
Chapter 3

RICE INDUSTRY

1. INTRODUCTION

In Myanmar rice is the most important crop to millions of farmers and to some landless farmhands who derive their income from working as seasonal laborers. Thus, rice is designated as national crop to highlight its great importance. Soaring price of the rice could not effect the reduction in quantities consumed. The demand for rice is relatively *price inelastic* because the demand for rice does not change very much in response to the price changes. By contrast, a 10% increase in rice price results in a 2 to 4% decrease in rice consumption in Vietnam¹.

According to the market reconnaissance, if the rice price goes down, consumers in Myanmar have a good opportunity to shift from low quality rice to better one depending on their individual income and preference. When the rice price starts to soar, consumer demand increase in the short term. The reason is that some consumers in urban area expecting further increase in price, try to purchase more than normal consumption to secure the family requirement. Because of this, stability of rice price is important both for consumers and government.

This study attempts to find out the constraints such as rice production, rice mills, government's supportive measures, internal and external trade, etc. and to recommend for the development of country's rice industry based on related issues such as National Rice Policy (NRP).

2. AGRO-ECOLOGICAL ZONES

Myanmar is endowed with natural resources such as agricultural land, favorable climate and available water source. It is located between

¹ Nicholas Minot and Francesco Goletti, *Rice market liberalization and poverty in Vietnam: International Food Policy Research Institute*.

9° 58' and 28° 31' N latitude and 92° 10' and 101° 09' E longitude. The total area is 261,228 sq miles (676,577 sq km), with the length of 1,275 miles, extending from North to South and 582 miles from East to West. Myanmar shares border with² Thailand, Laos, China, India and Bangladesh and has a long coastal line of 1,388 miles along the Bay of Bengal, Gulf of Mottama and the Andaman Sea.

2.1. Climate and Water Source

The tropic of cancer passes through the ancient city of Tagaung (Sagaing Division) divides the country in the Temperate North and the Tropic South. There are three seasons: the summer season lasting from mid-February to mid-May, the rainy season from mid-May to mid-October and the cool season from mid-October to mid-February.

The Southwest monsoon is the major source of rainfall for the country. Normally, it moves from southern part of the country to delta region from which it gradually moves to the central part of the country and northern part of the country. The precipitation of the various parts of the country is classified into three groups according to Dr.C.R Panbokker's method.³

- (1) R3: There is sufficient rainfall for crop production during the rainy season and the rainfall pattern is normally *uni-modal*. There is no dry spell during the rainy season. This pattern occurs in Rakhine, Mon, northern part of Kachin State, Ayeyarwady and Tanintharyi Division, which receive over 100 inches of rainfall.
- (2) R4: There is sufficient rainfall for crop production during the rainy season and three months period of continuous summer season or at least three months of no rain during a year. During the rainy season, a dry spell may occur, or excessive rainfall and flood. The rainfall pattern is normally *uni-modal*. This pattern occurs in Chin, Kachin, Kayah, Shan State and Bago-Yoma hill, which receive from 40 to 100 inches.

² The Length of contiguous frontier is 3,828 miles (6,129 kilometers), sharing 1,370 miles with China. 1,310 miles with Thailand, 832 miles with India, 1,687 miles with Bangladesh and 148 miles with Laos respectively.

³ Land Use division, Myanma Agricultural Service, MOAI.

- (3) R5: The amount of rainfall varies year by year and the rainfall pattern is in most year *bi-modal*. It means that rainfall pattern shows upward trend from May to June and declines in July. After that it starts to upward in August and September. If the precipitation has become less and occurrence of dry spell is long during the July, the success of rainy crops especially sesame is uncertain. This pattern occurs in the dry zone including Mandalay, Magway and lower part of Sagaing Division, which receive less than 40 inches of rainfall.

In addition, the country has four prominent major rivers, namely, the Ayeyarwady, the Chindwin, the Sittaung and the Thanlwin flowing from North to South into the Andaman Sea. The Ayeyarwady and its major tributary, the Chindwin, are navigable through the center of the country and many small rivers of the Ayeyarwady create a vast fertile region before flowing into the sea. This delta region is favorable to grow summer rice after harvesting of monsoon rice due to abundant water resource.

2.2. Soil Type

Myanmar is unique for its forest-clad mountains, plateaus, valleys and vast plains. The parallel chains of mountains have an altitude range from 3,000 to 7,000 feet above sea level. The soil classification system in use recognizes 24 different soil types, which are classified into five groups based on the method of FAO-UNESCO.

The land utilization of classification is based on traditional terms used by farmers. Settlement Land Record Department (SLRD) originally introduced it in 1911, under British rule for land tax purposes. SLRD distinguished 7 types of land use, namely (1) Le land, (2) Ya land⁴, (3) Mayin land, (4) Kaing kun⁵, (5) Garden land⁶, (6) Taungyar, (7) Dani land⁷ among which Le land and Mayin land which is a special kind of Le land

⁴ Ya land is the second most widely use cropland. It may be best defined as unsuitable for paddy. Most of Ya land is situated in the central zone area.

⁵ Kaing land is the land near rivers, which is flooded during the rainy season including patches that fall dry in the riverbed.

⁶ Garden land is commonly used for horticultural crops.

⁷ Dani land is land with nipa plant, which is widely grown for stitched nipa palm leaf flaps to be used for roofing in rural area of delta and coastal region.

are suitable for paddy cultivation. Taungyar is known as upland which is favorable for cultivation for upland rice.

Based on the agro-ecological zones, the country can be divided into four major regions: delta region, coastal region, central dry zone region and hilly region. Le land is mainly found in the Delta and coastal regions in lower Myanmar, but also in Central Myanmar and in the valleys of Shan State and other hilly areas. It is flat and banded, most often with impermeable heavy soils.

3. RICE AND MYANMAR

It is learnt that paddy cultivation probably dates back to the earliest age of man and long before the era of which we have historical evidence it was probably the staple food and the first cultivated crop in Asia⁸.

Myanmar is traditional rice exporting country. Before the pre-war era, rice export volume was in the range of 2.5 to 3.4 million metric tons from 1930-31 to 1939-40. Afterwards, the country's rice economy collapsed due to the World War II. Later on, rice was continuously exported, however, its traded volume did not regain before the pre-war level.

Based on the time-series data from 1947-48 up to 2001-02, the rice export volume amounted to 1.18 million metric ton in 1964-65. From then on, rice export declined for three decades, its rice export in 1994-95 was 1.04 million metric ton, regained the level of 1964-65. Then, the country's rice export showed fluctuation and reached around 1 million metric ton in 2001-02.

3.1. Historical Information

The successive governments in Myanmar adopted by social, economical and political policies had not been the same however their common interest is to provide rice for the increase demand of country's population and have exportable supplies. For historical information of Myanmar

⁸ Cheng Siok-Hwa, *The Rice Industry of Burma (1852-1940)*, page 16.

rice industry, there can be classified into the distinguished six eras from Ancient Myanmar King Era to Socialist Economy Era, which is highlighted in this section.

3.1.1. Ancient Myanmar King Era

In Myanmar, the monarchical rule lasted about 800 years. During those days, it is learnt that the ancient Myanmar king encouraged the cultivation of rice to provide sufficient quantity for the entire kingdom. At that time, the capitals of the kingdom were situated in central Myanmar. To increase the rice-cultivated areas, old irrigation works constructed by the successive ancient kings were renovated and new irrigation tanks were constructed. In lower Myanmar, most of the land was densely covered with jungles and had very few rice growing areas.

According to Durate Barbasa, most of the rice was shipped from Bago to Malacca and Sumatra at the beginning of sixteen century. In the first half of the seventeenth century, the Dutch, who were very active in the East Indies frequently, went to Arakan (Rakhine) to obtain rice⁹.

3.1.2. British Colonial Era (1824 to 1941)

Myanmar (Burma) was under the British colonial rule for about 100 years. By the end of the first Anglo-Burmese war in 1824, British annexed Rakhine and Tanintharyi, the coastal region of lower Myanmar. Again, the delta region of lower Myanmar fell under the British rule at the end of the second Anglo-Burmese war in 1852. From 1853 to 1878, the upper Myanmar was under the rule of Mindon, the ancient Myanmar king whose palace was situated in Mandalay.

In lower Myanmar, the delta region had abundance of cultivable fertile lands and their climatic conditions were favorable to grow rice. The major constraint was that there were not enough laborers to expand rice areas for clearing dense jungle and swampy land to transform them into cultivable Le-land. Accordingly, the British government made efforts by the

⁹ Cheng Siok-Hwa, *The Rice Industry of Burma (1852-1940)*.

following measures:

- Assisted transmigration of settlers from the upper Myanmar to lower Myanmar by means of tax exemption for a period of two years.
- Assisted immigration of Indian to lower Myanmar, to develop the Ayeyarwady Delta as a major rice producing area.
- Provided tax exemption for 12 years period for a newly cleared land.

One of the reasons of country's rice production highly related to opening of Suez Canal in 1869. Thus, journey to Europe had shortened and the transport cost of rice to Europe declined in 1872. Due to increase demand of rice export, rice price in domestic market increased sharply which was attractive to farmers. From 1862-63 to 1885-86, rice export volume was in the range of 0.284 to 0.962 million metric ton. In 1885, British annexed the upper Myanmar and the whole country was under the British rule. To develop the rice economy, rice mills and port facilities, provision of agricultural loan, construction of irrigation works in central Myanmar and embankments in lower Myanmar were provided. In 1906, Department of Agriculture was established with an objective of rice production.

The first increase of country's rice production can be found in this era and it was achieved by *area expansion*. The country's paddy sown area increased from 3.1 million in 1880-81 to 12.3 million acres in 1941-42. At the same time, rice export volume was in the range of 2.5 to 3.4 million metric ton from 1930-31 to 1939-40. During that period, Myanmar was prominent in the world market due to the largest share of rice export. Thus, paddy was by far the most important crop in the agricultural economy of the country.

The country's rice production ranged from 5.8 to 8.0 million metric ton. However the average yield per acre was round about 30 baskets (0.63 MT) per acre, which did not significantly increase during that era.

According to the Census, the population of Myanmar was 2.75 millions in 1872 and it increased to 14.67 millions in 1931 and 16.82 millions in 1941. Although there was tremendous increase in population during that

time, rice production could be supplied for the requirement of domestic consumption and exported.

Table 1 : The Trend of Population Increase

Census Year	Census Date	Area of enumeration (sq.miles)	Total Population ('000)	Indian Population('000)
1872	15th August	76	2,747	137
1881	17th February	76	3,737	243
1891	26th February	152	8,098	421
1901	1st March	226	10,491	568
1911	10th March	229	12,115	743
1921	8th March	233	13,212	887
1931	24th February	233	14,667	1,018
1941#	-	n.a.	16,824	n.a.

Source: *Rice Industry*, P-265.

Statistical Year Book 1965, BURMA.

Regarding rice varieties, farmers used traditional rice varieties and most of them were cultivated under ancient Myanmar king's era. Although over one thousand paddy varieties have been cultivated different vernacular or local names are given to the same varieties in different localities¹⁰.

Table 2 : Classification of Myanmar Rice

Group		Dimension of grain			
		With Husk (Paddy)		Husked (Rice)	
Sr. No.	Name of rice	Length (mm)	Length/Breadth (Ratio)	Length (mm)	Length/Breadth (Ratio)
A	Emata	9.41 and above	3.30 and above	7.00 and above	3.00 and above
B	Letywezin	8.40 to 9.80	2.80 to 3.30	6.00 to 7.00	2.40 to 3.00
C	Ngasein	7.75 to 9.00	2.40 to 2.80	5.60 to 6.40	2.00 to 2.40
D	Medon	7.35 to 8.60	2.00 to 2.40	5.00 to 6.80	1.60 to 2.00
E	Byat	9.00 and above	2.25 to 3.00	6.40 to 7.35	2.00 to 2.50

Source: BSPP: *The Record of Burma Rice Production and Trade (in Myanmar)*, P-30. This classification is known as Beale Classification. Ngasein, Medon and Byat groups are short grains while Emata and Letywezin are long grains.

To overcome this problem, Mr. R.A. Beale, a botanist, had standardized Myanmar local rice varieties in 1927 and grouped into five, based on paddy length and ratio of length and breadth. This classification is still

¹⁰ Cheng Siok-Hwa, *The Rice Industry of Burma (1852-1940)*.

applied in domestic rice marketing. During that time, both Ngasein and Emata rice varieties were traded to Europe and some Emata rice was exported as boiled rice.

3.1.3. Japanese Era (1942-1945)

In 1942, the British government withdrew from Myanmar and the Japanese army took over the country. Rice production decreased dramatically due to the World War II. A large number of farmers in rural area were forced to work by the Japanese Armies as forced laborers. Rice farmers faced shortages of seasonal laborers, drought cattle and farm implements for their rice cultivation, which caused the decline of country's rice production.

3.1.4. Pre-independence and Parliamentary Government Era (1946 to 1961)

When the World War II ended in 1945, the British troops reoccupied the country. Afterwards, Myanmar gained independence in January 4, 1948. Unfortunately, a civil war broke out soon after the country gained independence. From 1947-48 to 1951-52, the country's rice export volume was in the range of 0.618 million to 0.917 million tons and export volume of boiled rice ranged from 0.231 to 0.518 million metric ton.

From 1952-53 to 1959-60, the parliamentary government of Myanmar implemented the *Eight Year Pyi-daw-thar Plan* with the main objectives of increasing rice production. It is anticipated 2.5 million ton of rice by the end of planned period. Actual rice export could be achieved from 0.8 to 1.41 million ton. During that period boiled rice demand from India and Sri Lanka was quite substantial especially among rubber plantation workers, since it remained unspoiled throughout the day after it was cooked. Traded volume of boiled rice was in the range of 0.257 to 0.749 million ton.

3.1.5. The Revolutionary Council Government Era (1962 to 1973)

This era lasted 12 years from 1962-63 to 1973-74. During that era, over

one million metric ton of rice was exported in 1963-64 and 1964-65. Afterwards, its export volume was declined continuously and reached 0.196 million metric ton in 1973-74. During that era, the country's rice production situation was mentioned as follows:

- The population census of Myanmar was conducted in 1973, which was recorded 29.52 million. The population in 1962-63 was 23.19 million and reached 29.52 million in 1973-74. Thus, the average growth of population is 2.2 percent during that period. Thus rice was more demanded due to the increase of rice consuming population.
- Due to population pressure on the country's rice production after World War II, demand of domestic utilization increased dramatically. Rice production increased from 7.7 million in 1962-63 to 8.6 million metric ton in 1973-74. The average growth of country's rice production was only 1%. Thus, the country's rice production was sluggish during that period.
- It is found out that the growth of population was higher than that of rice production.

The first high yielding variety (HYV) was introduced in Myanmar for the increase of farmers' yield. In 1960's the world research community introduced the *Green Revolution*, which resulted in the development of HYV and new proven technology were developed for many crops. IR-5 and IR- 8, high yielding variety, were obtained for International Rice Research Institute (IRRI) in 1966 and 1967 respectively.

These varieties were known among farmers as *Yakyaw-1* (IR-8) and *Yakaw-2* (IR-5). *Yakyaw* means over 100 and the name was given because yield per acre of these varieties were over 100 baskets if farmers applied chemical fertilizers with recommended rate and proper cultural practices. During that period, the area planted to HYV was 0.637 million acres, which shared 5% of the country's paddy sown area in 1973-74.

3.1.6. Socialist Economy Era (1974 to 1987)

The country's ruling party known as Myanmar Socialist Program Party adopted the centrally planned economic policies which lasted from 1974-75 to 1987-88.

The second increase of rice production can be found in this era and it was achieved from 1970's to the early 1980's. In contrast to the first increase, it was due to *the achievement of yield increase*, not by the sown area expansion. The main reason was the implementation of the *Whole Township Paddy Production Program*¹¹ (WTPPP), which led increase of rice yield. This program started in two townships in 1977-78. Afterwards, the programmed townships were extended from year to year and reached 82 townships in 1985-86. The area coverage of selected townships was amounted to 6.32 million acres, which constituted 52 percent of the country's total paddy sown area. It is found out that the effective results of this program were:

- The area planted to HYV increased dramatically due to widespread adoption of rice farmers in programmed townships and other rice major growing areas. As regards HYV, it increased from 1.29 million in 1977-78 to 5.84 million acres in 1985-86 which contributed 48 percent of 12.11 million acres, the country's rice area sown.
- Along with the increase of HYV sown area, utilization of chemical fertilizer on paddy showed an increase trend during that period. The quantity of chemical fertilizer such as urea, triple super phosphate and potash in 1977-78 was 0.106 million metric ton raised by 0.218 million to 0.324 million metric ton in 1985-86.
- At the same time, proven new technology¹² was diffused in programmed townships and government encouraged to success this program by supporting of local authorities.
- On the whole country's rice production increased mainly due to the yield increase, not by the rice area expansion.

In 1984-85, the result of the program showed stagnation. It is because the state's purchasing paddy price was not attractive to rice farmers.

¹¹ This program consisted of five major components: (1) proven new technology, (2) government support and leadership, (3) Selectivity and concentration and (5) demonstration and competition.

¹² Extension workers provided ten impact points of rice technology to diffuse among farmers. These points are (1) The use of high yielding varieties both exotic and local, (2) proper tillage, (3) high plant population per unit area, (4) transplanting of 25-30 days-old seedlings, (5) application of chemical fertilizer at recommended rates, (6) proper weeding, (7) basal application of farmyard manure, (8) improved water managements, (9) control of pest and diseases, and (10) minimizing losses at harvesting.

During that period, government distributed chemical fertilizer with subsidized price. In turn, farmers sold paddy to the State with support price depending on their yield. During that era, *paddy/fertilizer price ratio* is set out in the following table.

Table 3 : Paddy/Fertilizer Price Ratio During the Centrally Planned Economy Era

Type of chemical fertilizer	Chemical fertilizer		Paddy		Paddy/ fertilizer price ratio
	Selling price (Kyat)		Purchasing price		
	(50kg bag)	(1 Kg)	(1 basket)	(1 Kg)	
1	2	3	4	5	6 (5÷3)
Urea	18.00	0.36	9	0.43	1.20
Triple Super Phosphate	62.20	1.24	9	0.43	0.35
Mutate of potash	29.90	0.60	9	0.43	0.72

Source: MOAI.

As can be seen, paddy/fertilizer price ratios were 1.2 for urea, 0.35 for triple super phosphate and 0.72 for mutate of potash. According to the calculation of paddy/fertilizer price ratio, prices of triple super phosphate (TSP) and mutate of potash (MOP) were high compared to the state paddy-purchasing price. Urea fertilizer was supplied from domestic plants and imported while the rest of fertilizers relied on imported volume. During that era, the government monopolized the fertilizer marketing including importation and distribution in the domestic market.

