MYANMAR AGRICULTURAL SECTOR REVIEW AND INVESTMENT STRATEGY FORMULATION

UNDP/FAO - MYA/01/008

WORKING PAPER No. 6

Agroindustry and the Transformation of Agricultural Products in Myanmar

Government of the Union of Myanmar
United Nations Development Programme
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Preface

This report[1] is one of a series of working papers reviewing the agricultural sector in Myanmar under a UNDP and FAO sponsored Agricultural Sector Review and Investment Strategy Formulation Project

This report presents a review of agroindustry in Myanmar, concentrating on the major agricultural industries with significant post-harvest processing activities; namely rice milling, cotton ginning, edible oil production, wheat milling, pulses and beans processing, and sugar milling. In addition, input provision in terms of agricultural machinery and fertilizer production is reviewed.

The key constraints to sectoral growth and policy implications arising from private and state sector involvement in the industries are discussed, as well as the major policy implications and potentials for agroindustrial development. Finally, a sectoral strategy is defined, and a series of investment profiles are presented.

The field work for this report was carried out over three months, from 17 August - 16 October 2003 and 5-25 January 2004 in Myanmar. The first two months in 2003 concentrated on identifying the issues and constraints underlying the agroindustry sector in Myanmar, while the final month in 2004 involved the presentation of results at a workshop in Yangon, articulation of a sector strategy with workshop participants, and the development of a series of investment profiles for the sector.

Thanks go to the Agroindustry Counterparts U Tin Nwe and U Kyaw Yee (Deputy General Managers, Myanma Agriculture Service) and to U Tun Naing (UNDP Programme Officer) for their generous support and sharing of information.

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Weights and Measures

Unit		Conversion	Unit
Acre	(ac)	0.4047	hectares
Basket Paddy	(bskt)	46.0000	pounds
Basket Paddy	(bskt)	20.8652	kilograms
Basket Paddy	(bskt)	16.0000	pyi
Basket Rice	(bskt, rice)	72.0000	pounds
Basket Rice	(bskt, rice)	32.6586	kilograms
Can Rice	(can)	0.5859	pounds
Can Rice	(can)	0.2658	kilograms
Hectare	(ha)	2.4710	acres
Imperial Gallon	(Igal)	4.5460	liter
Kilogram	(kg)	2.2046	pounds
Kilogram	(kg)	0.6124	viss
Kilogram/Hectare	(kg/ha)	0.8922	pounds/acre
Kilogram/Hectare	(kg/ha)	0.2478	viss/acre
Kilometer	(km)	0.6214	mile
Mile	(mi)	1.6093	kilometer
Pound	(lbs)	0.4536	kilograms
Pound	(lbs)	0.2778	viss
Pound/Acre	(lbs/ac)	1.1208	kilograms/hectare
Pound/Acre	(lbs/ac)	0.2778	viss/acre
Pyi Paddy	(pyi, paddy)	0.0625	Basket Paddy
Pyi Paddy	(pyi, paddy)	2.8750	pounds
Pyi Paddy	(pyi, paddy)	1.3041	kilograms
Pyi Rice	(pyi)	4.6875	pounds
Pyi Rice	(pyi)	2.1262	kilograms
Tical	(tcl)	0.5250	Troy Ounce
Ton	(ton)	2240.0000	pounds
Ton	(ton)	1.0160	tonnes
Ton	(ton)	622.2222	viss
Tonne	(mt or t)	1000.0000	kg
Tonne	(mt or t)	2204.6229	pounds
Tonne	(mt or t)	0.9842	ton
Tonne	(mt or t)	612.3953	viss
Troy Ounce	(Toz)	0.0311	kilograms
US Gallon	(gal)	3.7862	liter
Viss	(viss)	1.6329	kilograms
Viss	(viss)	3.6000	pounds
Viss/Acre	(viss/ac)	3.6000	pounds/acre
Viss/Acre	(viss/ac)	4.0349	kilograms/hectare

Notes

Fiscal Year: April 1 - March 31
Myanmar Currency: Kyat (K)
US Currency: Dollars (US$, USD or $)
Market Exchange rate: Varies, during study period (September-October 2002) average K1000=US$1
Official Exchange rate: Varies according to commodity and Ministry/Organization concerned.

List of Acronyms

AcD-MAS	Accounts Division
ADB	Asian Development Bank
AD-MAS	Administration Division
AED-MAS	Agricultural Extension Division
AIA	ASEAN Investment Area
AISP	ASEAN Integration System of Preferences
AMD	Agricultural Mechanization Department
ASEAN	Association of South East Asian Nations
ATFA	ASEAN Free Trade Area
CARI	Central Agricultural Research Institute
CARTC	Central Agricultural Research and Training Center
CSO	Central Statistical Organization
DAP	Department of Agricultural Planning
DGM	Deputy General Manager
DOLF	Directorate of Livestock and Fisheries
EDB	Economic Development Board
FAO	Food and Agriculture Organization of the United Nations
FAQ	Fair Average Quality
FDI	Foreign Direct Investment
FFA	Free Fatty Acid
FQ	Fair Quality
GM	General Manager
GMS	Greater Mekong Sub-Region
GOM	Government of Myanmar
GSP	Generalized System of Preferences
HYV	High Yielding Variety
ID	Irrigation Department
IDE	Institute of Developing Economies
JETO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
LBVD	Livestock Breeding and Veterinary Department
LUD-MAS	Land Use Division
MADB	Myanma Agricultural Development Bank
MAPT	Myanma Agricultural Produce Trading
MAS	Myanma Agriculture Service
MCSE	Myanma Cotton and Sericulture Enterprise
MFE	Myanma Farms Enterprise
MFN	Most Favored Nation
MICo	Myanma Industrial Company Limited
MIDB	Myanma Industrial Development Bank
MIDC	Myanma Industrial Development Committee
MIS	Market Information Service
MJI	Myanma Jute Industries
MNPED	Ministry of National Planning and Economic Development
MOA	Ministry of Agriculture

MOAI	Ministry of Agriculture and Irrigation
MOC	Ministry of Commerce
MOE	Ministry of Energy
MOGE	Myanma Oil and Gas Enterprise
MOI(1)	Ministry of Industry No. 1
MOI(2)	Ministry of Industry No. 2
MOLF	Ministry of Livestock and Fisheries
MPCE	Myanma Perennial Crop Enterprise
MPE	Myanma Petroleum Enterprise
MRMA	Myanmar Rice Millers Association
MRTA	Myanmar Rice Traders Association
MRTLC	Myanmar Rice Trading Leading Committee
MSE	Myanma Sugar Enterprise
MTI	Myanma Textile Industries
NAIC	Newly Agro-based Industrializing Country
PDD-MAS	Procurement and Distribution Division
PPD-MAS	Plant Protection Division
PPMED-MAS	Project Planning, Management and Evaluation Division
SD-MAS	Seed Division
SEE	State Economic Enterprises
SLORC	State Law and Order Restoration Council
SLRD	Settlement and Land Records Department
SME	Small and Medium Enterprises
SOE	State Owned Enterprises
SPDC	State Peace and Development Council
SQ	Special Quality
UMFCCI	Union of Myanmar Federation of Chambers of Commerce and Industry
UN	United Nations
UNDP	United Nations Development Programme
WB	World Bank
WRUD	Water Resources Utilization Department
WTO	World Trade Organization

1. Executive Summary

1.1. Introduction and Scope of Study

Over half a century since gaining independence, Myanmar still remains an agricultural based economy. Using the latest statistical information available (2000-2001), the agriculture sector contributed 57.2 percent of GDP at current prices while manufacturing contributed 7.2 percent of GDP. Compared with almost all of her neighbors, who have achieved a significant level of industrialization and structural change, Myanmar's share of industry in total GDP remains more or less constant at or around 12 percent; indicating no significant structural change in the economy over the five decades since independence. Agriculture itself has remained relatively stagnant, averaging around 37.5 percent of GDP over the last 15 years.

The main agricultural policies of the government revolve around the expansion of cropping and industrial crops, both within SOEs as well as through private sector involvement, and increasing the involvement of the private sector in agricultural input provision. The increasing mechanization of agriculture and the expansion of irrigation are important measures being used to increase production and productivity of agriculture, as well as increasing the area of land under cultivation. Of interest to agro-industry is the emphasis on private sector involvement in agricultural input and machinery distribution, and the absence of explicit policies outlining private sector involvement in the production of inputs or the trading in agricultural outputs.

While agriculture as a whole (crops, livestock and fisheries, and forestry) is an extremely important component of GDP, the crop sector is the most important sub-sector in Myanmar, contributing 48.8 percent of GDP. These are classified into seven crop groups; cereals, oilseeds, pulses, industrial, culinary, plantation and others. Of the cereal crops, paddy, maize and wheat are the most important ones, while sesame groundnut and sunflower are the most important oilseed crops. Black and green gram and pigeon pea are the most important pulses, while cotton, sugarcane and rubber are the most important industrial crops grown.

On the basis of the importance of the agricultural and cropping sector in the economy of Myanmar, the Myanmar Agricultural Sector Review and Investment Strategy Formulation Project aims to undertake a sector review of the agricultural sector for use by the Government of Myanmar and international donors to identify issues and define investment needs in order to stimulate broad-based agricultural growth.

1.2. The Status and Performance of Major Agroindustrial Activity

The Myanmar Government's national economic objectives highlight the role of agriculture as the driver of economic growth, but fail to explicitly identify agro-industrialization as a mechanism by which this can be achieved. Industrial policies and strategies that were implemented were mainly orientated towards import-substitution, and subsequently failed to achieve any meaningful growth in the industrial sector.

Despite this, the economic, social and environmental features of Myanmar are very favorable for agroindustrial development. There are abundant resources of industrial raw materials such as coal, iron and tin, a large potential for hydroelectric power, a domestic market of 50 million people with a relatively low population density, and a large potential regional and international export market. Coupled with a long-term deterioration in the terms of trade for raw, unprocessed primary products on the international market, this implies that the continued reliance on exports of primary products for foreign exchange is unsustainable. The experience of neighboring countries shows that the solution to

this dilemma is through the promotion and expansion of exports of value-added commodities produced by industries (Kudo 2001, pp 43-44).

This the report highlights the role of the state and private sector in agro-industrialization and the contribution of selected agroindustrial sectors to agricultural growth and development; the role of rice milling, cotton ginning, edible oil production, wheat milling, pulses and beans processing, sugar milling, agricultural machinery manufacturing, and fertilizer production. These industries are the major industries within the agricultural sector contributing to agricultural GDP and are thus important to continuing agricultural growth.

1.2.1 Rice Milling and Processing

1.2.1.1 Production Trends

Rice production is the major agricultural activity in Myanmar. Just over 6.4 million hectares of paddy was harvested in 2001-2002, yielding 3.4 tonnes per hectare, or almost 22 million tonnes of paddy (see Table 11). The majority of paddy is grown in the delta and central region of Myanmar (see Table 31). Exports of rice are currently around 0.9 million tonnes (2001-2002), but averages since 1988-89 have been around 0.3 million tonnes.

The introduction of high-yielding varieties (HYV) in 1977-78 generated a considerable increase in paddy production, which was further increased in 1992 with the introduction of summer (dry season) paddy production with the help of extended irrigation facilities and improved farm mechanization (Kudo 2003, pg 77). With the increase in production, more milling facilities were needed and their efficiency became more important.

The government's 30 year plan for rice indicates that paddy area is targeted to increase by nearly 30 percent while production will increase by nearly 54 percent. Corresponding yields are targeted to increase by nearly 35 percent. Most of this increase will have to come from intensification of existing paddy production in the delta region, although significant production increases in the dry zone area are planned. In order for this to be achieved, major investment in irrigation schemes in the dry zone area is planned or under current construction.

1.2.1.2 Prices

The price of rice is seasonal, peaking in September and October just before harvest time and bottoming out during the harvest of the monsoon rice in November to January. The level of rice surplus or deficit in the normally deficit regions in Myanmar play an important role as a residual in the market. At the end of 2000-01 the price was almost half of that at the beginning of the year due to an unusual surplus of rice in the normally deficit Upper Myanmar and hilly regions. After January 2002 the price started to rise again due to seasonal factors as well as the effect of increasing costs of inputs such as diesel oil and chemical fertilizers. Thein (2003) shows that the wholesale price of rice in Yangon market has risen significantly since the beginning of 2002; around K10,000 per 50kg bag of Pawsan rice, compared with between K2000-4000 per 50kg bag between 2000-2001.

Generally, Pawsan rice fetches the highest price in the Mandalay and Yangon markets, while Shwebo Manaw and Nga-Kywe are the second most expensive varieties in the respective markets. With some differences in volatility, the prices for different varieties generally track each other, indicating some consistency with market pricing for these different varieties.

1.2.1.3 Trade and Marketing

Myanmar as a whole is self-sufficient in rice but there are some areas, such as central Myanmar, the hilly regions and Taninthayi Division which are rice deficit (see Table 31). The surplus rice flows from the surplus areas of Ayeyawaddy, Bago and Yangon Division to the rice deficit regions. The private sector handles most of this trade.

Paddy is sold by farmers to primary collectors or commercial mills and the resultant rice is distributed to consumers through a wholesale network. Paddy destined for own consumption is milled in village mills, where millers get to keep the bran and husk as payment for milling services; for use in their livestock fattening enterprise or for sale to livestock producers. Private trade in paddy and rice was prohibited during the socialist period in Myanmar but since 1987 private traders have increased their involvement in domestic trade while the government still has some control over some farm gate transactions and exports. Since 1987 the main purpose of state paddy procurement was to supply rice to targeted groups (government employees, hospitals, other social welfare institutions and the military) at subsidized prices and the export of any surplus.

Until the 2003 harvest the state procured paddy from farmers at a rate around half of the normal market price. From April to December 2003, the government policy intention was that MAPT was to procure paddy directly from traders and millers, at the prevailing market price. The private sector was allowed to export rice under license, with MAPT no longer involved in the export trade. The policy for MAPT to procure paddy and rice directly from traders was never actually implemented, and the government announced a new policy in December 2003 involving the complete liberalization of the domestic market for rice (stopping the procurement of paddy and rice by MAPT) and the elimination of subsidized rations for government staff and other target groups. Exports of rice were subsequently banned, in an attempt to reduce the income effect on government staff by lowering prices and securing sufficient supplies of rice for the domestic market.

Most of the state rice milling sector falls under the Ministry of Commerce, and the Myanmar Agricultural Product Trading Enterprise (MAPT) under the MOC purchases paddy for milling on behalf of the government for targeted groups and exports. Total purchases for 2003 up until October 2003 were around 10 percent of production, which are milled by MAPT in their own mills or private contracted mills. MAPT owns 70 mills and employs a further 513 private mills on a seasonal basis.

As Table 7 shows, exports of rice have been limited in recent years to under K200 million and under 1 million tonnes. Existing export markets for rice include Indonesia, Singapore, Bangladesh, China, Thailand, the Philippines, and Gambia. Thein (2003) estimates that given the current state of production, on average less than 400,000 tonnes (3 percent of total production) can be exported on a sustainable basis and at current world prices exports are not profitable.

In 2001-2002, approximately 60 percent of MAPT rice was destined for the export market. This was significantly greater than in previous years but in future years MAPT will not be involved in exporting rice, with private traders taking up the slack.

As noted above, until the change in government policy in late 2003, exports of rice by the private sector were restricted to operating through MAPT, but private traders are allowed to operate in the domestic market. Primary collectors or village brokers purchase paddy from farmers and sell them to township wholesalers who sell mainly on a commission basis, although some do purchase paddy outright and make a profit on the arbitrage. Most collectors and traders deal in many different crops, rather than act as specialized traders. Collectors usually operate on very thin margins of 1-5 percent, while wholesale traders can have larger margins.

1.2.1.4 Processing Capacity and Efficiency

Private rice mills can be classified into three groups according to capacity; small, medium and large. Small village mills are called "har-lar-sek" or "hurler". Small village mills are found in large numbers in the rural areas and play an important role in milling part of farmers' marketable surplus as well as for milling home consumption. Most hurler mills provide milling free of charge, in return for keeping the fine broken rice, bran and husk, which can be used for miller's own livestock or for sale to livestock producers.

The busiest time for rice mills begins just after harvesting time, which is from December to April for the main rice producing area. The lowest operating period is during the rainy period.

Most millers buy paddy from farmers and collectors and sell the milled rice. Average milling recovery ranges from 45-65 percent, depending on the type of mill and quality of paddy. The very low recovery rates apply to the smaller mills in the private sector, with larger mills and SOE milling being able to afford newer equipment. Overall, MAS statistics indicate that recovery rates average at nearly 60 percent (see Table 17), although none of the milling operations visited by the ASR Review Team came close to that figure.

MAPT estimated that in 1994 there were 2189 registered mills, with an estimated milling capacity of 50,000 tonnes per day. Around 97 percent of capacity is in private ownership, and 54 percent is for small scale milling(Kudo 2003, pg 77-78). Given MAPT milled 80.8 million baskets of paddy in 2000-01 and 105.6 million baskets in 2001-02, this equates to a 71.4 and 54.6 percent capacity utilization for 2000-01 and 2001-02 respectively, assuming a 250 day per year operation (or 49 and 37 percent respectively for the full 365 days).

1.2.1.5 Key Constraints

Kudo (2003, pg 78) notes that while small-scale mills are manufactured locally and some of the state owned mills have been upgraded and are reasonably modern and efficient, the bulk of the milling sector are operating below their rated capacity and their machines are obsolete. The main cause of this has been capital and credit constraints, a lack of spare parts, and inefficient management. While the state rice milling sector has benefited from ongoing budgetary support and capital investments, the private sector is constrained in their ability to modernize.

Milling technology is low in the village milling sector, although mills are able to purchase spare parts. In addition to problems with wear and tear on machinery, the lack of sorting and de-stoning units in rice mills result in high levels of broken rice; with consequent effects on the profitability of milling operations. There are significant issues relating to the mixing of different varieties of rice in the collection and milling process and inadequate post-harvest and storage technologies which result in high levels of broken rice and a deterioration of rice quality. This significantly constrains the ability of Myanmar to enter into the world rice trade in any appreciable manner. Similarly, export restrictions on rice mean that rice millers have limited access to foreign markets, and market access is also compromised by limited information about foreign market conditions and competitive factors.

Private millers note that the cost and the reliability of electricity is a major constraint, with some mills unable to operate at efficient levels due to frequent power shortages.

1.2.2 Cotton Ginning and Processing

1.2.2.1 Production Trends

Area and production trends in cotton are shown in Table 12, which indicates that the largest area of cotton is devoted to long staple varieties (some 230-250,000 hectares) followed by short staple varieties (some 90,000 hectares). The area under long staple has been increasing over the past decade; while there have been declines in sown area for all other varieties. Yields for all but long staple varieties have been stagnant or slowly increasing, but the long staple varieties have shown declining yields over the past decade, as fertilizer and irrigation use has not kept up with the expansion of areas under production. Despite the reduction in yields, overall production has increased; due to the expansion of area.

Cotton production peaked in the mid 1980s (1984-85) under the whole townships high yielding varieties program before stagnating in the early 1990s as rising costs and low procurement prices encouraged farmers to diversify into alternative crops. Since the late 1990s areas under production and consequently production have increased; peaking at 202,000 tonnes in 1999-00. This has been a result of MCSE taking over responsibility for procurement after 1994-95 and increasing the procurement price for long staple cotton by 500 percent and short staple cotton by 400 percent over the following 9 years. In parallel, open market prices maintained a premium of 150-200 percent above government procurement prices; fuelling an increase in production, but diverting much of this to the private sector rather than the SOE sector as had been intended (U Tin Htut Oo and Kudo 2003, pg. 322).

1.2.2.2 Prices

The cotton industry in Myanmar has been dominated by the existence of compulsory procurement of cotton by MCSE, until last year 50 viss per acre for long staple cotton and 25 viss per acre for short staple. In 1980-81 MCSE procured over 52 percent of the entire crop, but this has fallen to just over 14 percent in recent years. The reduction in procurement volumes has been a result of the below market prices paid by MCSE, and the relative profitability of alternative crops such as chilies and chickpeas as well as pigeon pea and green gram in the dry-zone areas.

From late 2003, MCSE plans to eliminate the quota applied to all cotton farmers and concentrate on entering contracts with a limited number of growers (20,000 farmers on 60,000 acres) to provide cotton for seed production. In exchange for subsidised inputs and technical services, contracted growers will have to provide 100 viss per acre. The price for cotton for seed under the old system was fixed at K180 per viss for 2002-03, whereas for the upcoming 2003-04 season the price will be K400 per viss, plus a premium for quality (cleaned cotton). In comparison, the market price for cotton is K365-400 per viss, and up to K500 per viss for seed cotton.

1.2.2.3 Trade and Marketing

The Myanma Cotton and Sericulture Enterprise (MCSE) is responsible for cotton procurement in order to supply raw materials to SOE spinning factories at a fixed low price. Prior to late 2003, farmers in designated zones were allocated a quota every year and were required to deliver this quota to MCSE at a fixed price, usually below the market price. Due to the disparity between prices some farmers are reluctant to cultivate cotton and the MCSE has difficulty in enforcing the contract. Procurement quotas were 50 viss per acre of cotton, and farmers were required to supply this quota before they could sell their over-quota surplus on the open market. In order to ensure quota deliveries, private ginners and traders were banned from operating in the first 2 months of the harvesting season and farmers had to obtain a "yellow card" certificate of sale from MCSE for their quota before selling to private traders. Since quota deliveries were based on weight, not quality, this system encouraged farmers to deliver their lowest quality cotton to MCSE collection points and reserve their better cotton for sale to the private sector. As a counterbalance to the trend to deliver poor quality cotton to MCSE and reserve the better cotton for private sales, higher quality cotton is obtained in the early part of the harvest season, when private traders are banned from entering the market.

From late 2003, MCSE plans to eliminate the quota applied to all cotton farmers and concentrate on entering contracts with a limited number of growers to provide cotton for seed production. In exchange for subsidised inputs and technical services, contracted growers will have to provide 100 viss per acre.

1.2.2.4 Processing Capacity and Efficiency

With few exceptions, the majority of ginning in Myanmar is carried out using single roller machines manufactured in the late 1800s to early 1900s in Northern England. The private sector is exclusively single roller gins while the SOE sector has embarked on a modernization drive and has purchased some double roller gins from India and Japan, as well as some Saw gins from the US.

As Table 74 shows, the private sector has nearly 49 percent of the available capacity, and just over 76 percent of ginning capacity is from single roller gins. This represented a total capacity of just over 311,000 tonnes of cotton seed per year, or an estimated capacity utilization of around 60 percent (see Table 75). As noted in Table 89, there are wide discrepancies between gins on capacity utilization under full or "normal" operating conditions. Under full operating conditions (2 shifts per day, 365 days per year) the capacity utilization ranged from 23 percent down to less than 2 percent, with most surveyed gins operating at less than 8 percent. Under "normal" operating conditions (1 shift per day, ginning season depending on length of harvest and availability of cotton) capacity utilization ranged from 63 percent down to 23.7 percent; with three of the 5 gins surveyed having less than 26 percent capacity utilization. As a consequence, the data appear to suggest that the majority of ginning is carried out in the private sector and a significant proportion of the SOE ginning sector is chronically under utilized.

Actual costs and returns from the gins under MCSE were unable to be obtained in the short time available to the ASR Field Team. In terms of private ginning operations, the ASR Field Team visited one gin in Meiktila who had a profitability of 49 percent.

Cotton by-products include linter, cotton seed for planting, and cotton seed for oil production. Typical recovery ratios and amounts obtained by the State sector are shown in Table 77. Interviews with gins suggest that cotton seed reserved for seed varies between 30 percent (private gin) to 75 percent (SOE gins). The higher levels of seed reserved for planting is typical for the SOE gins, as they attempt to maintain adequate supplies of seed for delivery to farmers in their catchments area. A major constraint to sustainability of yields is the quality of seed supplied by MCSE gins to farmers for planting. Since quotas are set on weight, not quality, farmers typically provide their worst quality cotton to MCSE under the procurement system and germination rates of seed reserved for planting are typically between 40-60 percent. This in turn impacts not only on the quality of cotton grown in subsequent season, but on the quality of seed reserved for planting. MCSE notes that seeding rates should be 2-3 viss per acre, but are typically 10 viss per acre due to poor germination rates.

Cotton seed oil crushing facilities are apparently more numerous in the private sector, but actual outputs and capacities are unknown. Table 76 indicates that there are 6 SOE cotton seed oil mills and 30 private sector ones which are registered with MCSE, although there are many more unregistered ones. Cotton seed oil is used mainly for frying chickpeas, and the cake is used for livestock feed; particularly in aquaculture. Table 77 shows output of refined oil, soapstock and cotton seed cake from the state sector.

1.2.2.5 Key Constraints

One of the major constraints facing the SOE sector is the inability to secure sufficient quantities of cotton at the prevailing procurement prices. While MCSE continues to set fixed prices below the market rate cotton farmers will always prefer to sell on the open market. Part of the problem is the inertia inherent within any bureaucracy; where purchase prices are set at the beginning of the harvest season and rarely if ever changed. For example, the 2000-01 season was a bumper harvest and the open market

price fell commensurately. Since MCSE had fixed the procurement price at the beginning of the season, and this ended up being higher than the open market price, they were able to obtain sufficient quantities to meet their demands. Since private traders are able to vary prices almost instantaneously, the government price will always be below the market price as long as MCSE desires to secure supplies of cotton cheaper than what the private market will pay and supply conditions do not vary dramatically.

As noted above, in terms of technical constraints in the production of cotton, a major constraint to sustainability of yields is the quality of seed supplied by MCSE gins to farmers for planting. Farmers typically provide their worst quality cotton to MCSE under the procurement system and germination rates of seed reserved for planting are typically between 40-60 percent. This in turn impacts not only on the quality of cotton grown in subsequent season, but on the quality of seed reserved for planting.

1.2.3 Edible Oil Production

1.2.3.1 Production Trends

The oil crop sub-sector is second only in importance to rice in the agricultural economy of Myanmar (Kudo 2003, pg. 79). With a total sown area of 7.25 million acres (3.0 million ha) oil crops encompass a range of annual oilseeds and oil palm (a perennial crop). Oilseeds comprise around 16.4 percent of total sown area for agriculture, while total production is around 1.4 million tonnes. The most important oil crops, based upon a three year average (2000/01 – 2002/03), are sesame, groundnut and sunflower (3.4, 1.6 and 1.2 million acres respectively). Oilseed crops grown also include 0.3 million ha of cottonseed, which is a by-product of cotton fiber production and 116,000 ha of soybean, which has traditionally been used for culinary (non-oil) purposes. Niger seed and mustard are of local importance in the higher altitude areas but do not generally enter the commercial oil sector.

Over 80 percent of the oil crop production is concentrated in the central dry zone area, which encompasses the Divisions of Magway, Mandalay, Sagaing and parts of Bago. Sesame and groundnut are traditional crops within the region and remain dominant, although sunflower (a more recent introduction) and cotton are also important.

With the exception of mustard and niger, edible oil crops are sown in both monsoon and the cool dry season. The central dry zone area and the hilly areas of Shan State are the major producing areas of sesame, groundnut and sunflower in the rainy season. Sesame is mainly produced in Magway Division during the rainy season and in the lower part of Myanmar groundnut is sown as a second crop after the monsoon rice. Consumer preferences are highly regionalized, with consumers in the central and upper part of Myanmar preferring sesame oil, and those in the lower part preferring groundnut oil.

As noted above, sesame is grown in the central dry zone area during the monsoon season. In the central dry zone area the rainfall pattern is bimodal, and there are frequent occurrences of dry spells in July, when sesame is in its growing stage. Thus the harvested area and yield fluctuates sharply from year to year (see Table 11).

Average oilseed yields for sesame and groundnut are low compared to international levels, averaging no more than 288 kg/ha (pre-monsoon) and 498 kg/ha (post-monsoon) for sesame and 1,000 and 1,440 kg/ha respectively for groundnut. This difference in yield with only marginal differences in market price can result in very low profitability for the pre-monsoon crop. Yields for sunflower have tended to be closer to international levels, averaging 549 kg/ha.

Overall oilseed areas and yields grew moderately in the 1970s and 1980s, with sesame and sunflower being the main beneficiaries. However, in the last 15 years, total area sown to oilseeds has grown by an annual average of only 0.75 percent and total production by less than 1.75 percent per annum. Yields

have largely stagnated or have declined. Furthermore, these limited gains have been limited almost entirely to minor oil crops, with sesame and groundnut experiencing absolute declines in sown area.

1.2.3.2 Prices

Normally groundnut oil is the most expensive edible oil while palm oil is the cheapest in the market. However, prices of edible oils in general fluctuate widely. This is closely related to domestic production level of oilseed crops and import volumes of palm oil. Since the latter half of 2001 imports of oil palm have decreased and the retail price of edible oil has increased significantly. The price of palm oil out of Malaysia averaged around US$515 per tonne for 2001-2002, but increased to US$745 per tonne in the first half of 2003. However, the variability in prices is greatly reduced from previous years, indicating a rising but stable price for imports of palm oil.

Oil prices and by extension, oilseed prices, have been under increasing pressure since palm oil became widely available – in part to compensate for deficits in national production. Price increases for oilseeds have been lower than for rice over the last decade. While consumers prefer groundnut and sesame oil to palm oil, low average income levels preclude most households from paying a sufficient margin to offer attractive returns to oilseed production. This has contributed to a growth in palm oil consumption, stagnation in oilseed production and the rapid growth of pulses. Furthermore, limitations on oil palm imports have probably resulted in oil prices higher than would be seen in an open market, suggesting that integration within ASEAN may lower palm oil prices still further.

1.2.3.3 Trade and Marketing

The trade and marketing in edible oil is handled largely by the private sector. In the government sector various ministries are in control of different oil processing facilities. For example, MOAI is in control of Palm oil and other vegetable oil mills, while MOC is in control of Rice Bran oil mills.

Oilseed crops such as groundnut, sesame, sunflower, niger and mustard seed are important as raw materials for edible oil and traditional snacks. Consumers in Central Myanmar prefer sesame oil, whereas consumers in Lower Myanmar and hilly areas prefer groundnut oil. Sesame is not only an important oilseed crop for edible oil production, but also as an export crop, particularly black sesame seed to China for further export to high valued markets such as Japan. Private exports of sesame were allowed until 1998, when exports were banned with very short notice. The policy change was based on a desire for a stable domestic supply and self-sufficiency. Government policy with regard to oilseed sector is influenced by two key factors; the desire to provide incentives for oilseed farmers and the concern that increased edible oil prices will impact low-income consumers. Intervention in processing, marketing and trade has also been a source of revenue for the Government.

Private companies are not allowed to export sesame directly, but must do it through government agencies. For example, private exporters who have found an export buyer can sell their product to MAPT at the prevailing domestic market price, which then loads the sesame onto the ship and sends it to the buyer. MAPT keeps the foreign exchange revenue, less the 10 percent export tax. The domestic price of sesame has declined around 30-35 percent since the imposition of the export ban, and is most likely the cause of the decrease in sesame production over the last few years. Domestic production of edible oil is insufficient to meet local demand, and palm oil is imported from neighboring countries, mainly Malaysia.

In the absence of a formal oil export trade, oilseeds are consumed largely in the domestic market, where they must compete with palm oil. Producers typically either process their seed in local village mills for home consumption (often paying for the service with the cake) or sell to traders coming to the village. Village traders, in turn, sell to commercial mills in larger settlements and towns, often through the

medium of central crop exchanges (CCEs) where brokers charge an average 1.5 percent commission for negotiating sales but do not physically handle the crop. Reported marketing margins for oil seeds are low and evidence suggests that the marketing system is relatively competitive, with a wide range of participants. However, market price information is limited at village level.

1.2.3.4 Processing Capacity and Efficiency

All milling of sesame, groundnut and sunflower in Myanmar is undertaken in the private sector and in 2001-02 a total of approximately 400,000 tonnes of groundnut, sesame and sunflower seed oil were produced.

All private sector mills are of the expeller type and are commonly in the 1 tonne per day to 20 tonnes per day range, with a small number of mills reaching 50 tonnes per day or higher. Some 2,000 oilseed mills were identified by U Tin Htut Oo (2003), but this does not include Shan State and other areas, so the total number of mills will be higher. Considerable evidence exists of on-going privately financed expansion and upgrading of mills in this category, and there are a number of local companies manufacturing expellers, filter presses and related equipment. Other equipment is brought in from China.

In general oil extraction rates in Myanmar are below that of their international counterparts. As all sesame, groundnut and sunflower processing currently utilizes mechanical expeller technology, the resulting cake has a remaining oil content of 6-7 percent. Cake is an important secondary product and is primarily used for animal and aquaculture feed.

In terms of profitability, private mills are operating on small but lucrative margins. One sesame oil miller in Magway indicated that he was operating on a marketing margin of K35 per viss, with a profit of K7 per viss, equaling a 20 percent return. Another Sesame oil trader and miller interviewed by the ASR Field Team indicated that his cost of production was around K30 per viss, with another K30-50 per viss net profit; a 3-5 percent return. This indicates that there are significant variations in profitability between enterprises, contingent on the type of operation, their location, and seasonal constraints.

1.2.3.5 Key Constraints

Access to production financing is reported to be a serious limiting factor among small farmers, especially for groundnut which requires high levels of seed input which must be purchased for the monsoon crop. For other oilseeds, financing is principally required for fertilizer purchase or improved seed varieties. However, formal sources of financing for agricultural production, including oil crops, are limited.

A major contributor to the decline in prices paid for oilseeds has been competition from imported palm oil in the domestic market. Low oilseed prices and household incomes have limited the ability and willingness of farmers to adopt improved seed varieties and technology packages, and have been a direct cause of stagnation in domestic production levels over the last few decades. Yields for all oil crops are below international averages and are falling further behind every decade.

Most millers interviewed indicated a lack of raw material input as being a significant constraint on their operations. Although problems within the oil crops sector may be most serious with respect to prices and productivity, the limited efficiency of current processing operations poses a further problem. Expeller technologies currently in use are typically sub-optimal, in terms of both extraction efficiency and costs per unit. While the edible oil extraction industry suffers less capacity under-utilization than other agro-processing sectors, several constraints do exist to efficient use of existing plant. Firstly, delays in getting raw material inputs contribute to significant deterioration of existing stocks. For

instance, the rice bran oil plants have a significant trade with private mills in exchanging old bran for new; indicating that they store bran for too long before processing. Secondly, the majority of extraction plants visited by the ASR Field Team indicated that access to stable electricity supplies was a major constraint to their operations.

The major constraints affecting the edible oil sector in Myanmar involve institutional and policy issues. The role of the state sector in production and processing has been quite limited, leaving the way open for the private sector to conduct operations. While private enterprises do not have to compete with highly subsidized state enterprises as in other sectors, government external trade policies with respect to oilseeds have had a serious depressing effect on production and prices. By restricting the export of oilseeds and edible oil in an attempt to make Myanmar self sufficient in edible oil production, the government has lost the opportunity for valuable export earnings from exporting high valued sesame and groundnut oil and importing lower valued palm oil. While this policy regime is understandable; the desire to enable the population to have access to edible oil at reasonable prices, it ignores the fact that poorer consumers have to purchase the lower valued palm oil in any case and that the vast majority of oilseed producers lose out from having to sell their harvest at lower prices than that obtainable on the world market.

1.2.4 Wheat Milling and Cereal Products

1.2.4.1 Production Trends

The wheat industry in Myanmar is a small but important industry, comprising around 0.5 percent of the total sown area. Wheat production is mainly in Upper Myanmar, mainly in Sagaing and Mandalay Divisions, and is usually in rotation with paddy, maize, sesame or groundnuts. Although volumes of wheat have been increasing, this has been due to mainly increases in yield (due to improved technology and management) and imports. In 2000-01, the area under production was 198,000 acres, producing 92,000 tonnes (see Table 11). The actual areas under wheat production have been declining due to the higher profitability of chickpeas, a competing crop.

While the cost of production of wheat has increased, the farm gate price has also increased. Despite this apparently profitability of wheat production, the profitability of competing crops like chickpeas is higher, and many farmer prefer to plant chickpeas rather than wheat.

1.2.4.2 Prices

The price of wheat-based processed food is influenced both by the domestic supply of wheat grain and by the amount of imports of flour, and interruptions in the import flow. Varieties of wheat like Myaung and Myinmu fetch higher prices than varieties such as Shan and Monywa. Prices have increased significantly since the beginning of 2001, compared to 2000. While imported wheat is important for flour production, most millers and processors perceive that local varieties of wheat such as Myaung, Myinmu and Monywa produce higher quality flour for biscuit and noodle making. Generally these flours are mixed with imported flour to produce the desired qualities.

1.2.4.3 Trade and Marketing

The Ministry of Industry No. 1 owned Foodstuffs Industries (formerly the Foodstuffs and General Merchandise Trade Corporation, FGMC) purchases wheat grain directly from farmers or through cooperatives for use in its flour mills. Private traders and flour-mill owners can also purchase wheat grain directly through the market. Flour milled by Foodstuffs Industries is either distributed to state owned processing factories or sold on the open market. In general, because wheat is not a controlled

crop item, the government owned enterprises act like any other private enterprise and can purchase, distribute and sell wheat, wheat flour and wheat flour products on the open market. Imports of wheat and wheat flour are carried out solely by the private sector. Private millers note that it is moderately difficult to import wheat grain and flour, due to general government restrictions on imports and exports.

The majority of wheat used in Myanmar falls between 9-12 percent protein content (90 percent of wheat purchased for milling). Another 5 percent of wheat has protein contents above 12 percent, while the remaining 5 percent of wheat has protein contents below 9 percent. Most of the wheat imported is of the higher protein content, which is then mixed with locally produced wheat to the desired characteristics.

The busiest time of the year for millers is January to March, just after harvest. Millers sell flour to traders in the locality and to the bigger markets of Mandalay. Imported wheat flour and local flour are often mixed and sold with different brand names, the price varying with the quality of the flour. Industrial users of wheat flour (for biscuit and noodle manufacture) usually pay higher prices for premium brand flour due to the consistency of the flour. Smaller mills operate on the residual market, entering the market only when returns are economical. According to industry sources, even though the milling sector is top heavy (with the larger mills producing most of the flour), the industry is quite competitive since there are many small mills able to leverage any changes in market prices. However, the larger mills are more profitable due to their ability to hold stock. In some years the larger mills have actually purchased flour from the smaller mills for storage in their silos and waited until market conditions changed.

1.2.4.4 Processing Capacity and Efficiency

Most of the flour mills in Myanmar are small mills, with very few large and medium size mills. According to one industry source, in Myanmar as a whole there are only 2 large commercial mills, less than 10 medium size mills, and over 100 small size mills. Most of the processing plants produce noodles and assorted biscuits.

FAO (2000, pp. 43, 47) notes that Mandalay the Crop Exchange Center had 115 wheat millers as members in 2000. In Sagaing Division there are wheat mills in the industrial zone of Monywa and in Sagaing Town there is a wheat flour mill and a noodle manufacturing plant. The association of Traders and Millers of Monywa and Sagaing had 26 wheat flour millers and 8 wheat noodle processors as members in 2000.

Private milling factories are located mainly in Yangon and Mandalay, although the government does have their own wheat flour processing factories producing noodles and assorted biscuits. While the capacity of the state sector processing factories is relatively high, the utilization rates are uniformly low, with most having utilization rates below 35 percent.

In the private sector capacity utilization is relatively high, running around 60-75 percent. One of the larger private mills interviewed in Yangon noted that they had just invested in new milling operations and consequently their utilization rates had fallen to 55-60 percent. This miller noted that they had the capacity to store around 35,000 tonnes of flour each year (54.3 percent as bulk in silos and the rest as bags in godowns). This equates to 26.3 percent of total supply of wheat.

The ASR Field Team was unable to obtain information about recovery rates from milling operations due to the limited number of millers interviewed. However, FAO (2000, pg. 67) notes that recovery rates for milling varies between 63-67 percent.

1.2.4.5 Key Constraints

The key constraints for wheat processing include the relatively low levels of domestic production of wheat. In part this is due to the agroecological difficulties in growing wheat in Myanmar, but mainly it is due to the costs and returns to wheat versus other crops that are suitable to be grown in the same area. For example, profitability of wheat is around US$110 per acre while chickpeas' net return is around $212 per acre (on an FOB basis). While large quantities of cheap wheat and flour can be imported, particularly if US and EU subsidies are operating, there is less incentive for domestic production of wheat.

In addition to the low levels of domestic production and the restrictions on imports, millers note that the difficulty in obtaining reliable and stable supplies of electricity is an important constraint on their milling operations. While larger mills are able to build their own sub-station, and get preferential access to electricity, smaller mills are significantly constrained in their number of hours of operation. Since these mills operate on the residual market, only operating when changes in relative prices make it profitable to mill wheat, this impacts on their ability to exploit sudden changes in prices and maintain competitiveness with the larger mills.

Domestic demand for wheat products is limited since wheat is not considered a staple food. Consumption of wheat is mainly for breads, biscuits, cakes and noodles, and consumers are price sensitive. With increases in incomes consumption should increase.

