458	18,663	4336	352	681
1999/2000	56,583	7,861	19,015	5156	347	679

Source: Office of Agricultural Economics, Ministry of Agricultural and Cooperatives, 2000

4.2.2 Extent and production in Taiwan

Taiwan farmers have grown rice for centuries, and their irrigation systems are designed for rice production. On average, each farmer own one hectare of arable land. By Taiwan's estimates, the support for rice ranges from 30 to 40% of the aggregate measure of support to the agriculture sector. Due to this high level of protection, rice remains a dominant crop and is grown on more than 40% of the agricultural land. The hot and humid climate provides a suitable environment for growing rice and for other farm products. Farmers in the north can grow two crops of rice each year while three crops a year is possible in the South. Most of the rice areas are in the Central and Southwestern parts of Taiwan, i.e. Changhwa, Yunlin, Chiayi, Tainan and Taichung (Figure 4.2) There are two growing seasons: the first from January through May and the second from July through December.



Figure 4.2 Map of Hsien in Taiwan

Over the past 25 years, however, Taiwan's rice sector has declined substantially. On one hand, the total planted area had a downward trend, decreasing from 4,939 million rais in 1975 to 2,270 million rais in 1999, a total reduction of 54.05%. This a decline in rice production, (after reaching its peak production of 2.7 million tons in 1976) to 1.56 million tons in 1999. On the other hand, there has been a significant increase in the productivity of land used for rice growing, with the yield per rai rising from 505 kg in 1975 to 706 kg in 1999, an increase of 39.80%. Higher yields per rai are due largely to improved varieties, more and better use of fertilizers and better cultivation methods (Council of Agriculture, 2000). However, rice farming has become less attractive because of increased production as land prices and labor costs have risen. Taiwan has lost the competitive advantage it once held in rice production, supported by low labor cost, land availability, and easy access to water (Lee, 1996).

Table 4.2 Planted area, total production, and average yield of wet season rice and dry season rice in Taiwan during 1990/91 – 1999/2000

Year	Planted area (1,000 rais)		Total production (1,000 tons)		Average yield (kg/rai)	
	wet season	dry season	wet season	dry season	wet season	dry season
1990/91	1,515	1,331	1,063	743	702	561
1991/92	1,422	1,259	1,141	678	802	539
1992/93	1,309	1,174	984	644	752	548
1993/94	1,326	1,121	1,048	772	792	690
1994/95	1,227	1,062	1,007	672	821	634
1995/96	1,235	1,037	988	698	800	673
1996/97	1,143	1,037	909	668	795	648
1997/98	1,263	1,014	1,014	648	803	640
1998/99	1,260	980	935	554	742	568
1999/2000	1,232	975	1,000	559	812	573

Source: Council of Agriculture, Taiwan, 2000

4.3 Rice supply and utilization

4.3.1 Thailand rice consumption and export

Rice consumption in Thailand can be categorized into three classes: direct food, processed foods such as noodles, flour, alcohol and beer, and broken rice and rough rice with bran widely used by farmers for animal feed. The other grains are used for paddy seed and stock. Rice supply and utilization in Thailand are shown in Table 4.3 Domestic consumption of rice has increased every year i.e. approximately 65% of rice consumption annually. The annual excess supply, 35% of total production, export to the world market. The trend in rice production, is exported and domestic consumption from 1993 to 1997 were stable. Stock ran down or piled up in response to production harvested and led to unusual declines and rises of per capita utilization (Wiboonpongse et al., 2000).

Table 4.3 Production, domestic utilization and export of milled rice in Thailand ^(a)

Year	Production (1) (1,000 tons)	Export (2) (1,000 tons)	Domestic (3) use & stock	Per capita (4) (kg / yr)
1981 – 1985 ^(b)	12,177	3,773	8,404	169.1
1986 – 1990 ^(b)	12,433	4,999	7,434	136.9
1991	13,161	4,333	8,828	156.0
1992	12,850	5,117	7,733	134.9
1993	11,901	4,987	6,914	119.2
1994	13,620	4,859	8,761	149.2
1995	14,204	6,198	8,006	134.8
1996	14,408	5,460	8,948	149.1
1997	15,213	5,567	9,646	160.8

Sources: Office of Agricultural Economics, 1984, 1988, 1991, 1994, and 1999

Notes: (a) conversion ratio: paddy = 1 : 1.55

(b) five year average.