In 1983, the second population census was conducted and the country's population was 35.66 million. In 1985-86, total population was estimated to be 37.07 million, which increased from 29.78 million in 1974-75. Rice production increased from 9.46 million in 1977-78 to 14.32 million metric ton in 1985-86. Thus, the average growth of population was only 2% while the average growth of rice production is 5.3%. Although rice production increased dramatically during that era, the rice export volume recorded was in the range of 0.158 to 0.787 million metric ton.

During that period, government pricing policy of rice was not favorable for farmers. The reason is that government purchased paddy based on individual farmer yield. Thus the more yield farmers obtained the more

quota that farmers had to sell to the government. From the farmers' point of view, this paddy-purchasing policy was negative effect for them.

The government brought to an end WTPPP due to the stagnation of yield and production. In 1986-87, the country's ruling party collected the detail information of each farmer paddy sown acre lead by Myanmar Socialist Program Party in various township levels. The rice sown area was categorized by three groups such as special high yielding, high yielding and ordinary based on supply of agro-inputs, soil condition, the area planted to HYV and local variety (LV).

During that era, rice self-sufficiency program was implemented in rice deficit areas however it did not succeed due to limitation of land, water, resources, laborer and unfavorable pricing policy.

After 1985-86, the government faced a tight economic situation and could no longer provide the required agricultural inputs such as chemical fertilizer, spare parts and fuel as it did before¹³. As a result, the country's rice production in 1987-88 was 13.6 million metric ton, down 5 percent from the level of 1985-86. So, the external trade of rice declined steeply and reached 0.196 million metric ton in 1987-88.

3.2. Current Information

In 1988, the government adopted the market oriented economic polices with the appropriate reform measures, while its direct involvement was gradually reducing. In the area of agricultural marketing, the government has also become less involved and encourages private sector to play a larger role. From then on, the activities of private sector have been more functioning compared to centrally planned economy era.

From British government era to socialist economic era, the domestic utilization and rice export relied on only monsoon rice production. Due to the population pressure, quantity of rice demanded showed increasing trend.

¹³ Tin Htut Oo, *Myanmar Agriculture under the Economic Transition: Present Situation and Emerging Trends*.

The third increase of rice production mainly attributed to the summer rice area expansion in 1990's. In 1992-93, summer rice production was introduced with the provision of irrigation facilities such as diesel, small-scale irrigation pumps, irrigation canal and dams that was provided to farmers in major summer rice growing areas.

For area expansion, summer rice cultivation is more feasible. The reason is that it can be produced on the same land. Thus, summer rice is planted as second crop after harvesting of monsoon rice in major rice producing area.

If the valuable agricultural land resources, i.e. fallow land and waste agricultural land excluding forestland, are to be exploited, major land reclamation projects are required. In addition to that, settlement of new village, migration, transportation, market facilities and communication are also required. However, rice after rice cropping pattern tends to degrade the soil. For this, monsoon rice-pulses-summer rice pattern is widely practiced in Delta region which can remedy soil depletion naturally.

Planting of monsoon rice begins in May and is complete in September. It is harvested from 3 to 4 months, up to February. As for summer rice, sowing is from November to April and harvesting from March to July, depending on the agro-ecological zones and sources of irrigation.

In the lower Myanmar, summer rice is harvested from March to April. The main reason is to overcome the showers of Southwest monsoon during the harvesting period. In the central dry zone area, summer rice start to harvest in July.

For the increase of rice production, national rice researchers recommend summer rice varieties based on different rice environment. Besides, chemical fertilizer, appropriate technology, imported diesel and small-scale irrigation pumps were supplied to farmers. With regard to fertilizer marketing, the government encouraged private sector.

In the present era, the irrigated rice area increased dramatically due to

the summer rice production program. The government endeavored to increase the irrigated area by constructing of new dams depending on available water resources and by provision of small-scale irrigation pumps. The irrigated rice area increased from 2 million acres in socialist economy era to around 4.8 million acres in the present era.

The area planted to summer rice increased from 0.821 million in 1992-93 to 2.9 million acres in 2001-02. Due to the implementation of summer rice production program, the country's rice sown area rapidly increased from 12.68 million in 1992-93 to 15.94 million acres in 2001-02. Monsoon rice accounts for 80% of aggregate production and the remaining 20% coming from summer rice production.

During the present era, the country's rice production, rice consuming population and rice export are set out in the following table.

Table 4 : The Country's Rice Production, Population and Rice Export During the Present Era

Year	Rice sown area ('000acre)			Yield per acre (bsk/acre)			Production ('000 mt)	Population (million)	Rice export ('000 mt)
	Monsoon rice	Summer rice	Total	Monsoon rice	Summer rice	Total			
1988-89	11,807	-	11,807	56.40	-	56.40	13,162	39.29	24
1992-93	11,863	821	12,684	56.51	62.78	56.91	14,835	42.33	195
1993-94	11,871	2,150	14,021	57.53	68.98	59.24	16,757	43.92	261
1994-95	11,981	2,662	14,643	59.48	70.26	61.45	18,192	44.74	1,041
1995-96	12,149	3,017	15,166	55.67	65.92	57.72	17,950	45.57	354
1996-97	12,413	2,105	14,518	57.52	70.58	59.43	17,673	46.40	93
1997-98	12,104	2,190	14,294	58.31	67.24	59.73	16,651	47.26	28
1998-99	11,928	2,302	14,230	58.88	69.54	60.68	17,075	48.12	120
1999-00	12,732	2,796	15,528	61.05	71.00	62.85	20,122	49.13	55
2000-01	12,992	2,721	15,713	63.35	76.39	65.62	21,320	50.13	251
2001-02	13,066	2,875	15,941	64.16	75.90	66.29	21,912	51.14	939

Source: Settlement and Land Record Department, MOA.

After lasting three decades, the country's rice export reached over 1 million metric ton in 1994-95, which regained the previous rice export level of 1964-65. However, it fluctuated again from 1995-96 to 2000-01. It could be exported around 1 million mt in 2001-02.

From British government era to the present era, change of country's rice sown area, production and rice export is mentioned in Annex-1.

4. RICE DEFICIT REGIONS

For the country as a whole, rice is surplus however some regions are still not rice sufficient. If we look into each region, delta region accounts for 69% of the country's rice production and it is important region in Myanmar rice economy. It has huge rice surplus with the exception of Yangon Division.

In central dry zone region, Sagaing Division is surplus in rice while Mandalay and Magway Division are not sufficient. In coastal region, Tanintharyi Division is not sufficient for local consumption while Rakhine State is rice surplus area. In the hilly region, Kachin State is only rice surplus area. Yangon Division showed a little bit rice deficits due to denser population. According to the market reconnaissance, rice traders and millers sold rice to the rice deficit area and some supplied to the wholesalers in Yangon City. The following table shows the rice deficit and rice surplus situation in 2000-2001 based on production, population and utilization.

Table 5 : Regional Rice Production, Domestic Utilization, Rice Surplus and Deficit in 2000-2001

('000 baskets)

Region	Paddy production			Seed and waste#	Consumption*		Domestic utilization	Surplus/ deficit
	Sown acre	Yield	Production		Population	Quantity		
1.Delta region	9,736	68.07	660,966	38,944	20,416	306,240	345,184	(+) 315,782
2.Coastal region	1,188	61.94	73,270	4,752	4,200	63,000	67,752	(+) 5,518
3.Central dry zone region	2,795	65.11	175,539	11,180	17,028	255,420	266,600	(-) 91,061
4.Hilly region	1,994	56.58	112,195	7976	8,481	127,215	135,191	(-) 22,996
Total	15,713	65.62	1,021,970	62,852	50,125	751,875	814,727	(+) 207,243

Source: MAS.

Note: 2.471 acres = 1 hectare, 46 lb of paddy = 1 basket, 1 Kg=2.205 lb. 1mt=2205lb.

2 baskets of seed for per acre and 2 baskets of waste for per acre.

* Per capita consumption of rice is estimated 15 baskets.

Based on paddy production, regional utilization and surplus situation is mentioned in Annex-2. During the present era, rice self-sufficiency pro-

gram is implemented in Tanintharyi Division located in coastal region, central dry zone region and Shan State located in hilly region. Due to the limitation of area expansion and water resources, the program is not fully success. However, rice production increased substantially compared to last decade. Self-sufficiency of rice for the whole State and Division is not ensured due to the limitation of land and water resource and comparative advantage of pulses and oilseeds crop grown in rice deficit area.

In Myanmar, rice is basic staple food for the population of 51 million. In addition, They heartily consume rice based processing food such as vermicelli, rice noodle and rice cake etc. Due to the wide spread utilization of rice, per capita consumption of Myanmar is estimated to be over 200 kilograms per year, which is rather high, compared to neighboring countries. Generally speaking, consumption of rice per capita in rural area is greater than urban area. The following table shows the amount of rice recommended to be consumed daily based on age group.

Table 6 : Recommended Per Capita Consumption of Rice

Age Group	(kg/daily)	(kg/year)
1-3 year	0.133	49
4-6 year	0.199	73
7-9 year	0.332	121
10-12 year	0.399	146
13-19 year	0.531	194
- Male (Adult)	0.531	194
- Female (Adult)	0.399	146
Pregnant Mother	0.399	146
Breast Feeding Mother	0.531	194

Source: National Nutrition Center, *Family Nutrition and Myanmar Food*, Jan. 1990.

5. RICE MILLS

In the process of transformation from paddy to rice, rice mills are vital role for domestic consumption and external trade. The development of rice mills in Myanmar rice economy is summarized in this section.

5.1. British Government Era

Under the British rule, before 1870, rice mills which were only capable of processing cargo rice (husked paddy) were largely concentrated in port areas of Yangon, Sittway, Patheingyi and Mawlamyine. Later such rice mills were augmented with rice whitening machinery and became full-fledged rice mills.

The European companies owned most of the rice mills and their capacities were very large. When development of rice industry had become accelerated during 1900s, Messrs. Steel Brothers Co. even constructed a biggest rice mill in the world at that time of which the milling capacity was 1,500 tones per day. In the early days, around 1894, there were about 54 rice mills in Myanmar (Burma) and after 40 years, in 1934, the number of rice mills had reached 637. The increase in number of rice mills was due to strong demand of rice exports.

As a result, big rice mills (capacity more than 1000 tones per day) owned by the European companies and small rice mills (capacity ranging from 10-100 tones per day) owned by the Myanmar, Chinese and Indian entrepreneurs were concurrently undertaking the rice processing operations either for local consumption or for rice exports. The emergence of small scale rice mills had also added in Myanmar rice products range as “Small Mills Specials, SMS” and “Small Mills Quality, SMQ” competing with “Big Mills Specials, BMS”, “Straight Quality, SQ”, Europe Quality, EQ” etc.

During the British government era, rice exports concentrated in the four main rice export centers: Yangon, Patheingyi, Mawlamyine and Sittway. Out of 3 million tones of rice and rice products exported at that time, Yangon shared about 76% and the rest 10%, 6-7%, 6-8% respectively. Therefore, at that time, rice mills located in Yangon area were major players for rice exports. Big mills consist of about half a dozen European firms were large milling establishments handling about one third of the rice output in the province. Numerous small rice mills owned by Myanmar, Chinese and Indian handled the rest. However, most of the big rice mills and some small rice mills were destroyed during the World War II¹⁴.

¹⁴ Department of Agriculture, *Market Section Survey No.9 Rice, Burma 1958*.

5.2. Socialist Economy Era

During the time of socialist economy era, rice mills in Myanmar could be classified into three categories according to situation: rice mills owned by Agriculture and Farm Produce Trading Corporation (AFPTC) (now MAPT), private rice mills registered with AFPTC to mill the contracted paddy on commission basis, and private rice mills that process exclusively paddy for farmer's own consumption. The majority of the privately owned rice mills were constructed about 25 to 50 years ago and now becoming superannuated. At that time, rice mill owners only depended on milling charges, which was not adequate to replace the worn out spare parts, and had no incentive to renovate their rice mills to improve the productivity and capacity¹⁵.

During 1980s, AFPTC, State Economic Enterprise, constructed modern rice mills of Japanese origin and mechanized grain storage warehouses with financial assistance from Japanese OECF loan, ADB loan and World Bank loan to upgrade the quality of rice and rice products. Rehabilitation of rice mill industry was so significant that the rice produced from the new modern rice mills had fetched a better price in the international rice market. Some private rice mills were also renovated with the financial assistance from IDA loan to improve the quality of rice and rice products.

5.3. Present Era

In 1989, when government liberalized domestic rice marketing private rice mills have become a key role in the marketing activities of rice processing. During 1990s, MAPT (predecessor of AFPTC) also constructed two new 250 tones per 24 hrs rice mills and two new rice reprocessing plants of 360 tones per 24 hrs adding a number of 68 rice mills in order to improve the productivity and also the quality of products. Out of 68 rice mills under the management of MAPT, some are not suitable to process the export quality rice so that to meet the annual target of rice exports set by the government, MAPT has to rely on the

¹⁵ U Win Maung, *History of Rice Marketing in Burma*, unpublished, March 1987.

privately owned rice mills. Ratio between MAPT owned and private owned rice mills processing MAPT's procured stock from 1988-89 to 2001-02 has been shown in Annex (3). From 1997-98 MAPT rice mills processing quantities had been significantly increased¹⁶.

In 2000-01, 462 privately owned rice mills were organized and contracted with MAPT to mill the export quality rice with the full support of Myanmar Rice Millers Association. For their outstanding performance and willingness to take part in the rice export business, recently MAPT honored such privately owned rice mills for their best performance in processing the export quality rice for the year 2000-01.

In 1980, the number of conventional rice mills was 1,877 and currently the number of private-owned conventional rice mills is only 1,149 excluding 68 MAPT owned rice mills. List of rice mills owned by MAPT and private owned rice mills registered with MAPT for the year 2000-01 has been shown in Annex (5). There was a significant reduction in number of private owned conventional rice mills within the two decades of time. The dilapidated condition of worn-out, superannuated rice milling machinery and facilities is the major cause of the disadvantageous position in rice milling industry. This is an alarming for the development of rice industry as rice is the main stay in Myanmar economy.

In 1980, the number of *wunza* rice mills (service milling for farmers) was about 2,000 and today the number of *wunza* rice mills is estimated that more than 20,000. They are registered with local authorities in divisions and states and they all are operating under the supervision of local authorities to carry out service milling for farmers for their own consumption and is shown in Annex (7).

The rapid emergence of small scale *wunza* rice mills has made a great impact on private owned conventional rice mills of which majority are only operating service milling. However, previously as large number of farmers and their families were milling rice by hand pounding at their houses, such emergence of small scale rice mills in remote villages has

¹⁶ U Min Hla Aung, *Commercialization of National Foodgrain Agencies: Problems, Issues and Experiences*, July, 2002.

to be welcome although milling losses are relatively high compared to conventional rice mills.

In 1999, Post Harvest Technology Application Centre conducted a survey on “Situation of losses occurred at *Wunza* Rice Mills in Myanmar”. A random survey was made in 138 *wunza* rice mills in 18 townships in Ayeyawady, Bago, Yangon, Mon, Mandalay and Sagaing. The survey mainly emphasized on processing methods, weakness in supervision, capabilities, support to farmers and how losses can be occurred. It was suggested *wunza* rice mills should be systematically registered and minimum capacity and rice milling machinery used should also be prescribed. Systematic supervision and control of such rice milled through Myanmar Rice Miller’s Association has also been recommended ¹⁷.

In Myanmar, most of the private owned conventional rice mills undertake rice processing only in the form of service milling either for MAPT or rice merchants or farmers and very few have been engaged in commercial milling which is widely practiced in other rice growing countries. Commercial milling refers to that of rice millers who purchase paddy, process and sell white rice. Although domestic rice marketing has been liberalized in Myanmar since 1989, most of the private rice millers still engaged in service milling because of capital intensive and sensitive nature of rice, which is designated as a political crop.

In the case of commercial milling, the milling business itself is of rather secondary importance as their expectations of profit from the commercial transaction selling are far greater. As they mill paddy of their own, their skill in the technical processes such as storage, milling and logistic services directly reflects to their economical standing. Therefore, economic incentives for the technical improvement of processing do exist.

In the case of service milling, the economic incentives to make them strive for technical improvement are rather weak. The reason is that when the contract of service milling is to mill the paddy brought by the customers and to return all the products, on some definite milling charges,

¹⁷ PTAC, *Situation of losses occurred at Wunza Rice Mills in Myanmar*, survey report, February, 1990.

however the milling recovery might be improved and the additional white rice produced is nothing to do with the millers. When the milling charge is paid with by-products such as bran or cow bran or small brokens, which is also practice in Thailand, Indonesia and some parts of Myanmar lower the milling recovery the better the profit millers as it produces more by-products. The following is the calculation of rice recovery as an example for 25% brokens (export quality).

Table 7 : Calculation of Rice Recovery

1. Paddy to be milled 100 baskets (1basket = 46 lbs)	=	4600 lbs
2. Immature, dust, stones, & sand etc: (0.5 lb per basket)	(-) =	50 lbs
	Clean paddy	= 4550 lbs
3. Rice husk, cow bran & points	(-) =	1160 lbs
paddy husk = 1020 lbs		
cow bran = 110 lbs		
points = 30 lbs		
	Lonzain rice	= 3390 lbs
4. Rice and rice products recovery	(-) =	648 lbs
rice brokens 4 baskets = 288 lbs		
rice bran 8 baskets = 360 lbs		
5. Rice recovery		
(a) rice obtained in lbs	=	2742 lbs
(b) equivalent to rice baskets	=	36.56
6. Through put of paddy baskets for processing 1 ton of rice of 25 % brokens (export quality)	=	81.69

Source: MAPT.

Note: 1 paddy basket = 46 lbs
1 rice basket = 75 lbs
1 basket of rice brokens = 72 lbs
1 basket of rice bran = 45 lbs

Total rice recovery = $2742 + 288 = (3030 \div 4550) \times 100 = 66.59 \%$

Head rice recovery = $2742 \times 60\% = (1645 \div 4550) \times 100 = 36.16 \%$

As the practice of paddy quality grading system has not yet been fully prioritized the rice recovery obtained is relatively low compared to other rice producing countries. Average head rice recovery obtained in MAPT's rice mill is 39-40% where as total rice recovery is 62-67%. The main reasons for low rice recovery is excessive content of foreign kernels and red rice and impurities (sometimes more than 2% of which the official limit is 0.5%) which can affect the total rice recovery.