Millers note that higher protein content wheat needs to be imported in order to blend with lower protein wheat from domestic sources. Part of the constraint to the domestic production of higher protein wheat is the limited availability and use of inputs such as fertilizer and irrigation, but part is also due to the varieties of wheat grown in Myanmar. Breeding and screening of different wheat varieties are carried out to a limited extent at CARI, but wheat has a lower priority for scarce research funds than other crops such as rice and pulses.

1.2.5 Pulses and Beans Processing

1.2.5.1 Production Trends

The pulse industry in Myanmar is very important, contributing to 72 percent of agricultural exports in 2000-2001. Approximately 34 percent of pulses were exported in 1999-2000, while around 80 percent of pigeon pea was exported. The area under pulses has grown rapidly from around 1 million hectares in 1990 to over 3 million hectares in 2001-2002 (see Table 11). While pulses comprise around 20.4 percent of the sown agricultural area in Myanmar, Black Gram and Green Gram are the major types of pulses grown.

There are around 22 different pulses grown in Myanmar, but black gram, green gram, pigeon pea, chickpea and cowpea are dominant species. Nearly 50 percent of the area under pulses is grown to black and green gram. The significant growth in production of black gram and green gram was due to their integration into rice production as a second crop following the monsoon rice in lower Myanmar. In the central region of Myanmar the area of green gram has increased following their integration into the upland rice and sesame production system as an early maturing legume crop during the late monsoon period (U Tin Htut Oo and Kudo 2003, pg 156).

Pigeon pea is mainly grown in the central dry zone region of Myanmar, and the production has increased due to its drought resistance and value as a source of fuel wood. Pigeon pea is normally intercropped with sesame. Chickpea and cowpea are mainly grown as a relay or sequential crop with rice, and there are some upland areas where chickpea follows sesame, maize and green gram. The major areas for chickpea are Sagaing and Mandalay, while cowpea is mainly grown in Magway.

1.2.5.2 Prices

Most of the pulses are traded in the Mandalay and Yangon markets. Prices have increased steadily over time, but have not experienced the dramatic increases shown in rice prices; mainly due to the relatively mature open market for pulses relative to rice. On the export market, prices for black gram have fallen significantly from an average of US$468 in 2001 to US$285 in 2003. Reductions in prices for green gram and chickpea have not been as drastic, while prices for pigeon pea have actually increased over the same time period.

1.2.5.3 Trade and Marketing

The market for beans and pulses was liberated a decade ago and the resulting growth in the sector has been rapid. In the ten years following liberalization, the total area sown to pulses and beans have expanded three-fold to more than 3 million ha, and total shipments reached 938,000 tonnes in 2002/2003.

The export of pulses has expanded rapidly, from only 71,000 tonnes in 1980-81 to 831,000 in 2000-01. Likewise the value of exports has increased from K152 million to K1658 million over the same period.

Exports of pulses were originally to India, but after this market collapsed Myanmar sought other overseas buyers. The Japanese market was key to the exports of pulses from Myanmar in the 1960's but this market was taken over by first Thailand and then more recently China. Myanmar is the third largest exporter of pulses in the world, and it the largest producer in South East Asia. Prices for pulses from Myanmar vary according to the type, the quality, and the destination, as well as weather and general demand conditions. In general, prices for Fair Average Quality pulses range from US$170 to US$300 per metric tonne.

Most pulses are marketed by the private sector, which has been a major factor in the rapid increase in production over the last decade. FAO (2000, pg. 26) notes that there are about 20 big exporters of pulses and oilseeds, handling over 10,000 tonnes per year. The main destination is India, where fair average quality is acceptable. On the other hand, exports to Japan comprise very high quality pulses and oilseeds, mainly for culinary purposes rather than oil.

Domestic marketing for pulses is through a large network of small and medium size traders and wholesalers. For example, pulses grown around Pyay in Bago Division are transported to Yangon and Mandalay where they are cleaned and graded for export.

1.2.5.4 Processing Capacity and Efficiency

The extent of processing of pulses depends on their final use. Most of the pulses are exported as fresh produce, involving only limited grading and sorting. Machine splitting of husks is gaining popularity, although machine peeled pulses fetch less on the market due to the low levels of technology used resulting in damaged pulses. U Tin Htut Oo (2003, pg 162) notes that there are a few millers who process black gram, green gram and pigeon pea but more are involved in processing chickpeas, particularly around Sagaing and Mandalay. Most of the private enterprises who have installed cleaning and sorting equipment are involved in the export trade.

Processing of split gram to produce fried split gram and split gram flour to produce tofu and Vermicelli soup is important in Myanmar. Recovery rates are between 75 and 78 percent, depending on the size and cleanliness of the grains. MOI(1) estimates that there are around 500 enterprises involved in pulses and beans processing. Although not stated, presumably these enterprises comprise large and medium size

operations that have been registered with MOI(1) and do not include the large number of small operations scattered around the country.

FAO (2000, pp. 77-78) interviewed 6 chickpea millers, all of whom owned medium sized mills of 10-25 hp. Recovery rates ranged from 74-80 percent and mills operated from 3-10 hours per day, depending on electricity supplies and raw material supplies. Most mills were kept running throughout the year, with the number of hours per day the highest just after harvest.

1.2.5.5 Key Constraints

Constraints in the pulse processing sector are relatively few compared with other agroindustrial sectors. The main reason for this is the lack of government involvement in production, processing or trading. Most of the pulses are not processed to any great extent, mainly husking and splitting seeds. Cleaning and grading are rarely done for domestic sales, with some cleaning and grading done for export quality pulses. As a consequence, except for splitting of pulses like chickpeas, most trade in pulses is of the unprocessed type. This has significant implications for the quality of pulses, and consequently prices able to be obtained in both the domestic and international markets.

Interviews with processors indicate that the major processing problem is the low level of technology used for processing, particularly husking and splitting machines. Access to stable and reliable supplies of electricity is another problem facing processors, but not as significant as for other industries. The storability of dried pulses enables processors to spread out processing as electricity supplies permit. However, the effects of prolonged processing times relative to the throughput of the enterprise has an effect on efficiency and profitability of those enterprises.

Availability of credit is a constraining factor on the ability of processors to modernize their enterprises. Most processors of pulses are relatively satisfied with the capitalization of their enterprise, in the context of their overall situation. However, if production levels were to increase, domestic and international consumers were to demand higher levels of processing and Myanmar were able to export more of their surplus, then capacity and capitalization would become a constraining factor. In the short term however, the processing capacity of the pulse industry is adequate to meet current demands.

1.2.6 Sugar Milling and Processing

1.2.6.1 Production Trends

The majority of sugarcane is produced in Mandalay, Bago, Magway and Sagaing Divisions and in Shan State. The area of production in 2001-2002 was around 163,000 hectares (1 percent of total sown area for agriculture and 20 percent of industrial crop area), and 7.116 million tonnes of cane was harvested in 2001-02 for an average yield of 43.7 tonnes of cane per hectare (see Table 140). This is an increase in the area under cultivation from 2000-2001 (343,000 acres or 138,812 hectares) and production (5.8 million tonnes of cane), although the yield remained the same (see Table 12). On average, sugarcane area under the control of the MSE is around 50 percent of total sugarcane area, while production is around 52 percent. The private sector thus provides half of the production of sugarcane and sugar.

Yields of sugarcane under the control of the MSE are significantly higher (20.2 tonnes per acre compared with 18.8 tonnes per acre on a national level). In part this is due to the ability of farmers to apply fertilizer since they receive some advance payment for their quota, but more importantly MSE pays for cane on the basis of weight rather than CCS; providing an incentive for farmers to grow cane to maximize weight rather than quality.

As Table 140 shows, production of sugar by SOEs in 2000-2001 reached an estimated 80,000- 92,937 tonnes, around a 72 percent increase in production from the previous year. This is a significant increase above the long term average of 45,400 tonnes per year from 1980/81-1999/00. MSE plans to increase the area of cane under SOE mill command areas to around 200,000 acres, of which some 80,000 acres will be under their procurement scheme (Lwin 2003).

1.2.6.2 Prices

The SOE mills sell sugar at fixed prices which cover their operating costs but are significantly below the open market price for sugar. Low government procurement prices for cane have meant that sugarcane production and the volume of sugarcane flowing to SOE mills have been lower than that expected in an open market. From the 2003-04 crop year MSE will be experimenting with increasing their procurement price to K3500 per tonne, up from the current K2500 per tonne (Lwin 2003). This scheme will be voluntary, and MSE will provide technical and material assistance to farmers in exchange for selling their crop to MSE at a reduced price.

1.2.6.3 Trade and Marketing

The marketing and trade flows for sugar in Myanmar are outlined in Figure 18. State sugar processing facilities are under the control of MOAI, although downstream users of sugar, like soft drink and beverage factories, biscuit factories and alcohol distilleries are under the control of MOI(1). Under the MOAI, the Myanma Sugar Enterprise (MSE) is responsible for sugarcane procurement in order to supply raw materials to SOE cane factories at a fixed low price.

Under the quota system, farmers are required to deliver a certain amount of cane to the SOE sugar factories under MSE and can then dispose of surplus cane as they see fit; usually for sale to jaggery processors. Cane procurement is based on a quantity of cane basis (tonnes of cane per acre), whereas jaggery sales are based on the quality and sugar content of cane. Thus most farmers tend to deliver lower quality cane to MSE and keep their best cane for sales to jaggery processors.

While the private sector has been prohibited from exporting sugar, the state sector is engaged in limited exports of white plantation and refined sugar. Domestic consumption of sugar is relatively low; with per capita consumption of sugar estimated at around 4kg per head (see Table 140). Most of the domestic sugar market involves sugar for manufacturing purposes, rather than direct consumption. The majority of sugar goes towards producing alcoholic beverages (Rum), condensed milk, biscuit and confectionary makers, and soft drink manufacturers. In Myanmar, jaggery is an important component of the diet and sweetmeats and cakes are prepared with jaggery in one form or another.

1.2.6.4 Processing Capacity and Efficiency

Overall, the private sugar processing industry was estimated to produce 127,774 tonnes of sugar in 2001-02, compared with 115,655 tonnes from the state sector; the private sector having 52.5 percent of the market. The production of sugar from the state sector has increased in recent years, from below 55,000 tonnes prior to 1999-2000 to over 94,000 tonnes after 2000-01. This has been due to the construction of 9 new mills under MSE which came online during the 2000-01 crop year.

By 2000-01 there were 17 mills in the state sector with a total crushing capacity of 4 million tonnes of sugar over a 160 day season (see Table 134 and Table 135). Presently there are 18 mills in operation, with a plan to construct an additional 20 mills over the next 25 years. According to MOI(1), there are around 819 SME sugar mills in Myanmar. These do not include the numerous small sugar and jaggery processing plants that are scattered across the country.

As noted above, the total crushing capacity of SOE mills is around 4 million tonnes per year. Actual sugarcane processing by SOE mills in 2002-2003 was around 0.93 million tonnes, or 23 percent of capacity. As Table 134 and Table 135 show, the majority of SOE mills produce white sugar (only two are producing small quantities of refined sugar), with an average maximum capacity of 1500-2000 tonnes of cane per day. The amount of refined sugar produced is minimal, and mainly destined for the export market.

The performance of SOE and private milling operations are detailed in Table 142 and Table 143. Overall, SOE mills appear to be running at around 28 percent capacity, recovering 8.5 percent of cane as white sugar and 4 percent as molasses. Sugar recovery rates are estimated at around 8 percent for the state sector and 4 percent for the private sector (see Table 129). The lower recovery rates for the private sector appear to be due to the predominant use of open pan technology for the manufacture of jaggery rather than vacuum pan and centrifugal technology used by more modern mills. The use of open pan technology results in lower recovery ratios due to the high temperatures used in evaporating cane juice in small scale milling operations. In contrast, the recovery rate of around 8 percent for more modern mills is still significantly below best practice, and is predominantly due to the delays in crushing cane. In a significant number of cases SOE mills have to wait for up to a week before they receive enough cane to operate their mill for at least one day's crush. This lack of capacity utilization, and the consequent implications for economic viability of the SOE mills is disturbing, even more so considering that the 8 mills that were in operation prior to the big expansion of milling capacity in 2000 were in fact only operating at 37 percent of capacity themselves (see Table 134, Table 135 and Table 142).

Although the cane season is officially around 160 days, most SOE mills are operating for significantly less time, as evidenced by the underutilization of capacity. As an example, Pyinmana Sugar Mill No. 2 only operated for 68 days during the 2002-03 season due to lack of cane supplies. In contrast, private milling operations are usually over 140 days per year, and usually average 180 days.

As Table 144 and Table 145 indicate, cost of production for SOE mills is around K104/viss compared with K250/viss for private milling operations. For the SOE mills, the major cost of production is the cost of purchasing cane (44 percent of total cost), followed by transportation cost (14.5 percent). The cost of transportation is extremely high, and reflects the difficulties SOE mills have in obtaining cane from scattered smallholders. The above data implies that SOE mills are more efficient than the private sector, since their cost of production is lower. While it is true that recovery ratios of sugar are double that in the SOE sector, the SOE cost data are significantly biased by the use of official government input prices. Supplies of sugarcane, fuel, lubricants, spare parts, transportation, labor costs, and electricity (as examples) are obtained at prices significantly below market rates. While neither SOE nor private mills appear to take capital depreciation into account, those private mills that have current loans outstanding do take into consideration interest repayments, while SOE mills do not. Overall, the costs of production of SOE mills are likely to be significantly above that of private milling operations, making it unlikely that they would be competitive in a deregulated environment without significant changes to their operating policies.

1.2.6.5 Key Constraints

The key constraints facing the SOE sugar industry in Myanmar are outlined in Figure 19. The initial constraints include the high production cost of cane and the low purchasing price for cane, resulting in farmers being reluctant to provide sufficient quantities of cane to the factories. In addition, the scattered nature of production under smallholder control is the opposite required for a well functioning industrialized production process. Combined with a lack of adequate transportation infrastructure, the delays in getting cane to the mills mean that the quality of the crushed cane is significantly deteriorated.

The major constraints faced by the private sector processing plants are, firstly, access to sufficient supplies of raw material and, secondly, access to reliable supplies of electricity.

Despite the better recover ratios obtained by SOE mills, the recovery ratios are still far below international standard. This can be attributed to firstly, the significant delays in processing cane after harvest, as well as poorly maintained and obsolete equipment and processes in SOE mills. Not only are recovery ratios low, but the quality of sugar obtained is barely sufficient to meet the low end of the international market. While this may be sufficient to cater for the domestic market, the opportunities for export expansion are limited in the medium term until quality can be improved.

However, while the above problems indicate significant technological issues that need to be addressed, U Tin Htut Oo (2003, pg. 279) highlights the role an appropriate legal and policy framework plays in addressing fundamental constraints in the private sugar milling industry. The reliance on OP and mini-VP technology is a direct result of the infrastructural constraints involving the assembly and transportation of sugarcane, as well as risk reduction strategies on the part of private processors. The ability of processors to upgrade and modernize their equipment does not (per se) involve the creation of new technologies (they are already well known), but the institutional and legal framework to facilitate private entrepreneurs' access to markets, capital and existing technologies.

1.2.7 Agricultural Machinery Production

1.2.7.1 Production Trends

On an individual crop basis, Table 148 shows that around 18.8 percent of the cropping land planted to the major crops was covered by machinery in 1997-98. This apparently increased to 24 percent in 2000-01 and the MOAI plans to increase the coverage of machinery to 63 percent of crop land by 2030-31.

There are two ministries producing agricultural machinery; MOI(2) and MOAI. Under these ministries are several different enterprises and departments who are producing farm machinery. MOI(2) is responsible for producing tractors, power tillers, threshers, disc harrows, disc ploughs and machine parts. MOAI is responsible for producing power tillers, reapers, threshers, trailers and machine parts. There are also several small private manufacturing enterprises who are producing farm implements for sale, mainly based around Mandalay, see Kudo (2003) and Table 151.

The Agricultural Mechanization Department (AMD) was established in 1972 and distributed more than 4000 tractors to agricultural cooperatives up to 1980-81 under an installment payment scheme. This scheme was disbanded due to the high level of defaulters and from 1988 AMD started selling machinery to private traders and farmers in order to speed up the mechanization process. At present there are 99 tractor stations (retail outlets), 5 farm machinery factories and 1 farm machinery plant under AMD, with another factory due to come on line in late October 2003.

The actual official production of agricultural machinery is relatively difficult to estimate, given the predominance of the different ministries and SOEs in manufacturing these machines and the lack of consistent statistics on production output from different enterprises. According to official statistics from CSO, the stock of four wheel tractors in Myanmar in 2001 was around 11,000, while the stock of two wheel tractors (16hp power tillers and 6 hp power reapers) was around 42000 in 1997-98 (see Table 149 and Table 150). AMD themselves estimate that the stock of two wheel tractors is around 70,000 and four wheel tractors around 9000. AMD indicate that they have a fleet of 3,500 four wheel tractors (50-80hp) and 40 Korean made Combine Harvesters available for rent. AMD is also attempting to make their own Combine Harvesters, using Chinese technology, and so far 20 have been manufactured and are also available for rent.

Of course it is extremely difficult to estimate how many of the existing farm machines are still in service, considering AMD estimates that the power tillers can be used for only two years before parts need to be replaced. In terms of annual output of new machinery, AMD indicates that they have four factories producing 6000 2 wheel tractors, (16hp power tillers), and AMD's Farm Machinery Factory at Kyaukse will produce 10,000 power tillers and 5000 power reapers annually when it comes on line in late October 2003.

1.2.7.2 Prices

Due to the nature of the product being sold, prices are relatively stable and do not change much over the year. AMD farm machinery is sold through 99 AMD tractor stations throughout the country and sells power tillers for around K0.9-1 million. The factory gate price is around K750,000; a margin of 20-33 percent). The current price of paddy threshers is around K0.6 million.

Imported machinery is more expensive, with power tillers priced at K1-1.2 million each. The price differential between domestic and imported machines is due to quality differences, although AMD does not appear to fully cost the domestically manufactured machines.

AMD does rent machinery to individual farmers and cooperatives, in direct competition with the private sector. AMD rents their 4 wheel tractors to farmers for K1500 per acre tonne. This just covers fuel and lubricants and does not cover the full cost of the tractor usage. In comparison, private entrepreneurs charge K2500 per acre tonne. AMD also rents their Combine Harvesters to farmers for K2500 per acre. Again, this covers the cost of fuel and lubricants, but not the full cost of rental.

1.2.7.3 Trade and Marketing

Presently land preparation and threshing of paddy constitute major usage in farm mechanization, while machinery for transplanting and harvesting are gradually being introduced. AMD distributes farm machinery through its 99 tractor stations throughout the country. MOI(2) also distributes its farm machinery through AMD tractor stations.

As noted above, AMD and other government departments also hire farm machinery, particularly tractors to farmers and farmer cooperatives. This rental scheme mirrors that provided by the private sector; where farmers or entrepreneurs who have machinery rent them out to other farmers.

Imports of farm machinery from China, Korea, Japan and Thailand through cross-border trade and through Yangon port contribute to the pool of machinery available from the private sector. As an example, between April and August 2003 the Border Trade Department at Muse recorded just over 990 two wheel tractors and accessories imported from China.

1.2.7.4 Production Capacity and Efficiency

The production capacity of the state and private sector is difficult to estimate. While data exist for AMD fabrication plants, there is limited information available about private sector manufacturing. AMD has the ability to produce nearly 14,000 power tillers and 5500 power reapers per year. However, 10,000 of the power tillers and 5000 of the power reapers are supposed to come from the newly commissioned factory at Kyaukse which is yet to start operations.

Storage capacity for AMD machinery is significant, with 8000 power tillers (or equivalent) able to be stored at the Kyauske factory and at depots in Mandalay and Yangon. Additional storage space is available at the 99 tractor stations based around the country; indicating that close to a single year's

production is able to be stored. Obviously this has implications for how changes in demand are passed through to the supply side.

The efficiency of domestic production of farm machinery was unable to be ascertained, as neither AMD headquarter staff or factory personnel were able to provide cost of production data. The impression obtained by the ASR Field Team was that fixed costs were not included in cost calculations, and that official government prices for raw material inputs, fuel and spare parts etc was used to obtain an ex-factory price of machinery that was far below its true economic cost of production. This is particularly worrying as the ex-factory price of farm machinery is only slightly less than the price of imported machinery, indicating that under full economic costing of domestic production it would not be able to compete with imported machinery. This is more so as Myanmar may have a comparative advantage in labor intensive industries but it is doubtful that it would have such an advantage in capital intensive industries such as machinery manufacturing plants.

1.2.7.5 Key Constraints

The plan by MOAI to expand mechanization to cover 63 percent of crop land by 2030-31 is an ambitious program hampered by the high cost of machinery, the limited supply of machinery (both imported and domestically produced) and the lack of adequate demand analysis. Most farmers cannot afford to purchase machinery outright, and are either forced to form groups with other farmers or rent machinery from private contractors. As such, it is doubtful whether the level of demand for farm machinery reaches the level of supply of machinery from SOE machinery manufacturing plants combined with private sector and imported machinery.

The lack of capital is a major constraint for farmers wanting to purchase agricultural machinery. There are few financial institutions providing loans for equipment purchases, particularly after the recent financial crisis. MADB is unable to generate enough capital to extend their lending products to sufficient number of farmers, particularly for equipment purchases.

Currently, farmers are faced with purchasing either equipment manufactured within Myanmar, or imported from China, Korea, Japan and Thailand. There does not seem to be any study looking at the preferences of consumers (i.e. farmers) for the type of machines, the desired functions or the quality they wish to purchase.

On the supply side, manufacture of machinery is hampered by the need to import raw materials such as steel plate and pig iron as well as semi-manufactured parts that are unable to be fabricated in Myanmar. Such material needs to be imported using scarce foreign exchange. Combined with the distinct possibility that domestic SOE manufacture of farm machinery is uneconomic when full costs of production are calculated, it is uncertain what benefit accrues from investment in an import-substituting industry without any comparative advantage in the foreseeable future.

1.2.8 Fertilizer Production

1.2.8.1 Production Trends

The domestic fertilizer industry in Myanmar is concentrated around the production of urea fertilizer from the abundant sources of natural gas in the country. Smaller amounts of compound fertilizer, bio-fertilizer and foliar fertilizers are produced by both SOEs and private companies from imported materials. In the state owned sector there are three urea plants run by Myanma Petrochemical Enterprise (MPE), producing around 160,000 tonnes per year (see Table 166). These three plants have a total capacity of 425,000 tonnes per year. As Table 166 shows, production of urea from MPE fertilizer plants

has been relatively stagnant over time. Since the demand for fertilizer outstrips domestic production, large quantities of fertilizer are imported.

Urea fertilizer production is carried out under MOGE, who also imports urea fertilizer through MPPE (having taken over the MOAI import license in 2002). In addition to MOGE, MOAI imports fertilizer through its various departments; MAS, MSE, MCSE, MJE, MFE and MPCE for example. These enterprises import fertilizer for their own crop production programmes. In addition to MOGE and MOAI, there are several other ministries and enterprises importing fertilizer. The Ministry of Defense through Myanma Economic Holdings imports fertilizer for its military farms, and the Cooperative Department is also involved in fertilizer imports.

The main types of fertilizer imported are Urea, TSP (GSSP and GTSP mixes) and Muriate of Potash. There are several government and private fertilizer companies who are involved in both the importation of fertilizer as well as the manufacturing of compound fertilizer from imported raw materials. Common compound fertilizers include 15-7-8, 16-16-16, 16-16-8, 10-10-5, 12-8-0, and 12-13-0. Most of the compound fertilizer produced is either 15-7-8 (for paddy), 10-10-5 (for legumes), or 16-16-8 (general use).

In terms of private production of compound fertilizers, there are relatively few enterprises who are involved in production, as opposed to simply importing compound fertilizer.

1.2.8.2 Prices

Before 1993-1994 fertilizer prices were heavily subsidized by the government, which has since removed the subsidies on all but the MOAI subsidized crop production carried out by the individual enterprises under MOAI. Subsequently, the market prices have risen to international levels and the government has also allowed the private sector to import and distribute fertilizer. Despite the increases in prices, few private sector companies are willing to import and distribute fertilizers due to government restrictions on imports through their trade policy. While open market prices reflect world prices, MAS, MSE, MCSE, MJE, MPCE and other government agencies (such as MAPT and some cooperatives) are still providing fertilizer to selected farmers at subsidized rates. There is a distinct lack of information available at the central level on how much fertilizer is distributed, at what price, and to whom.

Table 169 shows that there are a wide range of fertilizers available on the open market. While there are large quantities of fertilizer available from the Middle East and ASEAN countries, most of these are imported through the Port of Yangon, while much larger quantities of fertilizer from China are available in Mandalay and distributed throughout Northern and Central Myanmar.

Fertilizer utilization is obviously dependent on price in an open market. With the significant increases in fertilizer prices over time it is probable that the demand for fertilizer has decreased significantly (see Table 166 and Table 169). Farmers purchasing power for inputs has been eroded by increasing costs of production (increases in input prices) while output prices have remained stagnant (particularly for prioritized crops which are subject to price controls). For those crops not on the priority list (for example high valued pulses, fruits and vegetables and culinary crops) anecdotal evidence suggests that fertilizer use has increased dramatically, along with yields.

1.2.8.3 Trade and Marketing

MAS is the largest procurer of fertilizer under MOAI. The Procurement and Distribution Division of the Myanma Agriculture Service (PDD-MAS) is responsible for providing fertilizers and pesticides to farmers for subsidized crop production. The main functions of the PDD includes the purchase of local

and foreign agricultural inputs, the timely distribution of farm inputs to farmers, and the prevention of damage to farm inputs during their transportation.

The amount of fertilizer distributed by PDD fluctuates from year to year depending on their budget allocations for local and imported fertilizer. The amount of fertilizer distributed to farmers by MAS peaked at 349,000 tonnes in 1994-95 and then declined to 219,000 tonnes in 2000-2001. As Table 166 shows, the amount of fertilizer distributed by MAS is less than the total amount utilized. Farmers are able to procure fertilizers on the open market from private traders who source fertilizer from imported raw materials (to make compound fertilizer), or from imported fertilizer.

With the advent of trade liberalization policies in the late 1980s and early 1990s the government initiated some measures aimed at promoting the supply and utilization of chemical fertilizers. One of these measures involved the elimination of taxes and import and export duties in 1992-93 on agricultural commodities (although a 10 percent export tax still remains on all exported items), and another involved the elimination of broad-scale subsidies on fertilizers in 1992 (although subsidized fertilizer is still available through MAS). With a severe shortage of foreign exchange, impacting on the government's ability to import fertilizer, the government instituted a Revolving Fund in 1992. This revolving fund used the foreign exchange obtained from exports of agricultural commodities such as rubber, cotton, sugar and pulses etc to purchase fertilizer and other "strategic" goods. While this fund was discontinued in 1996, the practice still continues today, with the requirement that 80 percent of export earnings has to be used to import "priority" goods; of which fertilizer is one.

While such trade polices have broader, macro-level effects on resource allocation and pricing, the effect of such policies on fertilizer demand and supply is unclear. On the one hand, it would be expected, *inter alia*, that this would result in an over-supply of fertilizer and a consequent reduction in price. However, market prices still appear to reflect world prices, and the production and import of fertilizers by the private sector is contingent on the volumes of fertilizer produced, purchased and distributed by the state sector. With large quantities of subsidized fertilizer leaking onto the wholesale market in Yangon and Mandalay, market prices are affected and profit margins squeezed. The end result is that less fertilizer is imported than would be the case in a completely open market, and it appears that importers prefer to import other items on the priority list, rather than fertilizers. Ultimately, farmer demand for fertilizer drives the supply of fertilizer, and this depends on the ability of farmers to obtain a high enough price for their output to justify increasing inputs.

Imports of fertilizer are from several sources; imports through Yangon port, sourced from countries such as Bangladesh, Viet Nam, Indonesia, Saudi Arabia and the UAE, and imports through cross-border trade (China and Thailand). While the Border Trade Department keeps accurate records of the imports of fertilizer coming across the border, and these are forwarded to their higher level authorities in Yangon, it does not appear that these data are included in the CSO statistics for imports. Interviews by the ASR Field Team with relevant government authorities indicate that the CSO statistics only record the fertilizer procured and distributed by MOAI under their subsidized inputs scheme and the amount of fertilizer used by selected farmers under the subsidized inputs scheme. Imports of fertilizer through cross-border trade, imports by other government departments and SOEs (other than MAS) and imports by private enterprises are not included in the CSO data.

1.2.8.4 Production Capacity and Efficiency

Domestic production capacity for chemical fertilizer is limited to three government owned urea plants, and small amounts of triple super phosphate, rock phosphate and gypsum. Apart from the urea plants, domestic production of the other chemical fertilizers is limited, and of low quality. The three urea plants are under the control of MPE. These were built in the 1970s and are effectively obsolete. Production of urea is stagnant, even though there is excess capacity in these plants. The urea plants rely on supplies of natural gas as their key input, and natural gas production is under the control of the MOGE. The MOGE

prefers to export natural gas in order to obtain much needed foreign exchange, and thus supplies of gas to the urea plants have been decreasing.

Maximum capacity of the three plants is around 425,000 tonnes per year. Using actual urea production data in Table 166, capacity utilization averages 35.5 percent over the period 1980-2001. It is probably a fair assumption to make that at 35.5 percent of capacity these plants are not running at minimum cost and that, based on observations the ASR Field Team has made of other SOEs, the primary constraint is a lack of raw material and an absence of production decisions made on the basis of market demand conditions.

There are several private companies who are involved in the production of compound fertilizer from imported raw material, as well as companies involved in the production of bio-fertilizers and foliar fertilizers. Most of the private companies contacted declined to provide detailed cost data, but one did indicate that their profit margins were around 11 percent. One of the advantages that private companies have over the SOEs is that they actually take into consideration profitability and consumer demand when deciding investment decisions, whereas the SOEs attempt to maximize output; usually without much success, given their chronic levels of capacity underutilization.

1.2.8.5 Key Constraints

Despite a lack of competition in the fertilizer market, most enterprises are finding it difficult to achieve profitability. For the fertilizer industry the major constraints differ depending on whether the firms are SOEs or private enterprises. For both types of enterprises the major constraints are the lack of reliable supplies of electricity and the lack of demand for their relatively expensive products.

For SOEs, the chronic underutilization of existing capacity is a function of the difficulties in purchasing raw material inputs, not only of fertilizer precursors but of spare parts and consumables. The main cause of this is the lack of foreign exchange to purchase inputs that have to be imported, and the lack of local currency to purchase domestically sourced inputs as well as to convert to foreign exchange. This is a direct consequence of the low prices set for SOE products, as well as an obvious lack of demand despite the lower prices.

For private enterprises, the main constraints other than those mentioned above are the difficulties in importing raw material inputs. Unlike SOEs which have difficulty in obtaining the foreign exchange, private enterprises have difficulty with the regulations governing imports and exports. Those companies wishing to be involved in the fertilizer import business must have another business dealing with exports.

For farmers, the ratio of fertilizer prices to crop prices is high, meaning that there are fewer incentives for farmers to apply more fertilizer in order to boost yields. Coupled with the low quality of agricultural products grown in Myanmar, this means that the prices on the domestic and international market act as a disincentive for producers to increase production by applying more fertilizer. This is illustrated by the low quality of Myanmar rice and the consequent low price it receives on the international market compared with pulses; which receive a high price on the international market and consequently farmers are more willing to apply higher levels of fertilizer.

Perversely, the change in the rice procurement scheme for the 2003-04 crop year has meant that farmers are applying less fertilizer than under the restrictive quota system that previously prevailed. The main reason for this is that under the previous scheme farmers were paid in advance for some of their quota deliveries, enabling them to purchase fertilizer. Under the present scheme farmers do not get access to this money and so do not have enough spare cash to purchase fertilizer.

Overall, the key constraints are institutional and policy orientated, rather than technical. With the exception of urea, Myanmar does not have enough supplies of raw materials to produce chemical

fertilizer and thus is dependent on imports. The regulatory regime applying to imports acts as a clear disincentive to private enterprises wishing to enter into the fertilizer industry. Conversely, the state clearly does not have enough financial resources to provide enough fertilizer to meet domestic demand. With the removal of the compulsory rice procurement scheme (and its replacement with compulsory procurement from traders and millers), there is even less justification for state involvement in controlling crop production and fertilizer inputs. Fertilizer inputs should be seen from the perspective of being essential for improved crop production, and thus regulations which restrict its free movement should be dismantled.

1.3. Key Constraints to Sectoral Growth

The majority of constraints affecting individual agroindustries are common to some extent. These include constraints on input supply, factory operations, investment and maintenance of existing processing machinery, processing output, and the marketing of output (see Table 181). Some constraints impact more on SOE operations, while others impact more on private operations.

For example, the high cost of processing is related to not only the high cost for raw material input but to the cost of consumables, lubricants, spare parts and energy. The vast majority of those individuals and enterprises interviewed by the ASR Field Team noted that access to reliable and stable supplies of electricity was the most important constraint.

Access to raw material inputs was also an extremely important constraint, and arguably more important that electricity supply, depending on the ability of enterprises to process all inputs that they acquired. The ease of access to raw materials depended not only on whether the enterprise itself was SOE or private, but also on what industry was involved. Those industries with more government involvement in production, procurement and distribution (for example cotton and sugarcane) had much more difficulties in obtaining raw materials. The main reason for this was the low procurement prices offered to farmers, with the consequent reductions in supply. Private enterprises involved in such industries found it difficult to access raw materials, usually due to some sort of government restrictions on private sales by farmers (such as in cotton), and they also found it difficult to compete on the output market due to low sale prices posted by government enterprises.

Difficulties in accessing raw material inputs, unreliable supplies of electricity and problems in purchasing spare parts manifested itself in extremely low levels of capacity utilization. SOEs had greater difficulties in utilizing their available capacity than private enterprises, while those SOEs that had undergone recent upgrading had the lowest capacity utilization of all.

A fundamental issue with the problem of access to raw materials is the low level of production of major crops used in agro-processing. Over 40 percent of arable (farming) land in Myanmar is classified as cultivatable wasteland; located particularly in the dry zone area. Unless government agricultural policies are conducive to creating an investment climate favorable to increased crop production, the issue of raw material supply will continue to be the key constraint to improvement in agroindustry. This means that the problems of increasing efficiency, modernizing processing plants, increasing output and improved marketing are irrelevant unless this production problem is addressed first.

In addition to constraints on the input side and processing operations, most enterprises visited by the ASR Field Team identified marketing issues as a problem. For those enterprises operating solely in the domestic market, marketing information was an issue. The ASR Field Team notes that FAO's Market Information Service Project TCP/MYA/8821 has addressed this problem by developing a Market Information Service within the MAS. However, circulation of the MIS newspaper is limited to around 7000 copies, and distributed to MAS officers and major centres like Yangon and Mandalay. For those enterprises involved in the export of processed agricultural policies, the biggest issue was the

government policies on import and export, and the lack of transparency, timeliness and consistency of regulations concerning which products could be exported at any particular time.

While it is understandable that the government wishes to maintain low prices for urban consumers as well as ensure food self sufficiency, restricting the export of high valued crops is less welfare enhancing than a policy that allows the export of high valued crops and the import of lower valued crops which can then be afforded by poorer elements of society.

Surprisingly, access to credit was not seen by agroindustrial enterprises as being as important as the other constraints. Most did not see this as a problem, due to limitations on input supply and underutilization of existing capacity being a binding constraint on operations before credit availability became an issue. To a large extent this was a reaction to the lack of credit availability; if there was no credit available then entrepreneurs were restricted to either funding operations themselves or through informal credit arrangements. If entrepreneurs could not afford to expand or modernize their operations then they were content to operate at the existing capacity.

In terms of access to energy, most enterprises interviewed by the ASR Field Team noted that they would be willing to pay extra (or invest in their own sub-station) if they could get access to reliable supplies of electricity. While noting that there was a disparity between what the private sector and the government sector pays for electricity, the cost of electricity in Myanmar is significantly below that in neighboring countries. Myanmar is investing heavily in new power generation projects, mainly hydroelectric power, but existing power infrastructure faces problems with reliability. Electricity generation in Myamar is set to almost triple in capacity between 2003-2006 to 3200 MW (14800 GWh). However, the existing national grid still faces line losses of over 24 percent, and it is unknown what the government plans are to increase the efficiency of the existing infrastructure.

While the majority of these constraints appear to be technical constraints, able to be solved by technical solutions, the key constraints are in fact institutional and policy ones. Excess capacity and obsolete machinery, high cost of processing and shortage and cost of spare parts and other inputs can be better addressed by tackling the issues of incentives and institutions.

1.4. Policy Implications, Opportunities and the Role of the State and Private Sector in Agroindustrial Development

1.4.1 Policy Implications for Agroindustrial Development

The largest proportion of agricultural investment in Myanmar has focused on improving production technology, for example through improved irrigation systems. Much less attention has been devoted to the chain through which agricultural commodities and products reach the final consumers within the country and abroad. Yet, post-production activities offers the opportunity of generating higher value-added than production activities. In some industrialized countries, post-production activities provide 80 percent of total value added in agricultural products.

Postharvest activities are important for all agricultural commodities. In the case of grains (rice and maize), activities such as drying, storage, milling, grading, and packaging contribute to reduction of losses, increase of labor productivity, and higher prices in international markets. Even though the quality of rice exports has increased over the years, still there is room for considerable improvement, particularly related to variety selection, storage, and milling. In the case of perishable commodities such as pulses, fruits and vegetables, and animal products, the scope for improvement is even larger. Perishable products require more sophisticated handling, storage, processing, transportation, and quality assurance systems than grains.

Postharvest research is still very limited in Myanmar. The private sector is virtually absent from it, and the public sector is grossly underfunded. Under-funding and organizational problems contribute to the weak capacity of researchers to contribute to the development of postharvest systems. Not only this will have negative effects on the export competitiveness of Myanmar agriculture, but also it will constrain domestic demand for products that are safe, high value-added, and convenient.

The distribution of firm size in food processing and agroindustry in general, suggests that there is a dichotomy between large enterprises, usually SOEs and the vast majority of private micro and small enterprises. Such distribution indicates the existence of constraints that the private sector in rural areas face in maturing from the stage of micro enterprise to the stage of medium and large enterprises, mostly because of limited access to raw materials, credit, technology, and markets.

Given that low levels of agricultural production can be addressed by appropriate policies at the farm level, probably the next most binding constraint for agroindustry is limited access to credit for small and medium enterprises. The consequences of this bias against SME in the rural agroindustry are perhaps less understood. The allocation of credit to large and inefficient enterprises has not only negative effects on efficiency, but also on employment generation and on the growth of agriculture. Because of its close links with agriculture, agroindustry development can contribute to the growth in production and income of farmers.

Given the conditions of Myanmar rural economy, with a land distribution characterized by small farms, an underdeveloped infrastructure, and a distribution of industry dominated by small enterprises, a broad-based approach to agroindustry development may be more adequate than a large-enterprise model to respond to the challenges or rural poverty. The broad-based approach recognizes the scope for economies of scale in the long-run, but it is also aware that in the short and medium term transaction costs, niche markets, and intra-industry linkages might actually make small and medium enterprises more conducive to growth than larger enterprises.

The limited importance of SMEs in Myanmar is highlighted by the small size of the private corporate sector. Between the millions of household enterprises and the large SOE, there is a gap. This is the gap of the SME belonging to the corporate sector, a sector that is still largely underdeveloped in Myanmar, despite its high potential to become an engine of growth.

The most important binding constraint on agroindustry development in Myanmar is in fact distortionary and often conflicting policies promoting the development of individual commodities and sectors over others, while at the same time preventing the proper operation of the market and distorting market signals to producers, traders and processors.

As an example, there are several issues in the new rice policy which conflict with the government's stated goals, namely the desire to maintain low consumer prices while simultaneously increasing producer prices, the subsidization of urban consumers through implicit and explicit taxation of the rural sector, the desire to stabilize prices while removing government controls on pricing policies, and the desire to maintain domestic consumption levels while relaxing controls on rice exports. The difficulties in determining appropriate producer and consumer prices, and the calculation of the costs incurred by a trader in the export market for reimbursement by the government under their new export tax system, are likely to be large. Thus serious concerns remain about the feasibility and the appropriateness of certain government policy reforms and objectives; particularly in the context of the general macroeconomic environment.

While some private milling operations are already considering or actively participating in a modernization process, this is the province of individual economic decision making which depends on the individual circumstances facing those enterprises. While government policies should be aimed at facilitating the private sector in upgrading their technology, there is a question on whether this should extend to overt assistance in the form of low interest loans or other distortionary policies that promote the growth of these firms or sectors over that of other firms or sectors.

1.4.2 The Role of the State and the Private Sector in Agroindustrial Development

It is clear that the private sector should have the driving role in determining the appropriate levels of investment in agroindustry; not only in the amounts to invest but in what sectors. The basic flaw of the standard commodity focus for promoting commercialization and development is that choices that are reasonable at one point of time and space are not appropriate at another point in time and space. Markets are dynamic processes and demand and supply conditions create new opportunities and new challenges at different points in time and space. Proposing a package of measures based on commodity choice is not necessarily the best way of promoting commercialization and development.