(3) = (1) – (2) and (4) = (3) / population.

The average annual per capita consumption has declined only by 4.91% from 169.1 kg of milled rice during 1981-85 to 160.8 kg of milled rice in 1997. Accordingly, rice remains as Thailand's staple food although wheat products are becoming popular. There is very limited direct substitution for rice in traditional dietary habits. Some indirect substitutions occur in large urban centers as a result of increased access to western food.

From a report by the Department of Business Economics, Ministry of Commerce for the 1999/2000 crop, Thailand produced 24.2 million tons of paddy, yielding roughly 16.5 million tons of milled rice. The rice mills production are included with the end stock in the last year and separated to usage in three categories; first, about 9.7 million tons are used for local consumption. Another 10% of total supply is used for stock and last, the excess supply of about 6.8 million tons is exported.

According to the USDA, Thailand is projected to be the world's top rice exporter with approximately 30% share in the world market. It has a reputation for high quality, long-grain, white rice, which usually commands a substantial price advantage over lower grades. Following closely behind is Vietnam at 4.5 million tons, while the United States is ranked third with 2.65 metric tons. As per the Department of Foreign Trade's statistical figures, Thailand's biggest customer, Indonesia, has abandoned importing rice from Thailand and switched to Vietnam. As a result, in 2000, Indonesia's imports dropped tremendously from 1,119,826 to 250,361 metric tons. This drop moved Indonesia from Thailand's number one export destination to number ten. In 2000, Nigeria, Senegal, and Iran, were the three largest export destinations for Thailand's rice. Iraq expanded its import of Thai rice and became the sixth largest export destination from tenth in 1999.

Table 4.4 Thai rice export classified by major importing countries (rank on year 2000)

No	Top major customers	Total ('000 MT)			
		1997	1998	1999	2000
1	NIGERIA	584,567	517,828	683,880	874,151
2	SENEGAL	90,500	174,339	368,711	625,766
3	IRAN	361,785	369,179	335,895	611,198
4	AFRICA	186,593	293,218	321,082	428,910
5	MALAYSIA	458,032	354,905	317,997	330,519
6	IRAQ	187,055	160,150	214,983	288,225
7	SINGAPORE	274,150	254,365	285,040	263,167
8	HONG KONG	248,042	228,098	257,154	254,215
9	INDONESIA	513,944	1,736,452	1,119,826	250,361
10	U.S.A.	214,836	224,298	243,548	243,705

Source: Department of Foreign Trade, Ministry of Commerce, 2000

4.3.2 Taiwan rice consumption, import and export

Rice grown in Taiwan is used for food, feed, seed, processing and brewing. It grows enough rice for its own consumption, since more than 90% of rice grown on the island is consumed as food (Lee, 1996) and exports about 100,000 tons each year. The distributions of rice production, domestic utilization, import and export has dramatically changed into domestic demand of rice.

Table 4.5 Production, domestic utilization and export of milled rice in Taiwan ^(a)

Year	Production (1) (1,000 tons)	Import (2) (1,000 tons)	Export (3) (1,000 tons)	Domestic (4) use & stock	Per capita (5) (kg / yr)
1990	1,806.6	5.7	121.7	1,833.5	65.94
1991	1,818.7	5.9	309.6	1,897.2	62.50
1992	1,627.9	6.3	291.0	1,694.2	62.23
1993	1,819.8	8.6	132.0	1,728.0	60.70
1994	1,617.8	6.0	137.5	1,680.4	59.89
1995	1,686.5	6.2	213.4	1,644.4	59.10
1996	1,577.3	5.7	120.1	1,567.5	58.84
1997	1,662.7	6.2	99.0	1,565.1	58.40
1998	1,489.4	4.7	77.3	1,538.6	56.74

Sources: Council of Agriculture, Taiwan, 2000

Notes: (a) conversion ratio: paddy = 1 : 1.55

(b) (4) = (1) + (2) - (3) and (5) = (4) / population.