In MAPT's paddy procurement depots paddy quality is assessed to a limited extent and sometimes disputes arise between procurement depot staff and farmers for demanding compensation weight according to weight loss due to excessive moisture content and impurities. MAPT has prescribed quality grading system applying modern instruments like moisture meters, locally made cleaning machines, etc. Generally as the paddy procurement prices are not very attractive to farmers MAPT receives only low or average quality paddy which will not give the good result in milling.

In Myanmar, rice mill's capacity is defined in output quantity of rice of 25% broken. If the rice mill process higher quality better than 25% broken the capacity will become less. For instance, if the rice quality to be processed is 5% broken Super quality the capacity will be less than the rated capacity. However, MAPT's capability in rice processing is only confined to low quality rice. Only 9% of high quality grade rice were processed for export in 2000-01 by MAPT rice mills. Table 8 has shown the actual quantity of various qualities of white rice processed for export.

**Table 8 : Various Qualities of Rice Processed for Export
by MAPT Owned Rice Mills in 2000-01**

Sr.	Qualities of rice	Quantity
1	Super 100 % white rice	5,917 mt
2	Super 10 % white rice	2,565 mt
3	Myanmar 15 % white rice	6,379 mt
4	Myanmar 25 % white rice	156,145 mt
Total		171,006 mt

Source: MAPT.

About 89 - 90% of the total production (monsoon and summer) has been processed in private owned conventional rice mills and small scale wunza rice mills located through out the country. In small scale wunza rice mills the machinery installed are locally made and as there is no code of standards with regards to rice milling such machines are varies in terms of design, effectiveness, efficiency and cost. The survey conducted in 1994, revealed that out of 50 small scale rice mills analyzed, only two rice mills have effectiveness of more than 70% in rice husking process.

Generally, in private owned conventional rice mills the effectiveness could be more than 80% where as in MAPT's modern rice mills because of using rubber roll huskers more than 90% husking efficiency is normally obtained¹⁸. During the financial year 2000-01 and 2001-02, the actual quantity of white rice processed by the MAPT rice mills, registered private conventional rice mills has been shown in the following table.

Table 9 : Actual Quantities of Paddy Milled by MAPT & Private Owned Rice Mills for 2000-01 & 2001-02

(million baskets)				
Year	Production (Summer + Monsoon)	MAPT rice mills	Private owned rice mills registered with MAPT	Wunza rice mills
2000-01	1021.20	29.2	51.6	940.40
2001-02	1050.33	26.5	79.1	944.73

Source: MAPT.

In 1999-2000 average throughput of paddy in basket to obtain 1 ton of white rice (25% broken) and rice outturn in baskets has been shown in Annex (9). It revealed that the quality of paddy from Mon State is relatively unique that the throughput of paddy was only 73 basket (rice recovery 65.65%) for rice for local consumption and 80 baskets (rice recovery 59.9%) for export quality white rice.

5.3.1. Milling Yield and Rice Outturns

The milling process converts paddy into 4 separate fractions, whose approximate proportions are indicated in the following Table.

Table 10 : Milling Process

Sr.	Component	Range in proportion
1.	Rice	45 - 69
2.	Excess broken	0 - 20
3.	Rice bran	8 - 11
4.	Husk & other waste products	23 - 25

Source: MAPT.

¹⁸ U Moe Paw, *Development of Myanmar Rice Industries*, Industrial Development Seminar, October, 2002.

Rice in turn can be further broken down into head rice and broken, the proportions varying according to grade as follows:

Table 11 : Minimum Percent of Head Rice

Sr. No.	Grade of rice	Head Rice (Minimum %)
1.	Super 100%	96
2.	Super 5%	80
3.	Super 10%	75
4.	Myanmar 15%	65
5.	Myanmar 25%	60

Source: MAPT.

It should be pointed out that several different factors influence milling yields. Broadly speaking these include¹⁹:

- Incoming paddy variety and quality or conditions: a function of the material supply chain from farmers to rice mill.
- Milling machinery and configuration: certain types of equipment are more effective than other.
- Personnel managing, supervision, operative and maintenance of the rice mill.

Deciding the relative significance and import of these and other variable on milling yield as a complex task. MAPT's head rice yield average about 39% and are independent of the rice output average throughput of paddy in baskets to obtain 1 ton of white rice and rice outturn in each division and state. Mon State had shown significant higher rice recovery.

5.3.2. Machinery and Spare Parts Development

Rice mill machinery and spare parts were supposed to be manufactured by government sector during the planned economy era but as the production system was not organized to undertake mass production, the production capacity was more or less limited. However, surprisingly there has been very limited specialized industry for manufacturing of rice processing machinery in Myanmar.

¹⁹ Dale Int'l, *Paddy and Rice Storage Project Report*, January, 1985.

It is likely that rice milling machinery themselves seems very simple and considered to be serviceable by any general machine shop. However, in order to make them functional exactly meeting to the requirement of the situations, specialized industry are necessary who understand not only machines but also characteristic of grains and processing technology²⁰.

In order to process large amount of paddy annually, it seems that two or three rice milling machinery manufacturing factories are needed even only for maintenance and repair of rice mills. A joint venture company, Myanma Rice Engineering Company, MREC related to manufacturing of rice milling machinery was established in 1992 by MAPT in cooperation with RES Co Ltd from Thailand to produce rice milling machinery locally but later due to failure to operate economically it was abolished in 1999. On the other hand, most of the private rice millers have shown little interest in renovating their rice mills and the sale of new machinery is not very much promising compared to other industries. Unfortunately, although its long existence, Myanmar rice milling industry has no code of standards for installation of rice machinery.

Some of the rice mill's spare parts like rubber rolls are imported from Thailand, Malaysia and Vietnam. Myanmar has been endeavoring to manufacture rubber rolls locally but some improved technology is still lacking. Although augmenting rubber roll huskers in rice mill could eventually give a better result in rice recovery, millers are reluctant to replace their husking machines because of limited incentive and increase in operating costs. MAPT owns Rubber Rolls Factory in Yangon but it was ceased production due to high costs of chemicals and the nature of trade secret, which was not easily available in international markets. It is more economical to import rubber rolls than locally produced because of high costs of chemicals. Currently MAPT has been trying to rehabilitate this factory in cooperation with the private sector.

The necessity of the specialized industry for the manufacturing of rice post-harvest machinery might strongly be felt when summer paddy cul-

²⁰ OMIC, *Rice Mills Project, Burma, Consultancy Report*, 1980.

tivation has been introduced to some extent when paddy driers will be required to maintain quality of paddy at the time of harvest. Several public and private firms have been manufacturing paddy driers but the quantity produced is very limited and also the level of technology is also poor and can only be used for small scale. MAPT constructed big scale paddy drier but the utilization has also become limited due to constraints like not enough power, more down time, costs vs quality is not very attractive for farmers, etc.

If private rice millers have intention to improve and augment their facilities such as paddy cleaners, vibrating sieves, blowers, dust collecting device, conveyors, wet polishers, there is no difficulty in manufacturing locally. However, due to poor benefits at the millers' side, majority of rice mills will still be reluctant to improve their rice mills. And on the other hand, rapid emergence of small scale rice mills in villages which are known as huller rice mills have also affected medium scale private conventional rice mills in terms of costs.

Many technical and engineering difficulties encountered in the operation of rice milling are delicate in nature and hard to be analyzed theoretically. Therefore, qualified engineers or mill operators specialized in rice milling technology are also scarcity in Myanmar and at the same time, human resource development programmes on such technology should also be formulated and implemented in-conjunction with Ministry of Science & Technology and related institution like MAPT.

5.3.3. Small-Scale Rice Mills

The rice farmers' produce requires the transformation from paddy to rice for their home consumption and rice marketing. Farmers rely on the small-scale mills commonly called "*har-lar-sek*" or huller, which is found in rural area. The milling capacity is over 5 metric ton. For marketable surplus of paddy and family consumption, most farmers mill their paddy in the village.

Based on the survey results, some small-scale mills were in the range of 15-30 metric tons of rice per day. The busiest time of rice milling re-

lates to the monsoon rice and summer rice-harvesting period. It is found out that the lowest operating time is monsoon rice-planting period.

Table 12 : Milling Activities of Small-Scale Rice Mills

Region	Milling activities	Description	Milling period
1. Rice surplus area	<ul style="list-style-type: none"> • The busiest operating time • The lowest operation time 	Monsoon rice	October-March
		Summer rice	April-May
		Monsoon rice	June-September
2. Rice deficit area	<ul style="list-style-type: none"> • The busiest operating time • The lowest operating time 	Monsoon rice	December-February
		Summer rice	May-September
		Monsoon rice	October-November
		Summer rice	March-April

Source: MAPT.

Note: This survey was conducted in Yangon, Ayeyarwady, Mandalay Division and Mon State 2001.

During the survey period, out of 12 rice millers interviewed in rice surplus areas, two involved in prior contract with agents which was accounted for 3-10 agents to purchase paddy from the surrounding areas of rice mills. Rice millers provided the advance payment to agents. The provision of working capital was in the range of 1.0 to 1.6 million Kyats.

The agents went out villages to purchase paddy and delivered paddy to the rice mills. Some agents sold paddy to rice millers with existing market price and paid back the advanced money. Some agents milled their purchasing paddy and sold the milled rice to the rice millers. In this case, the millers received milling charge and milled rice. Before milling, the agent considered the quality of paddy, average recovery rate of milling, existing rice price, brand and broken rice and cost and profit margin. The rice millers interviewed did not pay commission, or salaries or fixed rate commission on the purchasing quantity of paddy or of milled rice.

Only one of 12 rice millers interviewed used agents to purchase paddy from farmers and paid fixed rate of 10 Kyats per basket. The agent organized the farmers to sell their paddy and the rice miller interviewed arranged to collect the paddy and delivered to his mills. The survey result showed that 75 percent of paddy was purchased from farmers and the rest of 25 percent was provided by agents.

All of the small-scale millers interviewed required the paddy to store for the monsoon rice cultivation period. 58 percent in the sample stored the paddy to mill during the lowest operating time, the rest purchased paddy from farmers at their mills. To hold the stock, the requirement of paddy per month was 5,000-30,000 baskets (125-750 MT). The stored quantity depends on the milling capacity and finance available.

During the monsoon rice-planting period, paddy stored was not enough day-to-day milling. At times, the millers involved in custom milling. Some rice farmers stored the paddy to obtain higher price during the monsoon rice cultivation period. Thus, from the stock, some were taken out and it was milled both for family consumption and for selling. After milling, brand and broken rice were brought back to home for feed and milled rice was sold to rice millers or town wholesalers.

Only one of 12 millers interviewed stored farmers' paddy in his mill and did not take the storage charge from farmers. In turn, the farmers had to sell their rice to the rice millers with existing market price. In this way, the rice miller arranged to obtain paddy without using finance. From the economic point of view, the miller lost the opportunity cost of storage charge.

Some traders purchased paddy at the harvesting time in the expectation of higher price in later season. The rice millers interviewed stored paddy in his warehouse on behalf of the traders. For this, the miller did not take the storage charge. Afterwards, the trader sold paddy to rice miller when the paddy price was on the rise. In this case, the rice millers and traders trust each other due to the long-standing relationship. Thus, the rice miller interviewed did not require finance to store the paddy. As a matter of fact, the rice miller did not have enough working capital to store paddy for milling during the monsoon rice-planting period.

It is found out that the reason of holding stock for the lowest operating time is:

- to pay salaries and labor wages for permanent laborers and daily laborers in the mills.

- to supply to regular buyers of rice town wholesalers and market wholesalers in the same town.
- to sell milled rice to the traders in rice deficit areas.
- to receive the profit margin from stored paddy.

Only one of 4 millers interviewed in rice deficit areas provided credit without interest to 10-15 rice farmers to obtain the paddy at the harvesting time. The provision of credit is to purchase chemical fertilizers and to hire laborers for rice cultivation. At the harvesting time, the miller purchased paddy from farmers with existing market price and deducted the amount of credit from farmers' sale value. Normally, price of paddy begins to decline at the harvesting time. Thus, the miller received paddy with low price from farmers. The purpose of provision of credit to rice farmers was to increase the milling activities during the lowest operating time. Only 36% sample wholesalers used own fund and the rest relied on bank loan and informal moneylender.

A total of 22 small-scale millers interviewed in rice surplus area and rice deficit area. Out of 22 millers interviewed, 10 millers in rice surplus area involved in inter state-division trade. Of the operating capital, the proportion of own fund is greater than bank loan and informal moneylender.

6. UTILIZATION OF BY-PRODUCTS

In this section, bran oil mills, *mohinga* factories and rice-vermicelli mills are highlighted. There are also alcoholic business and other by-product of rice business which is not stated in this paper.

6.1. Bran Oil Mills

Regarding rice by-product utilization, in 1957, private entrepreneurs established the first rice bran oil mill in Myanmar with the financial assistance from Industrial Development Fund. The machinery installed was all imported from abroad. At the same year, Union of Burma Applied Research Institute (UBARI) constructed a pilot scale rice bran oil mill applying Hexane to extract oil from rice bran and the project

was succeeded. Base on the findings from the pilot project, from 1958 to 1962, six rice bran oil mills were constructed, obtaining fresh rice bran from rice mills and rice bran cooking oil was produced from these bran oil mills.

Later, State Agricultural Marketing Board (SAMB) constructed more rice bran oil mills in strategic rice producing areas and at present rice bran oil mills are operating to produce MAPT industrial oil and rice bran cooking oil mainly for local use. Defatted rice bran has been exported as animal feed.

Myanmar is one of the pioneers in South East Asian countries in commercial application of solvent extraction of rice bran oil from rice bran. After World War II, various capacities of rice mills were emerged in rice producing areas and as a result there were abundant supply of rice bran as by-products.

In 1955, Central Research Organization (CRO) conducted a pilot project on feasibility study on commercial processing of rice bran oil with the technical assistance from Armour Research Institute, USA. Base on the findings from pilot study commercial process of rice bran oil had been successfully applied by the private sector. The first rice bran oil mill of Japanese origin was established in 1957, capacity of 45 tons per day and refinery capacity of 10 tons crude oil per day. Later, series of rice bran oil mill of German and Japanese designs were established by the private sector. In 1962, rice bran oil mill of Myanmar design was implemented but due to technical problems it was not materialized²¹.

In 1963, because of non-availability of raw material (rice bran) private rice bran oil mill were no longer able to run and eventually all were transferred to SAMB (predecessor of MAPT). Currently, MAPT has been operating 18 number of rice bran oil mills producing more than 2,000 metric ton of edible rice bran oil annually. The list of MAPT owned rice bran oil mills has been shown in Annex (11). Recently MAPT constructed new bran oil mill in upper part of Myanmar to produce edible rice bran oil for local consumption. Processing of edible rice bran oil

²¹ MAPT, *Operations of MAPT Rice Bran Oil Mills*, Interim Report, June, 2002.

by MAPT owned rice bran oil mills from 1997-98 to 2001-02 has been shown in Annex (4).

Rice bran oil processing is a relatively small but technically complex production operations. Rice mills owned by MAPT or contracted private owned rice mills have been producing over 170,000 metric ton of rice bran annually. Only about 20 to 22% of this output has been processed by MAPT owned rice bran oil mills. Crude oil yields range from 12 to 14% with a further approximately 60% loss occurring during refining. Edible oil accounts for 40 to 50% of output, the remaining oil being sold as industrial oil. About 80% of rice bran input is salvaged as OERB (oil extracted rice bran) and exported as animal feed.

To produce edible rice bran oil it needs to transport the raw material rice bran from rice mill to rice bran oil mill within 48 hours. Otherwise because of enzymatic activity in rice bran free fatty acid content could be increased with the rate of average 1AV (acid value) per hour and if the AV reached 40, edible rice bran oil can not be obtained.

To be able to slow down the enzymatic activity of rice bran it is necessary to stabilize the rice bran immediately after whitening process in rice mills. It can control the rate of increase of AV in rice bran. In 1978, AFPTC (predecessor of MAPT) with financial assistance from Asian Development Bank installed 28 number of 5 tons/24 hrs and 6 number of 10 tons/24 hrs bran stabilization plants in private owned rice mills. But later due to insufficient boiler efficiency such stabilization plants were no longer utilized.

MAPT owned rice bran oil mills have to formulate transport plan to bring rice bran to their oil mill within 24 hours. If the transportation is not feasible MAPT developed rice bran extruder in 1998-99 to stabilize the rice bran. The first extruder was incorporated in MAPT owned 150 tons rice mill and later 4 extruders were also installed in other 4 MAPT owned rice mills. MAPT owned bran oil mills are more than 30 years old and their existing capacities are only 65% of their rated capacities. Processing and distribution of edible rice bran oil from 1999-2000 to 2002-2003 (end of November) has been shown in Annex (6).

6.2. Mohinga Factories

Mohinga is Myanmar favorite snack normally eats as breakfast. It is a fish flavored noodle soup widely consumed all over the country. The consumption rate is relatively high and most of the factories are small scale cottage industries. In Yangon, survey made by the *Myanmar Times* reveals that about 70 tons of *Mohinga* noodles have been consumed every day²².

Making the *Mohinga* noodles is a big business and there are scores of noodle factories throughout Yangon with some of the biggest production more than 2.5 ton a day. Such small factories are supplied by dough factories, which are small, family-run operations. Rice broken is used for dough making but sometimes rice has been used.

A 42 lbs bag of top quality rice broken can make more than 100 lbs of dough and in turn 97 lbs of dough can make up to about 215 lbs of *Mohinga* noodles. The noodles are made by forcing the dough through an extruder and the resulting strands drops into a cauldron of boiling water. After about 30 seconds they float to the surface are scooped up and drop pad into the cauldron of cold water. About 30 seconds later they are scooped up again and packed into small flat wicker baskets ready for deliver to *Mohinga* shops.

6.3. Rice Vermicelli Mills

In Myanmar, rice vermicelli is consumed as snack. For process of rice vermicelli, Ngasein rice is mainly used. The reason is that Ngasein rice is the cheapest price variety and suitable for processing of rice vermicelli due to high gel consistency. If Emata rice variety is used as raw material, rice vermicelli has become stick and soften. The food processors use Ngasein variety and white color of rice is good quality and if it is not, the color of rice vermicelli is not preferred in the domestic market.

According to the market reconnaissance, Thonegwa Township,

²² Myanmar Times, *The Nation's Favourite Snack*, July, 15-21, 2002.