The role of the state sector should be in providing an enabling and facilitating environment for private agroindustry to develop. A supply-driven approach, typical of most development projects is unlikely to be successful in bringing the necessary linkages and transformation of agriculture required for commercial agriculture. A supply-driven approach implies that the experts, the planners and the public sector know what are the problems and the solutions of commercial agriculture more than the commercial agriculture stakeholders themselves. This approach has proved often unsuccessful in the past, as implied by the either low growth of agriculture or by unsustainable practices.

A demand-driven approach recognizes that commercial stakeholders need to develop their capacity of making investment decisions in order to learn how best to adapt and innovate in a changing environment. Having commercial stakeholders in the driving seat of project investment decisions is also consistent with the policy changes that have happened in the 1990s, namely the adoption of a more market-oriented approach and the emphasis on participatory planning and decentralization. Even though policy recognizes a greater role for the private sector and the civil sector in the implementation of government programs, in practice participatory planning and the view of the public sector as facilitator of development are still at a beginning stage.

It is argued that the underlying nexus between these various themes is that the major constraint in the agroindustrial sector in Myanmar is a fundamental lack of an enabling environment, in terms of infrastructure and institutions, needed to facilitate the development of the agricultural sector to improve food security, rural poverty, and export generation.

The conceptualization of this idea is provided in Figure 30. As shown in the diagram, the role of an enabling environment has an overarching impact on the major constraints in the agroindustrial sector. For example, lower transaction costs are argued to impact credit markets by reducing the costs of credit, which will have the effect of stimulating investment in the farm and milling sectors and serve to raise productivity and the use of better inputs. Greater public investment in infrastructure will have positive effects on market access, while increased transparency and stronger government institutions will lead to lower transactions costs.

A major debate in the establishment of this “enabling environment” involves what role needs to be played by the public sector in the development of the agroindustrial sector. There is a view that the private sector and public sector approaches are somehow incompatible, and that policy choices need to be made between them. However, as an example, Viet Nam is currently, and successfully, following these two approaches simultaneously. The role of the public sector in Myanmar should not be in providing support to SOEs which have no incentives to modernize or become efficient. As noted above, private investment in high-quality edible oil mills and pulses and beans processing has occurred over the last few years and encountered some success both with farmers and in terms of exports. This has been a result of the relaxing of the export licensing system, enabling private firms to invest in export enterprises. A major constraint to this has been the institutional and transactional constraints enabling private companies to successfully complete export contracts. In particular, the export paperwork and procedures inhibit efficient functioning of the system.

Economies of scale in the processing and exporting sector indicate that rationalization will eventually occur (and will need to occur). This will be facilitated by an eventual privatization of SOEs and the imposition of financial discipline as a result of increased privatization. The role of the Government should be to smooth this structural adjustment path and put in place mechanisms to assist vulnerable groups within this adjustment process. This suggests that underlying this goal of establishing an "enabling environment" is the need to develop synergies between public and private actors. Indeed, from a policy and poverty reduction standpoint, it is argued that these two approaches could be followed simultaneously, and that policy instruments are broad enough to encourage (on the one hand) private investment in agricultural production and processing, and (on the other hand) allow the majority of poor farmers to share in the benefits from globalization.

1.4.3 Opportunities for Agroindustry in Myanmar

On the basis of the above discussion, what then are the opportunities for agroindustry in Myanmar? Clearly, improvements in agricultural productivity, processing efficiency and export opportunities are the desired outcomes of any sectoral development strategy. These should be broad-based and not targeted towards any particular commodity or market, in order to enable the private sector to make the most of their entrepreneurial skills in their investment strategies. There appears to be extremely limited scope for further expansion of state intervention in agricultural production, processing and marketing, a fact recognized by most of the government bureaucracy. With limited capacity and budgetary resources, opportunities for state intervention appear limited to a regulatory and advisory role.

The growth potential for agroindustry lies typically not so much in specific products or processes, as in overall increases in efficiency arising from the removal of sub-sector wide constraints. However, it is clear that there are some specific areas in which considerable benefits could be realized. These are discussed briefly below.

1.4.3.1 Improvements in Rice Milling

Without a doubt, the most important short-term potential for growth within the agroindustry sector lies with private sector rice milling. It is clear that average recovery rates in Myanmar are well below regional and international standards, and that considerable improvement can be made in efficiency through more modern equipment and better control of operations (e.g. replacement of rollers or use of improved roller materials). These gains could amount to as much as 20 percent for smaller private sector mills, and perhaps 10 percent for larger or more modern private sector ones. Given that the national paddy harvest in 2001/02 was an estimated 22 million tonnes, an average 10 percent increase in recovery alone would yield 2.2 million tonnes of additional rice each year (although there would be a reduction in broken grain and other secondary products). With wholesale rice prices in 2002 ranging from K80,000 to K150,000 per tonnes, depending upon variety and market, gross total gains could be estimated at K250 billion per annum, or approximately US$250 million at the prevailing market rate of exchange.

1.4.3.2 Improvements in Edible Oil Milling

A further area of significant potential is in solvent extraction within private sector oilseed milling. Currently, the approximately 1.4 million tonnes of groundnut, sesame and sunflower produced annually in Myanmar are milled entirely mechanically, leaving oilcake which is relatively high in residual oil. If only approximately 60 percent of the cake produced in the central Dry Zone area were subject to further solvent extraction, a further 3 percent of oil (or approximately 5-7 percent of residue in the cake) could be extracted (assuming a high level of mechanical extraction having taken place already). This would

contribute a further 20,000 tonnes per annum (or more than 5 percent) to national oil supplies, with a gross value in the region of K15 billion per annum (US$15.5 million at market rates of exchange), without taking into account any possible increase in the value of the de-oiled cake, which in international markets fetches a better price than oilcake.

The development of private sector solvent extraction capacity in Myanmar would have the added advantage of providing a processing capacity for soybean, which is unsuited to expeller extraction. With production of soybean in 2000-01 exceeding 100,000 tonnes, and considerable agronomic potential for the introduction of soybean into delta crop rotations, the processing of soybean offers a major opportunity to reduce the national edible oil deficit.

1.4.3.3 Improvements in Agricultural Mechanization

While mechanization of agriculture is still extremely limited, most smallholder farms are able to utilize draft power to meet their tillage requirements. However, significant underutilization of land, both in terms of cropping intensity and extensification, is in part due to the lack of mechanization. This is particularly the case with households with land holdings over 2 hectares in size, where double oxen draft power is not sufficient to till the whole land holding. This in turn has significant implications since the 1992/93 Agricultural Census estimates that the average farm size is 2.5 ha and 54 percent of farmers out of a total of 2.72 million agricultural land holdings have less than 2 ha; occupying 21 percent of cultivated land. The potential for mechanization is therefore the potential to reach 46 percent of farmers, covering 79 percent of the 15.5 million acres of cultivated land.

Considering that some 21-24 percent of cultivated land is covered by machinery (around 3.18 million acres), even if in the short to medium term only a modest additional 10 percent of farmers were able to effectively and efficiently use mechanization, and only an additional 10 percent of cultivated land was suitable for mechanized tillage services using power tillers and reapers, this would equate to some 270,000 households, and 1.55 million acres of land. Considering domestic SOE manufacturing capacity for agricultural machinery is only some 21,000 machines per year, it would take nearly 13 years of production for the SOE factories to satisfy this additional demand. There is considerable scope for increased sales of agricultural machinery to farmers for their own crop production or for private sector contract services.

As the country evolves towards a market based economy it would be expected that the commercial activities of the Agricultural Mechanization Department (AMD) to be divested over time to the private sector. The long-term roles of AMD should therefore be to monitor and regulate the sub-sector, provide an incentive framework for increased private sector involvement in manufacture and hire services, and train and support private farmer operators and agricultural contractors in the technical aspects of mechanization and in hire service management.

1.4.3.4 Improvements in Cotton Production and Processing

While there is some debate about the agroecological suitability of cotton production in Myanmar, particularly in the water scarce Dry Zone area, the importance of the downstream textile industry suggests that improvements in cotton production and efficiency will contribute greatly to the economic profitability of the sector as a whole.

As an example, the export orientated textile industry provides direct employment for over 150,000 people and hundreds of thousands more farmers, traders and millers employed in providing raw material inputs. In the year 2000, Myanmar exported nearly US$404 million worth of garments, illustrating its importance to the economic development of Myanmar. In addition to the export of textiles and garments, there are still significant levels of unmet domestic demand; necessitating a net import of

textiles. Per capita consumption of fabrics in Myanmar is around 5.47 yards, of which only 0.65 yards is provided by the SOE sector, 1.42 yards from the cooperative sector and 0.27 yards from imports. This is significantly below the per capita average for regional neighbors. Before the current round of sanctions placed on exports from Myanmar to the US and EU, the retail prices of garments made in Myanmar and sold in the US were price competitive with those from Viet Nam and India. Given the higher cost structure of the garment industry in Myanmar compared with those two countries, there is considerable scope for increased competitiveness if the cost structure could be reduced further. Major constraints to this include the cost of imported raw materials and energy costs.

Improvements in seed quality, fertilizer use and agricultural practices will play a big role in increasing cotton yields. Similarly improvements in marketing through the formulation of quality standards and the sale by quality and weight rather than just weight alone will improve the quality of cotton seed being offered for sale. Modernization of ginning operations will not play an important role in improving cotton industry productivity, as existing gins are grossly under-utilized, most particularly in the SOE sector. Production would have to almost triple before capacity constraints justified a review of ginning operations and their upgrading potential. As such, any upgrade of ginning operations would have to be looked at on a case-by-case basis, and individual entrepreneurs would have to make their own decision. The role for governments and donors would be in providing an enabling environment and access to broad-based credit to facilitate private sector development in the cotton industry.

1.4.3.5 Reform of State Owned Enterprises

A final significant area of growth potential identified in this report relates to the activities of State Owned Enterprises within the agricultural sector. Due to the restrictions that these entities work under – in terms of pricing, capital investment and business planning – they suffer major losses in operations and have a significant distortionary impact on the market for the commodities in which they deal.

Low government procurement prices for raw material inputs have left SOEs struggling to operate plants at more than 50 percent utilization rates. In some SOE plants processing cotton, for example, utilization rates are under 4 percent. In the private sector capacity utilization rates are higher, but still less than economical in the long run.

The liberalization of SOEs to operate under market conditions offers a significant potential for growth in agro-industry in Myanmar. By eliminating lower than market procurement prices and output sales prices, and by allowing SOEs to structure their operations in accordance with market demands, improved operating efficiencies would be expected in rice milling, cotton ginning, sugarcane milling and in ancillary, but important, industries such as machinery and fertilizers. Improved operating efficiencies would in turn permit improved prices for producers and so contribute to further sector growth. While quantification of such gains is not possible at this stage, it is noted that the SOEs in the agricultural sector lost some K17.7 billion in 1999/00 and K63.5 billion cumulatively over 1994-2000. If these enterprises were made to breakeven, this would save K17.7 billion per year in government expenditures, based on 1999/00 data. If they became even modestly profitable, say a 10 percent return, this would add nearly K20 billion per year to the economy, based on 1999/00 expenditures. Thus the net benefit would be almost K40 billion per year, or US$40 million based on current exchange rates.

1.5. A Strategy for Agroindustrial Development

1.5.1 Background and Rationale

The Government of Myanmar has increasingly stressed the importance of a more diversified agriculture to achieve its goals of modernization and rural industrialization. This is consistent with similar strategies followed by other Asian rice economies during the 1970s and 1980s, where agricultural diversification

was seen as a desirable response to changes in supply (the success of the green revolution resulted in food self-sufficiency and declining real rice prices) and demand (rising income and urbanization increased the demand for non-rice food products). Some of these economies have been successful at diversifying the agricultural and rural economy. However, it was also realized that agricultural diversification was a much more complex process than changing the output mix.

Agricultural diversification and rural industrialization as an enabling strategy for rural income growth and poverty reduction in Myanmar will require enormous investment and will take time. The constraints are of staggering complexity: the presence of a large population in rural areas characterized by widespread poverty; low productivity of agricultural labor; low level of infrastructure development; poorly integrated markets (in terms of formalized value chains); poorly functioning factor markets such as land and credit; and an underdeveloped rural industry characterized by a dichotomy between micro enterprises and large (usually SOEs) enterprises. These constraints are aggravated by a still incomplete process of liberalization in the transition from a centrally-planned to a market-oriented system.

There are enormous challenges in pursuing the goal of accelerating agricultural growth in a sustainable and equitable way. Change in policy, investment allocation, and institutional development will have to create the conditions to implement such a strategy.

The link between agricultural and rural development has been already recognized by the government of Myanmar and is embedded in policy guidelines, decisions, and programs. One major challenge in the future will be to effectively promote these linkages in a financially sustainable way. That will require the participation of all stakeholders (rural households, private corporate sector, SOEs, NGOs, and civil service) in order to ensure better coordination.

Effective participation of all stakeholders should result in a mobilization of human and economic resources to attain the goals of rural development. By itself, the state will not be able to attain these goals, given the limited amount of resources available and institutional weaknesses. In fact, the strengthening of the orientation toward the market already offers the opportunity to tap the resources of the country. The state can facilitate this process, but cannot expect to do better than the private sector in the conduct of business.

1.5.2 A Vision for Agroindustry in Myanmar

A vision for agroindustry in Myanmar necessarily implies the development of the industry past the current situation and constraints towards a (realistic) ideal. A vision does not concentrate on short term targets or development plans, but rather identifies the role that the industry will play in the greater context of the agricultural sector and agricultural development. A vision informs and guides the subsequent strategy for the development of the sector. As such, the vision and subsequent strategy for agroindustry in Myanmar needs to incorporate three themes articulated in the above report and the ASR strategy as a whole:

1. A shift from a commodity and sub-sector approach to a market-orientated farming systems and community based approach,
2. A continuation of the move away from centrally planned development towards locally determined priorities and institutions, and
3. A change in the role of government from operations to ensuring an appropriate enabling environment, regulations and infrastructure.

The vision for agroindustry in Myanmar is encapsulated in a single summary statement:

> ***A developed agro-industry and agri-marketing system which gives the farmers the best possible price.***

Embedded within this vision are four realizations:

Firstly, there is a realization that agroindustry and marketing systems are best developed by the private sector. Limited government budgets, cumbersome regulations, the lack of knowledge and management capacity in agroindustry, and the experience of failed SOEs lead to the conclusion that the government is unable to play an interventionist role through the active participation in production, processing or marketing of agricultural produce.

Secondly, there is a realization that any development strategy must recognize that investment funds directed to farmers will not achieve poverty alleviation unless there are opportunities for them to sell their products at the best possible price in an unhindered open market. The best possible price given to farmers does not imply that returns to farmers should be artificially inflated or managed through distortionary policies. Rather, the best returns to farmers are those that occur through the proper functioning of the market system so that farmers can make the choice of what crops to grow in order to make the best return.

Thirdly, following on from this is the realization that the best possible price given to farmers should also apply to other actors in the value chain. There is no reason to make interpersonal comparisons of utility, particularly in the case where all actors are reliant on the goodwill of the other actors within the chain. In such a situation, the best framework is the formation of linkages and partnerships within the value chain in order to increase returns to all actors; while ensuring that imperfectly competitive outcomes and the exertion of market power are suppressed.

Fourthly, as a consequence of the second realization, there is the understanding that targeted commodity programs run counter to the principle that individual decision makers (the farm household, traders, processors and all actors along the marketing or value chain), are in the best position to identify their own opportunities. As such, government intervention in agroindustry (and in agriculture in general) should be confined to what government does best; provision of an enabling environment and regulatory oversight.

1.5.3 Constraints to the Development of Agroindustry in Myanmar

1.5.3.1 Policy Constraints to the Development of Agroindustry

In terms of policy constraints, it is noted that there is a lack of consistency and transparency in policy making, with policy announcements seemingly ad-hoc and subject to constant revision. This is particularly the case with policies affecting the rice sector in particular and exports and imports of agricultural products in general. The lack of clear and consistent policy and regulations impacting on agroindustry imposes a significant financial cost on private enterprises. This has significant effects on the incentives facing private enterprises and their investment decisions. Unless there is a consistent and transparent process for policy formulation, and stability in the policy environment, private enterprise is unlikely to increase investment in agroindustry.

From the government side, it is noted that there is a lack the resources to articulate the policy questions, analyze the policy options, and make the appropriate policy decisions. These decisions then have to be articulated in an appropriate manner to the policy makers at the political level. There is a perception that decisions are made on the basis of limited information, and mechanisms for getting the appropriate information from policy analysts to policy makers are currently limited.

From the policy makers' perspective, there is obviously a need for policy advice to be consistent, transparent, and analytically rigorous. In the absence of these characteristics, there is no reason to accept the advice as being sound and policy makers would be justified in rejecting such advice. Thus, the

constraints in policy formulation - lack of effective policy analysis and lack of trust in policy advice - appear to be inextricably linked.

1.5.3.2 Institutional Constraints to the Development of Agroindustry

In terms of institutional constraints, government management of agroindustry enterprises makes it difficult for those enterprises to adapt to rapidly changing market conditions. For example, procurement prices for cotton and sugar are set at the beginning of the season and are not changed despite changes in market conditions as the season progresses. Government bureaucrats in charge of SOEs lack the resources and capacity to conduct efficient business management practices, particularly since SOEs are ultimately not profit maximizing institutions. The operations of SOEs spill over onto the private sector, as subsidized inputs and heavily discounted sale prices impacts on the ability of the private sector to compete. While the rationale behind SOE operational practices is clear - to provide consumers with low priced goods - the effects are somewhat different. Producers face clear disincentives to produce enough output, producers and processors do not have any incentive to provide high quality outputs, and consumers do not get the products that they demand.

The regulatory environment impacting on agroindustry is difficult and Byzantine. While the private sector is forced to comply with many different regulations, there is a lack of transparency on which regulations apply in any particular situation. In terms of some of the more important regulations, like those affecting the export market, no official documentary record of regulations exist; with policy and regulation changes announced only in the mass media.

More importantly, standards and norms pertaining to marketing and quality control are seriously lacking. Weights and measures used in marketing are a combination of Imperial (miles, gallons, pounds), Metric (liters, kilograms, tonnes), and native Myanma (basket, viss, pyi). While most agricultural commodities are sold on a volume basis (basket), and these volume standards vary not only across locations but according to the specific buyer or seller, effective marketing standards cannot be enforced. The creating of a Quality and Standards Bureau, or the strengthening of those government departments supposedly in charge of these issues, needs to be carried out as a matter of urgency.

1.5.3.3 Private Sector Constraints to Agroindustry Development

In terms of private sector constraints, it is noted that there are limited examples of partnerships and linkages between different levels of the marketing chain and within each level (vertical and horizontal integration). Contracts between farmers and traders and processors are virtually non-existent, and when they do exist they are more honored in the breach than in compliance. In part this is due to the lack of an effective Contract Law, and the lack of enforcement of contractual obligations. However, it is obvious that the underlying reason is that individual actors find it more profitable (at least in the short run) to renege on contracts rather than adhere to an agreement. Until participants within the value chain see greater benefit from complying with contracts rather than breaking them there will be extremely limited development of agricultural value chains within Myanmar. The evidence from other countries, both developed and developing, indicates that opportunities do exist for the poor to benefit from participation in agricultural value chains, as long as they can be organized into effective marketing groups. The challenge is to find out ways of implementing the creation of trust, partnerships and linkages to form value chains for agricultural products in Myanmar.

1.5.4 Strategy for Agroindustry in Myanmar

The strategic approach to develop agroindustry in Myanmar is consistent with the themes of the Agriculture Sector Development Strategy to promote rural development in general:

1. A shift from a commodity and sub-sector approach to a market-orientated farming systems and community based approach,
2. A continuation of the move away from centrally planned development towards locally determined priorities and institutions, and
3. A change in the role of government from operations to ensuring an appropriate enabling environment, regulations and infrastructure.

This strategic approach will require a combination of policy improvements, institutional and capacity building and investments carried out in a sequenced manner. Broadly speaking, the actions will fall within three categories:

1. Support to Policy Analysis and Policy Reform,
2. Support to Regulatory Reform and Institutional Reform in the SOE sector, and
3. Support to Private Sector Marketing and Agroindustry Development.

1.5.4.1 Support to Policy Analysis and Policy Reform

As noted above, the implementation of policy requires that the formation of policy advice is based on consistent, transparent and analytically rigorous policy analysis. The proposed investment strategy involves the creation of a policy analysis and advice unit within MOAI, the creation of a series of diagnostic tools for policy analysis and commodity forecasting, and the building of capacity within that unit for policy analysis and modeling and policy advice.

The policy analysis unit is designed to deliver high quality policy advice on sectoral and commodity issues to the Minister of Agriculture and Irrigation and the Minister of Livestock and Fisheries on a regular basis. The support package involves six interrelated components:

1. The establishment of a policy analysis unit within MOAI, including budgetary provision for personnel, equipment and consumables.
2. A training needs assessment study carried out with MOAI staff to tailor a specific capacity building program to the needs of the MOAI in general and the policy analysis unit in particular.
3. The development of a multi-market model of agricultural commodities for Myanmar (e.g. rice, oilcrops, pulses and beans, livestock, forestry products, fruits and vegetables, and industrial crops[2]).
4. The placement of an international advisor within the policy analysis unit for a period of 2-3 years to assist the unit in undertaking high level analysis for agricultural commodities.
5. The provision of short-term capacity building programs in policy modeling techniques (approximately 3 per year) to assist the unit in undertaking high level analysis for agricultural commodities. These programs will strengthen capacity in multi-market modeling as well as other economic and econometric modeling techniques.
6. The establishment of a regular workshop series and publications designed to promote the activities of the policy analysis unit and obtain feedback from various stakeholders (government, private sector) on the desired policy questions to be analyzed.

1.5.4.2 Support to Regulatory Reform

Regulatory reform includes the creation and strengthening of a Quality and Standards Bureau to implement and enforce marketing standards for the domestic and export markets. In addition, it involves the strengthening of government capacity in the drafting of laws and regulations pertaining to marketing and agroindustry. While it is important to integrate regulatory reform in an overall agroindustry

[2] A fisheries model could be built separately.

development strategy, it is understood that this issue is cross-cutting with agricultural product marketing and as such the particular investment strategy is contained in the report of the Marketing Specialist in the UNDP/FAO Agricultural Sector Review Final Report.

1.5.4.3 Support to Institutional Reform in the SOE sector

A diagnostic study and financial audit of all SOEs under MOAI and MOLF should be carried out in order to allow policy makers to make fully informed decisions regarding these SOEs' future operations. It should be noted that the diagnostic study and financial audit is not a punitive exercise, and the purpose is to generate constructive recommendations for future operations. Once a diagnostic study and financial audit has been completed a reform or restructuring plan for SOEs can be designed and implemented, including the development of individual business plans and management capacity strengthening for any SOE retained within government control.

The diagnostic study and financial audit should cover the areas of governance, strategic planning, organizational structure, human resources management, pricing policies and procedures, purchasing and selling policies and procedures, products and demand, compliance review, financial and accounting systems, management information systems, and financial analysis. The financial audit should be conducted to international accounting standards in order to gain an accurate representation of the individual SOE's financial situation. Full market costing of inputs and outputs, including depreciation of assets should be used. International donor support will be necessary for the diagnostic study and audit of each SOE.

1.5.4.4 Support to Private Sector Marketing and Agroindustry Development

The objective of the proposed investment strategy is to increase the degree of agricultural commercialization in Myanmar by promoting the development of a network of well-functioning value chains that are competitive and innovative. The goal of the project is to increase the level of commercialization of agriculture in one pilot region in Myanmar in a sustainable manner.

In order to achieve the overall objective of moving to a higher level of commercial agriculture in the pilot region, the project is organized into five inter-linked components:

1. The formation of a Commercial Agriculture Network (CAN) to facilitate exchange of information between key stakeholders (producers, traders and processors) and service providers.
2. The formation of a Commercial Agriculture Alliance (CAA) with a properly constituted Board and the formation of a Commercial Agriculture Fund (CAF) to provide a mechanism for different types of key stakeholders (producers, traders and processors) to work together by formulating and selecting investments that move commercialization to a higher level.
3. The Strengthening of the existing Agriculture Market Information Service (AMIS) to provide a strongly needed service to stakeholders involved in commercial agriculture. This service will expand the AMIS role from just providing market information on prices to a limited audience, to include information specifically required by commercial agriculture and agroindustry on a much wider scale.
4. The development of Social Mobilization for Agricultural Commercialization (SMAC) to keeps the process of commercial agriculture continuously moving upwards, by facilitating the transformation of loosely-organized farmer groups already involved in low-level commercialization into better-organized and larger farmer groups operating at a higher-level of commercialization.
5. The formation of a the Institutional Capacity Development for Commercial Agriculture (ICDCA) component strengthens existing capacity and builds new capacity of service providers to adequately understand and respond to the needs of commercial agriculture.

Different components of the investment strategy address market failures related to the formation of commercial organizations, provision of information, and investment in new technology and infrastructure. The CAN, the CAA and the SMAC components address the failure of diverse commercial stakeholders to organize themselves into larger units and to establish mutually beneficial relationships; the AMIS and ICDCA addresses the failure of supplying and disseminating information to improve production and marketing. The CAF and its managing Board address the failure of investing in new technologies and infrastructure providing public good benefits.

1.5.4.5 Support to Agricultural Machinery Usage

The objective of the proposed strategy is to increase the level of mechanization in agriculture by providing support to the private sector in investment in machinery hire and purchase[3]. The current low level of agricultural mechanization is due in part to the lack of demand for machinery, which in turn is a function of the lack of access to broad-based credit, lack of appropriate machinery technology, lack of fuel, lubricants and spare parts, and the small farm sizes making it uneconomical for individuals to purchase machinery for themselves.

The proposed strategy involves firstly the restructuring of the AMD and the devolving of its responsibilities for contract machinery operations to the private sector. Unless AMD stops subsidizing it contract machinery operations by only charging for operating costs, there is limited chance that the private sector will be able to expand their own contract machinery operations. Secondly, the strategy increases support to private sector operations. The proposed strategy has several interlinked components:

1. The divestment of the commercial contract machinery activities of the AMD to the private sector. Either machinery and equipment are auctioned off piecemeal to local private enterprises (including farmers), or the whole commercial unit is privatized as a contract machinery enterprise.
2. The privatization of the 100 tractor stations (retail outlets) owned and operated by AMD.
3. A review of existing legislation, regulations and practices governing imports of agricultural machinery in order to eliminate any constraints to the import of machinery. Machinery should be seen as an important input into agricultural production, and not restricted in any way.
4. A review of the existing legislation, regulation and practices governing imports of fuel, lubricants and spare parts in order to eliminate any constraints to the import of these components. The private sector should be allowed to obtain import permits for fuel and lubricants for agricultural machinery operations as needed.
5. Capacity building for AMD operations in monitoring and regulation of the sub-sector, and provision of training and support functions to private farmer operators and agricultural contractors in the technical aspects of mechanization and in hire service management.
6. Provision of an incentive framework for increased private sector involvement in manufacture and hire services, including provision of machinery to private sector enterprises (including farmers) on a hire-purchase

1.5.5 Priorities and Sequencing of Sectoral Strategies

Within the above strategy categories there are priorities for the government and the agroindustry sector in particular. These priorities will need to be sequenced in a proper manner in order to ensure the best possible chance for agroindustry development to succeed. It is envisaged that the strategy investments will be phased in over the short (2004-2006) to medium term (2006-2010) and that long term

[3] This investment strategy is formulated in response to a request from MOAI and FAO for such a strategy to be included as part of the agroindustry investment proposals.

investments should not be necessary; if private sector involvement in agroindustry is to succeed, this will require the phasing out of support as quickly as possible.

Obviously an enabling policy and regulatory environment is needed before the private sector can be convinced of the need to increase investment in the agroindustrial sector. As such, in the short term (2004-2006), capacity building for policy analysis and policy reform is required. This will require some donor input in terms of technical expertise, but large scale investments from the donor community is not required for this phase.

Similarly, a diagnostic study and financial audit of SOE operations could be implemented at an early stage, with the development of business plans and restructuring (if needed) carried out over the medium term (2006-2010).

While the initial feasibility studies and pre-project technical assistance for support to private sector agroindustry development can be carried out over the short term, actual implementation of such a project should be carried out over the medium term after institutional and policy reforms have had a chance to impact on the economy.

1.5.6 Impacts on Poverty Reduction and Pro-Poor Development

The expected impact on poverty reduction and pro-poor development is expected to derive through four channels:

1. Broad-based policy reform arising from high quality policy advice delivered by a strengthened policy unit within MOAI,
2. Reduction in market distortions arising from privatization of SOEs and the strengthening of economic management of SOEs remaining under government ownership.
3. Employment generation, social mobilization and organization of smallholder farmers into larger groups, and additional income opportunities in a more dynamic rural economy arising from strengthening linkages in commercial agriculture.
4. Increases in agricultural productivity arising from increased mechanization of agriculture.

1.5.7 Impacts on Social and Gender Development

The main theme of the strategy for agroindustry development is to ensure the movement of commercial ventures in agriculture from a low level of commercialization to a higher level of commercialization. However, the conceptualization of the strategy recognizes that the majority of farmers are operating at subsistence level and many are at a very low level of commercialization. Moreover, the core problem for commercialization is that the vulnerability of rural households is one of the main causes for the absence of a network of functional value chains.

Most of the poor and vulnerable groups have few assets and little education. As a consequence, their main source of income is low-skill wage labor. However, employment opportunities are limited in rural areas, and the poor and vulnerable often resort to different coping mechanisms (including migration and indebtedness). Their capacity to organize and interact with other stakeholders in the value chains is limited. Their low education and social status usually prevents them from gaining access to markets (for labor), and to credit and programs that might improve their condition. The limited access to social services aggravates the plight often arising from their exposure to different types of risk.

Even though women represent a large share of the labor force in agriculture, there is limited active participation of women in commercial agriculture. Women entrepreneurship in commercial agriculture is quite limited and the involvement of women in formal trading is quite rare in Myanmar with only few

women playing a leadership role in activities related to trade, marketing, processing and post-production activities. When involved in these activities, usually women are employed as wage labor (in processing plants, in grading produce and storage operations), rather than as managers or entrepreneurs.

An analysis of the effects of various projects within the strategy on poverty and gender suggests that the strategy might in fact play an important role in reducing poverty and redressing gender imbalance. The two objectives will be achieved through an acceleration of broad-based agricultural growth in the country.

The strategy is formulated under the awareness that many poor farmers and rural households will be able to benefit directly from growth of commercial agriculture primarily as wage earners, either as laborers on farms or as laborers in the post-production system. In some cases, poor households might be able to get out of poverty through sharecropping or through the starting of micro enterprises and provision of services related to agribusiness.

The strategy envisages a dynamics of the commercialization process that sees the formation of value chain linkages as one step in a continuum of degrees of commercialization ranging from semi-subsistence to sophisticated commercialization. By providing a mechanism to move the groups already commercialized to a higher level, the strategy facilitates the dynamics of social change necessary to commercialization.

1.6. Conclusions

As Myanmar is in transition from a socialist command economy towards a market-orientated economy there are relatively high levels of government control over various industries, depending on historical factors as well as their perceived importance for food security and other national objectives.

Industries such as rice, cotton and sugarcane; with a large SOE sector, are faced with problems in procurement and capacity utilization that are not faced in other sectors with less government involvement; for example pulses and edible oils. Capacity utilization and efficiency are lower for SOEs than the private sector, due to the latter's ability to rapidly implement changes in their operating procedures and investments in accordance with changes in market conditions. In some sectors the SOEs have recently undergone extensive modernization of plant and equipment, thereby making those enterprises more technically efficient. However, fundamentals of market supply and demand have been left unaddressed; resulting in less capacity utilization than before and higher levels of state indebtedness. Thus while enterprises may be technically efficient in terms of scale and modernization, they are not economically efficient.

Low government procurement prices for raw material inputs have left SOEs struggling to operate plants at more than 50 percent utilization rates. In some SOEs in cotton, for example, utilization rates are under 4 percent. In the private sector capacity utilization rates are higher, but still less than economical in the long run. Most enterprises (state and private) ignore fixed and capital costs when calculating rates of return.

In industries with less government involvement in production and processing, as in pulses and edible oils, capacity utilization and economic returns are much higher. In the case of edible oils the restrictions on exports hampers the industry significantly and reduces potential production.

In all industries reviewed, the major constraints were lack of raw material input and access to reliable supplies of electricity. For the latter constraint, it is noted that the government plans to triple capacity on the national grid between 2003-2006; mainly through hydroelectric schemes. This will go some way to reducing the number of blackouts experienced by households and enterprises but does not address the dilapidated condition of the existing network.

For the former constraint, it is noted that around 40 percent of arable farming land is currently classified as "cultivatable wasteland", mainly in the dry zone area. While the government is embarking on large scale irrigation schemes to address the lack of water in the dry zone area, the choice of cropping patterns (rice, cotton) does not appear to be ideal; considering other crops such as pulses and oilseeds are more agroecologically suited to that area and are less water intensive.

Fundamentally, the lack of raw material for agroindustry is a function on the low procurement prices offered by SOEs and the distortionary marketing policies in place; particularly for the export market. As an example, the ban on oilseed and edible oil exports is purportedly for food security issues; yet the export of high valued edible oils such as sesame and groundnut and the import of low valued palm oil would not only earn valuable foreign exchange but lower the overall price of oil for the poorer sections of the community.

In terms of government interventions, there is a role for the state in supplying essential services such as infrastructure (roads, market access, irrigation and rural electricity) and in applying economic policies conducive to proper operation of a market-orientated economy. The role of the private sector is in supplying the inputs, production, processing and marketing operations necessary to provide agricultural products to consumers. In other words, the private sector should be involved in the operation of the supply or value chain, while the government provides infrastructure facilities and an enabling and facilitating environment for the proper functioning of that value chain.

Improvements in agricultural productivity, processing efficiency and export opportunities are the desired outcomes of any sectoral development strategy. These should be broad-based and not targeted towards any particular commodity or market, in order to enable the private sector to make the most of their entrepreneurial skills in their investment strategies. There appears to be extremely limited scope for further expansion of state intervention in agricultural production, processing and marketing, a fact recognized by most of the government bureaucracy. With limited capacity and budgetary resources, opportunities for state intervention appear limited to a regulatory and advisory role.

The growth potential for agroindustry lies typically not so much in specific products or processes, as in overall increases in efficiency arising from the removal of sub-sector wide constraints. As such, the vision and subsequent strategy for agroindustry in Myanmar needs to incorporate three themes articulated in the above report and the ASR strategy as a whole:

1. A shift from a commodity and sub-sector approach to a market-orientated farming systems and community based approach,
2. A continuation of the move away from centrally planned development towards locally determined priorities and institutions, and
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4. Increases in agricultural productivity arising from increased mechanization of agriculture.

2. Introduction and Scope of Study

2.1. Topography and Agroecological Zoning

Myanmar is located between latitudes 9°58´ to 28°31´N and longitudes 92°10´ to 101°11´E. Myanmar has a total area of 675,600 square kilometers and a coastal line of 2832 kilometers (see Figure 1). The country is unique for its forest-clad mountains and plateaus, valleys and plains. The parallel chain of mountains; Rakhine Yoma, Bago Yoma, Chin Hill and Shan Plateau have an altitude ranging from 900m to 2130m.

Myanmar has three distinct seasons. The dry season begins from mid February to mid May, the rainy season starts from mid May to mid October and the dry cool season sets from mid October to mid February. Although the country lies within the tropical monsoon climate zone, the northern region, approximately one third of the country in size, has a sub-tropical climate. The average annual rainfall varies ranging from 1115mm to 6439mm in the coastal regions, 679mm to 4278mm in the hilly regions, and 591mm to 1337mm in central Myanmar (see Table 2).

While there is some debate as to the precise number of agroecological zones in the country; ranging from 4 to 11 zones depending on the level of detail used, most observers recognize either 9 or 11 zones. Using 11 agroecologial zones, the largest area, Zone 7 (R_4,S_6), comprises lateritic and red brown soils and receives 1016-2540mm of rainfall per year. The second largest area, Zone 5 (R_4,S_3) comprises loamy, lateritic and red brown soil and receives more than 2540mm of rainfall per year. Problems such as soil erosion, salinity, acidity and alkalinity are prevalent in different agroecological zones, making soil management and crop management difficult. For these reasons, some zones are more suitable for particular crops than others (see Table 1).

2.2. Agricultural Contribution to GDP and the Policy Context

Over half a century since gaining independence, Myanmar still remains an agricultural based economy. Using the latest statistical information available (2000-2001), the agriculture sector[4] contributed 57.2 percent of GDP at current prices (42.7 percent at 1985/86 constant prices) while manufacturing contributed 7.2 percent of GDP at current prices (10.2 percent at 1985/86 constant prices), see Asian Development Bank (2002) and Central Statistical Organization (2001). Compared with almost all of her neighbors, who have achieved a significant level of industrialization and structural change, Myanmar's share of industry in total GDP remains more or less constant at or around 12 percent; indicating no significant structural change in the economy over the five decades since independence (see Table 4, Table 5 and Figure 2). Agriculture itself has remained relatively stagnant, averaging around 37.5 percent of GDP over the last 15 years (see Table 15).

The main agricultural policies of the government revolve around the expansion of cropping and industrial crops, both within SOEs as well as through private sector involvement, and increasing the involvement of the private sector in agricultural input provision (see Box 1). The increasing mechanization of agriculture and the expansion of irrigation are important measures being used to increase production and productivity of agriculture, as well as increasing the area of land under cultivation[5]. As shown in Table 3, this latter aim has achieved limited success, with total agricultural area around 15 percent of total land since at least the 1980s. Of interest to agro-industry is the emphasis on private sector involvement in agricultural input and machinery distribution, and the absence of explicit policies outlining private sector involvement in the production of inputs or the trading in

[4] Comprising the sub-sectors of agriculture (=cropping), livestock and fisheries, and forestry.
[5] Large areas of land, particularly in the dry zone area are classified as "cultivatable wasteland" due to the lack of water available during the main growing season; despite having average rainfalls of over 900mm per year.

agricultural outputs (see Myanma Agriculture Service (2002, pp 3-4)). The exception to this latter case has been involvement of the private sector in the domestic trade and export of pulses and beans; resulting in a rapid expansion of both production and yield, as well as exports over the past decade (see Table 16)[6]. Increases in sown area of pulses have been averaging around 5.4 percent per year since 1990, while the expansion in rice production has been relatively stagnant, averaging around 1.3 percent increase in sown area per year since 1990 (see Table 17). In contrast, increases in sown area of maize have been increasing on average around 2.6 percent per year since 1995, and increases in sown area of fruits and vegetables have averaged around 5 percent over the same period (1995-2001); see Table 18 and Table 19.

While agriculture as a whole (crops, livestock and fisheries, and forestry) is an extremely important component of GDP, the crop sector is the most important sub-sector in Myanmar, contributing 48.8 percent of GDP at current prices (33.2 percent at 1985/86 constant prices), see Asian Development Bank (2002) and Central Statistical Organization (2001). These are classified into seven crop groups; cereals, oilseeds, pulses, industrial, culinary, plantation and others (see Table 20). Of the cereal crops, paddy, maize and wheat are the most important ones, while sesame groundnut and sunflower are the most important oilseed crops. Black and green gram and pigeon pea are the most important pulses, while cotton, sugarcane and rubber are the most important industrial crops grown[7].

2.3. Scope of Study

On the basis of the importance of the agricultural and cropping sector in the economy of Myanmar, the Myanmar Agricultural Sector Review and Investment Strategy Formulation Project aims to undertake a sector review of the agricultural sector for use by the Government of Myanmar and international donors to identify issues and define investment needs in order to stimulate broad-based agricultural growth.

As noted in Box 2, the agroindustry review aims to:

1. Review the activities of agroindustry institutions,
2. Analyze the management and operational practices of the industry, including the integration of smallholders into the supply chain.
3. Identify financial indicators, cost-structure and profitability,
4. Identify the necessity and scope for agroindustry development, and
5. Make recommendations to increase the efficiency of agroindustry institutions.

This review is outlined as follows. Section 3 reviews the status and performance of the major agroindustrial activities in Myanmar; Rice Milling and Processing, Cotton Ginning and Processing, Edible Oil Production, Wheat Milling and Cereal Products, Pulses and Beans Processing, Sugar Milling and Processing, Agricultural Machinery Production, and Fertilizer Production. Within this section, information on production trends, prices, trade and marketing, processing capacity and efficiency, and the key constraints will be presented.

On a sectoral basis, the key constraints to growth are discussed in Section 4 and the policy implications and opporunities that arise from these constraints are outlined in Section 5. Section 6 outlines a strategy for agroindustrial development, while Section 7 develops a series of investment profiles for agroindustry. Finally Section 8 concludes.

[6] Exports have increased from 17,000 tonnes ($8.3million) in 1988/89 to 831,000 tonnes ($265.7million) in 2000/01 (Asian Development Bank 2002, pg 10).