Rice consumption has declined over the decades, a result of a strong economic growth and resulting diet diversification. Average per capita rice consumption in 1998 estimated at 56.7 kg was about 14 percent of the level of the previous decade 65.9 kg (Table 4.5). Even though, rice provides about one-quarter of daily calories intake per person.

As Taiwan joined the WTO on January 1, 2002 (Government Information Office, Taiwan, 2001) it promised to open the rice market and import 144,720 tons, about 8% of domestic consumption, of rice in the first years after joining the WTO. Subsequently, there has been increase in import by 2% each year until the ban is totally lifted. Of the 144,720 tons, 35% or 50,720 tons is imported by the private sector and the remaining 65% by the government. From the beginning of 2002, the private sector, food companies and rice milling companies, have imported 10,000 tons of rice from Japan, U.S.A., Australia and Thailand.

4.4 Rice marketing channel

There are various intermediaries involved in the rice marketing system. They are dealers and merchants who purchase and gather paddy from farmers, millers who process paddy to milled rice, and wholesalers and retailers who buy rice at the local and regional levels. At the country level, brokers or commission agents have important roles in rice export, while the government also has a vital role in regulation of rice policy. The paths of rice intermediaries are described below in the rice marketing channel section.

4.4.1 Thailand rice marketing channel

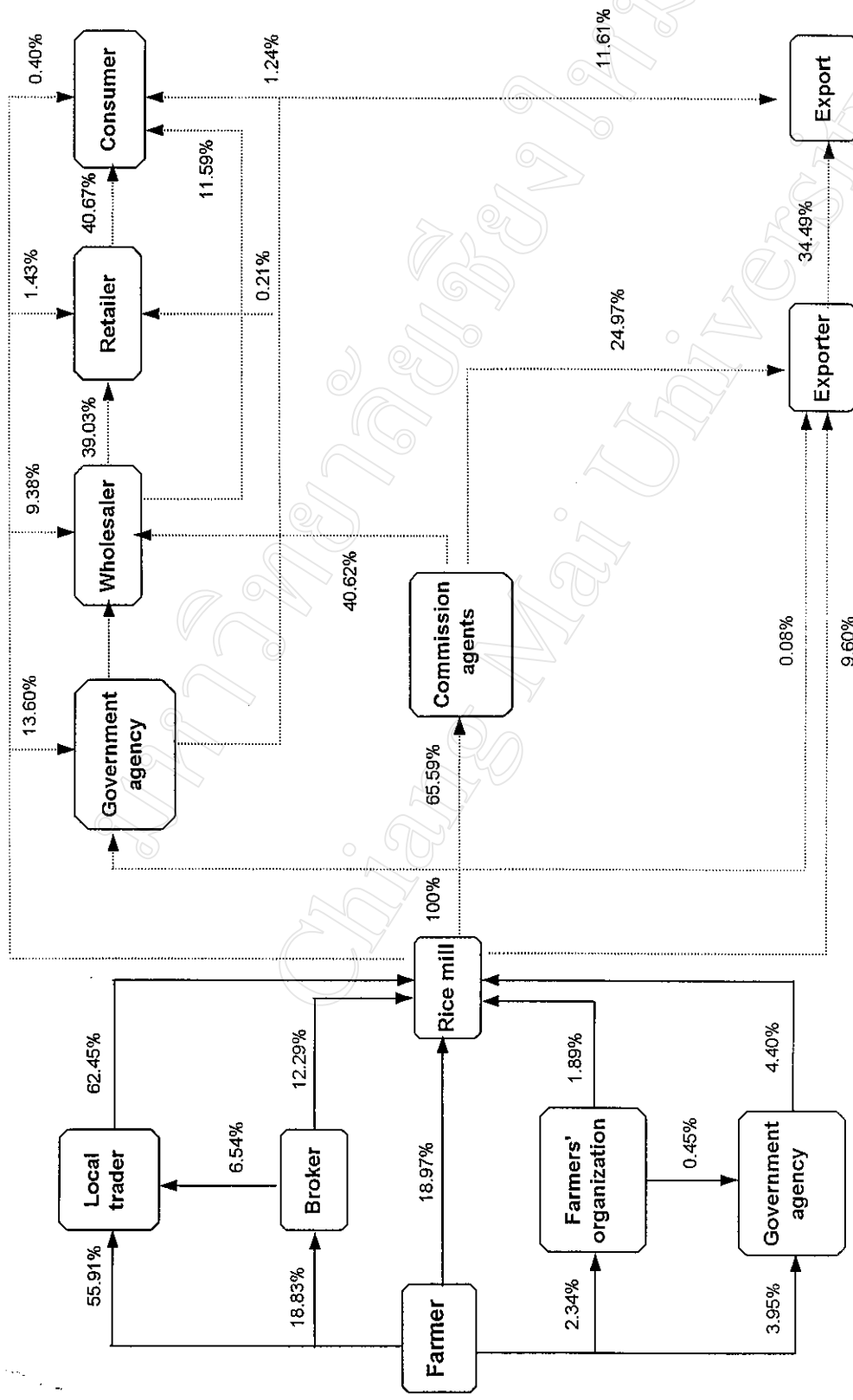
The rice marketing channel of Thailand is depicted in Figure 4.4. The marketing system can be subdivided into two levels. One is the paddy rice market, There are five marketing channels: P1) Farmer-Local trader, P2) Farmer-Broker, P3) Farmer-Rice mill, P4) Farmer-Farmer Organization, P5) Farmer-Government agency. The second level is the milled rice market, where seven marketing channels are involved i.e. M1) Miller-Exporter-Foreign customer, M2) Miller-Broker-Exporter, M3) Miller-Government agency, M4) Miller-Government agency-Exporter M5) Miller-Broker-Wholesale rice trader, M6) Miller-Wholesale rice trader-Retailer and Consumer and M7) Miller-Local consumption.