Kwanchankone Township and Hlaing-tha-yar in Yangon Division, Myaungmya Township in Ayeyarwady Division and Amarapura and Kywe-Se-Kan in Mandalay City in Mandalay Division are prominent for production and marketing of rice vermicelli. Large mills in industrial zone in Hlaing-tha-yar located Yangon City are modernized and they have dry room to dry rice vermicelli and small-scale factories rely to dry the rice vermicelli by means of sun. Thus, it is called sundry rice vermicelli. However, the small-scale factories cannot produce a large volume in the rainy season.

Food processors supplied to the market with different brands such as Nagani, Tharaphu, Hongkon, Pale and Pave. The first three brands are mainly sold to the Yangon market and the remaining brands are sent to the other markets.

According to the survey results, day-to-day production of rice vermicelli varies depending on season, small-scale and large mills, which are shown in Table 13.

Table 13: Requirement of Rice for Rice-Vermicelli Mills

Survey area	Type of mills	Season	Requirement of Ngasein rice variety (30 viss bag/day)	Requirement of Ngasein rice variety for 4 months	
				Number of Bags	(Metric ton)
Myaungmya	Small-scale mill	Summer	19	2,280	114
		Rainy	10	1,200	60
		Cool	19	2,280	114
		Total		5,760	288
Yangon	Small-scale mill	Summer	60	7,200	360
		Rainy	30	3,600	180
		Cool	45	5,400	270
		Total		16,200	810
Yangon	Large-mill	Summer	120	14,400	720
		Rainy	120	14,400	720
		Cool	120	14,400	720
		Total		43,200	2,160

Source: Survey conducted by the Study Group.

Note: 30 viss of rice bag x 20 bags = 1 metric ton of rice. Large mill in Yangon City use 120 bags of Ngasein rice per day due to 2-shift milling.

It is found out that small-scale mills and large mills are different turn-out. The finished product of rice vermicelli varies depending on the type of mill. The percent of turnout for small-scale mill ranged from 73 to 83 percent and 85 percent for large mill.

Table 14 : Turnout of Finished Product of Rice Vermicelli

Survey area	Type of mill	use of raw material (Ngasein rice variety)	Finished product of rice vermiceli	Percent of outturn
Myaungmya	Small-scale mill	30 viss	25 viss	83
Yangon	Small-scale mill	30 viss	25 viss	83
Yangon	Large-mill	30viss	26 viss	85
Mandalay	Small-scale mill	30 viss	22-25 viss	73-83

Source: Survey conducted by the Study Group.

Note: Staff of Market Information Service (MIS staff) conducted this survey in October 2002. The survey areas selected are Myaungmya, Mandalay and Yangon market.

Normally rice vermicelli is packed by plastic bag. After that polyethylene bags pack them again. On bag of polyethylene contains 7.50 viss (1 viss=1.63 Kg). The biggest flows of rice vermicelli are observed as follows:

- From Yangon to Tatkone, Pyinmana, Mandalay and Meikhtila market in Mandalay Division and Monywa market in Sagaing Division.
- From Yangon to Taunggyi market in Southern Shan State and Northern Shan State.
- From Yangon to Mon State and Myeik and Kawthoung market in Tanintharyi Division.
- From Mandalay to Kachin State, Southern and Northern Shan State.
- From Yangon to Patheingyi market in Ayeyarwady Division.
- From Myaungmya in Ayeyarwady Division to Yangon market.

According to the market reconnaissance, price of rice vermicelli relates to Ngasein rice price in the domestic market. In addition to that, its price increased in the rainy season because small-scale mills cannot produce usual quantity in cool and summer season. They faced the constraint of sundry and supply volume declined in the rainy season.

7. NATIONAL RICE POLICY

Rice marketing was controlled by the government, which lasted almost a quarter of century from 1963 to 1987. After the adoption of free market economic system, the government has been steadily reducing its direct involvement in rice marketing. With regard to rice, the *domestic marketing is partially liberalized while rice export is still in the hands of government.*

The present National Rice Policy (NRP) related issues are highlighted as follows:

- The main objective is to provide rice for the increase demand of domestic utilization and have exportable supplies.
- Presently, the government focus on two types of policy on rice:
 - a price policy that applies to rice farmers and
 - a subsidy policy that applies to low income consumers.
- On the production side, the government attempt to stabilize the price at the highest possible level in order to secure at least remunerative prices and to provide incentives to farmers to increase production and adopt more advanced technologies.
- On the consumption side, government try to stabilize the price at the lowest possible level with maintaining the buffer stocks in order to assure that all consumers can afford at least minimum nutritional requirement.
- To distribute rice to the government employee, military and their families with subsidized price and export surplus of rice, the government made price-setting arrangements for paddy purchasing scheme.
- At present, paddy is purchased from farmers with advance payment made at the time of cultivation. This event occurred from centrally planned economic system up to present era. In 1999-2000, the advance payment for full value of the contracted amount of paddy was made at the time of rice cultivation.
- At the same time, the government is still practiced its land tax and irrigation water tax which are very low rate for rice farmers. In other wards, it is a sort of subsidy achieved by present policy, which is the same as the centrally planned economy era.
- Rice farmers sell their quota paddy to (2 to 11 baskets per acre

according to divisions and states) Myanma Agriculture Produce Trading (MAPT), Ministry of Commerce, and the rest of marketable surplus of paddy can be sold to private sector. To increase the country's rice production, summer paddy can be sold in free market, no need to sell to MAPT.

- Regarding the land policy, it was stipulated by the farmer two constitutions of 1948 and 1973 remains unchanged with the ownership of all land by the State. Thus, *farmers are granted land use rights (the right to occupy and cultivate land) on their holdings, which cannot be transferred, mortgaged or taken over in lieu of loan repayment.*
- Regarding fertilizer marketing, the government encourages private sector for importation and distribution in domestic market.
- To provide the working capital to rice farmers, the state owned Myanma Agriculture Development Bank (MADB), borrowed the seasonal loan with the interest rate of 15 percent of interest rate per annum. The Central Bank of Myanmar charged commercial rate of on the MADB borrowings, which is currently 10 percent per year. In addition, MADB provides a portfolio for term loans: short-term loans (2.4 years) and long-term loans (5 years and above).

7.1. Paddy Purchasing by State

With regard to rice marketing, *the government nationalized both procurement and external trade of rice.* And it purchased paddy with support price in December 1963. In 1964, the government prohibited domestic marketing of rice processing, transportation, storage, wholesaling and retailing. Change of state paddy purchasing system is highlighted as follows:

- In 1965, Trade Corporation No.1 was formed and Union of Burma Agricultural Marketing Board (UBAMB) was restructured as Trade Corporation No 1. Under the centrally planned economic system, farmers had to sell their produce after deducting their own consumption to TC No.1. The main objectives were to distribute rice to majority of the population and to export rice to earn foreign exchange. At that time private rice mills were utilized to process the state owned paddy on contractual basis providing milling hire charges. Therefore,

all the private rice mills had to register with the TC No.1, for obtaining milling licenses.

- In 1973-74, the government adopted a legal supported paddy procurement system but due to many reasons it was not materialized in that year. Farmers had to sell their paddy according to individual sale statement. In the statement, minimum sale quota by each farmer was calculated on the basis of individual sown areas and yield per acre after deducting seed requirement, wastage and own consumption²³.
- In 1974-75, TC No.1 procured paddy with advance payment made at the time of cultivation. Paddy procurement system, which was called compulsory delivery system, had many problems in delivering the individual sale quota to government when there was unfavorable weather for that particular year of which the volume of production resulted a bare minimum.
- In 1976 TC No.1 was restructured and Agricultural and Farm Produce Trade Corporation (AFPTC) was emerged. Top, middle level management were also reorganized and corporate functions were oriented to be more efficient and commercialized. Paddy procurement prices were also reviewed and increased. Special paddy procurement prices were also prescribed for farmers who wished to sell extra quota after meeting their obligation. Or they were allowed to sell their surplus paddy in the markets within their township boundary.
- During the socialist government era, farmers had to sell all surplus paddy to the state, therefore in some areas, farmers had to turn their land to government because of no incentive at their side. As rice businesses were monopolized by the State, and private sector no longer involved there was a negative impact on development of rice mills, grain storage warehouses and transport vehicles.
- In 1989, SLORC liberalized procurement; marketing, processing, transportation and storage of food grains according to State owned Economic Enterprise Law. Co-operative societies, Joint-Venture Corporations, private merchant were allowed to undertake purchasing of food grains directly from farmers. However, government procured about 10% of the 210 million metric ton of paddy production, which were about 2.1 million metric ton (100 million baskets) for distribution of rice to target groups and for export from marketable

²³ BSPP, *Production & Marketing of Rice in Myanmar*, March 1987.

surplus. Paddy procurement prices were also increased but later market prevailing prices exceeded the government procurement prices and to some extent affected paddy procurement process. In 1993-94, government endeavored to establish policy of selling paddy 12 baskets per acre but later there were disputes in some areas on sown areas and yield among the authorities and farmers.

- In 1994-95 and 1995-96, as advance payment was not made at the time of cultivation, it seemed that there were no obligations at farmers side and affect the government paddy procurement process. In 1997-98, paddy procurement by tender system from private merchants was introduced but not succeeded. In 1998-99, paddy procurement by advance payment system was re-introduced and payment for full value of the contracted amount of paddy was made at the time of cultivation.

Table 15 : State's Paddy Purchasing Volume²⁴

Year	Sown acre (mil acres)	Yield (basket /acre)	Paddy production (mil baskets)	State purchasing amount (mil baskets)	% on total production	Rice supplied to target groups (mil mt)	National reserve (mil mt)	Rice & rice products export (mil mt)
1999-00	15.53	62.85	964.46	105.83	10.97	0.685	0.05	0.069
2000-01	15.71	65.62	1,021.97	101.74	9.96	0.594	0.01	0.257
2001-02	15.94	66.29	1,050.33	101.38	9.65	0.589	0.15	1.034

Source: MAPT.

After liberalization, MAPT annually procures paddy about 2-11 baskets per acre according to divisions and states. Paddy production (Monsoon & summer) and paddy quantity procured by MAPT in 2002-03 financial years has been shown in Annex (13). The government, through MAPT normally pays 100% of contracted value in advance at the time of cultivation. As such procurement system has been practicing since the time of planned of economy, farmers are well accustomed that they have

²⁴ MAPT, *MAPT in Figures, 2000-2001*, December 2002.

obligation to sell their allocated quantities to the government. It is likely that there is not much problems and issues for MAPT to collect paddy in kind at the time of harvest depending on the market prevailing prices. On the other hand, the average quantity of which they have to supply to MAPT is only 2-11 baskets per acre according to rice deficit and surplus areas which is a meager quantity and due to market liberalization they are allowed to sell the balance quantity with market prevailing prices. Annex (8) and Annex (10) have indicated specified paddy procurement prices as per state and division wise in 2001-02 and number of procurement depots to be opened during 2002-03 respectively.

7.2. Food Security

Previously under centrally planned economy, about 4 million metric ton of paddy was stock piled. But that was achieved only for three years with significant amount of grain stock from 1981-82 to 1983-84. As the procurement volume declined no stock could be kept anymore for emergency use since 1984-85. After grain trade has been liberalized in 1999-2000 national resource of 50,000 metric ton of rice has been kept in different locations in 5 divisions. Subsequently in 2000-01, 25,000 metric ton of rice and 41,700 metric ton of paddy was kept as national reserve in different locations in 5 divisions²⁵.

At the same time, Myanmar being a member of ASEAN, MAPT is responsible to maintain the stock of ASEAN reserve of 14,000 metric ton of rice. During the Second Meeting of the ASEAN Agriculture and Forestry Ministers and the Ministers of China, Japan and Korea, it was agreed to launch Pilot Project of the East Asian Emergency Rice Reserve on voluntary basis to improve the existing coordinating and monitoring system of the ASEAN Food Security Reserve Board (AFSRB) and to aim at the expeditions establishment of the East Asian Rice Reserve System with a view to strengthen food security and eliminating poverty in the region. Presently under the guidelines from AFSRB, Myanmar has formed a Working Group on National Food Security Information System.

²⁵ U Tin Shwe, *Stabilizing Domestic Grain Markets for Food Security in Trade Liberalization Mode*: December 2001.

8. RICE EXPORT

Rice is the staple food and also a leading earner of foreign exchange. Despite export of rice has dominated export of agricultural produce for the last few years, it is to be noted that export of pulses and beans have been increasingly replacing the export of rice. Regarding rice, efforts had been made to boost the export in 2001-02 achieving 1.034 million metric ton had been exported. At present, export of rice has been controlled by MAPT which is the only institution undertaking the rice export business.

MAPT's corporate goal is to significantly raise rice exports by capitalizing on increases in production due to increased process and production losses and higher possible consumption rates. Referring to statistics from the Ministry of Agriculture and Irrigation, it has indicated that exportable surpluses are increasing. However, increase in exportable surpluses would only be feasible if the following conditions for public and private rice sector are met.

- System losses are reduced.
- Average milling yield are raised.
- Minimal increases in per capita consumption rates occur.

At present, MAPT has been in the stage of rehabilitation process, striving to get some international market segments which had been disappeared during the last few years due to inferior quality and poor port services. Rehabilitation scheme includes paddy and rice quality improvement strategies at MAPT's grass root levels, application of effective price mechanism to be able to compete with Myanmar's traditional competitors, maintaining consistence supply to the buyers, flexibility on buyer's demand and improved services in vessel loading.

In fact, MAPT needs to develop a careful planned marketing strategy which links marketing effort to production capability. But on the other hand, MAPT paddy procurement has been oriented on quantity aspect rather than quality aspect, that has been rooted from the days of centrally planned economy selling only ordinary or inferior qualities to MAPT's procurement depots. In theory, MAPT should be free to control

procurement and export through price mechanism. However, as rice has been designated as political and social crop in the country and as there is limited incentive for individual farmer to boost up the paddy production output and skeptical on per capita rice consumption, export of rice will still be remained in the government's control.

In the export business, effective market research should be undertaken to identify a suitable product range to meet the needs of new market segments. But due to limitation on capabilities of rice processing facilities to process some better grades and limitation on quality of procured paddy, MAPT can supply only limited product range. White rice 25% broken is the product range of which MAPT can substantially supply at this moment.

In the future, it is likely to increase proportion of high grades in MAPT's rice exports. One of the attempts of which MAPT involves in this area is to promote export of premium quality fragrant rice to Malaysia and other lucrative markets. It is jointly implemented by Myanmar Agriculture Services, MAS, of Ministry of Agriculture & Irrigation, MAPT and BERNAS of Malaysia. MAS is the raw material supplier and responsible from production of premium quality paddy through contract farming with local farmers from selected areas; MAPT will be responsible for logistics, rice processing and export and at the Malaysian side, BERNAS will take care of distribution in Malaysian markets. Table 16. has indicated export of Myanmar rice and rice products through normal and border trade during the years 1999-2000 to 2002-02.

Table 16 : Export of Myanmar Rice & Rice Products Through Border & Normal Trade²⁶

Commodities	1999-2000		2000-2001		2001-2002	
	(mt)	Value (mil USD)	(mt)	Value (mil USD)	(mt)	Value (mil USD)
Rice	57,702	12.002	215,493	32.379	848,494	105.486
Rice broken	11,097	1.176	41,376	3.100	82,485	6.566
Paddy	18,246	3.391	81,826	7.870	96,079	14.707
equivalent rice (in million basket)			(7.686)		(2.249)	

Source: MAPT.

²⁶ CSO, *Statistical Year Book*, 2001.

In the export policy, it has also been clearly defined that government allows all export commodities that has not effected the domestic consumption.

9. RICE MARKETING

This section is highlighted for domestic rice marketing by private sector during the market oriented economic system.

9.1. Farmers' Marketing

Rice farmers in this country use to store seed from their production for next planting season and some carefully selected for their seeds. In addition to that, they sell their quota to MAPT paddy purchasing depot.

Then family requirement for consumption, which is called *wunza* and surplus of sale, are stored in granary. In this case, stored quantity varied from farmer to farmer, depending on the size of household, production volume and financial condition. Some farmers hired laborers paid by paddy as wages.

Generally speaking, large farmers kept their surplus of sale in the expectation of higher price in later season. Afterwards, stored paddy was taken out and sold to primary collector (village brokers) or agents of millers or rice millers. As regards sale, some farmers sold at the farm and some delivered to the nearest rice mills. After milling, some parts were delivered back to home for their consumption and the rest were sold to rice millers or town wholesalers. In addition, by products of broken rice and brand were taken back for feed.

Small farmers did not hold surplus of sale like large farmers. *Regarding the almost immediate disposal of paddy*, small farmers could not take advantage of the subsequent rise in the price of paddy when supplies became low during the monsoon rice planting period. The reason is that working capital urgently required for second crop such as pulses or summer rice after harvesting monsoon rice. Due to financial condition surplus of paddy was sold with low price. Normally, rice price starts to

decline when newly harvested rice begins to supply to the market.

As mentioned earlier, MAPT makes purchasing contract with rice farmers during monsoon rice planting period. It is learnt that the purchasing quota varies 10 to 11 baskets per acre for rice surplus area and 2 to 10 baskets for rice deficit area.

In some cases, large farmers milled their surplus of paddy and delivered back to village in which milled rice was sold to land laborers and small farmers who faced shortage in stored quantity during the monsoon rice planting period.

It is learnt that farmers sold their quota to MAPT purchasing depot however they endeavored to fulfill the quantity, without considering the quality. The main reason is *MAPT purchasing price is low compared to market price*. This is one of the important points because MAPT exports rice depending on its purchasing volume.

Regarding surplus of sale, the different of paddy basket size can be found in rural area. For example, if farmers sell their produce at the farm, traders purchased with basket in terms of volume basis. In actual transaction, rice farmers and traders negotiated depending on paddy variety, quality, moisture content, foreign matter content and size of baskets. However, MAPT purchased paddy based on weight basis and 1 basket of paddy is 46 lb (20.86 kg). It is learnt that some big rice mills purchased paddy by weight basis.

Purchasing price of paddy varies depending on size of baskets. Normally, one basket equals to 16 Pyis and 1 Pyi is equivalent to 8 tins (Nozibu). According to the field survey²⁷, difference of paddy basket size depending on locating and user is mentioned in Annex (14).

9.2. MAPT's Rice Prices

MAPT is only responsible to distribute rice to target groups such as government employees, military and their families. For target groups

²⁷ This survey was conducted by Ms. Ikukuo Okamoto.

MAPT distributes with subsidized prices. MAPT also distributes rice to hospitals, prisons, social welfare institutions and projects and the prices are at cost prices in sale prices by MAPT according to rice standards has been shown in Annex (15). In the Table “First category” prices are subsidized prices where as “Second category” prices are at cost prices. Current selling prices of rice products by MAPT locally has been shown in Annex (16)²⁸.