[7] See Asian Development Bank (2002, pp 4-7) for a concise overview of agricultural crop production and trends in Myanmar.

3. The Status and Performance of Major Agroindustrial Activity in Myanmar

3.1. Introduction

While a formal definition of agroindustry in Myanmar does not appear to exist, the general consensus is that agroindustry is an industry that has a direct input-output relationship with agriculture. It is an industry that mainly, if not solely, uses agricultural inputs to process and or produce value added products for use mostly in the agricultural sector, and, to some extent, in non-agricultural sectors as well. In other words, agroindustry is conceived as an agriculture resource based industry producing mainly processed foods and manufactures of consumer goods. For example, products like tires are included as agroindustrial products because the input used (rubber) is an agriculture-based resource and the output (tire) can be used for vehicles and machines which can be used directly or indirectly to support agricultural production (Kudo 2001, pg 50).

The Myanmar Government's national economic objectives highlight the role of agriculture as the driver of economic growth, but fail to explicitly identify agro-industrialization as a mechanism by which this can be achieved (see Box 3). Industrial policies and strategies that were implemented were mainly orientated towards import-substitution, and subsequently failed to achieve any meaningful growth in the industrial sector.

Despite this, the economic, social and environmental features of Myanmar are very favorable for agroindustrial development. There are abundant resources of industrial raw materials such as coal, iron and tin, a large potential for hydroelectric power, a domestic market of 50 million people with a relatively low population density, and a large potential regional and international export market. Coupled with a long-term deterioration in the terms of trade for raw, unprocessed primary products on the international market, this implies that the continued reliance on exports of primary products for foreign exchange is unsustainable. The experience of neighboring countries shows that the solution to this dilemma is through the promotion and expansion of exports of value-added commodities produced by industries (Kudo 2001, pp 43-44).

This section of the report highlights the role of the state and private sector in agro-industrialization and the contribution of selected agroindustrial sectors to agricultural growth and development; the role that rice milling, cotton ginning, edible oil production, wheat milling, pulses and beans processing, sugar milling, agricultural machinery manufacturing, and fertilizer production. These industries are the major industries within the agricultural sector contributing to agricultural GDP and are thus important to continuing agricultural growth. As illustrated in Table 6, Table 7, and Table 20, the rice, edible oil and pulses industries are the most important food crop industries in Myanmar, while wheat is the third most important cereal crop after maize (but the second most important edible cereal crop). Cotton and sugar are the most important industrial crops (excluding jute and rubber), while agricultural machinery and fertilizer are the most important inputs into the agricultural production process.

3.2. State and Private Sector Contributions to Agroindustrial Production

Although there is a strong representation of SOEs in the more capital-intensive agricultural based manufacturing subsector (for example sugar mills), the number and strength of these enterprises is still very limited and does not contribute to the GDP of the sector to any great extent. As such, the development of agroindustries in Myanmar depends on the development of the private sector; as almost the entire agricultural sector in Myanmar is in the hands of small private cultivators.

Given that Myanmar has significant land and water resources, low-cost labor and varied agroecological zones, and given its central location and proximity to markets in East, South and Southeast Asia,

encouraging the development of agroindustry would see it develop rapidly into a major foreign exchange earner and contributor to national economic growth (Kudo 2001, pg 47).

As opposed to heavy industry, with its reliance on capital intensive technologies and large amounts of investment, particularly in terms of foreign exchange, agroindustry is more labor intensive in nature, require relatively little amounts of investment, and suit Myanmar's resource endowments.

Most manufactured products in Myanmar tend to be more resource-based, having little value added and technology inputs. However, the light industrial sector tends to be more diversified, in which textiles, food stuffs, pharmaceuticals, ceramics, rubber, leather, paper and chemicals, among others, are included. Currently, over 80 percent of the value of manufacturing output falls into the food and beverages sub-sector alone. Consequently, the manufacturing sector is dominated by agro-processing industries such as rice, oil and sugar mills in the food and beverages category (Kudo 2001, pg 47).

Ownership of agroindustry enterprises fall into one of three categories; state-owned, cooperative owned, and private owned.

State owned agroindustry enterprises are under the management of different ministries, see Table 21. There is not a strict demarcation of responsibilities for different agroindustry types and the ownership of different enterprise types is an historical evolution, reflecting the different economic priorities over time. For example, the Ministry of Commerce is in charge of rice mills due to the national economic importance of rice in Myanmar, while the Department of Agricultural Mechanization under the Ministry of Agriculture and Irrigation has its own tractor and tiller manufacturing plants (Kudo 2001, pp 62-64). State owned agroindustry enterprises are regulated under the State-Owned Economic Enterprises Law (1989) and the Law Amending the State-Owned Economic Enterprises Law (1997).

The Department of Cooperatives manages all types of cooperatives, including producer cooperatives. In terms cooperative ownership of agroindustry, these include rice mills, edible oil mills, textile mills and cottage industries. Kudo (2003, pg 64) notes that the Sein Pan Cooperative in Mandalay, for instance, is a producer cooperative that manufactures a wide range of machines and equipment including oil mills, agricultural machines and equipment, water pumps, and motor car spare parts. The Meikhtila Cooperative Engineering and Naungyo Engineering Workshop in Yenangyaung also produce machinery and spare parts. Agroindustry carried out by cooperatives are regulated under the Law Relating to Forming of Organizations (1988), the Co-Operative Society Law (1992) which replaced the Law Amending the Union of Myanmar Co-operative Societies Law 1970 (1988) and Rules Amending the Union of Myanmar Co-operative Societies Rules 1970 (1988),

Private agroindustries are highly diversified and are both registered and unregistered (see Table 23). Private Industries are regulated under the Private Industrial Enterprise Law (1990) and the Promotion of Cottage Industries Law (1991). The industries registered under the Private Industrial Enterprise Law (1990) are controlled by the Directorate of Regional Industrial Coordination and Industrial Inspection of the Ministry of Industry No. 1. The latter act, the Promotion of Cottage Industries Law (1991) promotes cottage industries that utilize less than 3 hp of machinery and is voluntary (Kudo 2001, pg 64). These industries are registered with the Directorate of Cottage Industries Law and are classified into three different groups by size (see Table 22).

The food processing industry is an important industry within the industrial sector of Myanmar and is regulated under the National Food Law (1997). As shown in Table 5, the food products industry comprised 62 percent of industrial establishments and 53.5 percent of the industrial workforce in 1998. Private enterprises make up the bulk of the food industry and the private food processing enterprises make up the bulk of the registered private enterprises in Myanmar. In 1998 the total number of registered private enterprises under the Private Industrial Enterprise Law (1990) was 36,156, of which 61 percent were involved in food and beverage production. This percentage remained almost unchanged the following year (1999) when, as a consequence of government reforms promoting a shift towards a

market-orientated system, the total number of enterprises grew to 46,955 (60 percent being involved in food and beverage production).

As Table 5, Table 24 and Table 25 show, the number of food and beverage enterprises labor force, and value of production relative to other industry sectors increased significantly over the previous 40 years and into the late 1990s. At the same time, the role of the state and cooperative sectors has reduced and the proportion of private enterprises has increased from 94.6 percent in 1989-90 to 98.5 percent in 1997-98 (see Table 26).

By 2000, the food processing industry consisted of about 40 different categories of industry, of which rice mills, oil mills, powder processing, sugar mills, confectionary and pulses and beans processing constituted over 85.5 percent and Rice milling and oil milling constitute the largest industries (55 and 15 percent respectively) (see Table 27).

Most of the private food processing industry consists of small scale processing enterprises, the distribution of scale being similar to other private enterprises (see Table 29). Kudo (2003, pg 72) describes the categories of enterprises as being either

1. Import substituting enterprises,
2. Domestic market enterprises, or
3. Processing and value adding enterprises.

The importance of this distinction is that while the majority of small private enterprises fall into categories (2) or (3), government policies have induced several larger private enterprises to establish themselves as import substituting enterprises. The majority of the smaller enterprises lack the capital or equipment to produce the quality needed to compete with imported goods, while the larger private and state companies under category (3) have enough capital investment and modern machinery to compete with imported goods. The constraint of these latter enterprises is that they rely on the importation of machinery and raw material inputs in order to produce import substituting products for the domestic market (for example, in the case of soft drink manufacturing, enterprises have imported production lines, bottles, packing equipment and syrup ingredients - utilizing only labor, water and sugar from domestic sources).

3.3. Rice Milling and Processing

3.3.1 Production Trends

Rice production is the major agricultural activity in Myanmar. Just over 6.4 million hectares of paddy was harvested in 2001-2002, yielding 3.4 tonnes per hectare, or almost 22 million tonnes of paddy (see Table 11, Table 17 and Table 30 to Table 32). The majority of paddy is grown in the delta and central region of Myanmar (see Table 31). Exports of rice are currently around 0.9 million tonnes (2001-2002), but averages since 1988-89 have been around 0.3 million tonnes (see Table 32).

Actual rice surpluses are difficult to calculate, as they depend on estimates of yield, seed retention, post-harvest losses, milling recovery rates, and per capita consumption:

- Yield estimates can be distorted due to the local authorities attempting to meet government targets. Official estimates in 2001-2002 were around 3.42 t/ha (3.31 t/ha for wet season and 3.91 t/ha for dry season).

- Official seed retention rates of 2 baskets per acre (103kg/ha) are equivalent to transplanting rates in the Red River Delta Region of Viet Nam and wet season rice in Cambodia (80kg/ha), but significantly below the 200kg and more used under broadcasting in the Mekong River Delta Region

of Viet Nam, and the 150kg used for dry season rice in Cambodia; see (Agrifood Consulting International 2002; 2002).

- Official post-harvest losses are also 2 baskets per acre, which equates to around 3.3 percent of production. This compares with between 7-10 percent for Cambodia and between 4.5-16 percent for Viet Nam; the smaller amount for Viet Nam being specifically for on-farm losses with an additional 7-10 percent occurring further along the chain. None of these estimates for Cambodia and Viet Nam take into consideration household retention of paddy for animal feed, which is usually estimated at around 2-3 percent of production, and is in addition to animal feed offtakes further downstream; see (Agrifood Consulting International 2002; 2002).

- Estimates of milling recovery rates range from 45 to 66.6 percent (see Table 37 and Table 39). The official MAPT figure is 37-37.5 baskets of rice from 100 baskets of paddy (75 lbs/basket of rice and 46 lbs/basket of paddy); equating to a recovery rate of between 60.3 and 61.1 percent[8]. This compares with 69-72 percent for large mills and 64 percent for small mills in Viet Nam (average 66 percent) and 62-67 percent for Cambodia (average 64 percent); see (Agrifood Consulting International 2002; 2002). MAPT recovery rates for its mills and its private contractors are shown in Table 35, and these rates are used in the rice balance calculations in Table 32.

- Official per capita consumption is around 15 baskets of paddy per person. At a recovery rate of 66 percent, this equates to 189 kg of rice per person (or 172 kg at 60.3 percent). U Tin Htut Oo (2003) notes that rice consumption is generally believed to be over 200 kg per person (see Table 43).

With changes in government rice policies, the area and production of rice have increased along with an increase in yields (see Figure 3). These increases in yields have occurred with increasing usage of chemical fertilizers; although the actual rates of fertilizer use are extremely low (often 1 bag /acre). The low rate of fertilizer usage is a direct result of the high price of fertilizer (see Table 56), insufficient domestic production and difficulties in importing fertilizer.

The introduction of high-yielding varieties (HYV) in 1977-78 generated a considerable increase in paddy production, which was further increased in 1992 with the introduction of summer (dry season) paddy production with the help of extended irrigation facilities and improved farm mechanization (Kudo 2003, pg 77). With the increase in production, more milling facilities were needed and their efficiency became more important.

The government's 30 year plan for rice indicates that paddy area is targeted to increase by nearly 30 percent while production will increase by nearly 54 percent. Corresponding yields are targeted to increase by nearly 35 percent (see Table 14). Most of this increase will have to come from intensification of existing paddy production in the delta region, although significant production increases in the dry zone area are planned. In order for this to be achieved, major investment in irrigation schemes in the dry zone area is planned or under current construction. The efficacy of these schemes is uncertain, particularly when compared with the profitability of less water intensive crops.

3.3.2 Prices

The price of rice is seasonal, peaking in September and October just before harvest time and bottoming out during the harvest of the monsoon rice in November to January (see Figure 4 and Figure 5). The level of rice surplus or deficit in the normally deficit regions in Myanmar play an important role as a residual in the market. At the end of 2000-01 the price was almost half of that at the beginning of the year due to an unusual surplus of rice in the normally deficit Upper Myanmar and hilly regions. After

[8] Keeping other assumptions as per their official rates, using these latter recovery rates in Table 32 results in significant rice deficits in several years. As Myanmar continued to export rice during these periods it is doubtful whether those recovery rates would hold on average, at least for the specific years in question.

January 2002 the price started to rise again due to seasonal factors as well as the effect of increasing costs of inputs such as diesel oil and chemical fertilizers (Myanmar-Japan Cooperation Program 2002, pg. 109).

Figure 4 and Figure 5 and Table 13 show the pattern of rice prices in the Mandalay and Yangon markets from January 2000 to December 2001. Data from 2002-2003 are available from the MIS but at report writing were not yet available in a consistent format. Thein (2003) shows that the wholesale price of rice in Yangon market has risen significantly since the beginning of 2002; around K10,000 per 50kg bag of Pawsan rice, compared with between K2000-4000 per 50kg bag between 2000-2001.

Until the 2003 harvest the state procured paddy from farmers at a rate around half of the normal market price[9]. The procurement price was based on cost of production in the main rice growing areas, which in turn is based on the assumption that farmers can get access to subsidized inputs (see Table 45, Table 46, and Table 49). This price differential acted as an implicit tax on farmers, and was regressive as it was imposed on a per acre basis, regardless of farm size, land fertility and regional differences[10]. With the official procurement of paddy at prices below the prevailing market rate there are disincentives for farmers to provide good quality paddy[11]. As a result, not only do targeted groups receive poor quality rice (which they then sell on the open market to obtain better quality rice), but MAPT exports of rice receive lower international prices because of the reduced quality[12]. From April to December 2003, the government policy intention was that MAPT was to procure paddy directly from traders and millers, at the prevailing market price[13]. Perversely, this liberalization actually reduced farm-gate prices for paddy in 2003 as MAPT intended to only supply rice to the domestic market and was no longer to be involved in the export trade. The reduction in MAPT purchases over October-September 2003 was responsible for a glut of paddy on the domestic market and a 10 percent drop in the paddy price to just over the cost of production (Lwin 2003). The policy for MAPT to procure paddy and rice directly from traders was never actually implemented, and the government announced a new policy in December 2003 involving the complete liberalization of the domestic market for rice (stopping the procurement of paddy and rice by MAPT) and the elimination of subsidized rations for government staff and other target groups. Exports of rice were subsequently banned, in an attempt to reduce the income effect on government staff by lowering prices and securing sufficient supplies of rice for the domestic market.

Wholesale market prices for rice of different varieties are shown in Table 13 and Figure 4 and Figure 5. Generally, Pawsan rice fetches the highest price in the Mandalay and Yangon markets, while Shwebo Manaw and Nga-Kywe are the second most expensive varieties in the respective markets. With some differences in volatility, the prices for different varieties generally track each other, indicating some consistency with market pricing for these different varieties.

[9] Myanmar-Japan Cooperation Program (2002, pg. 112) notes that in 2000 the procurement price and the market price was the same due to the collapse of the market price.

[10] Myanmar-Japan Cooperation Program (2002, pp. 112-113) cites some cases where farmers had to purchase paddy on the open market in order to meet their quota deliveries, as well as some varieties and qualities of paddy not being accepted at the procurement depot (often without prior notice of the change in delivery policies).

[11] Myanmar-Japan Cooperation Program (2002, pg, 113) notes that the quality of procured paddy depends not only on price incentives but also quantity incentives. Some farmers apparently increase the moisture content of the paddy and add impurities in order to increase the weight. Conversely, some procurement depots have different (larger) baskets than the standard 46lbs, and increase the volume of the individual quotas that are delivered. The ASR Field Team saw some MAPT rice being milled that was obviously badly affected by moisture and had gone mouldy. Whether this was due to contamination at the farm level or due to poor storage is unknown (ASR Field Team Interview 15 September 2003).

[12] World Bank (1999, pg. 47) notes that the implicit taxation on exports of rice ranged from 24-41 percent in 1999. Currently the export price of rice is around US$160 per tonne, implying a implicit tax on procured rice of 78 percent, or just breakeven if paddy had been procured on the open market (indicating that MAPT is operating on the export market just to generate foreign exchange revenue (see Table 36).

[13] According to government sources, this purchase price was going to be the same price as that paid by traders and millers, implying that handling and storage costs would have been borne by the traders and millers themselves. Ultimately this cost would have been shared by farmers and traders according to their respective elasticities of supply and demand.

3.3.3 Trade and Marketing

Myanmar as a whole is self-sufficient in rice but there are some areas, such as central Myanmar, the hilly regions and Taninthayi Division which are rice deficit (see Table 31). The surplus rice flows from the surplus areas of Ayeyawaddy, Bago and Yangon Division to the rice deficit regions. The private sector handles most of this trade. Table 9 indicates that the transportation cost for rice has been stable for the past year at K500/30 viss bag from Mandalay to Lashio (282km) and K200 from Mandalay to Shwebo (114km).

As shown in Figure 6, paddy is sold by farmers to primary collectors or commercial mills and the resultant rice is distributed to consumers through a wholesale network. Paddy destined for own consumption is milled in village mills, where millers get to keep the bran and husk as payment for milling services; for use in their livestock fattening enterprise or for sale to livestock producers. Private trade in paddy and rice was prohibited during the socialist period in Myanmar but since 1987 private traders have increased their involvement in domestic trade while the government still has some control over some farm gate transactions and exports[14]. From 1987 to December 2003 the main purpose of state paddy procurement was to supply rice to targeted groups (government employees, hospitals, other social welfare institutions and the military) at subsidized prices[15,16] and the export of any surplus, see Table 45, Table 46, Table 49 and Table 53.

In April 2003 the government announced changes in the rice procurement policy that has major implications for the rice sector (New Light of Myanmar 2003). Thein (2003) noted that the change in government policy towards the rice sector had essentially two components; the removal of the compulsory quota delivery system for farmers and its replacement by purchases of paddy from traders and millers at market prices[17], and the lifting of the ban on private exports of rice under certain circumstances[18]. The new rice policy will be implemented by the Myanmar Rice Trading Leading Committee (MRTLC) which comprises members of the government (Secretary No. 2, MOAI, MOI(1), MOC, MOE), and the private sector (UMFCCI, MRTA, MRMA), see Box 4.

Most of the state rice milling sector falls under the Ministry of Commerce (see Table 21), and the Myanmar Agricultural Product Trading Enterprise (MAPT) under the MOC purchased paddy for

[14] The domestic market for rice was liberalized in 1987-88, with some restrictions on movement of rice imposed at the district level on a case by case basis (Thein 2003).

[15] Myanmar-Japan Cooperation Program (2002, pg. 108) notes that in January 2001 government employees received 12 pyi of rice per month, at K18/pyi, while the market price for the same quality rice was K106/pyi (probably lower quality Ngakywe rice selling for K2,437/30viss bag). The subsidy is thus around 83 percent, while some government departments provide the ration for free, with the cost covered by the respective departments' social welfare fund.

[16] Myanmar-Japan Cooperation Program (2002, pg. 108) also notes that the rationing system was supposed to be a counterbalance for the low wages paid to government staff. However, the quality of rice provided under the rationing system is extremely low and many government staff sell their allocation in the open market and buy better quality rice. Myanmar-Japan Cooperation Program points out that the high cost of operating the ration system is not compensated by the benefits accruing to government staff due to the low quality of the rationed rice and the extra effort it takes for staff to sell their ration on the open market. With compulsory acquisition of paddy from farmers (and from 2003 from traders and millers), there is no incentive for producers to sell the best quality rice at fixed prices below the prevailing market rate. Inefficient administration and storage of paddy, and poor milling technology at government owned mills and private contracted mills, means that the quality of the rice is extremely low. The ASR Field Team visited a private miller who was milling MAPT paddy under contract. The resultant polished rice was extremely discolored, mouldy, and crumbled in the hand (ASR Field Team Interview 15 September 2003).

[17] As noted in detail below, this procurement policy was eventually replaced in December 2003 with an elimination of the role of MAPT in milling rice for targeted groups, and the replacement of rice and edible oil rations to government staff with a direct cash payment of K5000 per month. Individual ministries are able to supplement this cash payment if desired.

[18] Rice exporters will continue to pay the 10 percent tax on export earnings but in addition they will be required to surrender 50 percent of the balance of foreign exchange receipts remaining after the tax payment. The government, in return, will share 50 percent of the cost of the exported rice (Thein 2003, pg. 2).

milling on behalf of the government for targeted groups and exports[19]. Total purchases for 2003 (up until October 2003)[20] were around 10 percent of production, which are milled by MAPT in their own mills or private contracted mills (see Table 44, Table 47 and Table 53). MAPT owns 70 mills and employs a further 513 private mills on a seasonal basis (ASR Field Team Interview 29 August 2003). Around 24 of the mills owned by MAPT are equipped with modern rice processing facilities. Until 2003, MAPT compulsorily acquired paddy from farmers at a rate of 2-11 baskets per acre (103-567 kg/ha), depending on the location[21], but from 2003 the intention was that MAPT would purchase paddy from traders and mills at market rates (ASR Field Team Interview 21 August 2003), although it is unclear where the budget for this would come from.

As noted above, the policy for MAPT to procure paddy and rice directly from traders rather than from farmers was never actually implemented, and the government announced a new policy in December 2003 involving the complete liberalization of the domestic market for rice (revocation of the requirement to supply rice and paddy to MAPT) and the elimination of subsidized rations for government staff and other target groups. Exports of rice were subsequently banned, in an attempt to reduce the income effect on government staff by lowering prices and secure sufficient supplies of rice for the domestic market. Government staff were given a salary increase of K5000 per month to cover the cost of purchasing rice and edible oil on the open market rather than having them supplied in a monthly ration. While the domestic price of rice and edible oil remains low, the K5000 salary supplement more than covers the K3000 cost of purchasing rice and edible oil (ASR Field Team Interview, 21 January 2004). However, in the absence of export market restrictions there is a potential for prices to rise and thus the government embarked on a policy of banning the exports of rice, sesame, onions, pulses and beans, and maize in order to secure domestic supplies at a reasonable price.

In 2000-2001 36 percent of the acquired paddy was milled by MAPT in their own mills, and the other 64 percent was contracted out to private millers (see Table 35 and Table 44). In 2001-2002 this ratio changed to 25:75 in favor of the private millers[22]. MAPT offers their private contractors milling charges of around K30 per basket for export quality rice and K17.5/basket for domestic rice, compared with K60-70 per basket on the open market. Myanmar-Japan Cooperation Program (2002, pg. 115) notes that these charges are usually set at 60 percent of the prevailing private sector charges for export quality rice and 35 percent for domestic quality rice. Due to the large volumes and prompt payment, private contractors are apparently willing to accept these lower rates (ASR Field Team Interview 21 August 2003). Some of the smaller private mills who are milling MAPT rice for the local township area are milling the paddy on the same basis as that for farmers themselves; farmers (or MAPT) get to keep the milled rice but the millers keep the bran, husk and small broken rice for their own livestock fattening operations or sale.

[19] MAPT sales of subsidized rice to the poor (as one of the targeted groups) are through marketplaces in respective townships (including Yangon). According to MAPT officials, there are no specific criteria for subsidized sales to this target group, in the form of certificates of entitlement or "poverty" certificates. According to MAPT officials, the official shops "know who the poor people are" and sell the subsidized rice to them accordingly (ASR Field Team Interview 21 August 2003).

[20] Under the old system introduced in 1998, the "Advance Paddy Purchase System", MAPT disbursed loans to farmers to cover harvesting costs at a rate of K30,000 for two tonnes of paddy. In return, farmers had to enter into a contract with MAPT to sell 0.28-0.32 tonnes of paddy according to locality. MAPT paddy procurement rice ranged from K300-400 per basket, compared with a farm gate price of K500-600 per basket. These loans enabled farmers to purchase fertilizer, pesticide and other inputs effectively on credit (Malhotra 2000, pg. 9).

[21] Myanmar-Japan Cooperation Program (2002, pg. 111) notes that the procurement quota prior to 2003 was 10-16 baskets per acre for rice surplus areas and 4-10 baskets per acre for rice deficit areas. The rate is uniform for village tract or township areas and differences in land holding or fertility is not taken into consideration (making the quota highly regressive for poorer farmers). ASR Field Team discussions with farmers and township officials about the quota system suggested that in some areas the quota is much higher than the official rate as the township itself puts an additional quota onto some farmers.

[22] In 2002-03 MAPT milled 252 lakh of baskets in their own mills and 600 lakh of baskets in private contracted mills (ASR Field Team Interview 29 August 2003).

Table 7, Table 32, Table 53, Table 54 and Table 55 show the value and volume of exports of rice from Myanmar from 1980-81 to 2002-03. The export market is a residual market after domestic demand has been satisfied, and conducted solely by MAPT. As Table 7 shows, exports of rice have been limited in recent years to under K200 million and under 1 million tonnes. Existing export markets for rice include Indonesia, Singapore, Bangladesh, China, Thailand, the Philippines, and Gambia, but there are significant export opportunities for other West African countries like Cote d'Ivoire, Nigeria and Sierra Leone (see Table 8). Thein (2003) estimates that given the current state of production, on average less than 400,000 tonnes (3 percent of total production) can be exported on a sustainable basis and at current world prices exports are not profitable.

In 2001-2002, approximately 60 percent of MAPT rice was destined for the export market. This was significantly greater than in previous years (see Table 53 and Table 54) but in future years MAPT will not be involved in exporting rice, with private traders taking up the slack (ASR Field Team Interview 21 August 2003).

Since MAPT is no longer involved in the export trade of rice, nor in the procurement of rice for target groups, the question remains as to what is the future role of MAPT. It is noted that MAPT retains it role as a trading organization for other agricultural products (notably pulses and beans) and that its rice mills can potentially be used for contract rice milling to the private sector. It is understood that UMFCCI was previously involved in the purchase and milling of (relatively) small quantities of paddy and now with the exit of MAPT from the rice market UMFCCI and the Rice Traders Association are now able to purchase much larger quantities of paddy. Apparently UMFCCI and the Rice Traders Association are able to contract out paddy milling operations to MAPT rice mills (ASR Field Team Interview, 21 January 2004).

As noted above, until the change in government policy in late 2003, exports of rice by the private sector were restricted to operating through MAPT, but private traders are allowed to operate in the domestic market. Primary collectors or village brokers purchase paddy from farmers and sell them to township wholesalers who sell mainly on a commission basis[23], although some do purchase paddy outright and make a profit on the arbitrage. Most collectors and traders deal in many different crops, rather than act as specialized traders. Collectors usually operate on very thin margins of 1-5 percent, while wholesale traders can have larger margins. Some traders in Pyay interviewed by the ASR Field Team indicated that their operating cost (across all crops traded) was between K1000-1500 per tonne, with the average profit margin being 25 percent (ASR Field Team Interview 8 September 2003). This can be compared with rice traders in Cambodia and Viet Nam, who are operating on profit margins of 0.3 percent and 2.8 percent respectively, while their marketing margins are 2.64 percent and 6.74 percent respectively (see Table 33 and Table 34).

Partial budgets for a rice miller and a wholesale rice trader are presented in Table 57 and Table 58. These indicate a profit margin of K77 per basket for millers (13.5 percent of paddy price) and K20 per 30 viss bag for traders (1.45 percent of rice purchase price). These are comparable to profit margins for millers and wholesalers in Cambodia of 14.9 and 4.5 percent respectively (see Table 33).

3.3.4 Processing Capacity and Efficiency

Private rice mills can be classified into three groups according to capacity; small, medium and large. Small village mills are called "har-lar-sek" or "hurler". Small village mills are found in large numbers in the rural areas and play an important role in milling part of farmers' marketable surplus as well as for milling home consumption. Most hurler mills provide milling free of charge, in return for keeping the fine broken rice, bran and husk, which can be used for miller's own livestock or for sale to livestock producers.

[23] Strictly speaking, the village "brokers" are collectors, while the wholesale "traders" are actually commission agents.

The busiest time for rice mills begins just after harvesting time, which is from December to April for the main rice producing area. The lowest operating period is during the rainy period.

Most millers buy paddy from farmers and collectors and sell the milled rice. Most use their own working capital to purchase paddy and then send their milled rice to wholesalers in Yangon and Mandalay. Millers also sell to traders and retailers in the local vicinity, and are conscious about the market conditions in their respective markets (Food and Agriculture Organization and Ministry of Agriculture and Irrigation 2000, pg. 65). Average milling recovery ranges from 45-65 percent, depending on the type of mill and quality of paddy (see Table 17, Table 35, Table 37, Table 38, and Table 39). The very low recovery rates apply to the smaller mills in the private sector, with larger mills and SOE milling being able to afford newer equipment. Overall, MAS statistics indicate that recovery rates average at nearly 60 percent (see Table 17), although none of the milling operations visited by the ASR Review Team came close to that figure. One MOC mill visited had recovery rates of around 44 percent (see Table 50, Table 51 and Table 52), although including broken rice brought the recovery rate up to 61.5 percent (ASR Field Team Interview 8 September 2003). In contrast, recovery rates for Cambodian and Vietnamese commercial mills are around 60 and 72 percent respectively for white rice (55 percent for head rice in Vietnamese rubber roller mills), and 57 and 64 percent respectively for white rice in village mills, see Table 40, Table 41 and Table 42 (Agrifood Consulting International 2002; 2002).

MAPT estimated that in 1994 there were 2189 registered mills, with an estimated milling capacity of 50,000 tonnes per day. Around 97 percent of capacity is in private ownership, and 54 percent is for small scale milling (Kudo 2003, pg 77-78). Other estimates vary significantly; with the Ministry of Industry No. 1 indicating that in 2000 there were 12,397 rice mills (see Table 27). MAPT itself owned 68 mills in 2000-01, with a capacity of 5,308 tonnes per day (see Table 47). In 2000-01 an additional 462 mills were contracted to MAPT, with a combined capacity of 12,347 tonnes per day. As noted above, the number of mills under MAPT have since increased to 70 mills owned by MAPT and a further 512 mills contracted by MAPT. Given MAPT milled 80.8 million baskets of paddy in 2000-01 and 105.6 million baskets in 2001-02 (see Table 44), this equates to a 71.4 and 54.6 percent capacity utilization for 2000-01 and 2001-02 respectively, assuming a 250 day per year operation (or 49 and 37 percent respectively for the full 365 days).

FAO (2000, pp. 39-42) notes that the largest concentration of rice mills in Myanmar is around Pathein, where in 2000 there were 15 large rice mills (over 100 t/day) and approximately 100 medium size mills (under 100 t/day). There were also 1868 officially registered Hurler (custom mills), which substantially underestimates actual number since there are over 12,000 villages in Ayeyarwady Division and each has at least one hurler. In Mon State there were 3 big rice mills in Mawlamyine operating under contract for MAPT and in the Mudon area there were 3 large rice mills and over 100 hurlers. In addition, in Thaton there were 2 big rice mills under contract to MAPT and another 152 small rice mills. In Magway Division there are 2 big rice mills owned by MAPT in Magway Town, and a number of medium-size private rice mills. All of the rice mills are located on the western side of the Ayeyarwady river. In Sagu Town, Magway Division, there are 2 rice mills with a capacity of 200 baskets of paddy per day, while Minbu Town has 10 rice mills of the same capacity and there are 10 to 12 small hurlers in each village tract.

3.3.5 Key Constraints

Kudo (2003, pg 78) notes that while small-scale mills (15-20 t/day) are manufactured locally and some of the state owned mills with more than 100 t/day capacity have been upgraded and are reasonably modern and efficient, the bulk of the milling sector are operating below their rated capacity and their machines are obsolete. The main cause of this has been capital and credit constraints, a lack of spare parts, and inefficient management. While the state rice milling sector has benefited from ongoing budgetary support and capital investments, the private sector is constrained in their ability to modernize.

Milling technology is low in the village milling sector, although mills are able to purchase spare parts. One village mill visited by the ASR Field Team noted that they had to replace the rubber rollers in their husking unit every 10 days, at a cost of RMB120 (K14,400) per roller (2 rollers per unit). This replacement cycle is excessive, and another miller a short distance away said that his replacement cycle was every 20 days, at a cost of RMB65 (K7,800) per roller (ASR Field Team Interview 14-15 September 2003). While there were differences in the cost and quality of the rollers, the major factor appeared to be the absence of a de-stoning unit in the first mill visited, resulting in significant wear and tear on the rollers and a shorter replacement cycle.

In addition to problems with wear and tear on machinery, the lack of sorting and de-stoning units in rice mills result in high levels of broken rice; with consequent effects on the profitability of milling operations. There are significant issues relating to the mixing of different varieties of rice in the collection and milling process and inadequate post-harvest and storage technologies which result in high levels of broken rice and a deterioration of rice quality[16]. This significantly constrains the ability of Myanmar to enter into the world rice trade in any appreciable manner. Similarly, export restrictions on rice mean that rice millers have limited access to foreign markets, and market access is also compromised by limited information about foreign market conditions and competitive factors.

Private millers note that the cost and the reliability of electricity is a major constraint, with some mills unable to operate at efficient levels due to frequent power shortages. While the cost of electricity is "high", relative to the subsidized rates offered to SOEs, the cost of electricity is lower than in China. One village mill visited by the ASR Field Team close to the Chinese border noted that the cost of electricity from Myanmar was K25-40/unit while electricity from China was K120/unit. Despite this, millers along the border appear to be willing to purchase electricity from China due to the greater reliability of supplies (ASR Field Team Interview 15 September 2003).

3.4. Cotton Ginning and Processing

3.4.1 Production Trends

Commercial cotton varieties in Myanmar are either short staple (*Gossypium arboreum*) or long staple (*Gossypium hirsutum*). In addition, local varieties called Mahlaing and Wagyi are also grown to a certain extent. Area and production trends in cotton are shown in Table 12 and Table 68, which indicates that the largest area of cotton is devoted to long staple varieties (some 230-250,000 hectares) followed by short staple varieties (some 90,000 hectares). The area under long staple has been increasing over the past decade; while there have been declines in sown area for all other varieties. Yields for all but long staple varieties have been stagnant or slowly increasing, but the long staple varieties have shown declining yields over the past decade, as fertilizer and irrigation use has not kept up with the expansion of areas under production. Despite the reduction in yields, overall production has increased; due to the expansion of area.

Cotton production peaked in the mid 1980s (1984-85) under the whole townships high yielding varieties program before stagnating in the early 1990s as rising costs and low procurement prices encouraged farmers to diversify into alternative crops. Since the late 1990s areas under production and consequently production have increased; peaking at 202,000 tonnes in 1999-00. This has been a result of MCSE taking over responsibility for procurement after 1994-95 and increasing the procurement price for long staple cotton by 500 percent and short staple cotton by 400 percent over the following 9 years. In parallel, open market prices maintained a premium of 150-200 percent above government procurement prices; fuelling an increase in production, but diverting much of this to the private sector rather than the SOE sector as had been intended (U Tin Htut Oo and Kudo 2003, pg. 322).

Long staple varieties of cotton are grown predominantly in the late monsoon season (July-August to December-January) and only have a limited area of production in the pre-monsoon period due to government policies favoring summer rice production in the dry-land areas. The government is currently completing new irrigation schemes in Sagaing Division (Thaphanseik Dam), which will enable significant increases in pre-monsoon cotton if government policies to this effect are enacted (U Tin Htut Oo and Kudo 2003, pg. 310)[24].

Data on supply and consumption of cotton are presented in Table 69. While total production of cotton has increased, this has barely kept pace with increases in exports and domestic population growth; resulting in a relatively stagnant per capita consumption of cotton ranging from 0.98 to 1.26 kg over the past 6 years. On a yardage of fabric basis, per capita consumption in Myanmar is around 5.47 yards, significantly below its neighbors such as Bangladesh (16.72 yds), India (18.48 yds) and Thailand (27.82 yds), see Table 67.

Out of the approximately 13 main manufacturing industries in Myanmar, the textile industry ranks fourth by value of production after food and beverages, mineral and petroleum products and industrial raw materials (see Table 25). This industry has seen a significant decline since the early 1960s when it comprised nearly 15 percent of industrial value of production, ranking second after food and beverages. Despite the decline in value of production, the clothing and textile industry still comprises a significant number of individual firms and enterprises; numbering over 4000 enterprises in 1998-99, or 7.81 percent of the over 55,000 registered manufacturing enterprises in Myanmar (see Table 24). This is second behind the food and beverage industry. According to U Tin Htut Oo (2003, pg. 287), the clothing and textile industry (both state and private) provide direct employment to over 200,000 people, in addition to the hundreds of thousands of farmers growing cotton and the thousands of other who are working in ancillary services such as trading, ginning and by-product processing. Data on production of textiles are shown in Table 6.

3.4.2 Prices

The cotton industry in Myanmar has been dominated by the existence of compulsory procurement of cotton by MCSE, until last year 50 viss per acre for long staple cotton and 25 viss per acre for short staple (ASR Field Team Interview 26 August 2003). In 1980-81 MCSE procured over 52 percent of the entire crop, but this has fallen to just over 14 percent in recent years (See Table 70). The reduction in procurement volumes has been a result of the below market prices paid by MCSE (see Table 71), and the relative profitability of alternative crops such as chilies and chickpeas as well as pigeon pea and green gram in the dry-zone areas (see Table 78).

From late 2003, MCSE plans to eliminate the quota applied to all cotton farmers and concentrate on entering contracts with a limited number of growers (20,000 farmers on 60,000 acres) to provide cotton for seed production. In exchange for subsidised inputs[25] and technical services, contracted growers will have to provide 100 viss per acre (ASR Field Team Interview 19 August 2003). The other cotton growers are presumably free to sell cotton direct to private traders. The price for cotton for seed under the old system was fixed at K180 per viss for 2002-03, whereas for the upcoming 2003-04 season the price will be K400 per viss, plus a premium for quality (cleaned cotton). In comparison, the market price for cotton is K365-400 per viss, and up to K500 per viss for seed cotton (ASR Field Team Interview 19 August 2003).

Apart from the procurement prices noted in Table 71, the ASR Field Team was not able to obtain time series data on cotton prices. U Tin Htut Oo (2003, pg. 323) computed the export parity price (social

[24] The relative economics of water use efficiency of cotton, rice and other suitable crops for the dry-zone area appear not to have been considered by relevant government planners.
[25] MAS provides MCSE enough subsidized fertilizer to cover 50,000 acres of cotton (ASR Field Team Interview 19 August 2003).

value of production) for long staple cotton in the 2001-02 crop year as being K348.75/viss, compared to the MCSE procurement price of K180/viss and open market price of K350-375/viss. Some current market prices obtained by the field team are shown in Table 72.

3.4.3 Trade and Marketing

The Myanma Cotton and Sericulture Enterprise (MCSE) is responsible for cotton procurement in order to supply raw materials to SOE spinning factories at a fixed low price. Prior to late 2003, farmers in designated zones were allocated a quota every year and were required to deliver this quota to MCSE at a fixed price, usually below the market price. Due to the disparity between prices some farmers are reluctant to cultivate cotton and the MCSE has difficulty in enforcing the contract. Procurement quotas were 50 viss per acre of cotton, and farmers were required to supply this quota before they could sell their over-quota surplus on the open market. In order to ensure quota deliveries, private ginners and traders were banned from operating in the first 2 months of the harvesting season and farmers had to obtain a "yellow card" certificate of sale from MCSE for their quota before selling to private traders (ASR Field Team Interview, 11 September 2003). Since quota deliveries were based on weight, not quality, this system encouraged farmers to deliver their lowest quality cotton to MCSE collection points and reserve their better cotton for sale to the private sector[26]. As a counterbalance to the trend to deliver poor quality cotton to MCSE and reserve the better cotton for private sales, higher quality cotton is obtained in the early part of the harvest season, when private traders are banned from entering the market[27].

From late 2003, MCSE plans to eliminate the quota applied to all cotton farmers and concentrate on entering contracts with a limited number of growers to provide cotton for seed production. In exchange for subsidised inputs and technical services, contracted growers will have to provide 100 viss per acre. The other cotton growers are presumably free to sell cotton direct to private traders.

In August 1998 the SPDC partially liberalized cotton marketing, allowing private traders and ginners to act in the market subject to registration and formal approval. Private traders were allowed to procure a pre-registered quantity of a specified type of cotton in a predesignated area. As Table 73 notes, there were 421 private traders and 370 private ginners registered with MCSE in 2000-01 for open market operations in cotton. Traders and ginners were liable to sell 50 percent of cotton procured to MCSE until 1999-2000, when this percentage was dropped to 25 percent (U Tin Htut Oo and Kudo 2003, pg. 323). One ginner interviewed noted that their quota was 20,000 viss, of which they had to transfer 25 percent to MCSE at the fixed procurement price of K400 viss for 2003. While the ginners can apply to increase the size of the permit, there is not enough cotton available anyway. In 1997, when the permit system was not in place, this particular ginner purchased 120,000 viss of cotton seed (ASR Field Team Interview 11 September 2003).