According to Figure 4.4, the major flow of paddy rice is from farmers to local traders, which accounts for 55.9% of total marketed rice. The direct flow of paddy rice from farmers to millers was approximately 18.9%. The third flow from farmers to brokers accounts for 18.3%. The flow of paddy from farmer to government agent and farmer to farmer cooperatives are in small proportion accounting for only 3.95% and 2.34%, respectively.

The market of milled rice can be classified into international and domestic markets, which account for 58% and 42% respectively. With respect to export markets, 9.6% of milled rice flows from the rice mill to exporters, 24.97% from Commission agents, representing 34.49% of export market from exporters. While only 11.7% is exported by government agencies. The main flow of milled rice in the domestic market (consumers) is from miller to wholesale traders amounting to 40.62% through commission agents, millers supply 9.38% to wholesale traders and

1.43% to retailers and while 0.40% is supplied directly from millers to local consumers. At the same time, 39.03% of milled rice flows from wholesalers to retailers and 11.59% to consumer. Government agencies receives 13.60% of milled rice from the rice mill, of which 0.62% flows to wholesaler, 0.21% to retailer and 1.24% to consumer.

มหาวิทยาลัยเชียงใหม่
Chiang Mai University



Source: Office of Agricultural Economy Zone 13, 1997

Figure 4.3 Marketing channel of rice in Thailand, 1996

4.4.2 Taiwan rice marketing channel

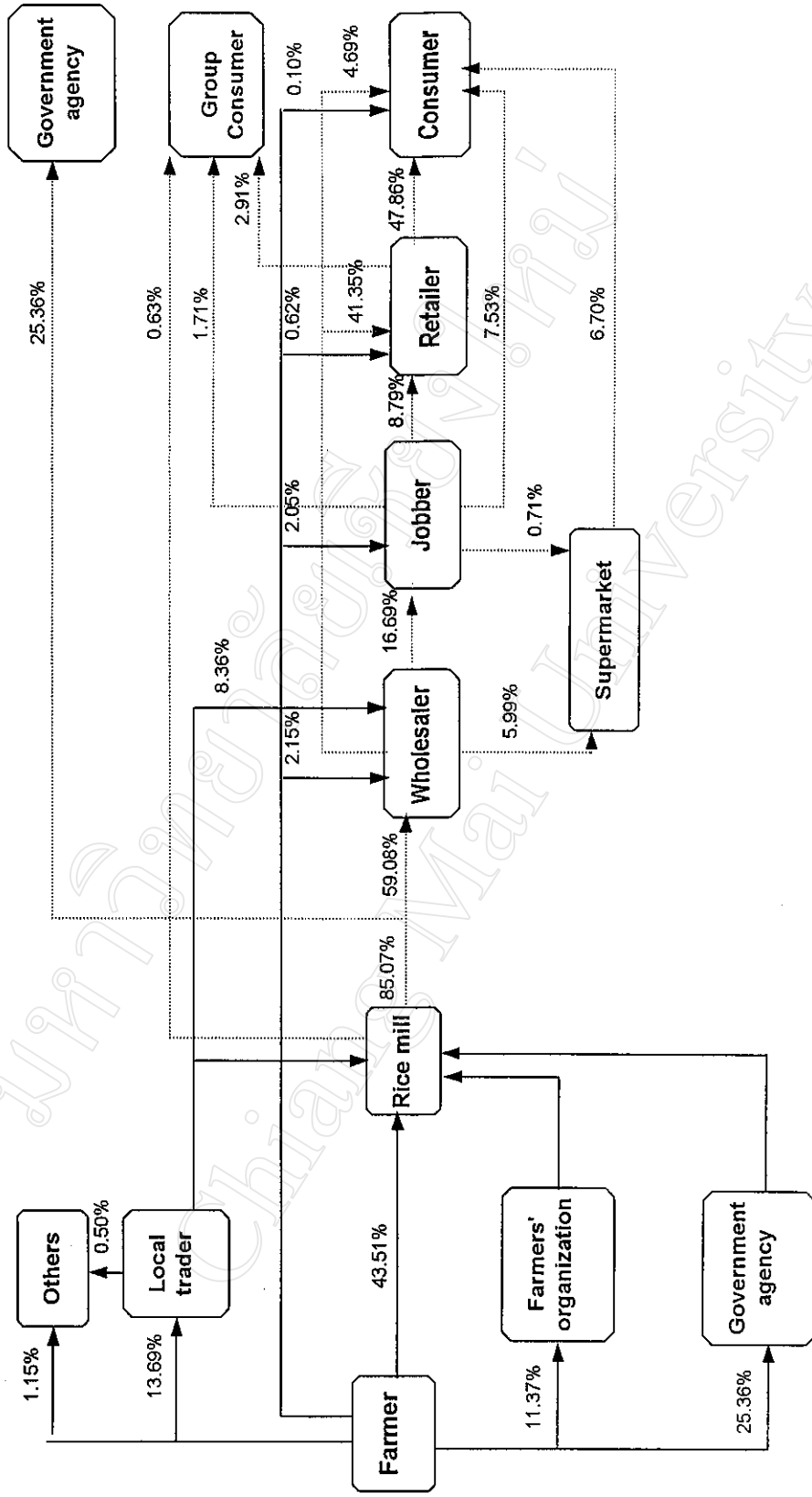
The rice marketing channels are illustrated in Figure 4.5. They are complicated and different from the long market channel in Thailand. The paddy marketing channel can be segregated as follows: P1) Farmer-Local trader, P2) Farmer-Rice mill, P3) Farmer-Farmer Organization, P4) Farmer-Government agency. While most of the paddy goes to rice mill, some portions of paddy flows from farmer directly to wholesale, retailer and consumer. Even local traders supply paddy to wholesale. In contrast to four paddy rice marketing channels, six marketing channels are engaged in milled rice trading i.e. M1) Miller-Government agency-Consumer, M2) Miller-Consumer, M3) Miller-Wholesale rice trader, M4) Wholesale rice trader-Supermarket-Consumer, M5) Wholesale rice trader-Jobber-Supermarket-Consumer, and M6) Jobber-Retailer-Consumer.