9.3. Paddy and Rice Quality

MAPT procures paddy directly from farmers with prescribed standard specifications according to varieties. Annex (12) has shown MAPT’s paddy specifications according to varieties. MAPT procurement staff has to inspect the paddy quality such as moisture content, impurities content, damaged kernels content etc. before receiving the stock. If the condition of paddy quality parameters exceed the rejection limits farmers are asked to dry or to treat the paddy stock until it reaches the prescribed quality parameters.

And if the paddy quality parameters fall within the tolerance limits farmers have to deliver weight compensation to MAPT according to Ready Reckoner. For instance, if the paddy moisture content is 20%, it will be rejected and farmers are asked to dry their paddy until it reaches the permissible limits. If it is 17%, weight compensation will be asked adjusting with permissible limits. As MAPT’s procurement prices are not very attractive, farmers are not willing to treat their paddy properly and deliver inferior quality to MAPT procurement depots.

Regarding rice and rice products, MAPT has 31 products range of rice and 16 products range of rice and rice products. Annex (17) has shown sample standard specification of Myanmar White rice 25% broken. Although MAPT offers 31 rice products in its specifications however only few have seen significant sales. In high demand products, only two products fall in this group yet they account for about majority of total export²⁹.

²⁸ MAPT, *MAPT’s Statistical Year Book, 1999-2000*, August 2001.

²⁹ MAPT, *Standard Specifications for Myanmar Rice and Rice Products*.

9.4. Rice Marketing by Private Sector

As discussed earlier, in 1963, State Agricultural Marketing Board (SAMB) was reformed as Union of Burma Agricultural Marketing Board (UBAMB) and paddy procurement by private sector was no longer allowed and the government controlled by marketing of food crops including rice, wheat and seven items of pulses.

In 1964, the government prohibited domestic marketing of rice, rice processing, transportation, storage, wholesaling and retailing. Rice was distributed to majority of the urban population, through the township level trade offices are retailing outlet. But later, rice was distributed through co-operative societies.

The government adopted *the same rice retail prices all over the country* without considering the marketing cost associated with handling cost, storage cost, packaging cost and transport cost. As a consequence, there was a huge subsidized cost at the state budget level. In 1965, rice price was re-adjusted depending on variety and locality.

In 1989, State Law and order Restoration Council (SLORC) liberalized procurement; marketing, processing, transportation and storage of food grains according to State owned Economic Enterprise Law. Corporations and private merchant were allowed to undertake purchasing of food grains directly from farmers. Regarding rice marketing, *private sector had become vital role after adoption of market oriented economic policy.*

Table 17 : Rice Surplus and Deficit Areas

Region	Rice surplus area	Rice deficit area
Delta region	Ayeyarwady, Bago, Yangon Division and Mon State	Yangon
Central dry zone region	Sagaing Division	Mandalay and Magway Division
Coastal region	Rakhine State	Tanintharyi Division
Hilly region	Kachin State	Shan (Southern, Northern and Eastern), Kayin, Kayah and Chin State.

Source: MAS.

Note: This calculation based on the country's rice production for the year 2000-2001. The total population is estimated to be 50.125 million.

For the country as a whole, rice is surplus however some regions are still deficit. Although monsoon rice and summer rice is grown in rice deficit area depending on the agro-ecological zones and available water resources, rice production cannot match the growing demand of local consumption. Thus, rice from surplus area is marketed to deficit area.

The wholesale price quotation varies depending on the market. The price quotation of rice is normally 30 viss bag (108 lb. or round about 50 Kg) including polyethylene bag in the domestic market.

Rice from Ayeyarwady Division was delivered to Yangon market by waterway as well as highway. Pakokku market is prominent market in Magway Division, one of rice deficit areas in the Central Myanmar. All of the 6 wholesalers in Pakokku market interviewed responded that Zeyar rice variety is the most common rice variety, which is marketed from Myaungmya Township and others towns in Myaungmya District in Ayeyarwady Division, one of largest surplus area in the Lower Myanmar. For Pakokku market, rice from Ayeyarwady Division was mainly transported by waterway. The reason is that it is located on the bank of the Ayeyarwady River, which is ever flow from the northern part of the country to the Delta region, southern part of the country. The Ayeyarwady and its tributary, the Chindwin, are navigable through the center of the country. Thus, rice from Ayeyarwady Division is transported to Pakokku market by waterway and the transport cost is cheap compared to cost of highway. Thus, traders and consumers thank to the Ayeyarwady River.

Rice from Sagaing Division was sent to Pakokku market by truck. From Yangon to Mandalay market, the wholesalers mainly used truck and some rely on the train. In Pyay market, rice wholesalers used to highway for the transportation of Mandalay market, Taunggyi market in Southern Shan State and waterway for Pakokku market. Rice is normally packed in polyethylene bag. In Bayint Naung market, some wholesalers open the purchasing rice bags and make to remove the dust with the help of big fan. It is pile up on the tarpaulin sheet. After that rice is repacked in new polyethylene bag.

According to the market reconnaissance, the inter State/Division trade of rice can be found in the country. *The biggest flows were:*

- From Bayint Naung market in Yangon Division to Mandalay, Myeik and Kawthoung Town in Tanintharyi Division, Kayin, Kayah and Mon State³⁰
- From Mandalay market in Mandalay Division to Lashio, Kyaukme, Hsipaw and Kutkai market in Northern Shan State
- From Sagaing Division to Mandalay market in Mandalay Division and Pakokku market in Magway Division
- From Ayeyarwady Division to Yangon Division and Pakokku market in Magway Division
- From Pyay market in western part of Bago Division to Mandalay market in Mandalay Division, Pakokku market in Magway Division and Taunggyi market in Southern Shan State
- From Mon State to Myingyan market in Mandalay Division
- From eastern part of Bago Division to Southern Shan State
- From Kachin State to Kywe Se Kan in Mandalay city
- From rice major producing area in Yangon Division to Magway and Mandalay Division

10. RICE PRICE IN DOMESTIC MARKET

In the domestic market, rice price varies depending on the *quality, variety, old rice and new rice*. Regarding the variety, Pawsan rice is the most expensive compared to other varieties. Each variety has again three different qualities: first quality (a-htat-sa), medium quality (a-lat-sa) and the lowest quality (auk-sa). This grading relates to the rice milling quality. Regarding the preference, consumers in Shan State located in hilly region more prefer a little bit sticky rice. In the lower part of the country, consumers prefer slightly sticky rice and in the central Myanmar non-sticky rice varieties. Normally, rice from surplus area supplied to the markets in deficit area.

³⁰ Brand of Champion Pawsan from Yangon market is sold to Mawlamyine market. Price of this brand is higher than local produce of Pawsan rice variety. In the rainy season, rice from Bayint Naung market is sent to Mawlamyine market from which rice is delivered to Tanintharyi Division by big boat with engine. This survey was conducted in June 2002.

There is the period that rice from previous production season, is called *old rice* by traders, rice millers and consumers. Newly harvested rice from the present production season is called *new rice*. Normally, new rice (produce of monsoon rice) starts to supply to the market towards the end of October. After that, rice price begin to decline due to the supply of new rice.

10.1. Collapse of Rice Price

During the market oriented economy period, rice price in domestic market collapsed in 2000-01. The main reason is due to the over supply production. The country's rice production increased from 17 million in 1998-99 to 20 million in 1999-2000. After that it reached 21 million metric ton in 2000-01. However, rice export volume did not show continuous increasing trend from 1998-99 to 2000-01. Thus, quantity of rice supplied to the domestic market is more than quantity demanded.

Table 18 : Change of Rice Production, Rice Export before Collapse of Rice Price

Year	Sown acre (‘000 acre)	Yield (bkt/acre)	Paddy production (‘000)		Population (million)	Rice export (‘000 MT)
			(Basket)	(Metric ton)		
1998-1999	14,230	60.68	818,467	17,075	48.12	120
1999-2000	15,528	62.85	964,562	20,122	49.13	55
2000-2001	15,713	65.62	1,021,970	21,320	50.13	251

Source: MAS.

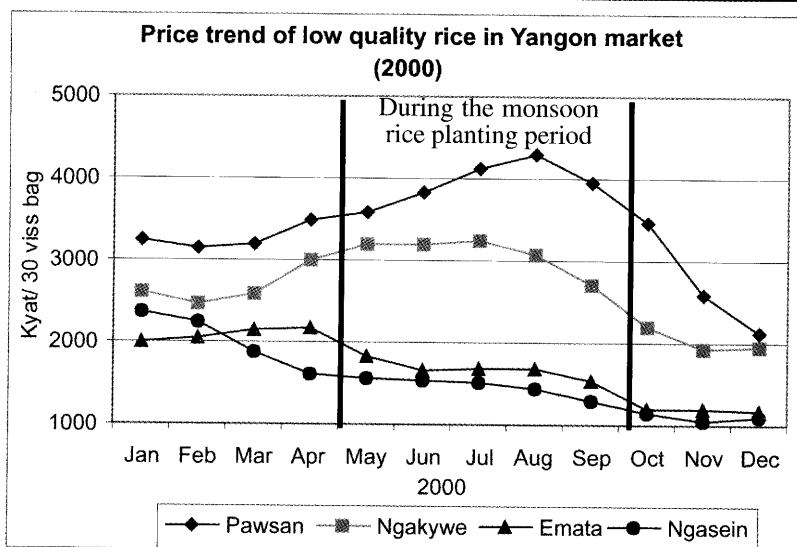
Generally speaking, rice price tends to increase during the monsoon rice planting period. However, the declining rice price trend started from September 2000 to April 2001. Thus, traders were reluctant to buy the paddy. October 2001, new monsoon rice began to enter the market leading to a sharp price decrease. Due to the rice price decrease, consumers enjoy for their staple food and have a good opportunity to shift from low quality to good quality rice depending on their individual income and preference. In addition, consumers are likely to use the money saved on staple food to buy larger quantities of food such as meat, edible oil, vegetables and fruits than they would normally consume³¹. However, rice

³¹ Andrew W. Shepherd, *Referred to Understanding and Using Market Information*.

Table 19(a) : Wholesale Price of Low Quality Rice in Yangon (2000)

(Kyat/30viss bag)

Month	Pawsan	Ngakywe	Emata	Ngasein
Jan	3,235	2,615	2,006	2,358
Feb	3,135	2,452	2,038	2,243
Mar	3,189	2,596	2,153	1,884
Apr	3,481	2,996	2,171	1,614
May	3,593	3,198	1,818	1,564
Jun	3,835	3,186	1,662	1,530
Jul	4,115	3,256	1,693	1,520
Aug	4,298	3,080	1,677	1,442
Sep	3,942	2,705	1,536	1,303
Oct	3,454	2,183	1,197	1,139
Nov	2,582	1,915	1,185	1,038
Dec	2,134	1,948	1,179	1,105
Average	3,416	2,678	1,693	1,562



Source: Survey.

farmers encountered negative margin due to collapse of rice price.

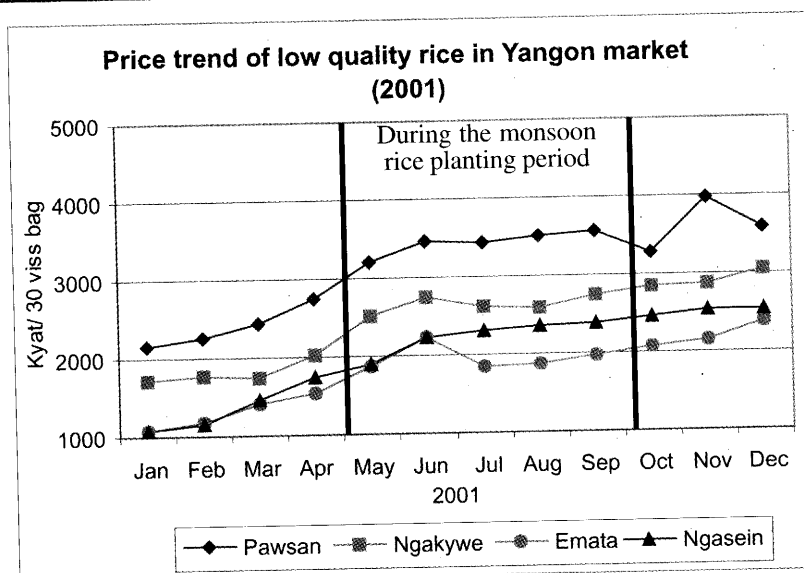
Normally, state paddy purchasing price is 320 Kyats per basket, which is low compared to market price. In year 2000-01, farm-gate price of paddy³² in major rice producing areas was below the state paddy-purchasing price

³² Prices of local varieties of Pawsan, Ngakywe and Kyauknyin (glutinous rice) did not sharply decreased compared to prices of high yielding rice varieties because the area planted to local rice variety was lower than those of HYV.

Table 19(b) : Wholesale Price of Low Quality Rice in Yangon (2001)

(Kyat/30viss bag)

Month	Pawson	Ngakywe	Emata	Ngasein
Jan	2,143	1,713	1,087	1,086
Feb	2,267	1,772	1,167	1,162
Mar	2,446	1,745	1,419	1,459
Apr	2,753	2,018	1,549	1,734
May	3,202	2,512	1,862	1,910
Jun	3,468	2,753	2,231	2,239
Jul	3,444	2,616	1,838	2,304
Aug	3,520	2,595	1,863	2,371
Sep	3,557	2,734	1,983	2,380
Oct	3,278	2,848	2,076	2,460
Nov	3,978	2,876	2,151	2,538
Dec	3,579	3,061	2,373	2,526
Average	3,174	2,437	1,800	2,017



Source: Survey.

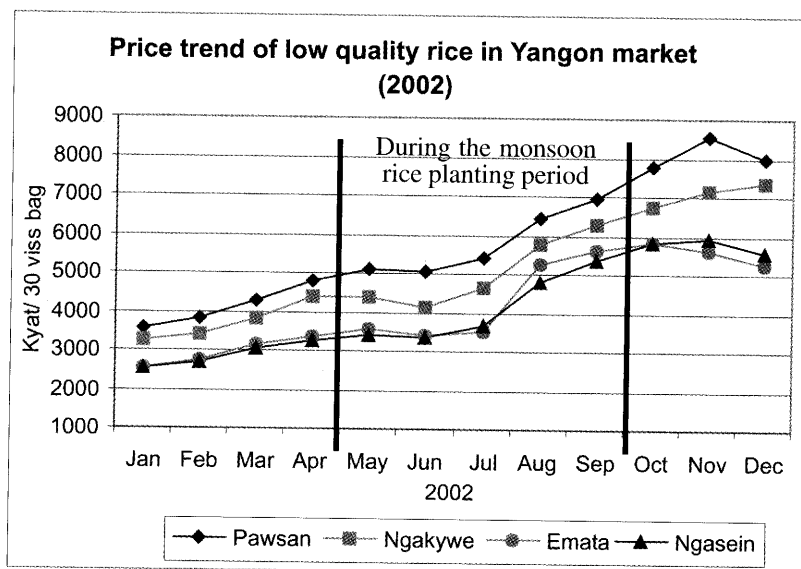
during the harvesting time of new monsoon paddy. MAPT purchased its quota from farmers with 320 Kyats per basket. After that, rice traders paid a little bit higher prices to rice farmers for their marketing.

From these experiences, low price of rice enjoyed for consumers while the profit margin return to rice farmers was negative. Accordingly, mutual benefit for consumers and farmers are important.

Table 19(c) : Wholesale Price of Low Quality Rice in Yangon (2002)

(Kyat/30viss bag)

Month	Pawsan	Ngakywe	Emata	Ngasein
Jan	3,588	3,264	2,559	2,537
Feb	3,839	3,429	2,720	2,697
Mar	4,295	3,802	3,175	3,039
Apr	4,820	4,383	3,334	3,239
May	5,118	4,388	3,579	3,409
Jun	5,054	4,122	3,390	3,344
Jul	5,394	4,644	3,538	3,690
Aug	6,447	5,757	5,239	4,781
Sep	6,972	6,300	5,632	5,343
Oct	7,787	6,740	5,798	5,827
Nov	8,537	7,152	5,610	5,933
Dec	7,958	7,367	5,264	5,582
Average	5,817	5,112	4,153	4,118



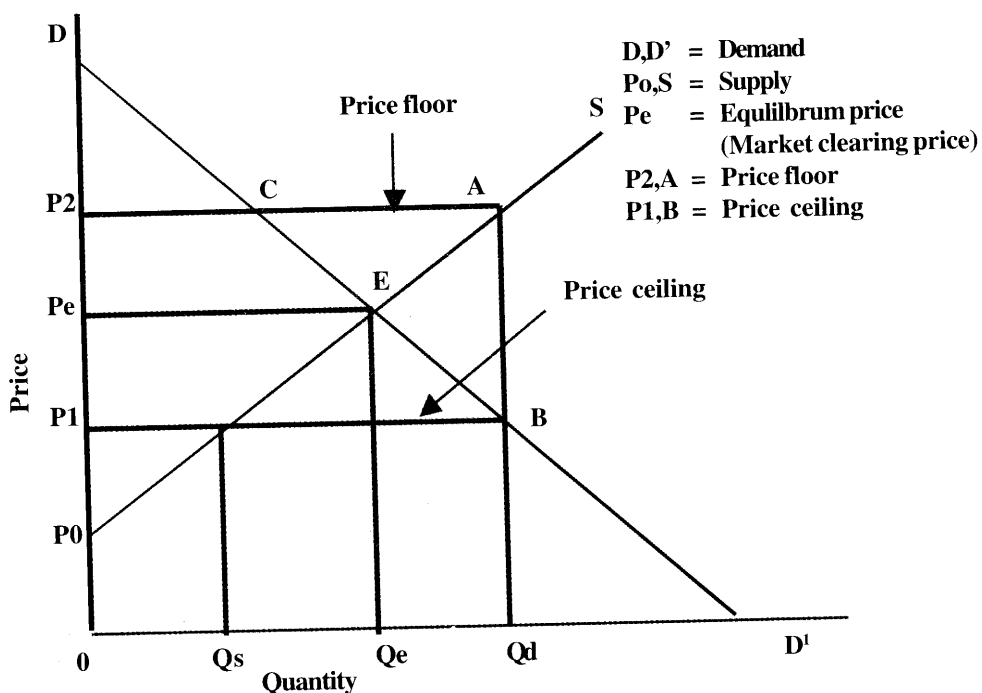
Source: Survey.

The most important thing is why collapse of rice price in the domestic market and what we have learned from this event. The major key point is over supply production and the country's rice production should be harmonized the domestic demand such as consumption, emergency food stock, waste and seed for next planting season and demand for external trade.