3.4.4 Processing Capacity and Efficiency

With few exceptions, the majority of ginning in Myanmar is carried out using single roller machines manufactured in the late 1800s to early 1900s in Northern England. The ASR Field Team saw

[26] Farmers occasionally delivered wet cotton to MCSE collection points in order to boost weight, with consequent deterioration in quality (ASR Field Team Interview, 11 September 2003).

[27] Some private ginners interviewed by the ASR Field Team noted that in order to ensure adequate supplies of good quality cotton, they would purchase farmers' cotton from them at the beginning of the season and deliver their quota allocation to MCSE on the farmer's behalf. The pooling of cotton from different farmers enabled the ginners to select the best cotton to keep and deliver relatively lower quality cotton to MCSE. The ginners themselves paid the difference between the open market price and the procurement price, less any negotiated discount to the farmers for taking care of the quota allocation. One ginner interviewed noted that the marketing margin between the cotton seed price and spun cotton price was around 300 percent, but their profit margins were only 15 percent after deductions for costs (K15 per viss) and delivering of the quota to MCSE (ASR Field Team Interview, 11 September 2003).

manufacturing dates from as early as 1888 to as late as 1938. The private sector is (as far as can be determined) exclusively single roller gins while the SOE sector has embarked on a modernization drive and has purchased some double roller gins from India and Japan, as well as some Saw gins from the US (see Table 74). By 2000-01 the MCSE owned 37 cotton gins, 11 cotton baling factories, 5 cotton seed oil mills, and 3 cotton lint processing factories (Asian Development Bank 2002, pg. 16). These data are similar to those cited by U Tin Htut Oo (2003, pg. 327) who noted 13 cotton baling factories, 2 lint processing factories, and 6 oil mills in addition to 30 oil mills in the private sector (see Table 76).

As Table 74 shows, the private sector has nearly 49 percent of the available capacity, and just over 76 percent of ginning capacity is from single roller gins. This represented a total capacity of just over 311,000 tonnes of cotton seed per year[28], or an estimated capacity utilization of around 60 percent (see Table 75). While this data indicates a respectable capacity utilization for the industry, the aggregate figures hide the sometimes vast differences between the private and state sector and between individual mills. The ASR Field Team visited several SOE gins and one private gin to gauge capacity utilization and performance. Performance data are presented in Table 80 to Table 89. As noted in Table 89, there are wide discrepancies between gins on capacity utilization under full or "normal" operating conditions. Under full operating conditions (2 shifts per day, 365 days per year) the capacity utilization ranged from 23 percent down to less than 2 percent, with most surveyed gins operating at less than 8 percent. Under "normal" operating conditions (1 shift per day, ginning season depending on length of harvest and availability of cotton) capacity utilization ranged from 63 percent down to 23.7 percent; with three of the 5 gins surveyed having less than 26 percent capacity utilization. Since data in Table 74 appears to cover most, if not all the gins under MCSE, there appears to be significant numbers of private sector gins not covered by the data, which presumably have sufficient capacity utilization to make up for the lack of utilization in the surveyed gins. As a consequence, the data (and lack thereof) on ginning capacity in the public and private sector appears to suggest that the majority of ginning is carried out in the private sector and a significant proportion of the SOE ginning sector is chronically under utilized.

Actual costs and returns from the gins under MCSE were unable to be obtained in the short time available to the ASR Field Team. Factory managers were unable to identify quantities of inputs (besides cotton seed), the costs, or the returns from production[29]. These data are apparently calculated at MCSE headquarters in Yangon but are not available at the factory level. Input costs are calculated at government procurement prices (for example diesel, electricity, labor costs excluding rations, etc.). An additional complication arises because gins within a respective cotton growing area act as one ginning unit; sending intermediate inputs between gins depending on individual gins' maintenance and repair cycles and available capacity at any particular point in time. For example, a gin may experience a breakdown in their baling machine, whereupon they send their lint to a neighboring factory for baling. In another example, a gin may send its de-linted seed to another mill for oil extraction. This transfer of product may or may not appear on either of the factories' books and there is potential for double counting to occur[30].

In terms of private ginning operations, the ASR Field Team visited one gin in Meiktila who had a profitability of 49 percent (see Table 87). This gin noted that after delivering part of the farmer's quota to MCSE as a condition of purchase their profitability is reduced to 15 percent (in order to get assured supplies of cotton, they agree with the farmer to be responsible for delivering their 50 viss per acre quota to MCSE) (ASR Field Team Interview 11 September 2003).

Cotton by-products include linter, cotton seed for planting, and cotton seed for oil production. Typical recovery ratios and amounts obtained by the State sector are shown in Table 77. Interviews with gins suggest that cotton seed reserved for seed varies between 30 percent (private gin) to 75 percent (SOE

[28] Apparently assuming 2 shifts per day, working 365 days per year.
[29] As far as factory managers were concerned, cotton seed arrived at the gate in trucks, was ginned, and then left from the gate by trucks. Consumables and spare parts were ordered from MCSE HQ as required.
[30] In the cotton seed oil example, the transfer of seed may not appear on the accounts of the receiving gin, but may appear as increased oil production; thereby giving an inflated recovery ratio of oil from seed.

gins). The higher levels of seed reserved for planting is typical for the SOE gins, as they attempt to maintain adequate supplies of seed for delivery to farmers in their catchments area. A major constraint to sustainability of yields is the quality of seed supplied by MCSE gins to farmers for planting. Since quotas are set on weight, not quality, farmers typically provide their worst quality cotton to MCSE under the procurement system and germination rates of seed reserved for planting are typically between 40-60 percent (ASR Field Team Interviews August-September 2003). This in turn impacts not only on the quality of cotton grown in subsequent season, but on the quality of seed reserved for planting. MCSE notes that seeding rates should be 2-3 viss per acre, but are typically 10 viss per acre due to poor germination rates (ASR Field Team Interview 9 September 2003).

Cotton seed oil crushing facilities are apparently more numerous in the private sector, but actual outputs and capacities are unknown (U Tin Htut Oo and Kudo 2003, pg. 327). Table 76 indicates that there are 6 SOE cotton seed oil mills and 30 private sector ones which are registered with MCSE, although there are many more unregistered ones. Cotton seed oil is used mainly for frying chickpeas, and the cake is used for livestock feed; particularly in aquaculture. Table 77 shows output of refined oil, soapstock and cotton seed cake from the state sector.

Within the state sector, Myanmar Textile Industries (MTI) under MOI(1) is responsible for operating the state-owned textile mills. In 2000-01 this comprised 18 different enterprises involved in spinning, weaving, garment manufacturing, blanket making and other types of textile manufacturing (see Table 59). These firms provide employment for over 18,700 people. U Tin Htut Oo (2003, pg. 291) notes that MTI controls over 125,800 spindles, 3,880 powerlooms and 3 dyeing and printing units and yet only provides 3.2 percent of total demand despite comprising the single largest share of the textile industry in Myanmar. U Tin Htut Oo (2003, pg. 292) notes that while insufficient installed capacity is a major factor for this low level of production, the inadequacy of cotton supply and the decreased efficiency of the state textile mills relative to the private sector are also contributing factors. According to U Tin Htut Oo, the state textile mills are running at about 60-70 percent of installed capacity. Individual textile operations are running anywhere from as low as 16 percent (blanket production) up to 90 percent (towels and cotton wool), see Table 61. Raw material requirements for textile mills are shown in Table 60. Combined with output statistics in Table 61 these data indicate that while some mills are able to access sufficient amounts of raw material, they are unable to utilize installed capacity to their fullest potential.

In addition to the textile mills under MOI(1), there are two large spinning and weaving mills operated by the Ministry of Defense; providing fabrics for military personnel and cotton-paper composite for printing currency. These mills have around 120,000 spindles and 1517 powerlooms (U Tin Htut Oo and Kudo 2003, pp. 294-295). According to U Tin Htut Oo (2003, pg. 294) these mills have a combined production capacity of 14.6 million pounds of yarn and 14.79 million yards of grey fabrics. Since these mills obtain cotton from MCSE, and thus face the same difficulties in obtaining an adequate supply of cotton. Over 1999-2001 MCSE could only supply 59 percent of lint cotton requirements to the state sector[31], indicating that the mills under the Ministry of Defense are possibly running at around 70-75 percent of capacity (U Tin Htut Oo and Kudo 2003, pg. 294). While the Ministry of Defense mills have underutilized capacity, these mills are also facing the same problems as those under MOI(1); having been built in the 1960s and 1970s as were the ones under MOI(1).

Despite difficulties in sourcing adequate supplies of cotton and the underutilization of existing capacity, there are currently 3 new spinning and weaving composite mills under construction by MTI and one spinning mill under construction by MCSE. When these start operation sometime after the beginning of

[31] U Tin Htut Oo (2003, pg. 294) notes that the Ministry of Defense has established its own irrigated and mechanized cotton growing enterprise of around 20,000 acres in Magway Division in an attempt to reduce its reliance on MCSE procurement of cotton. This step has been taken as the same time (but not necessarily planned as such) as MCSEs plan to reduce procurement of cotton to levels sufficient for maintenance of seed cotton stocks for planting but not enough for large scale textile production from the state sector. According to MCSE, MOI(1) and the Ministry of Defense are now able to procure supplies of cotton seed and cotton from the open market from late 2003 onwards (ASR Field Team Interview 19 August 2003).

2004 the 3 mills under MTI will have 29760 spindles and 2438 powerlooms each, while the MCSE mill will have 27126 spindles. This will increase SOE capacity by an additional 93 percent on spindles and 189 percent on powerlooms. According to U Tin Htut Oo (2003, pg. 294) this equates to 60 million yards of cloth, but there does not appear to be any government plan to increase the amount of cotton procured to supply these mills and they may have to purchase cotton on the open market.

Given the parlous state of production in the existing textile mills under MTI, the construction of new textile mills may appear odd. However, U Tin Htut Oo (2003, pg. 295) notes that most of the existing mills are beyond repair to their original capacities and that current levels of production can only be maintained with significant maintenance. As such, ignoring the fundamentals of adequate cotton supply and market demand for SOE textiles, the replacement of obsolete mills with newer technology does appear to be feasible.

In addition to textile milling under SOEs, the cooperative sector plays a significant role, see Table 62. Some 180,000 pounds of yarn and 71 million yards of cloth is produced each year. Most of the capacity in the cooperative sector is provided by handlooms, some 131,900 looms, rather than spindles as is the case for the SOE sector.

The private sector provides most of the capacity for textile milling in Myanmar, see Table 63. This sector is represented by small to medium size weaving mills and home hand spinning and traditional weaving units located at the village level (U Tin Htut Oo and Kudo 2003, pg. 296). Estimated production from the private sector is around 17.8 million pounds of yarn and 156.7 million yards of fabric. In addition to numerous small-scale private enterprises involved in textile production at the village level, there are some 1800 private registered textile enterprises operating on a commercial scale (see Table 64).

The cost of production for small scale, village level production of textiles is quite high, with raw materials accounting for some 75 percent of the cost of production. Profit margins are low, ranging from 7-9 percent, see Table 65.

U Moe Kyaw (2001) has extensively reviewed the performance of the export orientated private textile and garment industry in Myanmar. It is estimated that there are around 400 garment factories producing textiles for the export market, of which around 88 percent are locally owned, 8 percent are joint venture and the rest are foreign owned (U Tin Htut Oo and Kudo 2003, pg. 301). The production data for a survey of 310 of these factories is presented in Table 66. The main strengths of this industry from an export point of view is that while per unit labor costs are 30 percent more than that for the domestic industry, they are some 7 times less than wages in India and Thailand and 2 times less than in China and India.

3.4.5 Key Constraints

One of the major constraints facing the SOE sector is the inability to secure sufficient quantities of cotton at the prevailing procurement prices. While MCSE continues to set fixed prices below the market rate cotton farmers will always prefer to sell on the open market. Part of the problem is the inertia inherent within any bureaucracy; where purchase prices are set at the beginning of the harvest season and rarely if ever changed. For example, the 2000-01 season was a bumper harvest and the open market price fell commensurately. Since MCSE had fixed the procurement price at the beginning of the season, and this ended up being higher than the open market price, they were able to obtain sufficient quantities to meet their demands (ASR Field Team Interview, 9 September 2003). Since private traders are able to vary prices almost instantaneously, the government price will always be below the market price as long as MCSE desires to secure supplies of cotton cheaper than what the private market will pay and supply conditions do not vary dramatically.

While cotton may have some competitive advantages over crops such as sugarcane (see Table 79), there are questions as to its competitiveness with competing crops such as pulses and beans, chilies, and oilseed crops. These crops fetch much higher prices in the marketplace, are less capital and labor intensive, and utilize significantly less water than cotton or rice. In the dry zone area, where significant investment is required to deliver irrigation to cropping land, returns per acre or returns per mega liter of water would suggest that other crops are more suitable for production than cotton. Under a liberalized farming system, this would suggest that less cotton rather than more would be grown, putting further pressure on already marginally economic processing systems.

As noted above, in terms of technical constraints in the production of cotton, a major constraint to sustainability of yields is the quality of seed supplied by MCSE gins to farmers for planting. Farmers typically provide their worst quality cotton to MCSE under the procurement system and germination rates of seed reserved for planting are typically between 40-60 percent. This in turn impacts not only on the quality of cotton grown in subsequent season, but on the quality of seed reserved for planting.

Investment lags within the government ginning sector also impact on the profitability of SOE ginning enterprises, as decisions to invest appear to be made on the basis of past prices and performance, rather than forecasted demand and supply conditions (ASR Field Team Interview 9 September 2003).

U Tin Htut Oo (2003, pg. 292) notes that with the exception of two SOE garment factories that were established in the early 1990s, all the other SOE textile mills are old and worn out. These other mills have been operating for as long as 50 years, and MTI has difficulty in maintaining machinery due to the lack of capital and access to spare parts.

Although most factories have become obsolete, they have adequate capacity to meet the existing demand for processing of agricultural products. However, their processed products often have low quality and cannot meet the standards for exports. These factories do not generate high value added or create employment, unlike the private sector and joint venture enterprises involved in the export of textiles and garments.

The major reason for the existence of an export orientated textile industry in Myanmar, and the investment by foreign enterprises, is the quota allotment for garments by the USA, EU and Canada under the MFA. In mid 2000 the United States Senate Bill 926 imposed sanctions against the garment industry which resulted in nearly half of the factories to suspend operations (U Tin Htut Oo and Kudo 2003, pg. 303). The industry recovered somewhat in mid 2002 with increased orders from Europe and Japan. The industry has again been severely affected by a new round of sanctions from the US, in late 2003, which has been extended to the EU and Japan.

In addition to the political turmoil affecting the export garment industry, the textile industry as a whole is affected by limited and unstable supplies of electricity. According to U Tin Htut Oo (2003, pg. 303), some 40 percent of power supplies to the private sector textile industry have to be supplied by diesel generators, at an open market cost of 5 times the rate of the official price offered the SOE textile sector. Foreign registered firms have to purchase electricity using foreign exchange while domestically owned firms can pay in Kyats at almost the same rate.

Due to shortages in cotton supplies and other raw materials, almost all raw materials used in the garment industry are imported, the cost of which is one of the highest in the world due to shipping and processing costs as well as the long delays in getting import approvals.

3.5. Edible Oil Production

3.5.1 Production Trends

The oil crop sub-sector is second only in importance to rice in the agricultural economy of Myanmar (Kudo 2003, pg. 79). With a total sown area of 7.25 million acres (3.0 million ha) oil crops encompass a range of annual oilseeds and oil palm (a perennial crop). Oilseeds comprise around 16.4 percent of total sown area for agriculture, while total production is around 1.4 million tonnes (see Table 20). The most important oil crops, based upon a three year average (2000/01 – 2002/03), are sesame, groundnut and sunflower (3.4, 1.6 and 1.2 million acres respectively). Oilseed crops grown also include 0.3 million ha of cottonseed, which is a by-product of cotton fiber production and 116,000 ha of soybean, which has traditionally been used for culinary (non-oil) purposes. Niger seed and mustard are of local importance in the higher altitude areas but do not generally enter the commercial oil sector.

Over 80 percent of the oil crop production is concentrated in the central dry zone area, which encompasses the Divisions of Magway, Mandalay, Sagaing and parts of Bago. Sesame and groundnut are traditional crops within the region and remain dominant, although sunflower (a more recent introduction) and cotton are also important (see Table 1). FAO (2000, pg. 42) notes that Mandalay Division is the third largest area for the production of edible oil, after Magway District and Sagaing Division, and the area of sesame is the second largest in the country and the main surplus area is Myingyan and Meiktila districts. In Magway, the townships of Natmauk and Magway each have over 5 percent of the national production of sesame.

With the exception of mustard and niger, edible oil crops are sown in both monsoon and the cool dry season (see Table 90). The central dry zone area and the hilly areas of Shan State are the major producing areas of sesame, groundnut and sunflower in the rainy season. Sesame is mainly produced in Magway Division during the rainy season and in the lower part of Myanmar groundnut is sown as a second crop after the monsoon rice (Department of Agricultural Planning 2001). Consumer preferences are highly regionalized, with consumers in the central and upper part of Myanmar preferring sesame oil, and those in the lower part preferring groundnut oil.

As noted above, sesame is grown in the central dry zone area during the monsoon season. In the central dry zone area the rainfall pattern is bimodal, and there are frequent occurrences of dry spells in July, when sesame is in its growing stage (see Table 2). Thus the harvested area and yield fluctuates sharply from year to year (see Table 11).

Average oilseed yields for sesame and groundnut are low compared to international levels, averaging no more than 288 kg/ha (pre-monsoon) and 498 kg/ha (post-monsoon) for sesame and 1,000 and 1,440 kg/ha respectively for groundnut. This difference in yield with only marginal differences in market price can result in very low profitability for the pre-monsoon crop. Yields for sunflower have tended to be closer to international levels, averaging 549 kg/ha. Farmers' use of inputs is limited and generally includes seed retained from the last harvest or purchased from grain (non-seed) stocks. Manure is widely applied and, in some areas, gypsum, while relatively low levels of inorganic fertilizer use are common but not universal.

Cotton seed makes a significant contribution towards the stocks of oil seeds that are crushed for oil and protein meal as the seed contains about 22 percent oil and the residual protein cake contains about 27 percent protein (Food and Agriculture Organization, 2003b).

Overall oilseed areas and yields grew moderately in the 1970s and 1980s, with sesame and sunflower being the main beneficiaries. However, in the last 15 years, total area sown to oilseeds has grown by an annual average of only 0.75 percent and total production by less than 1.75 percent per annum. Yields have largely stagnated or have declined. Furthermore, these limited gains have been limited almost entirely to minor oil crops, with sesame and groundnut experiencing absolute declines in sown area. The government's 30 year plan for the oilseed sector indicates a 21 percent increase in area (to 3.4 million hectares), a 64 percent increase in production (to 0.98 million tonnes), and yield increases of 54 percent (to 0.92 tonnes per hectare), see Table 14.

Besides oilseeds, Myanmar also has many decades of experience with limited areas of oil palm, although only in the last decade has the sector experienced significant expansion in the extreme south of Tanintharyi Division, where the majority of the planted area of 82,000 acres (33,000 ha) in 2003 has now been established. Given the time required for oil palm to enter full production, the crop is still of limited economic significance and it remains unclear if national production – even in the more favorable extreme South where a latitude of 10°N is reached – can be competitive with Malaysia and Indonesia (Food and Agriculture Organization 2003). In regards to other possible oil sources, maize is sown over an area of approximately 620,000 acres (252,000 ha), primarily in Sagaing Division and Shan State, but no oil extraction occurs.

The state sector is also involved in the production of edible rice bran oil, for supply to government staff and other target groups. As Table 101 and Table 102 show, some 2118 tonnes of refined edible oil was produced from MAPT mills in 2002 and 1637 tonnes produced in 2003. The amount of rice bran oil produced follows the procurement pattern for paddy by MAPT.

3.5.2 Prices

Real prices for the major oilseeds (measured in constant Kyats) have declined significantly over the last twenty years, falling by as much as 30 percent in the case of sesame. By contrast, pulses prices have increased by more than 100 percent and even rice has increased by between 25-50 percent. A contributory factor in declining prices for oilseeds has been increasing levels of palm oil imports, now averaging over 150,000 tonnes per annum (Food and Agriculture Organization, 2003b).

Normally groundnut oil is the most expensive edible oil while palm oil is the cheapest in the market. However, prices of edible oils in general fluctuate widely. This is closely related to domestic production level of oilseed crops and import volumes of palm oil. Since the latter half of 2001 imports of oil palm have decreased and the retail price of edible oil has increased significantly. The changes in palm oil imports and prices of edible oils is shown in Figure 7, Figure 10, and Figure 11.The price of palm oil out of Malaysia averaged around US$515 per tonne for 2001-2002, but increased to US$745 per tonne in the first half of 2003. However, the variability in prices is greatly reduced from previous years, indicating a rising but stable price for imports of palm oil (see Table 10).

As Figure 8 indicates, oil seed prices in the Mandalay market were relatively flat over 2000 but rose steadily over 2001. Groundnut prices were higher than other oilseeds, while sunflower prices were the lowest. Oil seeds are not sold in the Yangon market, with the exception of groundnut (see Figure 9). Groundnut prices in the Yangon market fluctuated significantly over 2000-2001. Reported 2003 farm gate seed prices for groundnut varied by location, but averaged K363/kg. Sesame seed prices were slightly higher at K380/kg. Reported sunflower seed prices at farm gate were substantially lower, at K185/kg. Table 13 shows market price statistics for oilseeds in the Mandalay and Yangon Markets. For both markets the variability of prices increased dramatically in line with increases in average prices between 2000-2001, although more recent time series data is not available to identify any trends that may exist.

Oil prices and by extension, oilseed prices, have been under increasing pressure since palm oil became widely available – in part to compensate for deficits in national production. Price increases for oilseeds have been lower than for rice over the last decade (see Figure 4, Figure 5, Figure 8 and Figure 9). While consumers prefer groundnut and sesame oil to palm oil, low average income levels preclude most households from paying a sufficient margin to offer attractive returns to oilseed production. This has contributed to a growth in palm oil consumption, stagnation in oilseed production and the rapid growth of pulses. Furthermore, limitations on oil palm imports have probably resulted in oil prices higher than would be seen in an open market, suggesting that integration within ASEAN may lower palm oil prices still further.

Edible oil wholesale prices in Yangon market in 2003 have averaged K1000/kg for groundnut, K850/kg for sesame, and K800/kg for palm oil, although it is estimated that full liberalization of palm oil imports would reduce this last to approximately K700/kg (see Figure 11).

The export of high value groundnut and sesame oils into world markets could also have a significant impact on foreign exchange earnings. In Table 91 comparative average international prices for the three year period 2000/2002 are given for key edible oils of relevance to Myanmar. According to these prices each tonne or groundnut or sesame oil exported would pay for approximately two tonnes of imported palm oil. The export of 100,000 tonnes of these oils (approximately 25 percent of current national production) would yield a gross foreign exchange gain of approximately US$65 million.

As Table 94 and Table 95 show, sesame is competitive internationally, and could maintain its competitiveness at prices as low as two-thirds the lowest level currently observed. The data for palm oil and groundnut indicate that under a fully liberalized trading regime, and at current prices, imports of palm oil and groundnut oil would occur. This has significant implications for government concerns about maintaining an export ban on oilseeds in order to ensure adequate domestic supplies of edible oil.

3.5.3 Trade and Marketing

As noted above, edible oil is considered to be the second most important food item in Myanmar after rice. The main processing area for edible oil is in Central Myanmar, with distribution networks to other parts of the country. The trade and marketing in edible oil is handled largely by the private sector (see Table 27, Table 28and Box 7). In the government sector various ministries are in control of different oil processing facilities. For example, MOAI is in control of Palm oil and other vegetable oil mills, while MOC is in control of Rice Bran oil mills. MOI(1) is in control of oil hydrogenation plants (see Table 21).

The functioning of the market for oilseeds and edible oils has without doubt been one of the most important influences on oilseed productivity, as only 10-20 percent of oilseed production is retained on-farm, mostly for seed and household use. For all oilseeds except cotton, marketing is handled by the private sector, using an efficient system of primary collectors at village level, wholesalers, central crop exchanges (commodity trading floors), millers and retailers. Marketing margins within the system are low. Marketing system losses are also generally low, but groundnut stored for more than 3 months will face afflatoxin and other quality issues (Food and Agriculture Organization, 2003b).

Oilseed crops such as groundnut, sesame, sunflower, niger[32] and mustard seed are important as raw materials for edible oil and traditional snacks. Consumers in Central Myanmar prefer sesame oil, whereas consumers in Lower Myanmar and hilly areas prefer groundnut oil. Sesame is not only an important oilseed crop for edible oil production, but also as an export crop, particularly black sesame seed to China for further export to high valued markets such as Japan. Private exports of sesame were allowed until 1998, when exports were banned with very short notice. Prior to this restriction, sesame seed exports reached more than 20 percent of total production, but this has now fallen to less than 5 percent (Food and Agriculture Organization, 2003b). The policy change was based on a desire for a stable domestic supply and self-sufficiency. Government policy with regard to oilseed sector is influenced by two key factors; the desire to provide incentives for oilseed farmers and the concern that increased edible oil prices will impact low-income consumers. Intervention in processing, marketing and trade has also been a source of revenue for the Government.

Private companies are not allowed to export sesame directly, but must do it through government agencies. For example, private exporters who have found an export buyer can sell their product to MAPT at the prevailing domestic market price, which then loads the sesame onto the ship and sends it to the buyer. MAPT keeps the foreign exchange revenue, less the 10 percent export tax (ASR Field

[32] Used in bird-seed mixes.

Team Interview, 21 August 2003). The domestic price of sesame has declined around 30-35 percent since the imposition of the export ban, and is most likely the cause of the decrease in sesame production over the last few years.

Domestic production of edible oil is insufficient to meet local demand, and palm oil is imported from neighboring countries, mainly Malaysia (see Figure 7)[33]. The number of companies eligible to import palm oil is limited at present, and MAPT also imports some palm oil, depending on domestic market needs. Since October 2002 some 22,500 tonnes of palm oil was imported by MAPT, which is apparently about 20 percent of imports (ASR Field Team Interview, 21 August 2003). FAO (2000, pg. 26) notes that palm oil is imported on a regular basis from Malaysia and Indonesia by Myanmar Economic Holding in Yangon, which also controls the distribution to wholesalers. Cross border trade with Thailand accounts for substantial quantities of imports, but actual quantities are difficult to quantify. Most of the palm oil imports, whether through private or government channels, are sold on the open market through traders.

As noted above, under the current trade regime, no exports of edible oil are permitted from Myanmar, although anecdotal evidence suggests that there is informal cross-border trade, particularly into China. Intermittent exports of oilcake have occurred; reaching 11,000 tonnes in 1999-2000 but have been insignificant since that year. The value of exports is limited, with less than 1 million kyat of exports per year being made in recent years (see Table 7). Singapore, Malaysia, Thailand and the Netherlands are the main destination for oilcake; although Korea and the Philippines have been identified as potential markets (see Table 8). Sesame seed is exported by state-owned enterprises – principally to Japan and Singapore. According to the Myanmar Edible Oil Dealers' Association these exports have averaged 15,000-20,000 tonnes per annum over the last 3 years. Exports of Niger seeds – principally for birdseed - reached 14,000 tonnes in 1999-2000. Imports of palm oil are significant, and have ranged from a low of 74,000 tonnes in 1997 to a high of 222,000 tonnes in 1998, but have averaged around 160,000 tonnes per year. Palm oil imports were opened on a controlled basis to the private sector for the first time in 2003.

FAO (2003b) estimates that nationally only 20 percent of oilseed production is retained on-farm, mostly for seed and household use. This figure is skewed by groundnut, were only 75 percent of output is marketed due to the requirements of large quantities of seed for planting. For other oilcrops the marketed percentage can exceed 90 percent. For 2001-02 the total on-farm consumption amounted to an estimated 242,000 tonnes for sesame, groundnut, sunflower, mustard and niger.

In the absence of a formal oil export trade, oilseeds are consumed largely in the domestic market, where they must compete with palm oil. Producers typically either process their seed in local village mills for home consumption (often paying for the service with the cake) or sell to traders coming to the village. Village traders, in turn, sell to commercial mills in larger settlements and towns, often through the medium of central crop exchanges (CCEs) where brokers charge an average 1.5 percent commission for negotiating sales but do not physically handle the crop (Food and Agriculture Organization, 2003b). Because the CCEs do not keep records of volumes traded, the quantities moved through the CCEs can only be estimated. FAO (2003b) notes that average daily levels at peak periods in the Mandalay exchange can exceed 1,000 tonnes each for sesame and groundnut and 160 tonnes for sunflower. Reported marketing margins for oil seeds are low and evidence suggests that the marketing system is relatively competitive, with a wide range of participants. However, market price information is limited at village level (Food and Agriculture Organization, 2003b).

Smaller commercial millers sell primarily in local urban areas, but larger mills ship the majority of their product to Mandalay and Yangon, where cake is used for feed manufacture and oil is retailed (sometimes reportedly blended with palm oil to reduce costs and prices). Transportation costs for groundnut oil have been constant at K1500 per barrel over 2002-03 (see Table 9).

[33] While the volume of imports has decreased over time, the variability in imports increased, with coefficient of variations increasing from 18.6 to 45 over 2000 and 2001 respectively.

3.5.4 Processing Capacity and Efficiency

The annual average production of vegetable oils in Myanmar is estimated at about 500,000 tonnes. Sesame contributes 43 percent of this total, higher than the 33 percent derived from groundnut, largely due to the non-oil uses of groundnut. Sunflower contributes a further 18 percent of total domestic supply, with mustard, niger, cotton and oil palm providing a final 7 percent. Oilcake availability is approximately 620,000 tonnes.

The edible oil extraction industry in Myanmar consists of two types;

1. Numerous (estimated over 40,000 units) bullock-driven or electric belt-pulley system wooden presses of rotary mortar-pestle type processing about 40kg of oilseeds per eight-hour day and

2. Small-scale expeller mills with an average capacity of 670kg per day and numbering around 6000 units of which 25 percent have a capacity of above 1 tonne of seed per day.

The wooden presses produce better and cleaner oil but extracts only 35 percent of the 44 percent average oil content in the oil seeds. The expeller mills have a better oil extraction but produce poorer quality oil. Through wear and tea, the performance of both types of equipment is generally well below design capacity, in terms of quantity and quality, necessitating urgent repair, upgrading or replacement (Asian Development Bank 1995, pg. 46).

All milling of sesame, groundnut and sunflower in Myanmar is undertaken in the private sector and in 2001-02 a total of approximately 400,000 tonnes of groundnut, sesame and sunflower seed oil were produced. In addition, there are several Government owned mills handling cotton seed.

All private sector mills are of the expeller type and are commonly in the 1 tonne per day to 20 tonnes per day range, with a small number of mills reaching 50 tonnes per day or higher. Some 2,000 oilseed mills were identified by U Tin Htut Oo (2003), see Table 96 and Table 97, but this does not include Shan State and other areas, so the total number of mills will be higher. Considerable evidence exists of on-going privately financed expansion and upgrading of mills in this category, and there are a number of local companies manufacturing expellers, filter presses and related equipment. Other equipment is brought in from China.

Most of the expellers are based on 1950s East German designs and are well serviced y mechanical workshops which specialize in reconditioning these old machines. A major supplier in Mandalay manufactures expellers which are copies of Indian expellers which in turn are copies of 1970s Rosedown machines from the United Kingdom. The expeller sizes range from 5-8 inch barrel diameter, although a few machines of 9-10 inch barrels also exist. Because of the old designs of expellers, seed has to be pressed at least three times to reduce the oil-in-cake to less than 8 percent, see Table 98 and Table 99 (Food and Agriculture Organization, 2003b, pg. 33).

Due to insufficient raw material supplies, many mills operate only one shift per day. Nevertheless, efficient mills appear to be profitable, and a number of mills are expanding capacity. All expeller mills in operation in Myanmar use mechanical extraction, combined with pressure filters. The oil content of different oil seeds, and their best practice and average oil extraction rates are shown in Table 93. In general oil extraction rates in Myanmar are below that of their international counterparts (see Table 92 and Table 99). As all sesame, groundnut and sunflower processing currently utilizes mechanical expeller technology, the resulting cake has a remaining oil content of 6-8 percent (see Table 99). Cake is an important secondary product and is primarily used for animal and aquaculture feed. Such high oil residues not only reduce oil yields, they also reduce the value of the cake for animal feed purposes, as

high oil content cake turns rancid rapidly and will be rejected by livestock (Food and Agriculture Organization, 2003b).

FAO (2000, pp. 39-68) notes that in Ayeyarwady Division there are groundnut oil mills in the Pathein area, as well as a sunflower oil mill in Hinthada. In Bago Division even though there is no surplus oil production, there are around 50 oil mills in Pyay, of which 3 large ones are producing high quality oil from groundnut, sesame and sunflower. In Bago Town there are 4 large, 4 medium and 3 small oil mills situated along Thanutpin road. These millers purchase oilseeds from the northern part of Magway Division and sell oil in the Ayeyarwady, Bago and Yangon markets. In Mon State there are 2 coconut oil mills in Mudon which are supplying oil to Mawlamyine in Mon State and Bayint Naung Market in Yangon. In Mandalay the Crop Exchange Center had 196 oil millers as members in 2000. In Magway Division, Pakokku Town has 15 operating oil mills, while in Sagaing Division there are 61 oil millers who were members of the Monywa and Sagaing Association of Traders and Millers in 2000. In Myaing Town in Sagaing Division there are 7 groundnut millers and one big miller who also owns oil extraction machinery while in Kanbalu town there are 9 oil millers. FAO (2000, pg. 69) conducted a survey of 11 mills throughout Myanmar, their capacity ranged from 20-100 hp, with mills operating between 5-20 hours per day (dependent on supply of raw material, electricity, and demand). The particular recovery ratios for each type of raw material is shown in Table 92. Imported palm oil comes in drums which hold 116 viss (189.4 kg) while local oil millers of sesame and groundnut use second-hand barrels which hold 110-115 viss (179.6-187.8 kg); second hand barrels being dented, reducing their capacity. Actual transactions are based on weight, not on the number of barrels.

A total of 8 mills (5 private and 3 state-owned) are currently engaged in crude palm oil (CPO) production. There are two state-owned refineries handling crude palm oil, cotton seed oil and rice bran oil (see Table 100). Most CPO mills are operating at a capacity of 1.5 tonnes of FFB per hour, while one refinery is operating at a capacity of 6 t/hr and the other at 1t/hr[34]. The ASR Field Team did not visit any Oil Palm mills but notes that the Longlon CPO mill under MPCE processed 2339.04 tonnes of FFB in 2003-03, which, at 1.5 tonnes per hour capacity, is operating at between 53-78 percent capacity (250-365 days per year). Technologies utilized in these mills are generally not the most efficient, resulting in excessive oil residue levels and higher energy costs. As a result, oil from the MPCE mills has a high free fatty acid (FFA) content (7-10 percent) by international standards (Food and Agriculture Organization, 2003b).

Most cotton seed and rice bran milling is undertaken by state enterprises (under MOC and MOI(1)) using relatively large facilities with expellers for cotton seed and small solvent extraction units for rice bran. Solvent extraction technology is currently used in Myanmar only for rice bran oil extraction and capacities typically range between 10-25 tonnes per day. A new solvent plant, designed for soybean oil extraction and with a capacity of 150 tonnes per day, has recently been installed in Yangon, but is currently not functional. The older batch process solvent plants have high energy costs and safety concerns (Food and Agriculture Organization, 2003b).

All cotton seed oil and rice bran oil mills operate at very low capacity utilization rates. There are 6 cotton seed mills (some integrated with ginning operations) with a combined capacity of 111 tonnes per day, and 18 rice bran processing mills (see Table 103). The average capacity of the rice bran oil extraction plants is around 18 tonnes of rice bran per day (over 18 plants), producing around 11 tonnes of crude oil per day (over 11 plants). As Table 101 shows, recovery rates for rice bran oil averaged 9.84 percent in 2002 for crude oil and 39.7 percent of that as refined edible oil. Table 104 and Table 105 show the yearly production data for one MAPT rice bran oil processing plant in Bago. This plant was operating at 60 percent capacity.

The latest plant, which uses continuous processing, was imported from India and installed by MAPT. It has a capacity of 50 tonnes per day and is located in Kyaukse, Mandalay Division. Since this plant is

[34] (U Tin Htut Oo and Kudo 2003, pg. 235) notes that the second mill, O-3 at Insein is operating at 40 tonnes per hour. The Oil Crop Sector Development Project Team visited the mill and noted that its current capacity is 10 tonnes per day.

much safer than other plants, and operates at lower processing costs, much of the rice bran from neighboring areas is now diverted to this plant. MAPT has ordered another plant of the same capacity from the same Indian manufacturer, with nearly 1/3rd of the equipment being made in Myanmar. A third plant is being negotiated, which will be made mostly in Myanmar, with only a few critical items coming from India (Food and Agriculture Organization, 2003b, pg. 34).

Both groundnut and sesame derive their higher value from their distinctive taste and smell, and refining will eliminate these features. As a result, these oils are rarely refined. However, most other vegetable oils require refining to ensure quality and extend shelf life (Food and Agriculture Organization, 2003b). Most rice bran extraction plants have neutralizers but not refineries. The MPCE operates a 15 tonnes per day batch refinery in Yangon which handles both crude palm oil and cottonseed oil from MOAI mills, as well as occasional rice bran oil. As a result of the low temperature and vacuum levels developed in the batch operation, the residual FFA is up to 0.5 percent levels and the oil has associated off-flavors. The Ministry of Industry also operates an edible oil refinery in Yangon handling rice bran oil and imported crude palm oil (Food and Agriculture Organization, 2003b).

Peak activity for most oil mills is after harvesting of oilseed crops. While most mills reduce their milling gradually from their peak, there are some mills operating year round. One mill visited by the ASR Field team in Magway was operating 24 hours per day for 300 days per year (ASR Field Team Interview 9 September 2003).

In terms of profitability, private mills are operating on small but lucrative margins. One sesame oil miller in Magway indicated that he was operating on a marketing margin of K35 per viss, with a profit of K7 per viss, equaling a 20 percent return (see Table 106 and Table 107). Another Sesame oil trader and miller interviewed by the ASR Field Team indicated that his cost of production was around K30 per viss, with another K30-50 per viss net profit; a 3-5 percent return (ASR Field Team Interview, 9 September 2003). This indicates that there are significant variations in profitability between enterprises, contingent on the type of operation, their location, and seasonal constraints.

3.5.5 Key Constraints

The current situation within the oilseed sector has created a number of important problems for the Myanmar population and economy, including reduced household incomes, a lack of productivity growth, reduced oil extraction levels and quality, and increased net foreign exchange costs[35].

Given the limited range of crops suitable for cultivation in the dry zone, the stagnation of oilseed yields, combined with steep declines in real price levels for oilseed crops, has had a strongly negative effect on household incomes. Transfer of agricultural activity into pulses following liberalization a decade ago has provided an alternative income source, but cannot compensate entirely. With most households unable to produce rice - the staple food crop throughout Myanmar – declining real income from the sale of agricultural products is thus a real threat to food security. With more than one million farm households in the two principal oilseeds producing areas, the implications of lowered household incomes and increased food insecurity for national economic growth are significant.

Access to production financing is reported to be a serious limiting factor among small farmers, especially for groundnut which requires high levels of seed input which must be purchased for the monsoon crop. For other oilseeds, financing is principally required for fertilizer purchase or improved seed varieties. However, formal sources of financing for agricultural production, including oil crops, are limited. The Myanmar Agricultural Development Bank (MADB) restricts production loans to only a few thousand Kyat per acre; considerably below average per acre oilseed production cash costs which run from K20,000-60,000/acre depending upon input usage and crop. As private sector banks are formally discouraged by the Government from lending for agricultural production, and financing by

[35] Most of this section has been taken from (Food and Agriculture Organization 2003).

millers or traders is reported to be very limited, many producers rely on loans from local money lenders, who charge from 6-12 percent per month, depending upon collateral. This compares with MADB rates of 15 percent per annum. In contrast, the large number of participants in the marketing chain, although contributing to an efficient and competitive market structure, also appear to render it less appealing for input suppliers and traders to finance the production process.

A major contributor to the decline in prices paid for oilseeds has been competition from imported palm oil in the domestic market. Given the lower cost of producing palm oil, prices for traditional oilseeds have been forced down, as few Myanmar consumers can afford the luxury of purchasing higher priced oil even though it may be strongly preferred. It is interesting to note that palm oil imports have been authorized in part to make up for shortfalls in national edible oil production, thus generating a downward spiral in prices and output. In order to resolve the conflicting demands of higher oilseed prices for farmers and lower edible oil costs for consumers, it is necessary to separate the high-value oil market (groundnut and sesame) from the low-cost oil market (palm oil, sunflower, and soybean oil).