Considering the small land holding (of approximately one hectare of land) for rice production, farmers do not own barns to stock rice on the farm. Thus, farmers sell the produce immediately after the harvest. The major volume of the paddy market is from farmers directly to rice mill, which accounts for 43.51%. The second is from farmers to government agency at approximately 25.36%. Paddies from farmer to local trader and farmer to farmer's organization account for 13.69% and 11.37%, respectively.

The majority of milled rice is consumed in the domestic market. Approximately 5% of the milled rice is exported by government agency. The main flow of milled rice in the domestic market is from miller to wholesale trader (amounting to 59.08%), supplies milled rice to jobbers, supermarkets, retailers and

consumers to the tune of 16.69%, 5.99 %, 41.35%, 4.69%, respectively. Subsequently, jobbers supplied 8.79% to retailer, 1.71% to group consumer and 0.71% to supermarket. Finally, retailers supplied 47.86% to individual consumers and 2.91% to group consumer i.e. hotel and restaurant. From the public stock, government agency supplies 25.36% of milled rice to military, prisons and schools on routine basis.

มหาวิทยาลัยเชียงใหม่
Chiang Mai University



Source: Council of Agriculture, Executive Yuan, 2000

Figure 4.4 Marketing Channel of Rice in Taiwan, 1997

4.5 Number and characteristics of rice mills

4.5.1 Rice mill industry in Thailand

Rice mills are scattered through nearly every province in the main rice growing areas of the Central, North and Northeastern regions of Thailand. According to the 1999 statistics of the Department of Factories, Ministry of Industry, (Table 4.6) there are 42,532 rice mills in the whole country. However, the rice milling industry in Thailand exhibits a clear dual structure with a commercial sub-sector comprising medium and large mills and a service sub-sector comprising small household mills.

Table 4.6 Number of rice mill by region in Thailand, 1995 – 1999

Year	Region				Unit: Number of Mill
	North	Central	Northeastern	South	Whole kingdom
1995	10,065	5,129	24,888	4,390	44,472
1996	10,049	5,114	24,887	4,386	44,436
1997	8,779	3,232	28,533	2,731	43,275
1998	8,636	3,116	28,032	2,667	42,451
1999	8,666	3,141	28,049	2,676	42,532

Source: Factory Control Division, Ministry of Industry, 2000

The commercial sector mills purchase paddy from farmers and supply the output for domestic, urban, and export markets. The service mills by contrast do not purchase paddy but specialize in supplying a milling service to farmers. A service mill typically employs a single machine performing only the essential steps of milling i.e. husking and whitening. The output of service mills is not exported and is generally consumed by the farm households, or by consumers, in the rural areas. Thus the commercial mills can be called the trading sector, while the service mills may be

referred to as the non-trading sector. As interviewed, the number of commercial mills in Thailand is less than approximately 5,000 rice mills. As the volume of paddy processed in the service mill sector is small, the commercial mill sector is explored in the study to capture an adequate scenario of the rice mill industry.

4.5.2 Rice mill industry in Taiwan

The rice mill industry in Taiwan is definitely one of the most developed in Asia. There are more than 1,300 rice mills in Taiwan and most of them are commercial, however, they have distinctly different roles compared to mills in Thailand. In addition to milling functions, the mill operators function as warehouse/storage for local paddy traders. As these mills operate at full capacity, they do not intend to expand their operation or improve the technology. For that reason, mills also act as warehouse for private stock and public stock on a rental basis. The private stock is not supplied to other mills or food processing companies, as they process themselves. The government stock is supplied to the military, prisons and schools at regular intervals.

4.6 Milling process

This part deals with the milling process with the purpose of examining various rice milling techniques existing in the study areas. The different technologies in milling may be the most significant factors that affect the technical efficiency of the rice mills. It is, therefore, noteworthy to understand the process of how paddy is processed into rice for consumption.

Milling is a term that describes the process of converting paddy into rice. It includes five major steps.