10.2. Floor Price and Ceiling Price

In a market-oriented system, the price of a product is determined by supply and demand. Basically, a balance is achieved between what people are prepared to supply at a price and what people want to buy. This is referred to by economists as a “market equilibrium” price³³. At price “P0”, rice farmers cannot produce. The reason is that it cannot cover the production cost.

Fig 1 : Market Equilibrium Price, Price Ceiling & Price Floor



With regard to price ceiling, for example, if an the Least Developing Country (LDC) embarks on a policy of cheap food for the poor, say by setting the price at P_1 , it will reduce production by $OQ_e - OQ_s$ and $O, Q_d - O, Q_s$ will have to be imported to meet demand. (See diagram) If the governments want OQ_d to be produced domestically to avoid importing, then it would have to set the producer price at P_2 and find the funds to pay for the policy. In addition to that, for example, the European Community (EC) sets farm prices above the equilibrium level. The

³³ Andrew W. Shepherd, *Understanding and Using Market Information*.

result is a domestic surplus ($A-C=\text{Excess supply}$). The surplus must be purchased by the EC authorities and stored, at a considerable expense, or it must be exported, which will require subsidies if the world price below P2. Readers will realize the price floor, price ceiling and market price³⁴.

It is learnt that the Japanese government buys rice from farmers at about ten times international market prices. It is also subsidizes part of the cost to consumers. Still, Japanese consumers pay about four times as much as they would if they could buy rice in a California supermarket. All this cost the government about 2.5 billion dollars in 1992. The reason is that rice is staple food and the government encourages rice production.

Some governments made price-setting arrangements such as *price floor and price ceiling*. Regarding price floor, it is learnt that the government of Vietnam recently introduced a floor³⁵ paddy procurement price. The minimum price has been set at 1,300 dong³⁶ (1US\$= VND 14,536) a kilogram. Other measures to stimulate production include the postponement of first-half year agricultural taxes from rice farmers till the end of June. It means that government endeavored to increase rice production and to gain profit margin for rice farmers.

With regard to transport cost, price of fuel, number of trucks, distance and road condition such as paved road or unpaved road are important factors, which occur the fluctuation of transport cost.

11. CONSTRAINTS OF RICE PRODUCTION

The country's rice production has a huge potential for development. However the following key constraints need to be removed.

³⁴ FAO, *Agricultural price policy: Government and the market*.

³⁵ FAO, *Food Crops and Shortages No.2*, April 2001, *Country reports: Vietnam* (26 March), Page.8.

³⁶ A kilogram of paddy = 1300 dong = US\$ 0.08943.
one basket of paddy in Myanmar = 20.86 kilogram.

11.1. Chemical Fertilizer

It is learnt that chemical fertilizer such as ammonium phosphate and ammonium sulphate had imported and distributed to rice farmers since 1958. In 1980's demand of chemical fertilizer increased due to the widely adoption of fertilizer-responsive high yielding varieties in rice major growing areas. Thus, the government endeavored to produce urea (N-46%) from domestic plants, which were constructed at Sale, Kyunchaung and Kyawswa in 1970, 1971 and 1985 respectively. The others such as triple super phosphate and potash fertilizers were imported.

The quantity of chemical fertilizer supplied to rice farmers showed an increasing trend and it was in the range of 0.218 to 0.324 million metric ton during the implementation of the Whole Township Paddy Production Program from 1977-78 to 1985-86.

Afterwards, chemical fertilizer supplied to rice farmers declined due to reduction in import and reached 0.3 million metric ton in 1990's. It is clear from the fact that the area planted to fertilizer-responsive high yielding varieties increased year after year, which caused the strong demand of chemical fertilizer.

Due to the encouragement of government policy, private sector involved in fertilizer marketing: importation, distribution, and sale promotion after 1988. Thus different types of chemical fertilizer namely urea, triple super phosphate, compound fertilizer and potash fertilizer can be found in the market. However, quantity of chemical fertilizer supplied to the market was low compared to quantity demanded.

11.1.1. Use of Chemical Fertilizer in Neighboring Countries

With regard to rice, consumption of mineral fertilizer in terms of plant nutrients was rather low compared to the neighboring countries of Thailand and Vietnam, major rice exporting country. It can be seen, mineral fertilizer used in Myanmar is still low level. If it can be supplied from present level, it is quite certain that the country's rice yield has potential to increase its yield.

Table 20 : Consumption of Mineral Fertilizers

'000 mt (Plant nutrients)

Country	1989	1996	1997	1998	1999	Average annual growth rate (89-99)
Bangladesh	685.8	1230.5	1180.6	1170.5	1300.0	5.8%
Cambodia	0.3	7.8	21.9	0.1	7.9	3.9%
Indonesia	233.16	2715.9	2227.6	2727.7	2659.3	0.9%
Laos	0.3	3.8	7.8	4.6	8.1	25.8%
Myanmar	83.1	173.9	177.8	159.8	156.8	10.6%
Thailand	818.8	1520.0	1481.0	1637.0	1801.7	7.2%
Vietnam	563.0	1455.0	1561.0	1948.0	1934.6	14.5%

Source: Rap Publication, Selected indicators of food and agriculture development in Asia-Pacific region, 1999-2000.

11.1.2. Break-Even Point

Based on the nitrogen fertilizer response curve of HYV ($Y = 2147 + 13.8 N - 0.068N^2$), one bag (50 Kg) of urea fertilizer applied on paddy can yield 11 baskets or 230 Kg. If the urea fertilizer price was 7200 Kyat per 50 Kg bag (144 Kyat per Kilogram) and market price of paddy 1600 Kyats per basket (76.70 Kyat per Kilogram), additional increase of 4.5 basket of paddy cover the fertilizer cost, which is *break-even point* for rice farmers. If the additional increase paddy yield is over 4.5 baskets, rice farmers will receive profit margin due to the systematic use of urea fertilizers (Table 21).

11.1.3. Value-Cost Ratio

With regard to fertilizer application, the ratio between the value of additional increase yield obtained and the cost of fertilizer applied is important. The value-cost ratio (VCR) of fertilizer is the value of additional yield from using fertilizer, divided by the cost of fertilizer. If the additional increase of paddy is 23 baskets (488 Kg) of worth 37,430 Kyats and the cost of fertilizer is 10,600 Kyats, *VCR is 3.5*. In this case, a ratio of 2 is the minimum needed for farmers although VCR of this level is risky if there is a danger of drought, disease or crop price falling.

Table 21 : Break-Even Point Based on Market Price of Urea Fertilizer and of Paddy Price

Price of paddy (Kyat)*	Increase of paddy yield due to use of 50 Kg bag of urea (Basket)	Revenue of increased paddy yield (Kyat)**	Cost of 50 Kg bag of urea fertilizer (Kyat)	Profit margin (Kyat)
1600	1.0	1600	7200	(-) 5600
1600	2.0	3200	7200	(-) 4000
1600	3.0	4800	7200	(-) 2400
1600	4.0	6400	7200	(-) 800
1600	4.5	7200	7200	0
1600	5.0	8000	7200	(+) 800
1600	6.0	9600	7200	(+) 2400
1600	7.0	11200	7200	(+) 4000
1600	8.0	12800	7200	(+) 5600
1600	9.0	14400	7200	(+) 7200
1600	10.0	16000	7200	(+) 8800

Source: MAS.

Note * Market price of Manawthukha paddy variety in July 2002, MIS price bulletin.

**Market price of urea fertilizer in July 2002, MIS price bulletin.

1 basket of paddy = 46 lb = 20.86 Kg

Table 22 : Calculation of Value-Cost Ratio Based on Market Price of Fertilizer and Paddy

Type of mineral fertilizer	Use of mineral fertilizer rate of per acre		Market price of fertilizer (Kyat)	Cost of fertilizer (Kyat)	Additional increase of paddy yield (Kyat)	Value of additional increase of paddy (Kyat)
	(50 Kg bag)	Nutrient (Kg)				
Urea	1.00	23	7,200	7,200	240	18,408
Triple Super Phosphate	1.50	11	4,700	2,350	158	12,119
Murate of potash	0.75	8	4,200	1,050	90	6,903
Total	3.25	42		10,600	488	37,430

Source: MAS.

Note: Fertilizer response curve of HYV: $Y = 2147 + 13.8N - 0.068N^2$

$$Y = 2147 + 16.8P_2O_5 - 0.12(P_2O_5)^2$$

$$Y = 2147 + 14.18K_2O - 0.14(K_2O)^2$$

Urea = 46 % N, Triple Super Phosphate = 45% P₂O and Murate of potash = 60% K₂O
Market price of paddy in July, 2002 = 1,600 Kyat per basket for Manawthukha paddy variety (HYV).

Market price of fertilizer in July 2002, MIS price bulletin

No fertilizer use = 47 baskets of paddy (973 Kg)

In this calculation, application of fertilizer cost and the delivery cost of fertilizer from shop to field is not considered. The ratio of VCR closely relates to market price of fertilizer and paddy price. If the market price of fertilizer increases sharply and price of paddy stable, application of fertilizer rate should be decreased to obtain profit margin. The calculation of value-cost ratio is set out in Table 22.

As mentioned earlier, the value-cost ratio is 3.5. It means that if a farmer invests of 1 Kyat for fertilizers, the profit margin return to farmer is 2.5 Kyats. In this case, if a farmer borrows money from informal money-lender to purchase fertilizer, the interest rate is 5 percent per month for the fertilizer cost of 10,600 Kyats. From rice-planting time to harvesting, farmer has to pay 5 months of interest, which is K 2,650 ($K10,600 \times 0.05 \times 5$). The cost of buying fertilizer added by the interest is 13,250 Kyats ($K10,600 + K 2,650$). Thus, VCR of fertilizer is 2.8 ($37,430 / 13,250$). As noted earlier, the higher price of fertilizers has to be paid immediately; the increase returns from the crop come much later. In this case, market price of paddy and chemical fertilizer are compared as follows.

Table 23 : Paddy/Fertilizer Price Ratio During the Market Oriented Economy Era

Type of chemical fertilizer	Chemical fertilizer		Paddy		Paddy/fertilizer price ratio
	Selling price (Kyat)		Purchasing price (Kyat)		
	(50 Kg bag)	(1 Kg)	(1 basket)	(1 Kg)	
1	2	3	4	5	6 (5÷3)
Urea	7,200	144	1,600	77	0.53
Triple Super Phosphate	4,700	94	1,600	77	0.82
Mutate of potash	4,200	84	1,600	77	0.92

Source: MAS.

As can be seen, fertilizer price was rather high than paddy price. For the increase of paddy yield, chemical fertilizer is essential to apply with the recommended rate. Because of this, paddy/fertilizer price ratio is important for long-term to more use chemical fertilizers.

In this case, demand of chemical fertilizers highly relates to the market price. At present, prices of different types of imported chemical fertilizer increased somewhat in the domestic market.

11.2. Quality Seeds

In 1960s many local varieties were used in rice cultivation. Many different names were given to the same varieties in different locations. Due to the natural out crossing and mutation of rice cultivars, strains had emerged and those preferred by farmers were widely cultivated with their own names. This had created undesirable effects in standardizing the milling outturn and grain quality for rice export. Thus the department of Agriculture collected information on different paddy samples and sown area, grain quality and distinct characteristics before 1965. They were then assessed, evaluated and clarified by local researchers in agricultural farms and research center.

Two variety groups such as local improved varieties released by the Department of Agriculture and traditional varieties had been classified.

- Sown area, life period and type of each variety such as Emata, Ngasein, Medon and Byat were recorded. This classification is based on the Mr. R.A. Behale, a Botanist, who had standardized Myanmar rice varieties in 1927.
- Paddy varieties were grouped into three different categories, namely early-matured variety with life period of under 150 days (Kyauyin), medium variety with life period of 150-170 days (Kyuklatt) and late variety with life period of over 170 days (Kaukkyi) depending on their life period.

From 1980's to 1990's, high yielding varieties were widely adopted among rice farmers. Based on the agro-ecological zones, different high yielding varieties were grown in the same rice producing areas depending on the soil type, adaptable on climatic condition, potential yield, preference of rice quality and milling outturn.

In addition, most rice farmers stored seeds from their production for next planting season. In this case, some varieties deteriorated their genetic purity due to unsystematic selection of seed for planting. Thus, rice researchers endeavored to seed multiplication program based on breeder seed, foundation seed, registered seed and certified seed.

The Ministry of Agriculture and Irrigation (MOAI), provides registered seeds to contract farmers to produce certified seeds, which were redistributed to other farmers. For each variety, the certified seed require to substitute every three years to prevent deterioration of seed quality. In practice, MOAI cannot provide certified seeds to rice farmers all over the country. Thus, private sector should be involved in seed production and marketing. At present, vegetable seed marketing developed dramatically during the market oriented economic system due to the achievement of private sector however quality seed of rice production and marketing is very sluggish in Myanmar rice economy.

11.3. Insufficient Working Capital

As mentioned earlier farmers have not opportunity to mortgage the land for their working capital. It is learnt that some farmers borrowed collateral loan from informal moneylender. The interest rate is 3-5 percent per month. The bank-lending interest rate is 14.5 percent per annum however the borrower may prove title clearance of immovable properties such as rice mill, residence, storage facilities, tax, business license, balance sheet of business, fire risk insurance, and business activities to obtain the loan. In this case, traders and rice millers supplement their working capital by means of bank loan.

Some small rice farmers realize the proven technology however they cannot adopt the technology due to the insufficient working capital. For instance, even though fertilizer-response high yielding varieties are grown, the recommended rate of chemical fertilizer cannot be utilized for some farmers due to the insufficient working capital.

With regard to marketing, some farmers in lower Myanmar sell their paddy after harvesting immediately. The reason is that they required urgently working capital to grow next crop such as pulses. A large portion of paddy was sold immediately after harvest, which will inevitably lead to lower market price. Generally speaking, when the newly harvested paddy begins to enter the market, its price starts to go down. Even though farmers obtain higher yield their sale value is low. This is impor-

tant fact for small farmers. Some large farmers who have enough working capital stored their paddy to fetch a good price in later months³⁷.

As a whole, sufficient working capital is important to promote the farmers' yield as well as the increase of rice farmer income. Myanmar Agriculture Development Bank (MADB) provides the seasonal loan to rice farmers however it is rather low for rice farmers to purchase agro-inputs.

11.4. Small-Scale Agricultural Machineries

Regarding rice cultivation, drought cattle are essential to the efficient performance of operations for ploughing, harrowing, threshing. In addition to that, it is used for transportation of agricultural produce, for example, farm to village rice mills and provided cattle manure for the improvement of paddy soil. In 1940-41, number of drought cattle was estimated to be 3.2 million and the present drought cattle was 8.1 million. Regarding cultural practices, traditionally rice planting by women³⁸ is still practiced in Myanmar. Accordingly rice transplanting relies on the rural women laborers.

During the 1990's, the government encouraged local production, importation and marketing to private sector for the development of small-scale agricultural machineries. In rural area, rice farmers use hand tractors for land preparation and transportation of their produce. Small-scale irrigation pumps were widely utilized for summer rice production in lower Myanmar.

In major rice producing areas, threshing is practiced by small-scale machineries. The reason is that threshing floor is not required for paddy threshing and farmers can manage to cultivate next crop before the loss

³⁷ From the marketing economics point of view, if farmers stored paddy, opportunity cost of paddy value storage cost and handling cost are considered as marketing cost. If the market price of paddy goes up, farmer who stored paddy will sell to trader or rice millers. In this case, selling price must cover all the marketing cost.

³⁸ MOAI persuades the rural women in participating the competition of transplanting of rice in major rice producing areas.

of soil residual moisture. Use of small-scale agricultural machineries highly relates to the price of fuel, spare parts, capital investment of farmers and credit system.

12. CONCLUSION

To develop the Myanmar rice economy, the following key points are required for the long-term which are highlighted.

12.1. Rice Area Expansion for Long Term

To develop the rice economy, rice area expansion and increase of yield are required. For area expansion, land reclamation project including new settlement of village, migration of landless workers from rural areas to new settlement area, irrigation and drainage program, credit scheme, communication and transportation facilities are required. For the long-term, Kachin state located in northern part of the country, hilly region and delta region are potential for the development of area expansion.

12.2. Rice Research

Research and development program is essential for the development of the country's rice economy and to provide the needs of technology for rice farmers and extension workers. Research program should base on the domestic market demand and international market demand. At present, MOAI endeavors to establish Myanma Rice Research Center for Research and Development (R&D). At the same time, human resource development program (HRD) requires for the development of rice research.

12.3. Post Harvest Technology

Productivity improvement is a major component or engine of true growth and development. While research and technical development had occurred at MAPT over the past decades it seems not to have received the emphasis and support that it justifies. Effective research and development means identifying, investigating and solving problems through effective use of technology. The emphasis should be on effective problem

solving rather than theoretical research: hence the term technology transfer.

Initiated as the R & D unit of the Myanma Agricultural Produce Trading under the Ministry of Commerce, Post Harvest Technology Application Centre was established in 1979. Food & Agriculture Organization of the United Nations prepared and drafted a Project Document on the development of PTAC and financial assistance had been sought. In 1981, Asian Development Bank agreed to support for consultancy service, training and procurement of laboratory equipment and technical books. For further development, the government of Japan was requested and eventually extended a grant aid for full fledged implementation. PTAC undertakes as the main function research & development activities with regards to food grains in order to minimize post-harvest losses and to maintain the quality of products³⁹.

PTAC's research projects are geared towards solving technical problems confronted in the post-harvest operations. It is one and only institution in Myanmar to contribute to the benefit of agricultural marketing activities indirectly. It also serves as a focal point for bridging between pre-harvest and post-harvest operations. Agricultural marketing enterprises could derive much benefits by effective utilization of improved technologies in post-harvest operations. The major factor limiting the scope of activities in R & D training and extension works is the shortage of well qualified personnel to undertake the projects.

12.4. Land Policy

As noted earlier, farmers cannot borrow loan from bank to mortgage their farmland. If farmers have opportunity to mortgage, they can manage development of their land as well as crop production. Because of this, some small-scale farmers encounter the insufficient working capital for their rice farming.

Some traders and millers borrowed loan from private bank for their

³⁹ MAPT, *Profile of Post-harvest Technology Application Centre*.

agricultural marketing. For this, assessor evaluates the present value of borrowers' properties such as land or home or rice mills or warehouse. Bank lawyers clarified the rights of borrowers. Afterwards, private bank release the loan to borrowers.

Land policy is important issue for the development of rice economy in future. For the long-term, land policy should be considered for farmers to invest their production and land improvement.