Consumers in wealthy industrial countries can afford to indulge taste preferences, and can sustain prices for preferred oils that are double those for low-cost alternatives. This price differential would allow oils such as groundnut and sesame to capture higher margins in foreign markets and would significantly increase prices paid to oilseed producers. At the same time, while increasing supplies of low cost alternatives on the national market would enable consumers to continue to benefit from low prices.

Low oilseed prices and household incomes have limited the ability and willingness of farmers to adopt improved seed varieties and technology packages, and have been a direct cause of stagnation in domestic production levels over the last few decades. Yields for all oil crops are below international averages and are falling further behind every decade.

The lack of productivity growth over the last two decades not only affects farm incomes, but has also significantly reduced national oil production. Average yield improvements for oilseeds of only 20 percent over the last 20 years could have resulted in current production levels some 0.08-0.1 million tonnes per annum higher than at present, even without higher oil contents. The government's 30 year plan for oil palm is ambitious, with a 93 percent increase in area and an 84 percent increase in production (see Table 14). Most millers interviewed indicated a lack of raw material input as being a significant constraint on their operations. Low productivity may also have contributed to the slow uptake of unutilized land suitable for agriculture. Growth in agricultural land area has totaled only 5 percent over the last 20 years, in a country where less than 60 percent of potential agricultural land is in cultivation. However, much of this expansion potential will be in Shan State and other highland areas, rather than in the dry zone.

Although problems within the oil crops sector may be most serious with respect to prices and productivity, the limited efficiency of current processing operations poses a further problem. Expeller technologies currently in use are typically sub-optimal, in terms of both extraction efficiency and costs per unit. Improved expeller designs could reduce extraction costs, while the introduction of solvent extraction methodologies for oilcake would yield a further 3-5 percent of oil, increasing national output by 30,000-50,000 tonnes per year[36]. Furthermore, current high oil content levels within oilcake result in poor quality cake with reduced storage times before the product deteriorates and lower palatability for livestock. Thus the use of solvent extraction for oilcake would increase cake value.

While the use of solvent extraction plants would increase oil extraction rates, the fundamental issue of the low technologies and low efficiency of the numerous existing mechanical expeller plants spread across the country needs to be addressed. Private sector investment in new technology is hampered by a lack of a stable policy and regulatory environment, lack of access to broad-based credit, and lack of

[36] Taking the world price of sesame as a guide (see Table 91), at US$600 per tonne this would equate to an extra US$18-30 million dollars a year in revenue if this productivity increase could be extended across Myanmar.

access to modern technology designs, spare parts, and (in the case of solvent extraction plants) solvent itself.

Expanded capacity will also be needed to handle the increased output of oil palm fruit arising from recent and current plantation establishment. This includes in-field capacity for crude palm oil production and an upgrading and expansion of secondary refining capacity. Attention to environmental aspects of CPO mills and their procedures for effluent disposal may also be necessary.

While the edible oil extraction industry suffers less capacity under-utilization than other agro-processing sectors, several constraints do exist to efficient use of existing plant. Firstly, delays in getting raw material inputs contribute to significant deterioration of existing stocks. For instance, the rice bran oil plants have a significant trade with private mills in exchanging old bran for new; indicating that they store bran for too long before processing. Secondly, the majority of extraction plants visited by the ASR Field Team indicated that access to stable electricity supplies was a major constraint to their operations.

In Magway and Bago Divisions most of the millers do not employ steam for heat conditioning and have to employ 5, 6 or 10 passes through expellers (see Table 98 and Table 99). This practice results in high electricity costs as well as poor quality oil from subsequent passes (dark color and higher FFA). Even when steam conditioning of seed is practiced, the operation is not at all optimum as they are not regulated by temperature gauges. Even with multiple pressing the oil-in-cake content is quite high and uncrushed particles are visible in the final cake. This is a direct result of absence of knife bars (or, poor maintenance of same) in the expellers and absence of cake breaking after the first press (Food and Agriculture Organization, 2003b, pg. 33).

The milling sector currently has little, if any, analytical quality control mechanisms for either seed intake or oil and meal quality. All the quality parameters are estimated based on personal judgment (Food and Agriculture Organization, 2003b). The main parameters which should be controlled are: moisture content; impurities and damage in seed; color; FFA; sediments and clarity in the oil, and; moisture and oil content in cake. Oil content is the single most important quality control parameter (Food and Agriculture Organization, 2003b). The government solvent extraction plants are equipped with apparatus for oil content and FFA, and whilst these tests are regularly done, moisture is never determined. The new solvent extraction plant built for soybean in Yangon does not have any analytical apparatus at all (Food and Agriculture Organization, 2003b).

FAO (2003b, pg. 35) notes that FFA levels are quite high for refined rice bran oil, ranging from 12-25 percent, with the yield of refined oil being only 45-65 percent. With the present practices of rice bran collection it would be difficult to reduce the FFA to any significant extent. However, there is some scope for improvement in logistics control so as to reduce the lag between rice milling and bran extraction by 3-4 hours and could reduce FFA by 2-3 percent leading to increased oil yields of 5-7 percent. Introduction of centrifugal separators for the neutralizing operation could reduce the losses by another 2 percent; however, this could be economical only if capacity utilization of the 10 tonne per day refineries were to increase to over 70 percent, up from the current 20-50 percent.

Finally, the lack of any form of national standards for edible oils in Myanmar poses serious risks for export quality and renders effective oversight of imported oil quality impossible. Ensuring such a capability will require consideration and definition of appropriate standards, the drafting and enactment of necessary legislation and administrative procedures and the establishment of an analytical capacity linked to these standards.

An important negative impact of the current situation of the oilseed sector is apparent in terms of net foreign exchange earnings for the country. The 205,000 tonnes of palm oil imported in 2000-2001 had a foreign exchange value of approximately US$72 million at 2001 prices. An increase in the domestic production of oil crops, particularly low cost oils such as domestic palm oil, sunflower oil or soybean oil could reduce or eliminate this cost. A doubling of the current sown area of sunflower, for example (501,000 ha), would yield approximately 100,000 tonnes of edible oil at current yields and oil

conversion ratios, while the same increase in supply could be achieved through 40,000-50,000 ha of new oil palm plantations, at current yield levels.

The major constraints affecting the edible oil sector in Myanmar involve institutional and policy issues. The role of the state sector in production and processing has been quite limited, leaving the way open for the private sector to conduct operations. While private enterprises do not have to compete with highly subsidized state enterprises as in other sectors, government external trade policies with respect to oilseeds have had a serious depressing effect on production and prices. By restricting the export of oilseeds and edible oil in an attempt to make Myanmar self sufficient in edible oil production, the government has lost the opportunity for valuable export earnings from exporting high valued sesame and groundnut oil and importing lower valued palm oil. While this policy regime is understandable; the desire to enable the population to have access to edible oil at reasonable prices, it ignores the fact that poorer consumers have to purchase the lower valued palm oil in any case and that the vast majority of oilseed producers lose out from having to sell their harvest at lower prices than that obtainable on the world market.

3.6. Wheat Milling and Cereal Products

3.6.1 Production Trends

The wheat industry in Myanmar is a small but important industry, comprising around 0.5 percent of the total sown area (see Table 20). Wheat production is mainly in Upper Myanmar, mainly in Sagaing and Mandalay Divisions, and is usually in rotation with paddy, maize, sesame or groundnuts (see Table 1, Table 108 and Table 109). Additional amounts are grown in Shan State, in rotation with paddy, groundnuts, maize, soybean and pulses (see Table 108 and Table 109). Although wheat is not part of the staple diet, increasing incomes and relatively suitable agroecological areas has seen a gradual increase in the volumes of wheat being grown and consumed (see Table 11, Figure 12 and Figure 13). Although volumes of wheat have been increasing, this has been due to mainly increases in yield (due to improved technology and management) and imports. According to the CSO (see Table 11), in 2000-01, the area under production was 198,000 acres, producing 92,000 tonnes. Table 110 and Table 111 show the yields of wheat from 1980 to 2001, both under irrigated and non-irrigated regimes. Average yields are just over 1 tonne per hectare, significantly below comparable countries such as China, India and Pakistan (3.7, 2.6 and 2.2 tonnes per hectare respectively). The actual areas under wheat production have been declining due to the higher profitability of chickpeas, a competing crop. Most of the wheat is grown in 5 different areas in Myanmar, where the dry season is cold and suitable for wheat production. Table 109 shows the major varieties and areas where wheat is grown in Myanmar, along with their yields and production. Most of the wheat is grown under rainfed conditions, and the yields are lower than that under irrigation by a factor of between 2.1 and 3.7 (see Table 110). As Table 109 shows, Sagaing Division has the largest area of wheat, accounting for 70 percent of the total area. The most productive areas are Sagaing and Monywa Districts.

The domestic production of wheat is less than the demand, accounting for around 20 percent of total requirements (U Tin Htut Oo and Kudo 2003, pg. 123) and imports of grain and wheat flour are important to meet increasing demand for wheat flour products (see Table 112). Consumption rates are increasing, as incomes and dietary preferences change (see Table 112 and Figure 13).

While the cost of production of wheat has increased, the farm gate price has also increased (see Table 113). Despite this apparently profitability of wheat production, the profitability of competing crops like chickpeas is higher, and many farmer prefer to plant chickpeas rather than wheat.

In terms of production of wheat based products, most wheat flour is used in the manufacture of biscuits and noodles. The majority of enterprises are in the private sector, but there are several SOE factories producing these products. In terms of production capacity, approximately 90 percent comes from the

private sector while the state sector has the rest (ASR Field Team Interview 28 August 2003). Table 6 indicates that production of biscuits and noodles from SOE factories and Cooperatives ranges between 1-1.5 million tonnes per year for biscuits and under 0.5 million pounds (230 tonnes) for noodles.

3.6.2 Prices

The price of wheat-based processed food is influenced both by the domestic supply of wheat grain and by the amount of imports of flour, and interruptions in the import flow (Food and Agriculture Organization and Ministry of Agriculture and Irrigation 2000, pg. 66). Table 13, Figure 14 and Figure 15 show data for wheat prices in Mandalay Crop Exchange Center and Yangon Bayintnaung Market. Varieties of wheat like Myaung and Myinmu fetch higher prices than varieties such as Shan and Monywa. Prices have increased significantly since the beginning of 2001, compared to 2000. The average price for Myinmu was K6938 for a 60 viss bag in 2000, whereas in 2001 it was K15651. The variation in prices for all varieties has increased significantly as well. Prices for wheat flour in the Yangon market were around K30,000 per 25 viss bag in 2001, although updated prices from MIS are not yet available. While imported wheat is important for flour production, most millers and processors perceive that local varieties of wheat such as Myaung, Myinmu and Monywa produce higher quality flour for biscuit and noodle making. Generally these flours are mixed with imported flour to produce the desired qualities.

3.6.3 Trade and Marketing

MOI(1) is the ministry in charge of SOE biscuit and noodle factories (see Table 21). The Ministry of Industry No. 1 owned Foodstuffs Industries (formerly the Foodstuffs and General Merchandise Trade Corporation, FGMC) purchases wheat grain directly from farmers or through cooperatives for use in its flour mills. Private traders and flour-mill owners can also purchase wheat grain directly through the market. Flour milled by Foodstuffs Industries is either distributed to state owned processing factories or sold on the open market. In general, because wheat is not a controlled crop item, the government owned enterprises act like any other private enterprise and can purchase, distribute and sell wheat, wheat flour and wheat flour products on the open market (U Tin Htut Oo and Kudo 2003, pg 146-147). Imports of wheat and wheat flour are carried out solely by the private sector. Private millers note that it is moderately difficult to import wheat grain and flour, due to general government restrictions on imports and exports (ASR Field Team Interview 28 August 2003). One private miller interviewed noted that they plan to stop imports of wheat flour due to tightening import regulations and the increasing cost of imported flour, but would continue to import wheat grain for domestic milling purposes (ASR Field Team Interview 28 August 2003).

The majority of wheat used in Myanmar falls between 9-12 percent protein content (90 percent of wheat purchased for milling). Another 5 percent of wheat has protein contents above 12 percent, while the remaining 5 percent of wheat has protein contents below 9 percent. Most of the wheat imported is of the higher protein content, which is then mixed with locally produced wheat to the desired characteristics.

With domestically produced wheat varieties being of higher quality than imported wheat, Myanmar flour millers are able to import wheat grain and flour depending on price, rather than quality. As such, larger quantities of wheat are imported when US and EU export enhancement programs are in operation in the region (ASR Field Team Interview 28 August 2003).

There are two main varieties used in Myanmar, one suitable for bread making and the other for noodle manufacture. Wheat produced in Butalin Township, Monywa District is well known for its superior quality. The extraction rate is higher than other local varieties and is said to be better than imported Australian wheat. The Butalin wheat is sold straight to Mandalay market, where it fetches a premium

price of K50-70 (in 2000) over other types of wheat (Food and Agriculture Organization and Ministry of Agriculture and Irrigation 2000, pg. 66)

The busiest time of the year for millers is January to March, just after harvest. Millers sell flour to traders in the locality and to the bigger markets of Mandalay. Imported wheat flour and local flour are often mixed and sold with different brand names, the price varying with the quality of the flour (Food and Agriculture Organization and Ministry of Agriculture and Irrigation 2000, pg. 67). Industrial users of wheat flour (for biscuit and noodle manufacture) usually pay higher prices for premium brand flour due to the consistency of the flour. Smaller mills operate on the residual market, entering the market only when returns are economical. According to industry sources, even though the milling sector is top heavy (with the larger mills producing most of the flour), the industry is quite competitive since there are many small mills able to leverage any changes in market prices. However, the larger mills are more profitable due to their ability to hold stock. In some years the larger mills have actually purchased flour from the smaller mills for storage in their silos and waited until market conditions changed (ASR Field Team Interview 28 August 2003).

3.6.4 Processing Capacity and Efficiency

Wheat products utilized in Myanmar include wheat grain, fine and coarse flour, and semolina (U Tin Htut Oo and Kudo 2003, pg 142):

- Wheat grains are boiled and eaten for breakfast or a lunchtime snack with sugar or jaggery (rock sugar) in the northern parts of Myanmar. Wheat grains are also used in alcohol production.
- Fine flour is used for making quality breads, cakes, biscuits, crackers, noodles, pastries, and flat breads. It is also used in the preparation of soup, fries and curries, and is used for making glue.
- Coarse flour is used in the preparation of chapatti (flat bread) and is consumed by the large Indian population.
- Semolina is used for making "Sanwin-ma-kin", a soft cake served at parties, ceremonies and religious offerings.

Most of the flour mills in Myanmar are small mills, with very few large and medium size mills. According to one industry source, in Myanmar as a whole there are only 2 large commercial mills, less than 10 medium size mills, and over 100 small size mills (ASR Field Team Interview 28 August 2003). This corresponds to data from other sources, such as U Tin Htut Oo (2003, pg 148), who notes that there are two privately owned commercial size wheat flour mills in Yangon producing 25 different brands of wheat flour and in Mandalay, there are 127 privately owned small to medium wheat flour mills producing 16 different brands of wheat flour. Most of the processing plants produce noodles and assorted biscuits.

FAO (2000, pp. 43, 47) notes that Mandalay the Crop Exchange Center had 115 wheat millers as members in 2000. In Sagaing Division there are wheat mills in the industrial zone of Monywa and in Sagaing Town there is a wheat flour mill and a noodle manufacturing plant. The association of Traders and Millers of Monywa and Sagaing had 26 wheat flour millers and 8 wheat noodle processors as members in 2000.

Private milling factories are located mainly in Yangon and Mandalay, although the government does have their own wheat flour processing factories producing noodles and assorted biscuits (see Table 114). While the capacity of the state sector processing factories is relatively high, the utilization rates are uniformly low, with 4 out of the 6 mills listed in Table 114 having utilization rates below 35 percent. One of the mills listed in Table 114 has a utilization rate of 120 percent, presumably this factory purchases intermediate or finished products from other factories (either private or state) and sells it under its own name.

In the private sector capacity utilization is relatively high, running around 60-75 percent. One of the larger private mills interviewed in Yangon noted that they had just invested in new milling operations and consequently their utilization rates had fallen to 55-60 percent (ASR Field Team Interview 28 August 2003). This miller noted that they had the capacity to store around 35,000 tonnes of flour each year (54.3 percent as bulk in silos and the rest as bags in godowns). This equates to 26.3 percent of total supply of wheat (2001 data, see Table 112).

The ASR Field Team was unable to obtain information about recovery rates from milling operations due to the limited number of millers interviewed. However, FAO (2000, pg. 67) notes that recovery rates for milling varies between 63-67 percent.

3.6.5 Key Constraints

The key constraints for wheat processing include the relatively low levels of domestic production of wheat. In part this is due to the agroecological difficulties in growing wheat in Myanmar, but mainly it is due to the costs and returns to wheat versus other crops that are suitable to be grown in the same area. For example, profitability of wheat is around US$110 per acre while chickpeas' net return is around $212 per acre (on an FOB basis) (ASR Field Team Interview 28 August 2003). While large quantities of cheap wheat and flour can be imported, particularly if US and EU subsidies are operating, there is less incentive for domestic production of wheat.

However, domestic production of wheat is still currently profitable, due to general government restrictions on imports which affect imports of wheat and flour like any other commodity. As such, millers of wheat find it profitable to purchase domestic wheat while these restrictions are in place. While a competitiveness study of domestic and imported wheat grain and flour has not been done, the ASR Field Team notes that a general liberalization of the trading regime would have impacts not only on the competitiveness of domestic wheat production versus imported wheat, but also change the terms of trade for competing crops such as chickpeas.

In addition to the low levels of domestic production and the restrictions on imports, millers note that the difficulty in obtaining reliable and stable supplies of electricity is an important constraint on their milling operations. While larger mills are able to build their own sub-station, and get preferential access to electricity, smaller mills are significantly constrained in their number of hours of operation. Since these mills operate on the residual market, only operating when changes in relative prices make it profitable to mill wheat, this impacts on their ability to exploit sudden changes in prices and maintain competitiveness with the larger mills.

Domestic demand for wheat products is limited since wheat is not considered a staple food. Consumption of wheat is mainly for breads, biscuits, cakes and noodles, and consumers are price sensitive. With increases in incomes consumption should increase.

As with most commercial enterprises in Myanmar, the availability of credit is limited; particularly after the financial difficulties experienced in the beginning of 2003. Private banking operations have been suspended, but previously banks such as Asian Wealth Bank were involved in extending credit to millers (ASR Field Team Interview 28 August 2003). Other credit sources include Myanmar Industry Development Bank (MIDB), under MOI(2), which apparently can extend loans up to US$250,000. According to industry sources, at the peak of private banking operations, approximately 50-60 percent of agroindustry funding came from the commercial banks, which were able to loan up to US$1 million per loan, depending on collateral. In comparison, government banks were able to loan up to US$300-400,000. Available credit has fallen to around 30 percent of previous levels, and most milling operations have to use their own sources of capital, or delay payments to suppliers, in order to generate capital, which constrains the extent to which millers can expand (ASR Field Team Interview 28 August 2003).

Millers note that higher protein content wheat needs to be imported in order to blend with lower protein wheat from domestic sources. Part of the constraint to the domestic production of higher protein wheat is the limited availability and use of inputs such as fertilizer and irrigation, but part is also due to the varieties of wheat grown in Myanmar. Breeding and screening of different wheat varieties are carried out to a limited extent at CARI, but wheat has a lower priority for scarce research funds than other crops such as rice and pulses.

3.7. Pulses and Beans Processing

3.7.1 Production Trends

The pulse industry in Myanmar is very important, contributing to 72 percent of agricultural exports in 2000-2001. Approximately 34 percent of pulses were exported in 1999-2000, while around 80 percent of pigeon pea was exported (U Tin Htut Oo and Kudo 2003, pg 165). The area under pulses has grown rapidly from around 1 million hectares in 1990 to over 3 million hectares in 2001-2002 (see Table 11 and Table 16). While pulses comprise around 20.4 percent of the sown agricultural area in Myanmar (see Table 20), Black Gram and Green Gram are the major types of pulses grown.

There are around 22 different pulses grown in Myanmar, but black gram, green gram, pigeon pea, chickpea and cowpea are dominant species (see Table 117). As Table 115 shows, nearly 50 percent of the area under pulses is grown to black and green gram. The significant growth in production of black gram and green gram was due to their integration into rice production as a second crop following the monsoon rice in lower Myanmar. In the central region of Myanmar the area of green gram has increased following their integration into the upland rice and sesame production system as an early maturing legume crop during the late monsoon period (U Tin Htut Oo and Kudo 2003, pg 156).

Pigeon pea is mainly grown in the central dry zone region of Myanmar, and the production has increased due to its drought resistance and value as a source of fuel wood. Pigeon pea is normally intercropped with sesame. Chickpea and cowpea are mainly grown as a relay or sequential crop with rice, and there are some upland areas where chickpea follows sesame, maize and green gram. The major areas for chickpea are Sagaing and Mandalay, while cowpea is mainly grown in Magway.

FAO (2000, pp. 43-44) notes that the area of pulses in Magway Division is around 1.32 million acres, accounting for 22 percent of the total cultivated area. The main crops are pigeon pea, chickpea, green gram and cow pea. Pulses are intensively cultivated all over Magway Division, in Magway District, Pakokku District and Minbu District are the top three areas.

The government's 30 year plan for agriculture indicates that area under pulses is planned to increase by 27.5 percent (from just under 3 million hectares to 4 million hectares), while production will increase 52.5 percent (2.7 to 4.8 million tonnes) and yield will increase by 34.5 percent (0.77 to 1.18 tonnes per hectare), (see Table 14).

As a part of the staple diet, and due to their nitrogen fixing ability, pulses are grown widely in rotation with other crops. The main cropping systems under which pulses are grown include (U Tin Htut Oo and Kudo 2003, pg 156):

- A cash crop in a multiple cropping system.
- A contingent crop when the main crop fails, or could not be planted due to unfavorable weather,
- A main crop in a mono-cropped system in the central dry zone characterized by inadequate or erratic rainfall. and
- A cash crop under low external input conditions which has a high demand in the market.

3.7.2 Prices

Most of the pulses are traded in the Mandalay and Yangon markets. Data on prices for pulses in these markets are shown in Table 13 and Figure 25 to Figure 29. Prices have increased steadily over time, but have not experienced the dramatic increases shown in rice prices; mainly due to the relatively mature open market for pulses relative to rice.

Export prices for pulses are shown in Figure 29. Comparative prices for pulses on the Indian market are shown in Table 10. Prices for black gram have fallen significantly from an average of US$468 in 2001 to US$285 in 2003. Reductions in prices for green gram and chickpea have not been as drastic, while prices for pigeon pea have actually increased over the same time period.

3.7.3 Trade and Marketing

The market for beans and pulses was liberated a decade ago and the resulting growth in the sector has been rapid. In the ten years following liberalization, the total area sown to pulses and beans have expanded three-fold to more than 3 million ha, and total shipments reached 938,000 tonnes in 2002/2003.

The export of pulses has expanded rapidly, from only 71,000 tonnes in 1980-81 to 831,000 in 2000-01. Likewise the value of exports has increased from K152 million to K1658 million over the same period (see Table 7).

Exports of pulses were originally to India, but after this market collapsed Myanmar sought other overseas buyers. The Japanese market was key to the exports of pulses from Myanmar in the 1960's but this market was taken over by first Thailand and then more recently China (see Table 120). As noted in Table 8, Myanmar currently exports pulses to countries such as India, Indonesia, Japan, Bangladesh, Singapore, Hong Kong, Malaysia, Pakistan and Sierra Leone, while potential markets include Algeria, Djibouti, Egypt, Kenya, UAE and the Philippines. As Table 121 shows, Myanmar is the third largest exporter of pulses in the world, and it the largest producer in South East Asia (see Table 122). Prices for pulses from Myanmar vary according to the type, the quality, and the destination, as well as weather and general demand conditions. In general, prices for Fair Average Quality pulses range from US$170 to US$300 per metric tonne (see Table 123). Table 116 shows the export of agricultural commodities through Muse to China between April and August 2003. Most of the commodities are pulses, with a total value of over US$0.94 million (excluding soybean exports). Most of the pulses exported to China through Muse are green gram, in whole or partly processed form.

Most pulses are marketed by the private sector, which has been a major factor in the rapid increase in production over the last decade. In 1999-2001 the government attempted to procure pulses at fixed prices along the same lines as the paddy procurement scheme (Myanmar-Japan Cooperation Program 2002, pg. 106)[37]. This was abolished in 2002, with MAPT and MAS now exporting pulses purchased at market prices (see Table 118 and Table 119). FAO (2000, pg. 26) notes that there are about 20 big exporters of pulses and oilseeds, handling over 10,000 tonnes per year. The main destination is India,

[37] FAO (2000, pp. 72-76) notes that MAPT started to procure pulses (black and green gram) from farmers through a compulsory quota of 2-3 20viss baskets per acre, purchased at prices significantly below the market rates. Advance payments were made to farmers and an elaborate control system of farmers and traders put in place, involving much paperwork and roadblocks, which led to all kinds of efforts to escape these controls. Farmers that were unable to provide the quota were sometimes allowed to deliver paddy instead, or were required to repay their advance payments with interest. In some cases farmers were forced to repurchase their harvest from traders in order to deliver the required quota. The quota price in 2000 for green gram was K2200/basket, compared with K4000/basket on the open market. In comparison, black gram was procured at K1700/basket, compared with K3600/basket on the open market. While the procurement prices were significantly lower than the prevailing market price, these procurement prices were apparently set at close to the previous season's market price and thus had appeared attractive to those farmers who accepted the advance payments for their crop.

where fair average quality is acceptable. On the other hand, exports to Japan comprise very high quality pulses and oilseeds, mainly for culinary purposes rather than oil.

U Tin Htut Oo (2003, pp 161-162) notes that the type and quality of pulses demanded vary according to destination. For example, pigeon peas from Shewbo district are distinctive for their bright color and big and uniform size and are demanded by consumers in New Delhi. In contrast, pigeon peas grown in Mahlaing, Kyaukpadaung and Magwe are smaller in size, compact, are red in color and can be stored for longer; being preferred by consumers in Northern India and Bombay. Pulses are used for different purposes, such as artificial meat, curds, sauces and milks, used as snacks or used for oil extraction (see Table 124).

Domestic marketing for pulses is through a large network of small and medium size traders and wholesalers. For example, pulses grown around Pyay in Bago Division are transported to Yangon and Mandalay where they are cleaned and graded for export (ASR Field Team Interview 8 September 2003). Transportation costs vary depending on distance, ranging from K5000-5500 per tonne from Pyay to Yangon.

Due to the large number of traders in pulses it is difficult to get an idea of the size of the trade. The ASR Field Team interviewed a group of 7 traders in Pyay who formed the majority of those dealing in pulses in that township. They estimated that in Pyay the annual trade was approximately 20-30,000 tonnes of chickpeas, 10-15,000 tonnes of pigeon pea, 5-10,000 tones of black gram, 5,000 tonnes of lablab and 5000 tonnes of green gram (ASR Field Team Interview 8 September 2003). Operating costs was around K1000-1500 per tonne, with an average profit margin around 25 percent (including trading in rice and oilseeds). Those traders noted that the market for pulses in 2003 is not profitable, due to falls in wholesale prices while traders and purchased the farmer's harvest at a higher price. They noted that exporters in Yangon are willing to make a loss on the export of pulses since government regulations require importers to first export.

3.7.4 Processing Capacity and Efficiency

The extent of processing of pulses depends on their final use (see Table 124). Most of the pulses are exported as fresh produce, involving only limited grading and sorting. Machine splitting of husks is gaining popularity, although machine peeled pulses fetch less on the market due to the low levels of technology used resulting in damaged pulses (see Table 125). U Tin Htut Oo (2003, pg 162) notes that there are a few millers who process black gram, green gram and pigeon pea but more are involved in processing chickpeas, particularly around Sagaing and Mandalay. Most of the private enterprises who have installed cleaning and sorting equipment are involved in the export trade[38].

Pulses are normally packed into polyethylene bags (53-60 viss, 87-98 kg, depending on the density of the individual crop). Pulses for export are usually packed into 50kg (31 viss) bags. There are five big companies in Yangon involved in the export of pulses; Vitan (MSG Company), Seven Golden, Asia World, Green Mount and Shwe Tha Zin. As an example, the latter company uses cleaning machinery to produce export standard qualities (SQ - Special Quality, FAQ - Fair Average Quality, and FQ - Fair Quality). During the harvesting season (Feb-April) they work 2 shifts of 8 hours per day, preparing pulses for export to India, Singapore and Indonesia, as well as local sales to other exporters (Food and Agriculture Organization and Ministry of Agriculture and Irrigation 2000, pp. 72-73).

Processing of split gram to produce fried split gram and split gram flour to produce tofu and Vermicelli soup is important in Myanmar. Recovery rates are between 75 and 78 percent, depending on the size and cleanliness of the grains (see Table 126 and Table 127). All pulses can be used to make noodles, except soybean, lablab bean and horse gram (See Box 5).

[38] FAO (2000, pg. 77) notes that out of 6 wholesalers in pigeon pea interviewed, only one had cleaning facilities.

In 1998 there were approximately 32 noodle mills in Monywa, 2 in Mandalay, 2 in Shwebo and 2 in Bago (U Tin Htut Oo and Kudo 2003, pg 164). FAO (2000, pp. 43-44) notes that in Mandalay the Crop Exchange Center had 72 pulse processors as members in 2000, while Magway town had chickpea processing plants. In Sagaing Division there were 34 pulse processors who were members of the Monywa and Sagaing Association of Traders and Millers in 2000, while in Kanbalu Town in Sagaing Division there was one enterprise involved in splitting chickpeas. MOI(1) estimates that there are around 500 enterprises involved in pulses and beans processing (see Table 27 and Table 28). Although not stated, presumably these enterprises comprise large and medium size operations that have been registered with MOI(1) and do not include the large number of small operations scattered around the country.

FAO (2000, pp. 77-78) interviewed 6 chickpea millers, all of whom owned medium sized mills of 10-25 hp. Recovery rates ranged from 74-80 percent (see Table 127) and mills operated from 3-10 hours per day, depending on electricity supplies and raw material supplies. Most mills were kept running throughout the year, with the number of hours per day the highest just after harvest.

3.7.5 Key Constraints

Constraints in the pulse processing sector are relatively few compared with other agroindustrial sectors. The main reason for this is the lack of government involvement in production, processing or trading. Most of the pulses are not processed to any great extent, mainly husking and splitting seeds. Cleaning and grading are rarely done for domestic sales, with some cleaning and grading done for export quality pulses. As a consequence, except for splitting of pulses like chickpeas, most trade in pulses is of the unprocessed type. This has significant implications for the quality of pulses, and consequently prices able to be obtained in both the domestic and international markets.

Interviews with processors indicate that the major processing problem is the low level of technology used for processing, particularly husking and splitting machines. One chickpea processor interviewed indicated that they were aware of the technology required, but were unable to access information on where to obtain it (ASR Field Team Interview 11 September 2003). This appeared to be a common feature for a majority of agroindustrial enterprises interviewed by the ASR Field Team; awareness of the technology was not the problem, but access to information.

Access to stable and reliable supplies of electricity is another problem facing processors, but not as significant as for other industries. The storability of dried pulses enables processors to spread out processing as electricity supplies permit. However, the effects of prolonged processing times relative to the throughput of the enterprise has an effect on efficiency and profitability of those enterprises.

Availability of credit is a constraining factor on the ability of processors to modernize their enterprises. Most processors of pulses are relatively satisfied with the capitalization of their enterprise, in the context of their overall situation. However, if production levels were to increase, domestic and international consumers were to demand higher levels of processing and Myanmar were able to export more of their surplus, then capacity and capitalization would become a constraining factor. In the short term however, the processing capacity of the pulse industry is adequate to meet current demands.

3.8. Sugar Milling and Processing

3.8.1 Production Trends

The production of sugar and other sweeteners in Myanmar is of three types; modern (centrifugal) sugar produced from sugarcane, artisanal sugar (called Jaggery) also produced from sugarcane, and another

artisanal sugar produced from the juice of toddy palms (*Borassus flabellifer*, Linn) (Asian Development Bank 1995).

Jaggery (or Gur in India) is solidified and clarified cane juice: molasses does not appear as a by-product when it is made. It is hard, crystalline and has a color ranging from golden yellow to brownish yellow[39]. Different degrees and forms of solidification of jaggery are collectively termed as non-centrifugal sugar in the international market to differentiate it from the centrifugal sugar of which high-grade sugar crystals have been separated from molasses by centrifugal machine (U Tin Htut Oo and Kudo 2003, pg. 244).

In addition to cane jaggery, another source of non-centrifugal sugar is palm jaggery or Tanyet. It is obtained from the juice tapped from the inflorescence of the Palmyra tree (*Borassus flabellifer*, Linn). Palm jaggery is the indigenous source of sugar in Myanmar and jaggery manufacturing businesses are well established in Upper Myanmar. In contrast, cane jaggery is normally produced in Lower Myanmar (U Tin Htut Oo and Kudo 2003, pg. 244).

Under the MOAI, the Myanma Sugar Enterprise (MSE) is responsible for sugarcane procurement in order to supply raw materials to SOE cane factories at a fixed low price. The concentration of MSE sugar factories in the lower part of Myanmar since the early 1990s has driven private cane and sugar processing facilities (for jaggery) into Upper Myanmar and larger areas of sugarcane are now grown around Mandalay.

Jaggery production is usually carried out at the village level. Kudo (2003, pg. 99) estimates that there are around 3000 jaggery processing plants scattered in most sugarcane areas outside the state-owned mill areas. Most processing units have a cane crusher in a shed for extracting juice. Originally cane crushing rollers were made of wood but have been progressively replaced by iron rollers driven by either bullocks or small diesel engines of 10-20hp. The extracted juice is then placed in a jaggery furnace for boiling in an open pan. After reduction, the concentrated liquid is cooled and solidified into jaggery (U Tin Htut Oo and Kudo 2003, pg. 251). The resultant material, jaggery, molasses or rub sugar, is less perishable than sugarcane and can last up to 6 months.

As the sugarcane industry expanded, the use of jaggery has moved from small scale production for household use into the provision of a semi-finished product used as a raw material for centrifugal sugar production by SMEs.

The raw materials for sugar processing SMEs are locally called Thakaryi (liquid sugar), Pwet-yi or Pwet-thar in the markets. This is a syrup which is a concentrated sugar solution produced by evaporation of water from sugarcane juice. Boiling cane juice to about 60° brix produces syrup in the normal open pan process. This raw material is then sold to SME sugar factories for further processing. The sugar factories boil the raw material to over 82-83° brix in a vacuum pan produces a crystal and molasses mix called massecuite (U Tin Htut Oo and Kudo 2003, pg. 244). This is then processed into sugar crystals (see Figure 16).

Essentially, the private sugar processing industry revolves around the production of jaggery or molasses at farm level crushing plants (and thereby fulfilling the need to crush cane as soon as possible after harvest). The jaggery or molasses is then delivered directly to SME vacuum pan and centrifugal plants for processing into white sugar, or delivered to mini-centrifugal plants for intermediate processing into raw sugar (brown sugar), which can then be sent to SME processing plants for refining into white sugar. This complicated setup of intermediary processing plants is a direct result of the difficulties in sugarcane assembly and transportation and the need to crush cane as soon as possible after harvesting. For SOE mills under the MSE, factories process cane straight through to white and refined sugar using either a double sulphitation or double carbonation system (see Figure 17, Table 134 and Table 135). This is due

[39] In jaggery, sucrose content ranges from 65-85 percent, invert sugar from 10-15 percent, ash percentage 2-5 percent, moisture 3-6 percent, protein 0.25 percent, and insoluble matter 5 percent.

to their economies of scale and their ability to assemble and transport the large amounts of cane needed to feed their large scale milling operations.

The majority of sugarcane is produced in Mandalay, Bago, Magway and Sagaing Divisions and in Shan State. The area of production in 2001-2002 was around 163,000 hectares (1 percent of total sown area for agriculture and 20 percent of industrial crop area), and 7.116 million tonnes of cane was harvested in 2001-02 for an average yield of 43.7 tonnes of cane per hectare (see Table 20 and Table 140). This is an increase in the area under cultivation from 2000-2001 (343,000 acres or 138,812 hectares) and production (5.8 million tonnes of cane), although the yield remained the same (see Table 12). Table 131 and Table 132 give some indication of sugar production and area by State and Division over time and for Private versus SOE production. On average, sugarcane area under the control of the MSE is around 50 percent of total sugarcane area, while production is around 52 percent. The private sector thus provides half of the production of sugarcane and sugar.

Yields of sugarcane under the control of the MSE are significantly higher (20.2 tonnes per acre compared with 18.8 tonnes per acre on a national level)[40]. In part this is due to the ability of farmers to apply fertilizer since they receive some advance payment for their quota, but more importantly MSE pays for cane on the basis of weight rather than CCS; providing an incentive for farmers to grow cane to maximize weight rather than quality.

As Table 6 and Table 140 show, production of sugar by SOEs in 2000-2001 reached an estimated 80,000- 92,937 tonnes, around a 72 percent increase in production from the previous year[41]. This is a significant increase above the long term average of 45,400 tonnes per year from 1980/81-1999/00. MSE plans to increase the area of cane under SOE mill command areas to around 200,000 acres, of which some 80,000 acres will be under their procurement scheme (Lwin 2003).

As noted in Table 14, the 30 year plan for agriculture indicates a 66 percent increase in area under sugarcane cultivation (to 405,000 hectares), a 77 percent increase in production (to 25.4 million tonnes of cane), and a 32 percent increase in yields (to 62.7 tonnes of cane per acre). This is an ambitious target given the state of the international sugar market and the chronic under-utilization of the SOE milling sector.

3.8.2 Prices

Data on sugar prices are presented in Table 136, Table 137, Table 138 and Table 139. The SOE mills sell sugar at fixed prices which cover their operating costs but are significantly below the open market price for sugar (see Table 139). Domestic market prices of syrup for the major market in Mandalay are shown in Table 136. The data indicate that while average prices have been rising significantly over time (particularly since 1999), the variability in prices is relatively constant. Similarly, the prices for white sugar follow the same pattern; steadily rising prices with relatively constant variance (see Table 137).

Low government procurement prices for cane have meant that sugarcane production and the volume of sugarcane flowing to SOE mills have been lower than that expected in an open market. From the 2003-04 crop year MSE will be experimenting with increasing their procurement price to K3500 per tonne, up from the current K2500 per tonne (Lwin 2003). This scheme will be voluntary, and MSE will provide technical and material assistance to farmers in exchange for selling their crop to MSE at a reduced price.

Average international prices for sugar (Singapore market) are shown in Table 10. Over the last three years the international price has been falling, with current prices around US$217 per tonne. As Table 10 shows, the variability of prices in 2002 was significantly higher than that in both 2001 and 2003.

[40] Significantly different (P=0.000453).
[41] This latter figure is different from the 80,000 tonnes of sugar produced in 2000-01 shown in Table 140. Given the publication dates, presumably Table 6 shows an estimate for 2000-01.

International trading conditions are tight and US sugar policies are the primary driver of falling international prices.

3.8.3 Trade and Marketing

The marketing and trade flows for sugar in Myanmar are outlined in Figure 18. State sugar processing facilities are under the control of MOAI, although downstream users of sugar, like soft drink and beverage factories, biscuit factories and alcohol distilleries are under the control of MOI(1) (see Table 21). Under the MOAI, the Myanma Sugar Enterprise (MSE) is responsible for sugarcane procurement in order to supply raw materials to SOE cane factories at a fixed low price. The procurement system for cane by MSE is outlined in Box 8. While this system as outlined is the official plan, the reality is quite different, particularly in terms of scheduling cane arrivals at the factories. Most mills have difficulties in scheduling arrivals of cane, and often have to wait a week for sufficient cane to operate the crushing facilities.

Farmers in the designated zones are allocated a quota every year and are required to deliver this quota to MSE at a fixed price, usually below the market price. From the 2003-04 crop year MSE will be experimenting with increasing their procurement price to K3500 per tonne, up from the current K2500 per tonne (Lwin 2003). In exchange for the lower price farmers receive some advance payment for their crop. Due to the disparity between prices some farmers are reluctant to cultivate sugarcane and the MSE has difficulty in enforcing the contract (Myanmar-Japan Cooperation Program 2002, pg. 114).

Under the quota system, farmers are required to deliver a certain amount of cane to the SOE sugar factories under MSE and can then dispose of surplus cane as they see fit; usually for sale to jaggery processors. Cane procurement is based on a quantity of cane basis (tonnes of cane per acre), whereas jaggery sales are based on the quality and sugar content of cane. Thus most farmers tend to deliver lower quality cane to MSE and keep their best cane for sales to jaggery processors.

U Tin Htut Oo (2003, pg. 271) notes that it is customary for farmers to process the cane themselves (or under contract with a jaggery processor) and then sell the resultant syrup to jaggery processors. Processors usually take 40 percent of the syrup as payment for processing, and the farmer is free to sell the other 60 percent to dealers or SME factories. Most farmers take out loans with dealers or SME factories and thus deliver their product to them immediately after harvest, when the prices are at their lowest. U Tin Htut Oo (2003, pg. 272) notes that approximately two thirds of the syrup is processed by SMEs within the season, and the rest is reserved for processing during the off season. The amount stored by SMEs depends on storage and financial capacities.