1. **Cleaning:** Dried paddy passes through a ventilated sieve cleaner to remove large foreign material such as particles of sand, stone, straw, seeds etc. from the paddy.
2. **Husk separation:** Cleaned paddy then passes through a husker. The husker can be of two stone disks or two rubber rollers running against each other at different speed. When paddies pass through, The husks will be rubbed off the paddy, leaving brown rice and husk. The husk material will then be separated using ventilation.
3. **Paddy separator:** In order to lessen breakage in the husking process, the husker will not be pressed hard to rub away all husk, so there will be some paddy mixed in the brown rice. Brown rice will pass through a paddy separator, which separates paddy from brown rice by using the differences in gravity and surface friction. Separated paddy will return to the husker, leaving pure brown rice. The paddy separator will determine the total throughput speed of the whole rice mill.

4. **Milling:** This process is to strip off the bran layer from brown rice. Brown rice passes through different milling processes, typically in 2 to 3 cycles, depending on the milling degree required. Milling machine is made of stone cylinder rotating against rubber bars. Bran will be rubbed off the rice and sucked out by air ventilation.
5. **Grading:** Milled rice will be a mixture of different sized grains; whole grain, head rice, broken, (caused by breakage during husking and milling). Sizes are separated by sieve graders. The finished rice will be stored in individual bags, according to its grade, and the rice is then ready for delivery.

4.7 Milling technology

There are four general types of rice mill technology with respect to the source of power used. The three sources of power used by the mills in Thailand are diesel engines, electric motors and steam engines. In Taiwan, electric motors and automatic machines are used for milling.

Diesel engines: Diesel engines are mostly used by small rice mills and some medium-size mills in Thailand. They are easy to operate with a low investment cost. However, the operation cost for running the machine during production is higher than steam engines.

Electric motors: They are more stable than steam engines and easier to operate, (rather similar to diesel engines). However, its disadvantage is its high investment cost and energy consumption during operation. The sets of machinery are imported from Germany, Japan and Taiwan, while fabricated versions are also

available in other countries. In Thailand electric motors are used in new medium capacity mills.

Steam engines: Steam engines are mostly used by large mills in Thailand. These kinds of rice mill have high investment cost. A chimney, large steam boiler and husk stove are required. However, the steam engine is worthwhile installing in a commercial mill with high production and regular raw material supply. This is because the engine uses husks, a by-product of milling, to boil water for generating the power. The major limitations of Steam engines are the extensive time required to start up, and the excessive number of workers required to operate it.

Automatic machines: This kind of technology comes from technological improvement and solves the problem of limited labor. Its advanced computer controls are based on the desired degree of milling to be used in the mill operation. It is disadvantaged by its high cost of investment. They use modern machines such as coolers which control temperature, whiteness checking by ultra violet laser, and paddy dust storage machine. Additionally, some millers in Taiwan can start operation through their cell phones.

4.8 Summary

As mentioned earlier in this chapter, the summary of the general background of rice production and rice mills in Thailand and Taiwan, 1999 are presented in Table 4.7 below.

Table 4.7 Comparison of general information for rice and rice mills in Thailand and Taiwan in 1999

Item	Unit	Thailand	Taiwan
Location	-	Southeast Asia	East Asia
Area	km ²	514,000	36,000
Population	Million	61	22
GDP Per citizen	US\$	6,700	16,000
Rice growing season	-	1 st : July-November 2 nd : January-April	1 st : January-May 2 nd : July-December
Rice variety	-	Jasmine rice, white rice, and glutinous rice	Japonica rice and Indica rice glutinous rice
Rice area	million rai	64.4	2.2
Rice Production	metric ton	24.2	1.6
Average yield	kg/ rai	388	706
Rice consumption	-	9.7 million tons used for domestic consumption and 6.8 million tons used for export (30% of world market)	≥ 90% used for domestic consumption
Rice per capita	kg/person	160.8 (1997)	54.9
Marketing channel		Long channel	Complicated channel
Number of rice mills	mill	42,532	≅ 1,300
Milling technology	-	diesel engine, electric motor, steam engine, automatic machine (≥500 tons per day)	electric motor, automatic machine

Note: US\$ = 40.204 Baht = 31.263 NT\$ (Bank of Thailand, 2001)