12.5. Pricing Policy

Rice consumption is highly related to the level of income. For whom income is very low and fulfilling energy needs is a deep concern, coarse grains and root crops such as cassava and sweet potato are eaten. For him, rice is a luxury commodity. As the income increase, demand shifts from coarse grains and root crops to rice. At high level of income, rice becomes an inferior commodity and diverse foods with more protein and vitamins such as vegetables, bread, fish and meat are preferred.

It is learnt that growing urbanization that accompanies economic growth leads to change in food habits and the practice of eating away from home, which further reduces per capita rice consumption. *The annual thresh income threshold at which consumers start substituting higher quality and more varied foods for rice is estimated at round US\$1500.* This income threshold has not yet been reached in Bangladesh, China, India, Indonesia, Myanmar, the Philippines and Vietnam. These countries account for more than 80 percent of total rice consumption and are going to dominate the future growth in demand⁴⁰.

In Myanmar, rice is the most important commodity and it relates to social, economical and political issues. *Some said that rice is a political commodity.* Probably, low-income consumers Myanmar can give up other commodities. For instance, if price of chicken is on the rise, low-income consumers will substitute other types of meat such as pork or fish. *However, if the rice price increases sharply or steeply, low-in-*

⁴⁰ IRRI, *Rice Today*, September 2002, Vol.1 No.2, Page 29.

come consumers have problem cannot tolerate and put the blame on government's rice policy. Probably, a sharp increase of rice price and serious rice shortage in the country will beckon for discontent to the government policy.

Regarding the present price policy, government subsidy program in this country is confined to certain consumer groups such as government employees, military personnel, police and their families. For this, government purchase paddy based on 2 to 11 baskets depending on the rice deficit and surplus areas from rice farmers with pre-fixed price.

Production of agricultural produce is mostly in the hands of farmers who are given considerable freedom to choose their crop mix, technology, the extent of area to be cultivated and most importantly the marketable surplus the amount to be sold in excess of their own consumption. Regarding the present system of paddy procurement, there is a huge administrative costs and create opportunities for wide spread evasion which might be immeasurable effect on the overall performance of MAPT. Regarding rice trade liberalization, the procurement policy objectives are as follows:

- (a) to assure stable prices for both producers and consumers
- (b) to raise government revenue by enhancing export of rice
- (c) to maintain domestic stability by keeping food grain price low
- (d) to achieve economic growth through expansion of agricultural production and export and by initiation of agro-based industrial growth

Regarding the price setting arrangement, it is found out that the government paddy purchasing price is low compared to market price. According to market reconnaissance, rice price in surplus area is cheaper than in rice deficit area. Paddy purchasing prices are different in rice surplus and rice deficit areas.

Regarding rice policy, mutual benefit for farmers and consumers are essential. From the economic point of view, there is no conflict between rice farmers and consumers. Rice farmers would like high price for their paddy and consumers want low price for their staple food, but market forces of demand and supply will ensure the best compromise is

reached. Market price always does not guarantee to cover the rice farmers' production cost and marketing cost.

If the country's rice production is oversupplied, rice price in the domestic market collapsed. This experience suffered to rice farmers in 2000-01. The rice price stability in domestic market is important.

The price signal of rice in central wholesale markets should be monitored and if the rice price increased sharply, the main causes should be found out and taken necessary action. With regard to rice price increase, these following points are important:

- (a) Increase of consumer price index.
- (b) Increase of marketing cost associated with handling, storage, milling, transport, packaging material and capital.
- (c) Increase of paddy production cost associated with agro-inputs costs, hired labor cost and fuel cost.
- (d) Interim period between monsoon rice planting period and before newly harvested rice supplied to local markets.
- (e) Seasonal price fluctuation occurs in monsoon rice-planting period.
- (f) Present rice export policy and future prospect.

At present, export of rice is a state monopoly. To develop the Myanmar Rice Economy, rice export should be liberalized and encouraged to private sector. For this, the following points need to be considered:

- A large volume of High Quality Variety of rice varieties such as Pawsanhmwe, Hmawbi-2, Sinekari, Lone Thwe Hmwe, Zeera and Immayebaw rice should be exported.
- Generally speaking, High Quality Variety (HQV) can obtain premium price compared to the High Yielding Variety (HYV). Thus, low-income consumers prefer the cheaper price of HYV. The rice export volume of HQV cannot influence reduction in supply volume of HYV rice variety and the price of HYV in the domestic market. Thus, quality of rice export should be promoted for the future.
- The country's rice export should be encouraged to private sector. The reason is that the experience of Myanmar pulses liberalization of trade policy encourages pulses export, which shared largest volume in the world market. Because of this, rice export should be

- encouraged to private sector, similar to pulses export.
- Regarding rice export, the most important thing is that rice export volumes do not exceed the annual surplus of rice volume.
 - If the forecasting of rice surplus is over estimated, it will reduce in quantity of domestic utilization. Thus, the country's rice export should not be affected to the rice shortage in the domestic market. For this, emergency food reserved stock, illegal rice trade by neighboring countries and the level of domestic utilization should be estimated depending on the current paddy production level. Afterwards, the government should release volume of rice export and release rice export license to private sectors.
 - From the rice export earnings, private sector should pay back tax to the government from which the requirement of chemical fertilizer, small scale machinery, diesel, spare parts and new established of rice mills, will be imported for the development of rice economy.

12.6. Development of Rice Mills

It is an urgent need to develop rice milling industry in Myanmar. For development of rice mills, the following points are necessary :

- to attract investment in the following areas;
 - financial investment
 - technological investment
 - rice milling machinery and other related machinery
 - human resource development
 - organizing training programmes related to rice post-harvest technology
 - foreign training programmes
 - cooperation with international experts in rice milling technology
- to organize workshops, seminars on rice processing, storage and quality control
- to draft and enact "Rice Processing Law"
- to encourage manufacturing rice milling machinery locally
- to establish self-power generating unit in rice mills utilizing rice husk as fuel.

Out of 1,227 rice mills in Myanmar, which meets the conventional code

of standards, there is not sufficient rice mills to produce premium quality rice. To be able to increase the export of premium quality rice in the world market it is necessary to replace the modern rice milling machinery in conventional rice mills or contract new rice mills. New machinery such as colour sorters, wet polishers should be augmented in conventional private rice mills to produce better quality products. To attract private rice millers to invest in the development of rice mills, it is also vital to create an economical environment to get benefit from their investment, to support new technology in rice milling, to stimulate with incentive to get more interest from the rice millers etc.

12.7. Inventory Credit System

Sufficient working capital is essential rice farmers to increase rice production and marketing. From the production point of view, farmers cannot use chemical fertilizers and adopt proven technology due to the lack of them. In addition, if farmers who have enough working capital have options when and where to sell. For example, some rice farmers required the working capital to grow black gram after harvesting of monsoon rice as second crop and sold most part of their crop with low price. The reason is that price of paddy was low when the newly harvested crop began to supply to the market. However, it is impossible that the state cannot provide enough finance to all rice farmers. To overcome these constraints, inventory credit system should be introduced in Myanmar rice economy which are mentioned here.

There are three essential parties: borrower, banker and owner of warehouse are involvement in borrowing loan and it calls inventory credit. The borrower, who use the produce as a security for a loan. The lender, usually a bank, which is looking for a relatively secure way to its fund and expand its clientele. The warehouse operator, a third party, which maintains the produce in good condition and assure the lender that the collateral is secure. The warehouse operator will hold the grain in a warehouse which is either owned or leased from another party. The borrowers has a a fee to cover the cost of warehouse rent, managing the grain and insuring it against fire and unusual weather conditions charged. It is learnt that inventory credit system is practiced in neighboring countries

such as India and Philippine. Exporters receive the loan from private banks and government bank by means of pledge.

12.8. Quality Seed

To improve rice quality, quality seeds are essential. Rice farmers need to be aware of the value seed and grain to improve the yield and quality of produce. Apart from this, private seeds company should be encouraged for the long-term.

12.9. Agro-Inputs

To increase the rice production, agro-inputs such as chemical fertilizers, bio-fertilizers, organic manure, insecticide and small-scale agricultural machineries are required. Thus, the government should encourage the private sector by supporting of loan, rules and regulation.

For the increase of paddy yield, chemical fertilizer is required however paddy/fertilizer price ratio is important for rice farmers. Accordingly, demand and supply of chemical fertilizer are essential for farmers. Besides, use of combining organic and inorganic fertilizers is required for the improvement of rice yield and quality of soil and ground water. Thus, balanced fertilizer strategy is important issue in the long term.

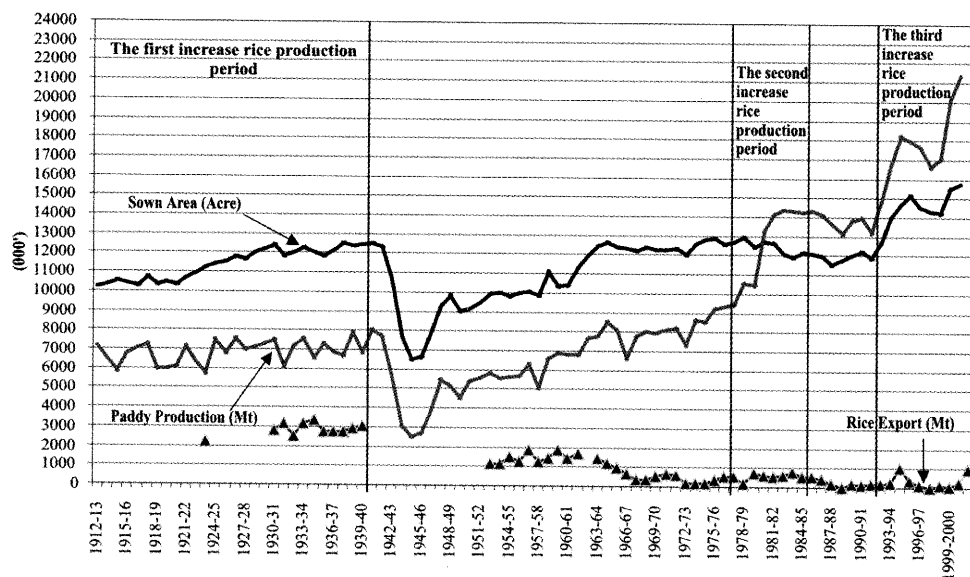
12.10. Market Information and Market Research

Extension workers concentrate on the increase of yield and advice to rice farmers how to increase their yield depending on soil type, suitable rice variety, proven technology, systematic application of chemical fertilizer, bio-fertilizer and cropping pattern etc.

If rice production technology, regardless of marketing aspect, is advised to farmers, valuable resources and costly agro-inputs will be wasted. Thus, post harvest technology storing, packaging and quality aspect of farmers' produce in line with market demand are required for farmers' produce. Thus, extension workers need to be aware of market information including domestic market and export market.

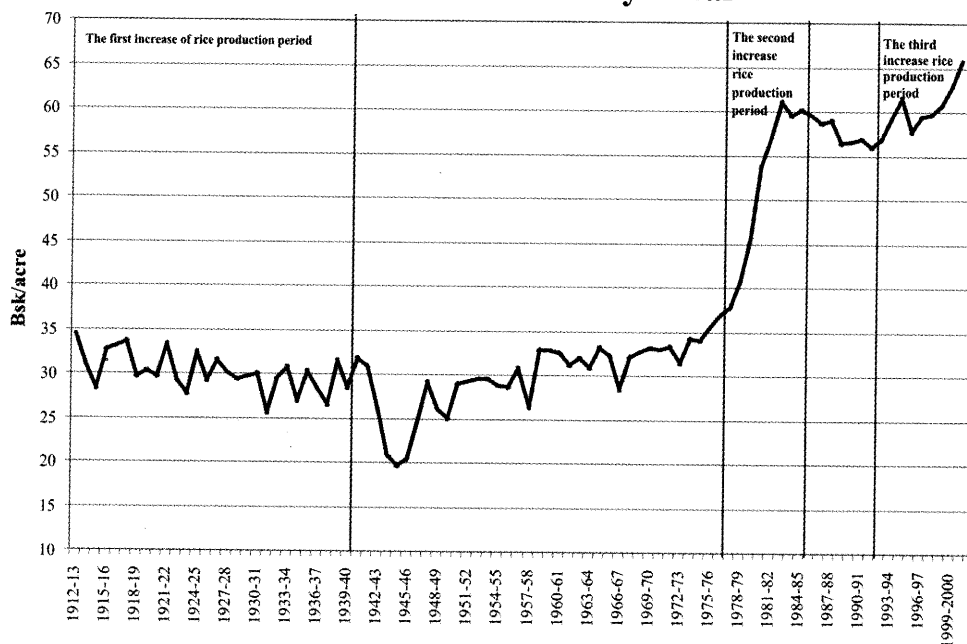
Annex - 1 (a)

Myanmar Rice Sown Area, Production and Export



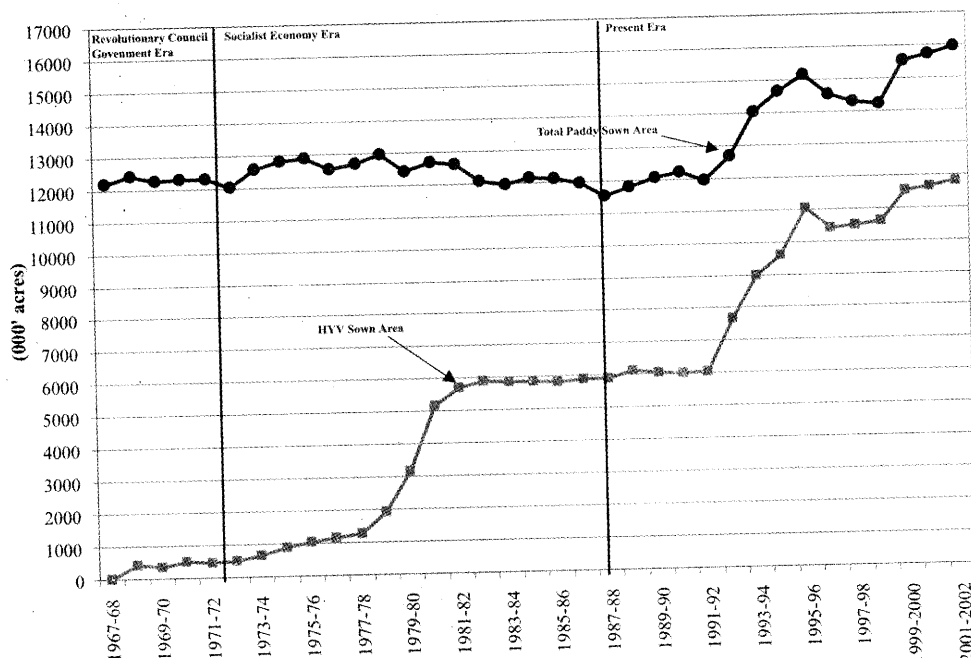
Annex - 1 (b)

Trend of Rice Yield in Myanmar



Annex - 1 (c)

Trend of HYV Sown Area and Paddy Sown Area in Myanmar (1967-68 to 2001-2002)



- Source: (1) *The Record of Burma Rice Production and Trade (in Myanmar)*.
 (2) *Statistical Year Book 1965, Burma*.
 (3) Cheng Siok-Hwa, *Rice Industry of Burma (1852-1940)*.
 (4) Myanma Agriculture Service (MAS), *Production of Some Important crops*.
 (5) *Report and Social Conditions of the Socialist Republic of the Union of Bruma, 1974-75 to 1986-87*.
 (6) *Review of the Financial, Economic and Social conditions for 1988-89, 1991-92, 1995-96, 1996-97 and 1997-98*.
 (7) Ministry of Agriculture and Irrigation (MOAI), *Report for crop production, land utilization and Irrigation (1998-99 to 2001-02)*.
 (8) Central Statistical Organization, *Statistical Year Book, 2000*, Yangon, Myanmar.
 (9) Distribution of chemical fertilizer, Myanma Agriculture Service, not include private sector.
 (10) *Agricultural Statistics (1985-86 to 1995-96)*.
 (11) Quantity of Imported fertilizer from (1955-96 to 1966-67) base on *Statistical Year Book, 1967*.

Annex -2

Regional Paddy Production, Domestic Utilization, Rice Surplus and Deficit in 2000-01

('000 baskets)

State/Division	Paddy production			Seed and waste#	Consumption*		Dome- stic utiliz- ation	Surplus/ deficit
	Sown acre	Yield	Produc- tion		Popul- ation	Quan- tity		
1.Delta region	736	68.07	660,966	38,944	20,416	306,240	345,184	(+)315,782
1.Ayeyarwady Division	4,988	71.20	355,114	19,952	6,921	103,815	123,767	(+)231,347
2.Bago Division								
-Bago	1,562	64.09	99,161	6,248	2,839	42,585	48,833	(+)5,650,328
-Bago (west)	1,023	66.96	67,993	4,092	2,307	34,605	38,697	(+)29,296
3.Yangon Division	1,388	64.98	90,097	5,552	5,801	87,015	92,567	(-)2,470
4.Mon State	775	62.80	48,601	3,100	2,548	38,220	41,320	(+)7,281
2.Coastal region	1,188	61.94	73,270	4,752	4,200	63,000	67,752	(+)5,518
1.Tanintharyi Division	237	59.41	13,931	948	1,388	20,820	21,768	(-)7,837
2.Rakhine State	951	62.53	59,339	3,804	2,812	42,180	45,984	(+)13,355
3.Central dry zone region	2,795	65.11	175,539	11,180	17,028	255,420	266,600	(-)91,061
1.Sagaing Division	1,486	61.93	89,158	5,944	5,418	81,270	87,214	(+)1,944
2.Mandalay Division	782	71.68	53,109	3,128	6,935	104,025	107,153	(-)54,044
3.Magway Division	527	64.59	33,272	2,108	4,675	70,125	72,233	(-)38,961
4. Hilly region	1,994	56.58	112,195	7,976	8,481	127,215	135,191	(-)22,996
1.Shan State								
-Southern Shan	373	62.77	23,092	1,492	1,910	28,650	30,142	(-)7,050
-Northern Shan	387	56.62	21,770	1,548	2,229	33,435	34,983	(-)13,213
-Eastern Shan	199	60.72	12,043	796	765	11,475	12,271	(-)228
2.Kachin State	399	58.97	23,396	1,596	1,308	19,620	21,216	(+)2,180
3.Kayah State	76	53.69	4,109	304	277	4,155	4,459	(-)350
4.Kayin State	454	52.67	23,882	1,816	1,512	22,680	24,496	(-)614
5.Chin State	106	36.69	3,903	424	480	7,200	7,624	(-)3,721
Total	15,713	65.62	1,021,970	62,852	50,125	751,875	814,727	(+)207,243

Source: MAS.