In Upper Myanmar, the majority of the trade in sugar, molasses and jaggery is carried out under the auspices of the Sugar and Syrup Traders' Religious Association (formed to collect contributions from the members for annual offerings to the Buddhist Monks). This association runs a trading center in Mandalay where buyers and sellers come together and conduct private transactions. Samples of goods are displayed and after a transaction has been agreed the buyer collects the actual product from the sellers' warehouse, elsewhere in Mandalay. There are 1030 members of the Association, covering approximately 98 percent of the market in Upper Myanmar. Of the 1030 members, approximately 400 are producers of raw sugar (from molasses), 78 produce white sugar, and the rest are traders. The Association's market covers a sugarcane area of around 30,000 farmers on 150,000 acres (average 4-5 acres each with a yield of 15 tonnes per acre across 3 ratoons), involving the production of 120,000 tonnes of sugar (ASR Field Team Interview 12 September 2003).

Most of the trade in sugarcane and sugar products (molasses, jaggery etc.) is carried out by road transportation; particularly after the construction of the Moegoke-Thabeikkyin-Tagaung-Shweli Road in 2000. In the past most of the transportation had been by river-barge to Mandalay. In 2002 only 408.6

tonnes of syrup had been unloaded from barges at the Mandalay jetty (U Tin Htut Oo and Kudo 2003, pg. 274).

While the private sector has been prohibited from exporting sugar, the state sector is engaged in limited exports of white plantation and refined sugar. While exports of sugar are combined with "other agricultural products" in the CSO export statistics (and thus sugar export data is unavailable), Pyinmana Sugar Mill No. 2 indicated that they exported 52.46 tonnes of white sugar and 167.3 tonnes of refined sugar from the 2002-03 crushing season. Export prices were US$240 and 260 per tonne respectively, which were apparently breakeven for MSE (ASR Field Team Interview 18 September 2003)[42]. Current export markets for sugar are Sri Lanka, Singapore and China, although Indonesia, Japan, Malaysia and South Korea have been identified as potential export markets (see Table 8). U Tin Htut Oo (2003, pg. 271) notes that unofficial border trade in molasses and raw sugar occurs with China, and white sugar with India. This border trade is governed by the differences in exchange rate and appears to be an arbitrage market rather than a consistent export market.

Domestic consumption of sugar is relatively low; with per capita consumption of sugar estimated at around 4kg per head (see Table 140). This is significantly below international levels of, for example, 60kg per capita for Cuba (see Table 147). Most of the domestic sugar market involves sugar for manufacturing purposes, rather than direct consumption. The majority of sugar goes towards producing alcoholic beverages (Rum), condensed milk, biscuit and confectionary makers, and soft drink manufacturers. In Myanmar, jaggery is an important component of the diet and sweetmeats and cakes are prepared with jaggery in one form or another.

3.8.4 Processing Capacity and Efficiency

In the private sector the majority of sugar processing plants are open pan processing (for jaggery) or mini vacuum pan and mini centrifugal processing. The majority of the mini vacuum pan and mini centrifugal plants are based in Mandalay and Shan State, and process over 23,700 tonnes of sugar annually (see Table 128). These enterprises directly employ over 6300 people, with substantial numbers of people employed in ancillary services. In Mandalay (as an example), the majority of private milling operations are centrifugal; taking syrup or molasses from farm level processing units and extracting raw sugar for further processing (see Table 130). Those enterprises that can process to the white sugar stage are fewer, with around 5 large, 58 medium size and 15 small mills in operation (see Table 130).

Overall, the private sugar processing industry was estimated to produce 127,774 tonnes of sugar in 2001-02, compared with 115,655 tonnes from the state sector; the private sector having 52.5 percent of the market (see Table 129). The production of sugar from the state sector has increased in recent years, from below 55,000 tonnes prior to 1999-2000 to over 94,000 tonnes after 2000-01 (see Table 141). This has been due to the construction of 9 new mills under MSE which came online during the 2000-01 crop year.

Whereas the production of artisanal sugar continues to be carried out under private and cooperative arrangements, responsibility for the centrifugal sugar industry was handed over by MOI(1) to MOAI in 1994 (Asian Development Bank 1995). The Myanma Sugar Enterprise (MSE) was constituted to undertake and coordinate the cultivation and processing of sugarcane and the production and marketing of sugar and its byproducts. In 1995 the MSE had eight factories located in Mandalay and Bago Divisions (2 factories each), and in Kachin, Shan, Mon, and Rakhine States (one factory each). In 1995 the combined processing capacity of the factories amounted to 9100 tonnes of sugarcane per day, or 91,000 tonnes of sugar per year from 1.4 million tonnes of cane during a 5 month processing season (6.5 percent recovery). Actual production during the early part of the 1990 ranged between 19,000 - 53,000

[42] These prices are highly surprising; given that the highest sugar prices in Singapore averaged US$217 in 2003 and US$224 in 2003, see Table 10.

tonnes of sugar, reflecting the enormous challenges faced by MSE in terms of production agronomy, input and raw material logistics and processing and marketing (Asian Development Bank 1995).

By 2000-01 there were 17 mills in the state sector with a total crushing capacity of 4 million tonnes of sugar over a 160 day season (see Table 134 and Table 135). Presently there are 18 mills in operation, with a plan to construct an additional 20 mills over the next 25 years (ASR Field Team Interview 26 August 2003). According to MOI(1), there are around 819 SME sugar mills in Myanmar (see Table 27 and Table 28[43]). These do not include the numerous small sugar and jaggery processing plants that are scattered across the country.

As noted above, the total crushing capacity of SOE mills is around 4 million tonnes per year. Actual sugarcane processing by SOE mills in 2002-2003 was around 0.93 million tonnes, or 23 percent of capacity. As Table 134 and Table 135 show, the majority of SOE mills produce white sugar (only two are producing small quantities of refined sugar), with an average maximum capacity of 1500-2000 tonnes of cane per day. The amount of refined sugar produced is minimal, and mainly destined for the export market[44].

The performance of SOE and private milling operations are detailed in Table 142 and Table 143. Overall, SOE mills appear to be running at around 28 percent capacity, recovering 8.5 percent of cane as white sugar and 4 percent as molasses. Sugar recovery rates are estimated at around 8 percent for the state sector and 4 percent for the private sector (see Table 129)[45]. The lower recovery rates for the private sector appear to be due to the predominant use of open pan technology for the manufacture of jaggery rather than vacuum pan and centrifugal technology used by more modern mills. The use of open pan technology results in lower recovery ratios due to the high temperatures used in evaporating cane juice in small scale milling operations. In contrast, the recovery rate of around 8 percent for more modern mills is still significantly below best practice, and is predominantly due to the delays in crushing cane. In a significant number of cases SOE mills have to wait for up to a week before they receive enough cane to operate their mill for at least one day's crush. This lack of capacity utilization, and the consequent implications for economic viability of the SOE mills is disturbing, even more so considering that the 8 mills that were in operation prior to the big expansion of milling capacity in 2000 were in fact only operating at 37 percent of capacity themselves (see Table 134, Table 135 and Table 142).

Although the cane season is officially around 160 days, most SOE mills are operating for significantly less time, as evidenced by the underutilization of capacity[46]. As an example, Pyinmana Sugar Mill No. 2 only operated for 68 days during the 2002-03 season due to lack of cane supplies (see Table 146). In contrast, private milling operations are usually over 140 days per year, and usually average 180 days (see Table 143).

As Table 129, Table 144, and Table 145 indicate, cost of production for SOE mills is around K104/viss compared with K250/viss for private milling operations[47]. For the SOE mills, the major cost of

[43] These data also give an indication of the number of downstream enterprises dependent on sugar as raw material inputs. For example, there are 496 confectionary enterprises and 107 soft drink manufacturers who are dependent on sugar inputs.

[44] Discussions with Pyinmana Sugar Mill No. 2 indicated that they produced 167.3 tonnes of refined sugar for export in 2002-03, out of a total 6772 tonnes of sugar (2.5 percent). The amounts of refined sugar produced are minimal, due to the significant amounts of energy needed to refine the white sugar (18 September 2003).

[45] In contrast, Australian sugar mills obtain a recovery ratio of 13.3 percent, with a yield of 82 tonnes per hectare (33 tonnes per acre).

[46] It is noted that the 8 mills purchased from China and commissioned in 2000 (see Table 135) are not only milling less than 3 months a year due to shortages of cane, but are also virtually defunct with a lack of spare parts and inappropriate milling technologies.

[47] These data refer to the 2000-01 cropping year and may be substantially higher now. ASR Field Team interviews with a private SME sugar mill, a private min-centrifugal (molasses to raw sugar) operator and Pyinmana Sugar Mill No.2 indicated that their cost of production was K240/viss, K213/viss, and K143/viss respectively (ASR Field Team Interviews, 12 September 2003 and 18 September 2003). Again, Pyinmana Sugar Mill No.2 operating costs were priced at government rates for inputs.

production is the cost of purchasing cane (44 percent of total cost), followed by transportation cost (14.5 percent). The cost of transportation is extremely high, and reflects the difficulties SOE mills have in obtaining cane from scattered smallholders. The above data implies that SOE mills are more efficient than the private sector, since their cost of production is lower. While it is true that recovery ratios of sugar are double that in the SOE sector, the SOE cost data are significantly biased by the use of official government input prices. Supplies of sugarcane, fuel, lubricants, spare parts, transportation, labor costs, and electricity (as examples) are obtained at prices significantly below market rates. While neither SOE nor private mills appear to take capital depreciation into account, those private mills that have current loans outstanding do take into consideration interest repayments, while SOE mills do not. Overall, the costs of production of SOE mills are likely to be significantly above that of private milling operations, making it unlikely that they would be competitive in a deregulated environment without significant changes to their operating policies.

3.8.5 Key Constraints

As far back as 1995 the ADB (1995, pg. 48) noted that there is a shortage of equipment and power for timely land preparation and for cane transportation, lack of suitable planting materials, fertilizer and agro-chemicals; lack of water for one or two irrigations in the latter part of the dry season. In the case of processing, the principal constraint has been the shortage of foreign exchange for the importation of spare parts, supplies and materials and replacement equipment. As ADB (2002, pg. 16) notes, although most SOE factories have become obsolete, they have adequate capacity to meet the existing demand for processing of sugar. However, their processed products often have low quality and cannot meet the standards for exports.

The key constraints facing the SOE sugar industry in Myanmar are outlined in Figure 19. The initial constraints include the high production cost of cane and the low purchasing price for cane, resulting in farmers being reluctant to provide sufficient quantities of cane to the factories. In addition, the scattered nature of production under smallholder control is the opposite required for a well functioning industrialized production process. Combined with a lack of adequate transportation infrastructure, the delays in getting cane to the mills mean that the quality of the crushed cane is significantly deteriorated.

The major constraints faced by the private sector processing plants are, firstly, access to sufficient supplies of raw material and, secondly, access to reliable supplies of electricity.

The open pan (OP) technology utilized by the jaggery and molasses processing plants at the farm level are more efficient than the SOE mills due to the logistical constraints of getting cane from the field to the sugar mill. Around 14.5 percent of the cost of production for SOE mills is the cost of transportation. This is minimized for OP plants who only have to transport cane a short distance to the processing plants, before transporting much less jaggery or molasses to SME plants for further refining. While this low level of technology has its advantages, including an indigenous manufacturing base, low capital requirements and ease of use, it also has some disadvantages. Firstly, this process is a batch process and is not suited to continuous cane supplies. Secondly, the yields of sugar from this process are around half that of the SOE milling sector. This is due to the high temperatures used in boiling the juice in the open pan (resulting in high levels of inverted sugar). In conjunction with this is the large amounts of fuel (wood and charcoal) needed to run the boilers in the mini vacuum pan and centrifugal processing plants further down the chain, compared with SOE mills which are able to use Bagasse. Finally, the quality of sugar produced by this method is inferior to that produced by SOE mills.

Despite the better recover ratios obtained by SOE mills, the recovery ratios are still far below international standard. This can be attributed to firstly, the significant delays in processing cane after harvest, as well as poorly maintained and obsolete equipment and processes in SOE mills. Not only are recovery ratios low, but the quality of sugar obtained is barely sufficient to meet the low end of the

international market. While this may be sufficient to cater for the domestic market, the opportunities for export expansion are limited in the medium term until quality can be improved.

However, while the above problems indicate significant technological issues that need to be addressed, U Tin Htut Oo (2003, pg. 279) correctly highlights the role an appropriate legal and policy framework plays in addressing fundamental constraints in the private sugar milling industry. The reliance on OP and mini-VP technology is a direct result of the infrastructural constraints involving the assembly and transportation of sugarcane, as well as risk reduction strategies on the part of private processors. The ability of processors to upgrade and modernize their equipment does not (per se) involve the creation of new technologies (they are already well known), but the institutional and legal framework to facilitate private entrepreneurs' access to markets, capital and existing technologies.

3.9. Agricultural Machinery Production

3.9.1 Production Trends

Most of the agricultural draft power provided in Myanmar is provided by livestock; cattle and buffalo. The average farmer owns 2-5 cattle. Cattle and buffalo are used in harrowing, plowing, leveling, threshing and rural transportation roles[48]. In 2002 the estimate of the number of working cattle and buffalo was around 8 million head, covering 12.42 million hectares (an average of 3.07 hectares per pair of oxen) (Myanmar-Japan Cooperation Program 2002, pg. 146). On an individual crop basis, Table 148 shows that around 18.8 percent of the cropping land planted to the major crops was covered by machinery in 1997-98. This apparently increased to 24 percent in 2000-01[49] and the MOAI plans to increase the coverage of machinery to 63 percent of crop land by 2030-31 (Myanmar-Japan Cooperation Program 2002, pg. 146).

There are two ministries producing agricultural machinery; MOI(2) and MOAI. Under these ministries are several different enterprises and departments who are producing farm machinery. MOI(2) is responsible for producing tractors, power tillers, threshers, disc harrows, disc ploughs and machine parts. MOAI is responsible for producing power tillers, reapers, threshers, trailers and machine parts. There are also several small private manufacturing enterprises who are producing farm implements for sale, mainly based around Mandalay, see Kudo (2003) and Table 151.

The Agricultural Mechanization Department (AMD) was established in 1972 and distributed more than 4000 tractors to agricultural cooperatives up to 1980-81 under an installment payment scheme. This scheme was disbanded due to the high level of defaulters and from 1988 AMD started selling machinery to private traders and farmers in order to speed up the mechanization process. At present there are 99 tractor stations (retail outlets), 5 farm machinery factories and 1 farm machinery plant under AMD, with another factory due to come on line in late October 2003.

The actual official production of agricultural machinery is relatively difficult to estimate, given the predominance of the different ministries and SOEs in manufacturing these machines and the lack of consistent statistics on production output from different enterprises. Official production statistics are given in Table 6. Estimation of total supply is also extremely difficult, considering the lack of sharing of information between different government agencies involved in the production of machinery (for example the AMD and MOI(2)), as well as the private enterprises involved in production, assembly and

[48] The importance of draft power in agricultural production is recognized by the government, with regulations preventing the slaughter of draft animals under the age of 16 and the ban on exports of draft animals. Of course, this is more honored in the breach than compliance, with large numbers of cattle being exported across the borders to Thailand and China and draft animals being re-designated as "meat cattle" before slaughter.

[49] AMD estimates that in 2002 there was 1.5 million acres of land plowed by four wheel tractors, of which 0.94 million was plowed by privately owned tractors, and a further 1.68 million acres plowed by private two wheel tractors (with no government owned two wheel tractors used). This equates to 3.18 million acres of land, being 20.8 percent of total cropping area.

importation of agricultural machinery (see Table 151 and Table 152). According to official statistics from CSO, the stock of four wheel tractors in Myanmar in 2001 was around 11,000, while the stock of two wheel tractors (16hp power tillers and 6 hp power reapers) was around 42000 in 1997-98 (see Table 149 and Table 150). AMD themselves estimate that the stock of two wheel tractors is around 70,000 and four wheel tractors around 9000 (ASR Field Team Interview 26 August 2003). AMD indicate that they have a fleet of 3,500 four wheel tractors (50-80hp) and 40 Korean made Combine Harvesters available for rent. AMD is also attempting to make their own Combine Harvesters, using Chinese technology, and so far 20 have been manufactured and are also available for rent[50].

Of course it is extremely difficult to estimate how many of the existing farm machines are still in service, considering AMD estimates that the power tillers can be used for only two years before parts need to be replaced. In terms of annual output of new machinery, AMD indicates that they have four factories producing 6000 2 wheel tractors, (16hp power tillers), and AMD's Farm Machinery Factory at Kyaukse will produce 10,000 power tillers and 5000 power reapers annually when it comes on line in late October 2003 (ASR Field Team Interview 26 August 2003).

Imports of farm machinery are difficult to gauge, although the Border Trade Department does keep some records of imports. Between April and August 2003 the Border Trade Department at Muse recorded just over 990 two wheel tractors and accessories imported from China, see Table 180 (ASR Field Team Interview 14 September 2003).

3.9.2 Prices

Due to the nature of the product being sold, prices are relatively stable and do not change much over the year. AMD farm machinery is sold through 99 AMD tractor stations throughout the country and sells power tillers for around K0.9-1 million. The factory gate price is around K750,000; a margin of 20-33 percent (ASR Field Team Interview, 17 September 2003). The current price of paddy threshers is around K0.6 million.

Imported machinery is more expensive, with power tillers priced at K1-1.2 million each. The price differential between domestic and imported machines is due to quality differences, although AMD does not appear to fully cost the domestically manufactured machines (ASR Field Team Interview, 26 August 2003).

AMD does rent machinery to individual farmers and cooperatives, in direct competition with the private sector. AMD rents their 4 wheel tractors to farmers for K1500 per acre tonne. This just covers fuel and lubricants and does not cover the full cost of the tractor usage. In comparison, private entrepreneurs charge K2500 per acre tonne. AMD also rents their Combine Harvesters to farmers for K2500 per acre. Again, this covers the cost of fuel and lubricants, but not the full cost of rental (ASR Field Team Interview, 26 August 2003).

3.9.3 Trade and Marketing

Presently land preparation and threshing of paddy constitute major usage in farm mechanization, while machinery for transplanting and harvesting are gradually being introduced. AMD distributes farm machinery through its 99 tractor stations throughout the country. MOI(2) also distributes its farm machinery through AMD tractor stations.

[50] AMD's rental charge for their 4 wheel tractors is K1500/acre tonne, compared with private sector charges of K2500/acre tonne. The AMD charge only covers fuel and lubricant costs. For their combine harvesters the charge is K2500/acre, again only covering marginal costs. Threshing machines are produced by the private sector after AMD stopped production in the mid-1990s. The private sector rental charges are around K50-70 per basket of paddy, depending on locality, cost of fuel, labor and weather conditions.

As noted above, AMD and other government departments also hire farm machinery, particularly tractors to farmers and farmer cooperatives. This rental scheme mirrors that provided by the private sector; where farmers or entrepreneurs who have machinery rent them out to other farmers.

Imports of farm machinery from China, Korea, Japan and Thailand through cross-border trade and through Yangon port contribute to the pool of machinery available from the private sector. As noted above and in Table 180, between April and August 2003 the Border Trade Department at Muse recorded just over 990 two wheel tractors and accessories imported from China (ASR Field Team Interview 14 September 2003).

3.9.4 Production Capacity and Efficiency

The production capacity of the state and private sector is difficult to estimate. While data exist for AMD fabrication plants, see Table 152 and Table 153, there is limited information available about private sector manufacturing (see Table 151). AMD has the ability to produce nearly 14,000 power tillers and 5500 power reapers per year. However, 10,000 of the power tillers and 5000 of the power reapers are supposed to come from the newly commissioned factory at Kyaukse which is yet to start operations. ASR Field Team Interviews with factory personnel at Kyaukse indicated that they themselves were unsure of their budgetary allocations for raw material purchases, most of which need to be imported. As such, the capacity utilization of this factory is under question, particularly as AMD does not appear to know how much demand there is for their equipment (ASR Field Team Interviews, 26 August 2003 and 17 September 2003).

Storage capacity for AMD machinery is significant, with 8000 power tillers (or equivalent) able to be stored at the Kyauske factory and at depots in Mandalay and Yangon. Additional storage space is available at the 99 tractor stations based around the country; indicating that close to a single year's production is able to be stored. Obviously this has implications for how changes in demand are passed through to the supply side.

The efficiency of domestic production of farm machinery was unable to be ascertained, as neither AMD headquarter staff or factory personnel were able to provide cost of production data. The impression obtained by the ASR Field Team was that fixed costs were not included in cost calculations, and that official government prices for raw material inputs, fuel and spare parts etc was used to obtain an ex-factory price of machinery that was far below its true economic cost of production. This is particularly worrying as the ex-factory price of farm machinery is only slightly less than the price of imported machinery, indicating that under full economic costing of domestic production it would not be able to compete with imported machinery. This is more so as Myanmar may have a comparative advantage in labor intensive industries but it is doubtful that it would have such an advantage in capital intensive industries such as machinery manufacturing plants.

3.9.5 Key Constraints

The plan by MOAI to expand mechanization to cover 63 percent of crop land by 2030-31 is an ambitious program hampered by the high cost of machinery, the limited supply of machinery (both imported and domestically produced) and the lack of adequate demand analysis. While mechanization of agriculture is still extremely limited, most smallholder farms are able to utilize draft power to meet their tillage requirements. As noted in the ASR Working Paper No. 2 on Crop Production, in most areas there are adequate oxen in good condition to cope with cultivation demand and in cases where farmers have mechanized it is has mainly been for convenience and speed rather than because of a lack of available power. Most farmers cannot afford to purchase machinery outright, and are either forced to form groups with other farmers or rent machinery from private contractors. The supply of spare parts is

limited and fuel constraints are critical. As such, it is doubtful whether the current level of demand for farm machinery reaches the level of supply of machinery from SOE machinery manufacturing plants combined with private sector and imported machinery. As noted in the ASR Working Paper No. 2 (Crop Production) prepared by the ASR Agronomist, the lack of farm power is not considered a major constraint at this time, and thus farm mechanization not an issue of the highest priority.

Myanmar-Japan Cooperation Program (2002, pg. 147) notes that the lack of capital is a major constraint for farmers wanting to purchase agricultural machinery. There are few financial institutions providing loans for equipment purchases, particularly after the recent financial crisis. MADB is unable to generate enough capital to extend their lending products to sufficient number of farmers, particularly for equipment purchases.

Currently, farmers are faced with purchasing either equipment manufactured within Myanmar, or imported from China, Korea, Japan and Thailand. There does not seem to be any study looking at the preferences of consumers (i.e. farmers) for the type of machines, the desired functions or the quality they wish to purchase. Most of the machinery produced within Myanmar is from low quality materials using outdated production technology from China (including the new AMD factory at Kyaukse).

On the supply side, manufacture of machinery is hampered by the need to import raw materials such as steel plate and pig iron as well as semi-manufactured parts that are unable to be fabricated in Myanmar. Such material needs to be imported using scarce foreign exchange. Combined with the distinct possibility that domestic SOE manufacture of farm machinery is uneconomic when full costs of production are calculated, it is uncertain what benefit accrues from investment in an import-substituting industry without any comparative advantage in the foreseeable future.

However, significant underutilization of land, both in terms of cropping intensity and extensification, is in part due to the lack of mechanization. This is particularly the case with households with land holdings over 2 hectares in size, where double oxen draft power is not sufficient to till the whole land holding. This in turn has significant implications since the 1992/93 Agricultural Census estimates that the average farm size is 2.5 ha and 54 percent of farmers out of a total of 2.72 million agricultural land holdings have less than 2 ha; occupying 21 percent of cultivated land. The potential for mechanization is therefore the potential to reach 46 percent of farmers, covering 79 percent of the 15.5 million acres of cultivated land.

As noted in Section 3.9.1, considering that some 21-24 percent of cultivated land is covered by machinery (around 3.18 million acres), even if in the short to medium term only a modest additional 10 percent of farmers were able to effectively and efficiently use mechanization, and only an additional 10 percent of cultivated land was suitable for mechanized tillage services using power tillers and reapers, this would equate to some 270,000 households, and 1.55 million acres of land. Considering domestic SOE manufacturing capacity for agricultural machinery is only some 21,000 machines per year, it would take nearly 13 years of production for the SOE factories to satisfy this additional demand. Considering the stark disparity between the relatively limited production capacity of the domestic machinery sector, and the potential domestic demand for machinery, it is surprising that there is limited evidence of widespread demand for machinery purchases. While several untested hypotheses can be put forward (lack of credit, lack of appropriate machinery, low quality of available machinery, lack of fuel and spare parts, sufficient availability of draft power, etc.) there remains scope for further research into the reasons for a demand, or lack of demand, for agricultural mechanization amongst farmers in Myanmar.

3.10. Fertilizer Production

3.10.1 Production Trends

The domestic fertilizer industry in Myanmar is concentrated around the production of urea fertilizer from the abundant sources of natural gas in the country. Smaller amounts of compound fertilizer, bio-fertilizer and foliar fertilizers are produced by both SOEs and private companies from imported materials. In the state owned sector there are three urea plants run by Myanma Petrochemical Enterprise (MPE), producing around 160,000 tonnes per year (see Table 154, Table 158 and Table 166)[51]. These three plants have a total capacity of 425,000 tonnes per year. As Table 166 shows, the demand for fertilizer outstrips domestic production, and large quantities of fertilizer are imported (see Figure 21).

Urea fertilizer production is carried out under MOGE, who also imports urea fertilizer through MPPE (having taken over the MOAI import license in 2002). In addition to MOGE, MOAI imports fertilizer through its various departments; MAS, MSE, MCSE, MJE, MFE and MPCE for example. These enterprises import fertilizer for their own crop production programmes. In addition to MOGE and MOAI, there are several other ministries and enterprises importing fertilizer. The Ministry of Defense through Myanma Economic Holdings imports fertilizer for its military farms, and the Cooperative Department is also involved in fertilizer imports.

The main types of fertilizer imported are Urea, TSP (GSSP and GTSP mixes) and Muriate of Potash. There are several government and private fertilizer companies who are involved in both the importation of fertilizer as well as the manufacturing of compound fertilizer from imported raw materials. Common compound fertilizers include 15-7-8, 16-16-16, 16-16-8, 10-10-5, 12-8-0, and 12-13-0. Most of the compound fertilizer produced is either 15-7-8 (for paddy), 10-10-5 (for legumes), or 16-16-8 (general use)[52].

Apart from MPE urea production data, there is very little information available on the amount of domestic fertilizer produced in Myanmar[53]. The ASR Field Team was able to interview several private companies producing compound fertilizer and bio-fertilizer, and the foliar fertilizer plant at CARI. As Table 166 and Figure 20 shows, production of urea from MPE fertilizer plants has been relatively stagnant over time.

In terms of private production of compound fertilizers, there are relatively few enterprises who are involved in production, as opposed to simply importing compound fertilizer. The ASR Field Team was able to identify one private enterprise in Yangon (Golden Lion), and two enterprises in Mandalay (Sun Company and 5 Chain Company) that are producing compound fertilizer[54]. There are several other companies which are just importing compound fertilizer. A typical enterprise making compound fertilizer is producing between 1000-2500 bags of fertilizer per day, and 100,000-250,000 bags per year (5,000-12,500 tonnes per year). For the three companies identified above, total combined production is approximately 22,500 tonnes per year.

[51] The Sale fertilizer plant notes that they produced 11,000 tonnes from plant A and 14,150 tonnes from plant B in 2002-03. The Kyawzwa plant produced 29,000 tonnes. The total target for all three plants (including Kyunchaung) is said to be 200,000 tonnes, although even running the Kyunchaung plant at maximum capacity of 70,000 tonnes will only achieve 125,150 tonnes (Oilcrop Sector Development Project Formulation Mission, September 2003).

[52] Of particular interest is the question of quality control of fertilizers. ASR Field Team Interviews with MOAI officials indicate that fertilizer samples sent to the PDD for analysis (those imported through Yangon Port) meet all quality specifications and officials can't recall any major case of the quality of the sample diverging from that stated on the shipping manifest. Schuurman (1994) indicates that the MPE urea factories analyze samples from every shift in their own laboratories and that they meet the required specifications. ASR Field Team Interviews with private fertilizer producers and traders indicated that there was some difference in the quality of fertilizer brought into Myanmar through the cross-border trade, but that this quality was reflected in the difference in price (i.e. there was no difference in quality compared with the stated specifications). In summary, despite the almost universal complaints from farmers in S.E. Asia about contaminated and "fake" fertilizer, the ASR Field Team could not find any obvious evidence of this claim. Having said that, MOAI officials did say that there was no concerted laboratory testing regime to analyze fertilizer samples offered for sale in the local markets.

[53] There are significant discrepancies between domestic urea production data depending on the source of the information.

[54] Domestic production of compound fertilizer will have already been included in any official import statistics through the import of raw materials - urea, TSP and potash.

In addition to compound fertilizer production, there are apparently many small cottage factories that are producing bio-fertilizer (compost and loam), in addition to one or two larger companies; such as Supreme Enterprise in Yangon and the Too Bwa Man Company in Mandalay which produces "Bullock Cart" Brand of bio-fertilizer using waste water from alcohol factories mixed with soil and imported chemical fertilizers (ASR Field Team Interview 12 September 2003). Both Supreme and Too Bwa Man have just started, or about to start production and thus actual production data is not available, although Too Bwa Man's plant has a capacity of 100 tonnes per day. Bagasse is also used in the production of fertilizer-compost mixes, where the composted Bagasse is mixed with chemical fertilizer. Approximately 100,000 tonnes of this is produced each year (ASR Field Team Interview, 15 October 2003).

The ASR Field Team understands that there are several companies both importing and producing foliar fertilizer domestically, but the team was not able to obtain information on these companies in the short time available to them. CARI itself is involved in commercial production of foliar fertilizer, as well as rhizobium inoculants production for legume crops. The CARI foliar fertilizer plant started production in 2001, and is currently producing 1 million 0.5l bottles per year of "Bio-Super Foliar Fertilizer". This is produced from groundnut or sesame cake (depending on availability) and mixed with chemical fertilizer and micronutrients (see Table 160). The rhizobium plant started production in 1978 and is currently producing 250,000 packets (100g per packet) which can inoculate 250,000 acres of pulses and beans (see Table 161 and Table 163).

3.10.2 Prices

Before 1993-1994 fertilizer prices were heavily subsidized by the government, which has since removed the subsidies on all but the MOAI subsidized crop production carried out by the individual enterprises under MOAI. Subsequently, the market prices have risen to international levels (see Table 167, Table 168, Table 169 and Table 176 to Table 178) and the government has also allowed the private sector to import and distribute fertilizer. Despite the increases in prices, few private sector companies are willing to import and distribute fertilizers due to government restrictions on imports through their trade policy[55,56]. While open market prices reflect world prices, MAS, MSE, MCSE, MJE, MPCE and other government agencies (such as MAPT and some cooperatives) are still providing fertilizer to selected farmers at subsidized rates. There is a distinct lack of information available at the central level on how much fertilizer is distributed, at what price, and to whom. Some scattered and inconsistent information on quantities and prices of fertilizer distributed by MAS is presented in Table 155 to Table 168, but information on other government agencies' distribution of fertilizer is not available.

Table 169 shows that there are a wide range of fertilizers available on the open market. While there are large quantities of fertilizer available from the Middle East and ASEAN countries, most of these are imported through the Port of Yangon, while much larger quantities of fertilizer from China are available in Mandalay and distributed throughout Northern and Central Myanmar.

[55] As noted before, importers have to export first and use their export earnings to import goods on the "A" and "B" schedules.

[56] Discussions with some government officials indicate that in addition to production of urea, MPPE also imports urea. With the official domestic cost of urea being significantly below that of the imported urea, there is a question of why MPPE would find it advantageous to import more expensive urea. The explanation is somewhat convoluted, but a simple example illustrates the situation. Say that the domestic cost of urea is K2000/50kg bag while the cost of imported urea is K10000/bag. By combining the two sources of urea together, MPPE can average the price at K6000/bag and provide this “subsidized” fertilizer to farmers. This explains to a certain extent fertilizer trader’s stated reluctance to get involved in imports of urea fertilizer whenever the government decides to import a shipment of fertilizer. Some traders are in regular contact with MAS to find out when the next government shipment is in order to organize their own shipments around this (ASR Field Team Interviews 28 August 2003 and 15 October 2003).

Fertilizer utilization is obviously dependent on price in an open market. With the significant increases in fertilizer prices over time it is probable that the demand for fertilizer has decreased significantly (see Table 166, Table 167, Table 168 and Table 169). Farmers purchasing power for inputs has been eroded by increasing costs of production (increases in input prices) while output prices have remained stagnant (particularly for prioritized crops which are subject to price controls). For those crops not on the priority list (for example high valued pulses, fruits and vegetables and culinary crops) anecdotal evidence suggests that fertilizer use has increased dramatically, along with yields.

3.10.3 Trade and Marketing

MAS is the largest procurer of fertilizer under MOAI. The Procurement and Distribution Division of the Myanma Agriculture Service (PDD-MAS) is responsible for providing fertilizers and pesticides to farmers for subsidized crop production. The main functions of the PDD includes the purchase of local and foreign agricultural inputs, the timely distribution of farm inputs to farmers, and the prevention of damage to farm inputs during their transportation (see Figure 24). Irrespective of the origin of fertilizer, the majority of the fertilizer distributed by MAS is channeled through 6 main depots; Thazi, Paleik, Sale, Kyawzwa, Kyaukphu and Yangon (Myanmar-Japan Cooperation Program 2002). From these depots the fertilizer is transferred to sub-depots and then onto the respective townships for distribution to farmers through the extension service. Distribution of fertilizer to the different regions is carried by the extension service, with most of the fertilizer being distributed to the delta region for paddy production (see Table 170 to Table 174).

Despite market liberalization in 1988, there are few private companies involved in the production, procurement and distribution of farm inputs (Asian Development Bank 2002, pg 13). The government monopoly on fertilizer supply and distribution was discontinued in 1990, but MAS and other MOAI enterprises still provide some fertilizer to selected farmers under its priority crops input subsidization program.

The amount of fertilizer distributed by PDD fluctuates from year to year depending on their budget allocations for local and imported fertilizer (see Table 156 to Table 167). The amount of fertilizer distributed to farmers by MAS peaked at 349,000 tonnes in 1994-95 and then declined to 219,000 tonnes in 2000-2001. As Table 166 shows, the amount of fertilizer distributed by MAS is less than the total amount utilized. Farmers are able to procure fertilizers on the open market from private traders who source fertilizer from imported raw materials (to make compound fertilizer), or from imported fertilizer.

With the advent of trade liberalization policies in the late 1980s and early 1990s the government initiated some measures aimed at promoting the supply and utilization of chemical fertilizers. One of these measures involved the elimination of taxes and import and export duties in 1992-93 on agricultural commodities (although a 10 percent export tax still remains on all exported items), and another involved the elimination of broad-scale subsidies on fertilizers in 1992 (although subsidized fertilizer is still available through MAS). With a severe shortage of foreign exchange, impacting on the government's ability to import fertilizer, the government instituted a Revolving Fund in 1992. This revolving fund used the foreign exchange obtained from exports of agricultural commodities such as rubber, cotton, sugar and pulses etc to purchase fertilizer and other "strategic" goods. While this fund was discontinued in 1996, the practice still continues today, with the requirement that 80 percent of export earnings has to be used to import "priority" goods; of which fertilizer is one.

While such trade polices have broader, macro-level effects on resource allocation and pricing, the effect of such policies on fertilizer demand and supply is unclear. On the one hand, it would be expected, *inter alia*, that this would result in an over-supply of fertilizer and a consequent reduction in price. However, market prices still appear to reflect world prices, and ASR Field Team Interviews with fertilizer producers and traders indicated that the production and import of fertilizers by the private sector is

contingent on the volumes of fertilizer produced, purchased and distributed by the state sector. With large quantities of subsidized fertilizer leaking onto the wholesale market in Yangon and Mandalay, market prices are affected and profit margins squeezed[57]. The end result is that less fertilizer is imported than would be the case in a completely open market, and it appears that importers prefer to import other items on the priority list, rather than fertilizers. Ultimately, farmer demand for fertilizer drives the supply of fertilizer, and this depends on the ability of farmers to obtain a high enough price for their output to justify increasing inputs.

Imports of fertilizer are from several sources; imports through Yangon port (see Table 179), sourced from countries such as Bangladesh, Viet Nam, Indonesia, Saudi Arabia and the UAE, and imports through cross-border trade (China and Thailand). While the Border Trade Department keeps accurate records[58] of the imports of fertilizer coming across the border (see Table 180), and these are forwarded to their higher level authorities in Yangon, it does not appear that these data are included in the CSO statistics for imports[59]. Interviews by the ASR Field Team with relevant government authorities indicate that the CSO statistics only record the fertilizer procured and distributed by MOAI under their subsidized inputs scheme and the amount of fertilizer used by selected farmers under the subsidized inputs scheme. Imports of fertilizer through cross-border trade, imports by other government departments and SOEs (other than MAS) and imports by private enterprises are not included in the CSO data[60].

As noted above, irrespective of the importing enterprise the imports of fertilizer are only through several channels. The Port of Yangon is the main channel through which fertilizer comes. This is followed by the township of Muse in North Shan State (fertilizer from China) and to a lesser extent across the border from Thailand through Tachileik in Southern Shan State and Myawaddy in Kayin State. Imports of fertilizer from India and Bangladesh across the border are unknown, but MIS notes that some urea fertilizer from Bangladesh is delivered to the Pyay market and then transported to Yangon, Mandalay and Magway markets (Market Information Service 2003; 2003; 2003)[61].

The ASR Field Team was able to talk with several private fertilizer traders, one of whom was the major trader in the Bago West Division (distributing around 100,000 tonnes in 2002-03). Fertilizer is sourced from the main wholesale centers in Yangon and Mandalay, with sub-centers in major Division and State cities and capitals. At the township level fertilizer sales are done on an individual farmer basis; the farmer contacts the trader and arranges a delivery of fertilizer at the nearest roadhead to the farm by

[57] This is despite overall volumes of state distributed fertilizer being relatively small, due to the lack of foreign exchange and budget needed to purchase and import fertilizer.

[58] The ASR Field Team conducted extensive interviews with Border Trade Department Officials, Traders, Farmers and local MAS officers on the topic of cross-border trade and fertilizers. At least in the case of Muse Township in North Shan State, the consensus is that all fertilizer coming across the border destined for areas other than Muse and its surrounding farming community is checked at 105 Gate just outside Muse and there are no alternate routes for large trucks to pass. Since imports of fertilizer are not subject to tax, there are no substantive financial incentives to avoid passing through the customs check at 105 Gate. Therefore there is a high probability that data recorded by the Border Trade Department at Muse is an accurate reflection of fertilizer imports from China. Having said that, the data presented in Table 180 show the imports of fertilizer for the first five months of the 2003 financial year. The Border Trade Department was unable to provide data on a historical basis, but said that imports over the rest of the year are negligible. One trader in Lashio claimed that he imported 40,000 tonnes in 2002, and that the trade was somewhere between 120,000-150,000 tonnes per year (ASR Field Team Interview, 14 September 2003).

[59] While each of the various ministries, departments and enterprises collate their own statistics on fertilizer imports and utilization, these are not aggregated by CSO. Under MOAI each of the departments and enterprises reports to the Minister of Agriculture on a weekly basis the year-to-date imports of fertilizer. However, these data are for internal use and are not forwarded onto CSO.

[60] Despite not being included in CSO data, information on non-MAS imports through Yangon Port is actually collected by PDD because firms wishing to import fertilizer must submit a sample to PDD for laboratory testing; the import source, importing firm, quantity of the shipment and technical parameters being recorded on the laboratory report.

[61] At least in the case of India, there is no evidence of Indian fertilizer for sale in the big wholesale markets of Yangon or Mandalay. In the case of Bangladesh, there are significant volumes of rice being unofficially exported from Myanmar, and this indicates well established transportation routes from Sittwe, particularly since Bangladesh is a major producer of urea fertilizer, given it significant resources of natural gas.

truck. Transportation from the roadhead to farm is by tractor and cart or bullock cart. Margins are slim, between 1-4 percent, depending on the fertilizer price and volumes sold (ASR Field Team Interview 8 September 2003).

Given that the total cropped area in 2000-2001 was about 15.4 million hectares, the average official consumption of fertilizer for all crops is estimated at 14kg/ha. As noted above, these figures only refer to the fertilizer used for the MAS subsidized inputs scheme[62]. CARI estimates that farmer application rates are around 185kg/ha of fertilizer in paddy (see Table 164), provided fertilizer is applied at all. In contrast, official recommended application rates for paddy are 2 bags of urea per acre, 1 bag of triple superphosphate, and 0.5 bags of Muriate of Potash, equivalent to 432kg of fertilizer per hectare. In 2000-2001 about 82.7 percent of fertilizer was used for paddy (average application rate 30kg/ha), and only cotton, jute, rubber and sugarcane received significant amounts of fertilizer (see Table 166 and Table 176 to Table 178). In sum, estimates by MAS suggest that only 0.1 percent of fertilizer requirements for rice production are supplied by domestic production and imports by MAS, although the amount of fertilizer imported by other agencies and the private sector would increase this percentage (ASR Field Team Interview, 19 August 2003).