Note: 2.471 acres = 1 hectare, 46 lb of paddy = 1 basket, 1 Kg=2.205 lb. 1mt=22,05lb.

2 basket of seed for per acre and 2 baskets of waste for per acre.

*Per capita consumption of rice is estimated 15 baskets.

Annex - 3

Rice Processing Quantity by MAPT & Private Owned Rice Mills According to Financial Years

Sr.	Financial year	Procured paddy (baskets)	MAPT owned rice mills		Private-owned rice mills contracted with MAPT		Ratio bet: State-owned & private-owned	Processing percentage on procured paddy %
			Paddy (baskets)	Rice (ton)	Paddy (baskets)	Rice (ton)		
1	2	3	4	5	6	7	8	9
1	1988-89	85.10	14.7	0.175	46.1	0.583	1:3.1	71.505
2	1989-90	63.00	19.1	0.240	59.2	0.776	1:3.1	124.493
3	1990-91	72.10	19.6	0.243	40.4	0.528	1:2.1	83.339
4	1991-92	74.70	20.3	0.248	45.9	0.590	1:2.2	88.672
5	1992-93	76.50	25.0	0.313	57.7	0.748	1:2.3	108.169
6	1993-94	92.30	27.0	0.343	50.9	0.666	1:1.9	84.412
7	1994-95	97.30	32.1	0.399	76.5	0.966	1:2.3	111.711
8	1995-96	92.90	27.4	0.346	67.1	0.850	1:2.5	102.009
9	1996-97	73.00	22.6	0.284	49.9	0.650	1:2.2	99.338
10	1997-98	44.70	21.7	0.270	37.2	0.484	1:1.7	131.598
11	1998-99	105.3	26.2	0.332	46.0	0.607	1:1.7	69.093
12	1999-2000	105.83	30.9	0.378	53.3	0.693	1:1.7	79.577
13	2000-2001	101.74	28.1	0.352	51.8	0.673	1:1.9	-

Source : MAPT.

Annex - 4

Processing of Edible Rice Bran Oil by MAPT Owned Rice Bran Oil Mills from 1997-98 to 2001-2002

Sr.	Financial year	Rice bran		Finished products			Crude oil refining	
		Fresh	Old	OERB	Industrial crude oil	Edible crude oil	Crude oil	Edible oil
1	1997-1998	21,741	13,594	27,312	1,113	2,081	1,956	740
2	1998-1999	35,306	2,722	29,581	178	3,348	3,024	1,130
3	1999-2000	41,765	222	32,078	23	3,880	3,922	1,515
4	2000-2001	37,130	189	28,523	17	3,591	2,975	1,198
5	2001-2002	53,793	421	41,266	-	5,335	-	2,118

Source: MAPT.

Annex - 5

List of Rice Mills Owned by MAPT and Privately Owned Rice Mills Registered With MAPT for the Year 2000-2001

Sub-division/State Township	State-owned Rice mill		Privately owned Rice mill		Total		Classification by power								Grand Total	
	No	Capacity	No	Capacity	No	Capacity	Boiler driven		Electrically driven		Boiler & Electrically driven		Diesel Engine driven			
							No	Capacity	No	Capacity	No	Capacity	No	Capacity	No	Capacity
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ayeyarwaddy	20	1890	138	4500	158	6390	119	3831	31	1809	8	750	-	-	158	6390
Bago (East)	7	500	51	1444	58	1944	29	894	28	1026	-	-	1	24	58	1944
Bago (West)	8	705	38	1059	46	1764	13	483	31	1242	2	-	2	39	46	1764
Yangon	12	1610	43	1156	55	2766	24	736	23	1730	2	200	6	100	55	2766
Rakhine	11	403			11	403	6	215		-	-	150	3	38	11	403
Sagaing	6	120	68	1610	74	1730	62	1486	6	139	-	-	6	105	74	1730
Mandalay	-	-	39	590	39	590	4	132	14	241	-	-	21	217	39	590
Mon	-	-	39	1212	39	1212	37	1182	1	15	-	-	1	15	39	1212
Magwe	2	40	15	270	17	310	7	150	1	20	-	-	9	140	17	310
Taninthayi	-	-	17	260	17	260		-	-	-	-	-	17	260	17	260
Kachin	-	-	14	246	14	246	14	246	-	-	-	-	-	-	14	246
Kayar	1	20	-	-	1	20		-	1	20	-	-	-	-	1	20
Kayin	1	20	-	-	1	20	1	20		-	-	-	-	-	1	20
Total	68	5308	462	12347	530	17655	316	9375	136	6242	12	1100	66	938	530	17655

Source: MAPT.

Remarks: Capacity = tons/8hr

Annex - 6

Processing and Distribution of Edible Rice Bran Oil from 1999-2000 to 2002-2003 (end of Nov.)

(metric ton)

Sr.	Yers	Opening balance	Processing quantity	Total quantity	Distribution quantity
1	1999-2000	100	1,515	1,615	1,242
2	2000-2002	373	1,198	1,571	1,549
3	2001-2002	22	2,118	2,140	2,127
4	2002-2003 (end of Nov.)	13	1,637	1,650	1,587

Source: MAPT.

Annex - 7

List of "Wunza" Rice Mills for the Year 2000-2001

Sr.	State/ Division	Boiler driven		Electrically driven		Diesel Engine driven		Boiler & Electrically driven		Diesel & Electrically driven		Total	
		No.	Capa- city	No.	Capa- city	No.	Capa- city	No.	Capa- city	No.	Capa- city	No.	Capa- city
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Ayeyarwaddy	196	4,770	19	425	150	2,423	3	156	1	16	369	7,790
2	Bago (East)	11	243	27	497	7	111	-	-	-	-	45	851
3	Bago (West)	22	531	34	627	32	519	-	-	-	-	88	1,677
4	Yangon	11	350	13	215	45	714	-	-	-	-	69	1,279
5	Rakhine	-	-	-	-	4	60	-	-	-	-	4	60
6	Sagaing	28	660	2	42	11	168	-	-	-	-	41	870
7	Mandalay	-	-	10	210	1	25	-	-	-	-	11	235
8	Mon	17	329	2	30	13	195	-	-	-	-	32	554
9	Taninthari	-	-	-	-	2	30	-	-	-	-	2	30
10	Kachin	-	-	-	-	10	76	-	-	-	-	10	76
11	Kayar	-	-	16	315	-	-	-	-	-	-	16	315
	Total	285	6,883	123	2,361	275	4,321	3	156	1	16	687	13,737

Source: MAPT.

Remarks: Capacity = tons/8hr

Annex - 8

Specified Paddy Procurement Prices as Per State/Division Wise

(Kyats per basket)

Sr. No.	Paddy group	Ayeyawady, Bago, Yangon, Rakhine	Kachin, Kayar, Kayin, Sagaing, Taninthayi, Magway, Mandalay, Mon, Shan
1	Ngasein group	300	350
2	Emata group	320	360
3	Special Emata group	350	-
4	Meedone group	350	400
5	Ngakywe group	400	400
6	Kaukhnyin (glutinous)	400	400

Source: MAPT.

Annex - 9

Throughput of Paddy in Baskets to Obtain 1 Ton of Rice and Rice Outturn for the Financial Year 1999-2000

Sr.	State/ Division	Throughput of paddy to obtain 1 ton of rice		Rice outturn (Rice basket)	
		local distribution	export quality	local distribution	export quality
1	2	3	4	7	8
1	Ayeyarwaddy	74.2	84.3	40.3	35.4
2	Bago (East)	77.9	88.6	38.3	33.7
3	Bago (West)	76.6	87.4	39.2	34.2
4	Yangon	76.2	82.7	39.2	36.1
5	Mon	73.0	86.9	40.7	37.4
6	Rakhine	75.5	-	39.5	34.3
7	Kachin	76.0	-	39.3	-
8	Mandalay	73.4	80.0	40.7	-
9	Sagaing	74.0	-	40.0	37.3
10	Magway	73.0	-	40.7	-
11	Kayin	75.6	-	39.5	-
12	Kayah	-	-	-	-
13	Taninthayi	74.1	-	40.3	-
14	Shan (South)	74.2	-	40.0	-
15	Shan (North)	74.2	-	40.0	-
16	Shan (East)	74.2	-	40.0	-

Source: MAPT.

Remarks: White Rice quality is 25% broken

Rice basket = 75 lbs, Paddy basket = 46 lbs

Annex - 10

Number of Procurement Depots to be Opened During the Financial Year 2002-2003

Sr.	Name of depots	Number	
1	Rice mill procurement depots	223	Units
2	Storage warehouses procurement depots	403	Units
3	Field procurement depots	485	Units
4	Mobile procurement depots	31	Units
	Total	1,142	Units

Source: MAPT.

Annex - 11

Rice Bran Oil Mills Owned by MAPT

Sr.	Location Division/State/Township	Crude Oil Plant		Refinery Plant	
		Capacity Tons/24hr. (Rice bran)	Maker	Capacity Tons/24hr. (Crude Oil)	Maker
1	Yangon, Hlaing Township	20	Myanmar	10	Germany
2	Yangon, Insein Township	25	Germany	6	Germany
3	Bago, Paungde Township	25	Japan	10	Japan
4	Bago, Lepadon Township	25	Japan	10	Japan
5	Bago, Nyaunglebin Township	25	Germany	10	Germany
6	Bago, Bago Township	25	Germany	6	Germany
7	Bago, Zeegon Township	15	Myanmar	-	-
8	Bago, Phyu Township	12	Myanmar	-	-
9	Ayeyawady, Henzada Township	25	Japan	10	Japan
10	Ayeyawady, Phyapon Township	15	Myanmar	-	
11	Ayeyawady, Kyeiklat Township	15	Myanmar	-	
12	Ayeyawady, Bogale Township	15	Myanmar	-	
13	Ayeyawady, Myaungmya Township	15	Myanmar	-	
14	Ayeyawady, Mawla Myaingun Township	15	Myanmar	-	
15	Ayeyawady, Pathein Township	40	Germany	10	Italy
16	Mon, Mawlamyaing Township	25	Myanmar	6	Japan
17	Rakhine, Sittway Township	25	Japan	6	Japan
18	Mandalay, Kyankse Township	50	India	10	India
Total		18		11	

Source: MAPT.

Annex - 12

Specifications of Myanmar Paddy

Sr.	Types of brokens	Type and name of paddy group			Remarks
		Emata	Ngasein	Meedone	
1	Moisture Content %	14-18	14-18	14-18	Tolerance limit
2	Dust & Impurities (1 lb / 46 lbs basket)	0.5	0.5	0.5	
3	Foreign Grains %	5-8	5-7	5-10	
4	Red Grain %	3-12	6-20	2-15	
5	Immature Grains %	1-2	1-2	1-2	
6	Chalky Grains %	10S	12	Na	
7	Yellow or damaged kernels %	2	2	2	

Source : MAPT.

n.a. = not applicable

Annex - 13

Paddy Production (Monsoon + Summer) and Paddy Quantity Procurement by MAPT for the Financial Year 2002-2003

Sr.	State & Division	Paddy Sown Acreage (mil. baskets)			Paddy Production Acreage (mil. baskets)			Plan Target of MAPT's paddy procu- rement (mil. bas- kets)	Procure- ment Percentage % base on production	Procure- ment Average basket per acre
		Mon soon	Sum mer	Total	Mon soon	Sum mer	Total			
1	2	3	4	5	6	7	8	9	10	11
1	Kachin	0.391	0.016	0.407	24.217	0.914	25.131	2.500	10.323 (9.948)	6.394 (6.143)
2	Kayah	0.068	0.009	0.077	3.541	0.532	4.073	0.120	3.389 (2.946)	1.765 (1.558)
3	Kayin	0.333	0.140	0.473	17.975	8.819	26.794	1.000	5.563 (3.732)	3.003 (2.114)
4	Sagaing	1.530	0.212	1.742	99.079	15.300	114.379	8.000	8.074 (6.994)	5.229 (4.592)
5	Taninthayi	0.250	0.014	0.264	15.250	0.999	16.249	1.500	9.836 (9.231)	6.000 (5.682)
6	Bago	2.374	0.247	2.621	156.051	17.644	173.695	25.000	16.020 (14.393)	10.531 (9.538)
	Bago (East)	1.442	0.135	1.577	92.215	9.956	102.171	15.160	16.440 (14.838)	10.513 (9.613)
	Bago (West)	0.932	0.112	1.044	63.836	7.688	71.524	9.840	15.414 (13.758)	10.558 (9.425)
7	Magwe	0.507	0.109	0.616	34.492	7.888	42.380	3.000	8.698 (7.079)	5.917 (4.870)
8	Mandalay	0.648	0.17	0.818	50.531	15.688	66.219	3.000	5.937 (4.530)	4.630 (3.667)
9	Mon	0.672	0.138	0.810	45.777	10.321	56.098	7.000	15.292 (12.478)	10.417 (8.642)
10	Rakhine	0.944	-	0.944	61.427	-	61.427	8.000	13.024 (13.024)	8.475 (8.475)
11	Yangon	1.177	0.250	1.427	82.390	20.000	102.390	13.000	15.779 (12.697)	11.045 (9.110)
12	Shan (South)	0.377	0.029	0.406	23.624	2.032	25.656	1.500	6.349 (5.847)	3.979 (3.695)
13	Shan (East)	0.192	0.015	0.207	11.873	1.070	12.943	0.910	7.664 (7.031)	4.740 (4.396)
14	Shan (North)	0.409	0.020	0.429	27.857	1.526	29.383	0.805	2.890 (2.740)	1.968 (1.876)
15	Ayeyawady	3.372	1.630	5.002	225.436	129.766	355.202	37.123	16.467 (10.451)	11.009 (7.422)
	Total	13.244	2.999	16.243	879.520	232.499	1112.019	112.458	12.786 (10.113)	8.491 (6.923)

Source : MAPT.

Annex - 14

Difference of Basket Size According to Location and User

Location	Division	User	Volume basis					Re- marks
			Pyi	Nozibu/ Pyi	Nozibu/ Basket	Lbs	Kg	
Standard			16	8	128	46	20.9	
Myaungmya	Ayeyarwady	Farmer	17.000	8	136	48.9	22.2	
		Trader	19.000	8	152	54.6	24.8	
Pyapon	Ayeyarwady	Farmer	16.375	8	131	47.1	21.4	
		Trader	16.500	8	132	47.4	21.5	
		Rice miller	-	-	-	52-54	23.6-24.5	
Myaungmya	Ayeyarwady	Rice Miller		-	-	50-57	22.7-25.9	For Hnankar variety
Pathein	Ayeyarwady	Rice Miller	-	-	-	54-65	24.5-29.5	For pawsan variety
Mawlamyine -gyun	Ayeyarwady	Rice Miller	-	-	-	48-49	21.8-22.2	For pawsan variety
Thongwa	Yangon	Farmer	12.000	11	132	47.4	21.5	
Htantabin	Yangon	Farmer	16.250	8	130	46.7	21.2	
Bago	Bago	Farmer	16.000	8	128	46.0	20.9	
Kyaukse	Mandalay	Farmer	16.000	8	128	46.0	20.9	
Myeik	Tanintharyi	Farmer	16.000	8	128	46.0	20.9	
Nyaungshwe	Shan	Standard	20.000	10	200	57.5	26.1	
		Farmer	21.000	10	210	60.4	27.4	
		Trader	22.000	10	220	63.3	28.7	
Kalaw	Shan	Farmer	16.000	10	160	46.0	20.9	
Magway	Magway	Farmer	16.000	8	128	46.0	20.9	
Taundwingyi	Magway	Farmer	16.000	8	128	46.0	20.9	

Source: Field survey by Okamoto, Ikuko.

Note : Weight is in terms of paddy.

Annex - 15

Sale Prices of Rice According to Rice Standards

Sr.No.	Quality of rice	First category		Second category	
		“Pyi” (Kyat)	50 Kilos bag (Kyat)	“Pyi” (Kyat)	50 Kilos bag (Kyat)
1	Ngasein 35%	13.45	316.00	53.00	1245.00
2	Emata 35%	14.10	341.00	54.00	1268.00
3	Ngasein 25%	14.50	341.00	55.00	1292.00
4	Emata 25%	15.45	363.00	56.00	1315.00
5	Meedone 38%	16.50	388.00	61.00	1433.00
6	Meedone 25%	17.00	400.00	63.00	1480.00
7	Meedone 15%	-	411.00	67.00	1573.00
8	Ngakywe 15%	-	411.00	-	1850.00
9	Ngakywe 25%	17.25	405.00	-	1597.00

Source: MAPT.

Remarks: 24 Pyi = 1 basket of white rice = 75 Lbs

Annex -16

Current Local Selling Prices of Rice Products by MAPT

(Kyats)					
Sr.	Commodity	Price for 50 kilo bag (without bag)	Sr.	Commodity	Price for 50 kilo bag (without bag)
1	Broken Rice B 1, 2	920.00	8.	Boiled Broken Rice 5, 6	540.00
2	Broken Rice Ordinary 1,2	920.00	9.	Special Rice Bran	470.00
3	Boiled Broken Rice 1,2	900.00	10.	Ordinary Rice Bran	430.00
4	Broken Rice B2, 3, 4	900.00	11.	Boiled Bran	430.00
5	Broken Rice Ordinary 2,3,4	800.00	12.	Cyclone	200.00
6	Boiled Broken Rice 2,3,4	810.00	13.	Cow Bran	150.00
7	Broken Rice 5,6 & Points				540.00

Source: MAPT.

Specifications of Myanmar White Rice 25% Broken

1.	Grain Composition	
	(a) Rice	75%
	(b) Broken	25%
	N.B Size of broken	
	(1) Not less than	0.25
	(2) Not more than	0.60
	The grain with a length of 0/75 and above shall be not less than 60%.	
	(c) Small Broken	Not more than 2%
2.	PADDY	4 grains per 100 cc
3.	MAXIMUM ALLOWANCE OF MIXTURE	
	(a) DAMAGE	
	- Yellow : 1 st half of the year	1.0%
	- Yellow : 2 nd half of the year	2.0%
	- Otherwise damaged	3.0%
	(b) Foreign Matters	1.0%
	(c) Red & Red Streaked Kernels	3.0%
	(d) Foreign Kernels	-
	(e) Immature Grains	-
	(f) Chalky Kernels	8.0%
4.	MILLING DEGREE	Reasonably well milled
5.	MOISTURE CONTENT	Not more than 14%

Source : MAPT.

N.B (1) Size of broken is determined in proportion to the average length of the unbroken kernels.

(2) Maximum allowance of mixture in damage, red and red streaked kernels and chalky kernels may be measured from the rice.