As noted above, most of the fertilizer procured by MOAI for distribution to farmers under their priority crops program has been for paddy production under the MAS (see Table 155, Table 159, Table 162, Table 166 and Table 176 to Table 178). Despite reaching only a small proportion of farmers involved in crop production, the data, at least on the surface, appear to lend support to the idea that MAS has been effective in increasing crop yields in paddy production (see Figure 22). However, there is a distinct lack of information available to draw any firm conclusions about the causal relationships, and the ASR Field Team notes from Table 155 that the major boost in productivity occurred in the late 1970s and early 1980s, when Green Revolution HYVs and the "Whole Township Special High Yield (SHY) Program" was introduced. From the early 1980s until the present, paddy yields have been relatively stagnant[63]. As Figure 23 shows, increases in fertilizer utilization have been associated with the Whole Township Special High Yield Program in the early 1980s and the Summer Rice Production Program in the mid 1990s. While the former program did result in some increases in overall yield, the latter program involves intensification of rice production into a double cropping system. There is no expectation that yields would be increased, merely that overall production would increase. CARI itself notes that the move towards a rice-rice production system without a rotation involving either fallow or legume crops has resulted in a decline in soil fertility with a consequent reduction in yields for the second crop (ASR Field Team Interview 17 September 2003).

While caution should be used when drawing a link between selective subsidized intervention and overall crop yields, and despite the lack of growth in paddy yields, there does appear to be a relationship between increasing fertilizer use and increased crop yields in Myanmar; particularly for those crops not under the prioritized crops scheme[64].

3.10.4 Production Capacity and Efficiency

Domestic production capacity for chemical fertilizer is limited to three government owned urea plants, and small amounts of triple super phosphate, rock phosphate and gypsum. Apart from the urea plants, domestic production of the other chemical fertilizers is limited, and of low quality (ASR Field Team

[62] The subsidized input scheme would not cover large areas of cultivated land in any case and therefore the figure of 14kg/ha is somewhat misleading as to the true fertilizer usage rates.

[63] This is shown in Figure 22, where the trend line including 1977-78 data shows a slightly significant upwards trend, but is not significant when the 1977-79 data is excluded. Regression coefficients (yield = f(constant, trend, ln(fertilizer)) indicate that both fertilizer use and a time trend are significant when all the data is included (p=0.006 and 0.008 respectively) but only the time trend is almost significant when the 1977-79 data is excluded (p=0.058 and 0.182 respectively).

[64] To be more specific, crops not under the priority crops scheme are subject to market forces, and there is an incentive for farmers to maximize returns by applying more fertilizer.

Interview, 19 August 2003). The three urea plants are under the control of MPE. These were built in the 1970s and are effectively obsolete. Production of urea is stagnant, even though there is excess capacity in these plants (see Table 154). The urea plants rely on supplies of natural gas as their key input, and natural gas production is under the control of the MOGE. The MOGE prefers to export natural gas in order to obtain much needed foreign exchange, and thus supplies of gas to the urea plants have been decreasing.

The ASR Field Team did not have enough time to visit MPE and the urea fertilizer plants, and so detailed cost of production data was not obtained. As such, the efficiency of the state sector in fertilizer production cannot be estimated. However, it is generally accepted that the 3 urea plants operated by MPE are obsolete, run-down, lacking in spare parts and running at below capacity, see U Nyi Nyi (2002). Maximum capacity of the three plants is around 425,000 tonnes per year. Using actual urea production data in Table 166, capacity utilization averages 35.5 percent over the period 1980-2001. It is probably a fair assumption to make that at 35.5 percent of capacity these plants are not running at minimum cost and that, based on observations the ASR Field Team has made of other SOEs, the primary constraint is a lack of raw material and an absence of production decisions made on the basis of market demand conditions.

There are several private companies who are involved in the production of compound fertilizer from imported raw material, as well as companies involved in the production of bio-fertilizers and foliar fertilizers. Most of the private companies contacted declined to provide detailed cost data, but one did indicate that their profit margins were around 11 percent. One of the advantages that private companies have over the SOEs is that they actually take into consideration profitability and consumer demand when deciding investment decisions[65], whereas the SOEs attempt to maximize output; usually without much success, given their chronic levels of capacity underutilization.

3.10.5 Key Constraints

Despite a lack of competition in the fertilizer market, most enterprises are finding it difficult to achieve profitability. For the fertilizer industry the major constraints differ depending on whether the firms are SOEs or private enterprises. For both types of enterprises the major constraints are the lack of reliable supplies of electricity and the lack of demand for their relatively expensive products.

For SOEs, the chronic underutilization of existing capacity is a function of the difficulties in purchasing raw material inputs, not only of fertilizer precursors but of spare parts and consumables. The main cause of this is the lack of foreign exchange to purchase inputs that have to be imported, and the lack of local currency to purchase domestically sourced inputs as well as to convert to foreign exchange. This is a direct consequence of the low prices set for SOE products, as well as an obvious lack of demand despite the lower prices[66].

For private enterprises, the main constraints other than those mentioned above are the difficulties in importing raw material inputs. Unlike SOEs which have difficulty in obtaining the foreign exchange,

[65] Storage capacity does not appear to be a problem for fertilizer enterprises interviewed by the ASR Field Team. Most private enterprises noted that if demand increased and they needed to store more fertilizer it was relatively easy to find additional storage space.

[66] In terms of the CARI foliar fertilizer plant, there is a distinct lack of capacity to enable them to produce their stated maximum capacity of 3 million bottles per year. This is similar with the Rhizobium inoculation facility, which only has 4 small fermentation tanks. Having said that, the demand for their products has not been assessed - either by the ASR Field Team or in fact by CARI themselves. The ASR Field Team has serious concerns about the safety of workers in the CARI foliar fertilizer plant, given the highly corrosive nature of the foliar fertilizer mixture and the lack of adequate protective equipment for the staff. Most of the steel supporting structure in the plant has been badly affected by corrosion and the fermentation tanks themselves show evidence of corrosive leaks - and subsequent spot welding patches.

private enterprises have difficulty with the regulations governing imports and exports[67]. Those companies wishing to be involved in the fertilizer import business must have another business dealing with exports. The Myanmar-Japan Cooperation Program (2002) report noted that demand for fertilizer is highly seasonal and thus the attractiveness of investment is lower than for other industries.

In terms of policy, while the government has recently enacted the Fertilizer Law (2002), this mainly deals with the regulations pertaining to obtaining licenses to produce or import fertilizer, and labeling and quality control issues. A more pressing problem lies with the difficulties in monitoring fertilizer inflows considering the many different agencies are involved and the proper scheduling of fertilizer imports to meet seasonal demand. Currently, government imports of fertilizer are not synchronized with cropping patterns, leading to imports of fertilizer at the start of harvesting, rather than the start of the planting season (ASR Field Team Interviews 15 October 2003).

For farmers, the ratio of fertilizer prices to crop prices is high, meaning that there are fewer incentives for farmers to apply more fertilizer in order to boost yields (see Table 56). Coupled with the low quality of agricultural products grown in Myanmar, this means that the prices on the domestic and international market act as a disincentive for producers to increase production by applying more fertilizer. This is illustrated by the low quality of Myanmar rice and the consequent low price it receives on the international market compared with pulses; which receive a high price on the international market and consequently farmers are more willing to apply higher levels of fertilizer.

Perversely, the change in the rice procurement scheme for the 2003-04 crop year has meant that farmers are applying less fertilizer than under the restrictive quota system that previously prevailed. The main reason for this is that under the previous scheme farmers were paid in advance for some of their quota deliveries, enabling them to purchase fertilizer. Under the present scheme farmers do not get access to this money and so do not have enough spare cash to purchase fertilizer.

Overall, the key constraints are institutional and policy orientated, rather than technical. With the exception of urea, Myanmar does not have enough supplies of raw materials to produce chemical fertilizer and thus is dependent on imports. The regulatory regime applying to imports acts as a clear disincentive to private enterprises wishing to enter into the fertilizer industry. Conversely, the state clearly does not have enough financial resources to provide enough fertilizer to meet domestic demand. With the removal of the compulsory rice procurement scheme (and its replacement with compulsory procurement from traders and millers), there is even less justification for state involvement in controlling crop production and fertilizer inputs. Fertilizer inputs should be seen from the perspective of being essential for improved crop production, and thus regulations which restrict its free movement should be dismantled.

[67] One private fertilizer company interviewed said that they wanted to set up their own quality control lab and had imported the necessary equipment from China. However, due to import restrictions the equipment has been held up at the border for the past 3 years; since they have already purchased the equipment they can't return it to the supplier.

4. Key Constraints to Sectoral Growth

The key constraints to sub-sectoral growth have been highlighted in the relevant sections above. This section attempts to synthesize common themes and constraints that affect the agroindustrial sector as a whole.

The majority of constraints affecting individual agroindustries are common to some extent. These include constraints on input supply, factory operations, investment and maintenance of existing processing machinery, processing output, and the marketing of output (see Table 181). Some constraints impact more on SOE operations, while others impact more on private operations.

For example, the high cost of processing is related to not only the high cost for raw material input but to the cost of consumables, lubricants, spare parts and energy (electricity and fuel). The vast majority of those individuals and enterprises interviewed by the ASR Field Team noted that access to reliable and stable supplies of electricity was the most important constraint.

Access to raw material inputs was also an extremely important constraint, and arguably more important that electricity supply or access to fuel, depending on the ability of enterprises to process all inputs that they acquired. The ease of access to raw materials depended not only on whether the enterprise itself was SOE or private, but also on what industry was involved. Those industries with more government involvement in production, procurement and distribution (for example cotton and sugarcane) had much more difficulties in obtaining raw materials. The main reason for this was the low procurement prices offered to farmers, with the consequent reductions in supply. Private enterprises involved in such industries found it difficult to access raw materials, usually due to some sort of government restrictions on private sales by farmers (such as in cotton), and they also found it difficult to compete on the output market due to low sale prices posted by government enterprises.

Difficulties in accessing raw material inputs, unreliable supplies of electricity and problems in purchasing spare parts and fuel manifested itself in extremely low levels of capacity utilization. SOEs had greater difficulties in utilizing their available capacity than private enterprises, while those SOEs that had undergone recent upgrading had the lowest capacity utilization of all. For example, in cotton ginning, capacity utilization averaged less than 24 percent for 5 gins visited by the ASR Field Team, and 4 of those were operating at less than 8 percent (see Table 89).

A fundamental issue with the problem of access to raw materials is the low level of production of major crops used in agro-processing. As shown Table 3, over 40 percent of arable (farming) land in Myanmar is classified as cultivatable wasteland; located particularly in the dry zone area. Unless government agricultural policies are conducive to creating an investment climate favorable to increased crop production, the issue of raw material supply will continue to be the key constraint to improvement in agroindustry. This means that the problems of increasing efficiency, modernizing processing plants, increasing output and improved marketing are irrelevant unless this production problem is addressed first.

In addition to constraints on the input side and processing operations, most enterprises visited by the ASR Field Team identified marketing issues as a problem. For those enterprises operating solely in the domestic market, marketing information was an issue. The ASR Field Team notes that FAO's Market Information Service Project TCP/MYA/8821 has addressed this problem by developing a Market Information Service within the MAS. However, circulation of the MIS newspaper is limited to around 7000 copies, and distributed to MAS officers and major centres like Yangon and Mandalay. For those enterprises involved in the export of processed agricultural policies, the biggest issue was the government policies on import and export, and the lack of transparency, timeliness and consistency of regulations concerning which products could be exported at any particular time. As an example of this

latter point, Both FAO (2000) and the ASR Field Team itself interviewed traders who had received export permits, loaded their trucks and drove to the border gates only to find that the commodity in question had been banned in the intervening period.

While it is understandable that the government wishes to maintain low prices for urban consumers as well as ensure food self sufficiency, restricting the export of high valued crops is less welfare enhancing than a policy that allows the export of high valued crops and the import of lower valued crops which can then be afforded by poorer elements of society.

The relative importance of some of the key constraints in the agroindustrial sector in Myanmar have been identified by Myanmar-Japan Cooperation Program (2002) in a survey of 620 food processing industries, see Table 182. The majority of respondents indicated that the unreliability in electricity supply and availability of fuel (such as diesel and fuel oil) was limited and of high cost (75 and 45 percent of respondents respectively). While private sector operations in Myanmar face high energy costs relative to the government sector, prices are significantly below world prices. Nearly 81 percent of respondents surveyed by Myanmar-Japan Cooperation Program (2002) noted that the procurement of raw materials was difficult due to price fluctuations, but that provided price was not an issue only 15 percent indicated that irregular supplies of raw materials was a problem. The majority of respondents indicated that a lack of foreign exchange meant that securing supplies of imported spare parts was difficult, leading to difficulties in maintenance and modernization of equipment. Almost 62 percent of respondents indicated that there was a problem with getting access to modern equipment.

Surprisingly, access to credit was not seen by agroindustrial enterprises as being as important as the constraints listed above and in Table 182. Most did not see this as a problem, due to limitations on input supply and underutilization of existing capacity being a binding constraint on operations before credit availability became an issue. To a large extent this was a reaction to the lack of credit availability; if there was no credit available then entrepreneurs were restricted to either funding operations themselves or through informal credit arrangements. If entrepreneurs could not afford to expand or modernize their operations then they were content to operate at the existing capacity.

In terms of access to energy, most enterprises interviewed by the ASR Field Team noted that they would be willing to pay extra (or invest in their own sub-station) if they could get access to reliable supplies of electricity. While noting that there was a disparity between what the private sector and the government sector pays for electricity, the cost of electricity in Myanmar is significantly below that in neighboring countries. As Table 183 and Table 184 show, Myanmar is investing heavily in new power generation projects, mainly hydroelectric power, but existing power infrastructure faces problems with reliability. Nearly 2060 MW (9800 GWh) of new power generation equipment is due to come onto the national grid between 2003 and 2006. This will complement the existing capacity of 1172 MW (5000 GWh). In other words, electricity generation in Myamar is set to almost triple in capacity to 3200 MW (14800 GWh). However, the existing national grid still faces line losses of over 24 percent, and it is unknown what the government plans are to increase the efficiency of the existing infrastructure.

While the majority of these constraints appear to be technical constraints, able to be solved by technical solutions, the key constraints are in fact institutional and policy ones. Excess capacity and obsolete machinery, high cost of processing and shortage and cost of spare parts and other inputs can be better addressed by tackling the issues of incentives and institutions; topics discussed in the next section.

5. Policy Implications, Opportunities, and the Role of the State and Private Sector in Agroindustrial Development

5.1. Policy Implications for Agroindustrial Development

The largest proportion of agricultural investment in Myanmar has focused on improving production technology, for example through improved irrigation systems. Much less attention has been devoted to the chain through which agricultural commodities and products reach the final consumers within the country and abroad. Yet, post-production activities offers the opportunity of generating higher value-added than production activities. In some industrialized countries, post-production activities provide 80 percent of total value added in agricultural products.

Postharvest activities are important for all agricultural commodities. In the case of grains (rice and maize), activities such as drying, storage, milling, grading, and packaging contribute to reduction of losses, increase of labor productivity, and higher prices in international markets. Even though the quality of rice exports has increased over the years, still there is room for considerable improvement, particularly related to variety selection, storage, and milling. In the case of perishable commodities such as pulses, fruits and vegetables, and animal products, the scope for improvement is even larger. Perishable products require more sophisticated handling, storage, processing, transportation, and quality assurance systems than grains.

Besides storage losses, other aspects of postharvest systems contribute to the final value added of agricultural production. For example, Viet Nam has been quite successful in technology development of the small driers for paddy that now are disseminated in other countries in Asia through IRRI. In Myanmar, the quality of rice exports has improved in terms of percentage of broken grains. While in 1999-2001 only some 63-66 percent of exports were of whole rice, the percentage rose to 83 percent in 2001-02 (see Table 54). Yet, despite these successes, there are many limitations due to technological aspects and a weak link between development of technology and marketing, particularly marketing of products for exports.

Quality assurance systems are needed to improve penetration and market share of Myanma products abroad. As supermarkets increasingly dominate the global agroindustry at the retail stage, the requirements of high product quality become more and more pressing. Grades and standards imposed by other countries often represent a barrier to trade for those countries such as Myanmar that cannot meet these quality requirements. This is more the case for perishables such as fruits and vegetables, and animal products, than for grains such as rice.

Postharvest research is still very limited in Myanmar. The private sector is virtually absent from it, and the public sector is grossly underfunded. Under-funding and organizational problems contribute to the weak capacity of researchers to contribute to the development of postharvest systems. Not only this will have negative effects on the export competitiveness of Myanmar agriculture, but also it will constrain domestic demand for products that are safe, high value-added, and convenient.

As Shown in Table 24, food and foodstuff manufacturing dominate with 51 percent of the number of establishments followed by textiles and garments (7.8 percent), construction materials (6.5 percent) and Mineral and petroleum products (5.86 percent). In total about 59 percent of all industries are based on domestic natural resources related to agriculture.

Private sector agroindustry is the major source of employment and income generation in agroindustry. Less than 1.5 percent of total employment in food processing industries is generated by SOEs and cooperatives (See Table 26). Yet, the allocation of state budget and credit is heavily biased in favor of agroindustrial SOEs.

Much agricultural growth in developing countries is linked to food processing. On average, in high-income countries, processing of food, beverages and tobacco accounts for 13 percent of value added from manufacturing activities, while it accounts for 30 percent in developing countries (see (World Bank 1995)). In most developing countries, agroindustrial products are the major products exported, frequently accounting for half of the exports.

Evidence for food processing in Myanmar, where it is a large and growing industry, seems to confirm these general statements. In 1989-99, value added in this sector was estimated at about 85 percent of industrial GDP (see Table 25). Moreover, the sector's contribution to GDP appears to be growing. In 1961-62, it represented just 60 percent of industrial GDP, but by 1991-92 it was 79 percent of industrial GDP. This is in the face of stagnant growth in the industrial sector itself, which contributes just 12 percent of GDP (see Table 4).

Food processing enterprises have less fixed capital than other enterprises in Myanmar and they are generally more profitable. In fact, the food processing sector is large, profitable, and growing. This illustrates some of the risks in assessing the potential of an economic sector based on its level of capital-intensity. It is striking that successful enterprises are not necessarily those with the most modern and technologically advanced equipment. Rather, the successful ones are those that are skilled at finding new and better ways to do something: the coffee producer who realizes he can save money on transportation by filling the truck for the return trip to Mandalay, the seafood processor who works to develop relationships directly with fish traders instead of wholesalers, or the vegetable exporter who accepts a loss on one shipment in order to maintain his reputation for reliability with the importer. “Modern” machinery is almost always more efficient from a technical point of view, but to be efficient from an economic point of view it must justify higher costs. Certainly, additional equipment is needed in many cases, but it will do little to improve the economic performance without strong management, responsive marketing skills, adequate training, and a good incentive structure.

The distribution of firm size in food processing and agroindustry in general, suggests that there is a dichotomy between large enterprises, usually SOEs and the vast majority of private micro and small enterprises. Such distribution indicates the existence of constraints that the private sector in rural areas face in maturing from the stage of micro enterprise to the stage of medium and large enterprises, mostly because of limited access to raw materials, credit, technology, and markets.

Given that low levels of agricultural production can be addressed by appropriate policies at the farm level, probably the next most binding constraint for agroindustry is limited access to credit for small and medium enterprises. The consequences of this bias against SME in the rural agroindustry are perhaps less understood. The allocation of credit to large and inefficient enterprises has not only negative effects on efficiency, but also on employment generation and on the growth of agriculture. Because of its close links with agriculture, agroindustry development can contribute to the growth in production and income of farmers.

In a study of the starch processing industry of Viet Nam, Goletti, Rich and Wheatley (2001) show that the injection of credit to small and large enterprises has markedly different effects. Income growth of the overall sector, as well as farmers’ income and processors’ income would be higher if the credit were given to the small rather than to the large enterprises. The main reason behind this striking result is the higher output-capital ratio of small enterprises. With limited amounts of capital equipment, small enterprises can employ their labor more efficiently than larger enterprises, find market niches, and adapt more flexibly to new environments. This is not to say that credit should be selectively extended towards certain sectors of the agricultural sector, or to certain sectors of the economy, but rather credit should be available to whoever can utilize it most effectively.

Given the conditions of Myanmar rural economy, with a land distribution characterized by small farms, an underdeveloped infrastructure, and a distribution of industry dominated by small enterprises, a broad-based approach to agroindustry development (see (Goletti and Samman 2002)) may be more adequate

than a large-enterprise model to respond to the challenges or rural poverty. The broad-based approach recognizes the scope for economies of scale in the long-run, but it is also aware that in the short and medium term transaction costs, niche markets, and intra-industry linkages might actually make small and medium enterprises more conducive to growth than larger enterprises.

The limited importance of SMEs in Myanmar is highlighted by the small size of the private corporate sector. In manufacturing (the part of industry that includes agroindustry), in Table 29 only 1.22 percent of all companies belonged to the medium size sector, while for food processing only 18 enterprises (1 percent) were classified as medium size. Between the millions of household enterprises and the large SOE, there is a gap. This is the gap of the SME belonging to the corporate sector, a sector that is still largely underdeveloped in Myanmar, despite its high potential to become an engine of growth.

The most important binding constraint on agroindustry development in Myanmar is in fact distortionary and often conflicting policies promoting the development of individual commodities and sectors over others, while at the same time preventing the proper operation of the market and distorting market signals to producers, traders and processors.

As an example, Thien (2003) identifies several issues in the new rice policy which conflict with the government's stated goals, namely the desire to maintain low consumer prices while simultaneously increasing producer prices, the subsidization of urban consumers through implicit and explicit taxation of the rural sector, the desire to stabilize prices while removing government controls on pricing policies, and the desire to maintain domestic consumption levels while relaxing controls on rice exports. The difficulties in determining appropriate producer and consumer prices, and the calculation of the costs incurred by a trader in the export market for reimbursement by the government under their new export tax system, are likely to be large. Thus serious concerns remain about the feasibility and the appropriateness of certain government policy reforms and objectives; particularly in the context of the general macroeconomic environment.

Myanmar-Japan Cooperation Program (2002, pg. 110) notes that policies encouraging regional self sufficiency, especially for areas traditionally in rice deficit, distorts the overall market price and while reducing rice prices, actually imposes not only an implicit taxation on farmers in surplus areas but increases the economic cost of production of farming in rice deficit areas. Likewise the policy of price stabilization by increasing production actually has counterproductive effects if the export of rice is still restricted. Myanmar-Japan Cooperation Program (2002) notes that increasing the opportunity for exports will result in not only obtaining much needed foreign exchange, but allows the domestic price to be stabilized (relative to the world price) by varying export quantities in line with domestic market equilibrium and international market conditions.

World Bank (1999, pg. 52) notes that the pre-2003 system of rice procurement only taxed price-producing land and not other agricultural land, and is inefficiently collected in the form of physical procurement of rice that gives farmers an incentive to supply their lowest quality rice which then becomes the stock available for export. They recommended that this system should be replaced by the direct purchase of rice by MAPT at market prices at the wholesale level, combined with an explicit land tax system levied in cash. This would able MAPT to control the quality of the rice that it receives, and would be substantially more efficient as MAPT would not have to procure small quantities of rice from a large number of farmers. As the World Bank points out, this would increase the total procurement cost significantly.

While the government has actually gone past several aspects of the World Bank policy recommendations, such as the elimination of procurement of rice and the replacement of rations for targeted groups with direct cash payments, this does not address the inefficiencies of the SOE mills versus the private sector mills.

The state procurement system for rice was a very expensive operation to run, with costs being borne not only for administration; but for procurement arrangements from farmers; enforcement of contracts;

monitoring of procurement, storage and milling; and storage and distributions costs. These costs were not only monetary but include large costs in human resources and time as well as opportunity costs. As obviously seen by the government with the change in policy in December 2003, the benefits of such a system was highly debatable, given the significant losses in quality during storage and processing and the obvious lack of consumer preference for the rations which are provided.

Prior to the change in procurement policy in December 2003, when paddy was procured at a low fixed price and distributed to targeted groups in lieu of wages, the dismantling of such a system would have implied a concomitant increase in wages to compensate for a loss of those rations. Since the change in policy in April 2003, where paddy was to be acquired from traders and millers at market prices, the state procurement system became even more untenable. Whereas before the cost of the system was counterbalanced by the lower purchase cost of the paddy, the cost of purchasing the paddy had to be added to the high cost of administering the procurement system. As seen by the government, there were no benefits from maintaining the system as opposed to a direct transfer of funds to the target groups so that they can purchase the rice on the open market.

While some private milling operations are already considering or actively participating in a modernization process, this is the province of individual economic decision making which depends on the individual circumstances facing those enterprises. While government policies should be aimed at facilitating the private sector in upgrading their technology, there is a question on whether this should extend to overt assistance in the form of low interest loans or other distortionary policies that promote the growth of these firms or sectors over that of other firms or sectors.

The World Bank (1999), notes that the divergence between the official and market exchange rates creates a situation where there is a large transfer of income to selected groups, and in particular results in significant protection to import-substituting enterprises and the SOEs. The implication is that undertaking an exchange rate realignment would result in significant reductions in the competitiveness of SOEs. Given the parlous state of SOEs, even under the current favorable exchange rate regime, there seems to be little scope for significant investment in SOEs in their current state. This is even more so if macroeconomic reform polices are implemented. Conversely, enterprises which do not receive benefits from the current exchange rate distortion, and which are doing well despite restrictions on their operations, are more likely to benefit from investment, particularly after reform policies are implemented.

5.2. The Role of the State and the Private Sector in Agroindustrial Development

Unlike in the more developed countries of the world, most commodity and resource markets in the less-developed countries are:

1. Highly imperfect,
2. Consumers and producers have limited information,
3. Major structural changes are taking place in the society and in the economy,
4. Supply and demand are often not in equilibrium, and
5. Economic objectives are dominated by political and social priorities, which differ from economic efficiency with utility and profit maximization.

Government intervention is pervasive both in less developed countries and in more developed countries. Examples of this intervention include: farm subsidies through price support in developed countries; taxation of agriculture in less developed countries through overvalued exchange rate, export taxes, industrial protection; price stabilization through food stocks and variable levies; minimum acreage as cotton in Egypt; maximum acreage as in USA and Europe; consumer subsides through food shops and food stamps; input subsidies on credit, fertilizers; monopolistic control by SOEs; public investment in agriculture such as in infrastructure, irrigation, research and extension.

The main dilemma of these interventions is that too few policy instruments are used to pursue several objectives such as growth and efficiency, distributional equity, food self sufficiency and food security; foreign exchange and foreign trade balance; and sustainability of resources.

The dilemma is even complicated by the fact that each intervention has several effects, often implying a conflict between the objectives.

What are the main rationales for government intervention in agriculture? There are two main sets of rationales. First, interventions may be oriented toward increasing efficiency, since it is perceived that markets are failing to perform adequately in conveying price signals, resulting in suboptimal use of resources (in other words there exist **market failures**). Second, there are interventions oriented toward objectives other than efficiency (see Table 185).

1. Efficiency oriented interventions
    a. Public goods: Pure public goods are in principle non-rival (that means use by one does not preclude use by another) and nonexclusive (use cannot be rationed). Private entrepreneurs do not supply these goods. Example: roads and irrigation projects, new technologies that cannot be patented.
    b. Externalities: In this case, the full costs and benefits of an activity are not fully reflected in the costs paid by private entrepreneurs or the return they can capture. The result is either under-provision or over-provision of the good. Examples of under-provision include the delivery of public health or educational services. Over-provision includes production activities that generate pollution, soil erosion upstream that reduces the irrigation capacity downstream.
    c. Economies of scale: These occur when there are savings that are acquired through increased in quantities produced. That implies that new entrants are barred. The government may want to intervene and subsidize new industries until they can compete in an open economy (sometimes this is called the infant industry argument)
    d. Transaction costs and imperfect competition: Imperfect information may lead to adverse selection and moral hazard. Adverse selection occurs when those who buy insurance tend to be those most at risk or those who are willing to pay high interest rates may be, on average, worst risks. Moral hazards are created by incentives to take greater risks when insured or to shrink on the job when paid a fixed wage. This leads to higher monitoring, negotiation, recruitment, and enforcement costs. Rural markets thus typically fail to provide enough insurance and credit.

2. Non-efficiency oriented interventions
    a. Welfare (Poverty reduction and income distribution): Redistribution of assets may be justified either on the basis of equity considerations or on efficiency grounds, particularly when some markets do not work. An example is land reform that redistributes land toward family farms with lower production costs because they have lower transaction costs on labour.
    b. Sustainability and intergenerational equity: Sustainability requires that the level of per capita utility achieved by this generation should not imply such depletion of natural assets that the following generation could not reach at least an equal level of per capita utility. Since future generations are not present to lobby for the cause of sustainability, it is typically the role of governments to assume implementation of a sustainability constraint on current development programs.
    c. Security (Food and other aspects): This requires that the poor be able to successfully engage in consumption smoothing. For net buyers, this implies a stabilization of prices through buffer stocks, trade controls, price fixing, and futures markets. For net sellers, this could be achieved through stabilization of income, or achieved through irrigation, diversification, and crop insurance schemes.

Within this context, what then is the role of the state and private sector in agroindustrial development in Myanmar? These can be grouped into issues dealing with policies, institutions, technology and infrastructure[68].

It is clear that the private sector should have the driving role in determining the appropriate levels of investment in agroindustry; not only in the amounts to invest but in what sectors. The basic flaw of the standard commodity focus for promoting commercialization and development is that choices that are reasonable at one point of time and space are not appropriate at another point in time and space. Markets are dynamic processes and demand and supply conditions create new opportunities and new challenges at different points in time and space. Proposing a package of measures based on commodity choice is not necessarily the best way of promoting commercialization and development. In most cases, the critical issue is not even what to do. Most of the problems are relatively well known (e.g. weak knowledge of plant and water management, high storage losses, limited information about markets). What is not known is how to solve them and who will do the resolving.

The commercialization strategy of choosing a few commodities and promoting them with adequate technical and financial support is sometimes known as "picking the winners". According to this view, projects should focus on few high-value commodities and try to promote their commercialization with adequate technical, financial and infrastructure support. This approach might not be consistent either with a truly commercial approach (farmers or enterprises might be interested in different commodities) or with a truly decentralized approach, whereby stakeholders plan and make their own decisions (they might be interested in other commodities than what those originally chosen by the project).

The role of the state sector should be in providing an enabling and facilitating environment for private agroindustry to develop. A supply-driven approach, typical of most development projects is unlikely to be successful in bringing the necessary linkages and transformation of agriculture required for commercial agriculture. A supply-driven approach implies that the experts, the planners and the public sector know what are the problems and the solutions of commercial agriculture more than the commercial agriculture stakeholders themselves. This approach has proved often unsuccessful in the past, as implied by the either low growth of agriculture or by unsustainable practices.

A demand-driven approach recognizes that commercial stakeholders need to develop their capacity of making investment decisions in order to learn how best to adapt and innovate in a changing environment. Having commercial stakeholders in the driving seat of project investment decisions is also consistent with the policy changes that have happened in the 1990s, namely the adoption of a more market-oriented approach and the emphasis on participatory planning and decentralization. Even though policy recognizes a greater role for the private sector and the civil sector in the implementation of government programs, in practice participatory planning and the view of the public sector as facilitator of development are still at a beginning stage.

One approach to commercialization would be to list the constraints to commercialization and then make the investments needed to alleviate those constraints. For example, limited access to modern inputs would imply provision of modern inputs and demonstrations. If successful, this approach might perhaps induce some crop diversification and increase the marketed surplus of some farmers and their income. However, their level of commercialization would not necessarily be different from the one currently in place. If the objective is to move one step-further in the path towards higher levels of commercialization, a different approach is needed. Such an approach could be to take the current situation of already commercialized farmers (organized as smallholder farmer groups or cooperatives), trade associations and agro-enterprise associations and facilitate them to move further along the commercialization path. In order to do so, the project will have to provide institutional mechanisms for these organizations to express their needs for technology, information, capacity development and infrastructure that would raise their business from its current level of commercialization to a higher level. Rather than the project telling the stakeholders what they need to do to further commercialize, the

[68] See Goletti, Purcell and Smith (2003) for a discussion on commercialization and agricultural development.

stakeholders will tell the project what their effective demands are. The expectation is that this change of approach will build ownership, address demand and facilitate the emergence of effective stakeholder networks.

It is argued that the underlying nexus between these various themes is that the major constraint in the agroindustrial sector in Myanmar is a fundamental lack of an enabling environment, in terms of infrastructure and institutions, needed to facilitate the development of the agricultural sector to improve food security, rural poverty, and export generation.

The conceptualization of this idea is provided in Figure 30. As shown in the diagram, the role of an enabling environment has an overarching impact on the major constraints in the agroindustrial sector. For example, lower transaction costs are argued to impact credit markets by reducing the costs of credit, which will have the effect of stimulating investment in the farm and milling sectors and serve to raise productivity and the use of better inputs. Greater public investment in infrastructure will have positive effects on market access, while increased transparency and stronger government institutions will lead to lower transactions costs.

A major debate in the establishment of this "enabling environment" involves what role needs to be played by the public sector in the development of the agroindustrial sector. There is a view that the private sector and public sector approaches are somehow incompatible, and that policy choices need to be made between them. However, as an example, Viet Nam is currently, and successfully, following these two approaches simultaneously. The role of the public sector in Myanmar should not be in providing support to SOEs which have no incentives to modernize or become efficient. As noted above, private investment in high-quality edible oil mills and pulses and beans processing has occurred over the last few years and encountered some success both with farmers and in terms of exports. This has been a result of the relaxing of the export licensing system, enabling private firms to invest in export enterprises. A major constraint to this has been the institutional and transactional constraints enabling private companies to successfully complete export contracts. In particular, the export paperwork and procedures inhibit efficient functioning of the system.

Economies of scale in the processing and exporting sector indicate that rationalization will eventually occur (and will need to occur). This will be facilitated by an eventual privatization of SOEs and the imposition of financial discipline as a result of increased privatization. The role of the Government should be to smooth this structural adjustment path and put in place mechanisms to assist vulnerable groups within this adjustment process. This suggests that underlying this goal of establishing an "enabling environment" is the need to develop synergies between public and private actors. Indeed, from a policy and poverty reduction standpoint, it is argued that these two approaches could be followed simultaneously, and that policy instruments are broad enough to encourage (on the one hand) private investment in agricultural production and processing, and (on the other hand) allow the majority of poor farmers to share in the benefits from globalization.

In all but the provision of irrigation there is a definite role for the private sector and the role of the public sector should be relegated to an enabling function. In terms of the public sector's role in provision of irrigation works, there are serious questions as to the economic rationale and viability of large scale irrigation schemes (as opposed to micro-level schemes, tube wells and portable pumps). This is a question which is not unique to Myanmar. The poor internal rates of return for large scale irrigation works in neighboring countries, and problems in implementing and managing a complex scheduling of water use, demonstrate the weakness in relying on these large scale irrigation schemes as a panacea for constraints in agricultural production. As the experience in neighboring countries has shown, significant investment in irrigation has not resulted in the increases in production or yield expected from an economically viable project.

When the question of irrigation is separated out from other agricultural inputs, it is clear that the private sector can provide these inputs just as well, if not better than the public sector. The role of the public sector in this case is one of providing an enabling environment, both through the provision of legislation

as well as providing services which are not necessarily unique to agriculture. As an example, the provision of fertilizer and pesticide inputs ideally should be the role of the private sector. However, the cost and availability of these inputs are constrained mainly by the cost of transportation and to a second degree by government regulations governing official imports. Import substitution policies for intermediate goods do not engender an efficient industry; merely raise the cost of production of goods further downstream. The Government needs to carefully determine its priorities in this area.

The issue of credit is a major impediment to improvements in agricultural productivity. The problem of credit in Myanmar is not entirely an issue of high interest rates or constraining collateral requirements (although these are always mentioned as the number one complaints), but rather the lack of access to affordable and viable credit (in terms of administrative procedures). Again, this suggests the role for the public sector in creating an environment that can reduce the costs of credit to the rural sector. The existence of moneylenders charging 10-20 percent per month illustrates that, firstly, credit providers (however usury) do exist, and that demand for credit is high. However, it should be emphasized that the cost of providing credit remains high. The high cost of servicing small loans increases the burden on both banks and borrowers. Moreover, credit providers (official and otherwise) face exceedingly high administrative costs, due to a lack of infrastructure and human resources, which raise the effective costs of borrowing to the agricultural sector. Public policies that aim to reduce these institutional costs to the provision of credit would likely have significant, positive effects in the agricultural sector and throughout the economy. It is not suggested, however, that the public sector attempt to subsidize and distort credit markets for agroindustry and agriculture. The recent difficulties faced in the banking sector in Myanmar, for instance, should serve as a warning for public involvement and guidance in the administration and provision of capital to agriculture.

The last input that needs to be considered in the context of increasing both quantities produced and yield is the provision of the appropriate varieties of seeds. The adoption of improved varieties of rice, has been instrumental in the adoption and expansion of rice production in the delta region. The area under improved varieties has grown significantly over the last decade and has contributed greatly to the rice surplus and export market.

This leads into a debate about an emphasis on niche market exports of high quality agricultural products like rice versus exports of low quality products. This approach sees a major role for the private sector in determining which markets are profitable and which technologies (seeds, production practices, milling processes) are needed in order to exploit these markets. The role of the public sector is again relegated to one of facilitation and the creation of an enabling environment. While it is tempting to identify roles for the public sector in providing subsidized credit and other inputs, the thrust of this approach is a commercial one, and thus if a particular niche market is unprofitable without government subsidies, then there is a question of whether commercial enterprises should be investing in this market to begin with. The provision of inputs and seeds is necessarily the role of the private sector in this development approach. It is interesting to note that existing models of niche market development in the Cambodian and Thai rice sectors concentrate on the export of high quality rice. This demonstrates the divergence of approaches between the private sector niche market development and the public sector broad-scale development of an export market based on average quality rice.

The role of the government in the development of the private sector should be limited to fostering the environment in which the private sector can operate. The provision of artificially cheap credit is not recommended. Rather, the public sector can take steps to help reduce the costs faced in the marketing and export of agricultural processed products in Myanmar. This includes assistance in the improvement of infrastructure and taking steps to reduce the high transactions costs, in the form of unofficial costs and non-transparent port and clearance measures, which reduce the competitiveness of Myanmar agricultural exports.

The private sector should be encouraged to develop high valued niche markets, which will benefit those farmers who are supplying high quality varieties of agricultural products. Simultaneously there needs to be efforts to encourage an increase in quantity and yield of the bulk of the remaining crop. Again, the

role of the public sector is an enabling role, rather than to provide subsidized inputs or research. Links between export-led growth and poverty alleviation are often tenuous.

Most efficiency gains are to be realized from reforming the domestic production, processing and trade systems, rather than from reforms at the border. Resulting reductions in transaction costs would benefit both producers and consumers.

In localized areas where there are currently no opportunities to access other domestic and international markets, increased trade opportunities would result in an increase in local agricultural commodity prices. This would benefit those with adequate resources to produce surplus product, but would increase costs of purchasing food for those who lack the resources to produce all household food requirements. On the other hand, improved access to trade and higher farm gate prices would provide improved incentives for increased investment in production and this would generate increased employment.

While it is possible that some of the poor (for example. those that are net consumers of rice) could suffer welfare losses from increased agricultural trade, proposed improvements are expected to have a major positive net contribution to reducing poverty.

However, it should be strongly emphasized that the potential competitiveness of commodities such as rice be weighed against the competitiveness of other products, such as pulses and beans, edible oils, maize, livestock, or aquaculture, in the development of medium-term agricultural strategies. While improvements in agricultural productivity will benefit the poor and improve food security, in the end policies that promote the production of particular commodities may need to be combined with policies aimed at achieve crop diversification in order to alleviate rural poverty.

5.3. Opportunities for Agroindustry in Myanmar

On the basis of the above discussion, what then are the opportunities for agroindustry in Myanmar? Clearly, improvements in agricultural productivity, processing efficiency and export opportunities are the desired outcomes of any sectoral development strategy. These should be broad-based and not targeted towards any particular commodity or market, in order to enable the private sector to make the most of their entrepreneurial skills in their investment strategies. There appears to be extremely limited scope for further expansion of state intervention in agricultural production, processing and marketing, a fact recognized by most of the government bureaucracy. With limited capacity and budgetary resources, opportunities for state intervention appear limited to a regulatory and advisory role.

The growth potential for agroindustry lies typically not so much in specific products or processes, as in overall increases in efficiency arising from the removal of sub-sector wide constraints. However, it is clear that there are some specific areas in which considerable benefits could be realized. These are discussed briefly below.

5.3.1 Improvements in Rice Milling

Without a doubt, the most important short-term potential for growth within the agroindustry sector lies with private sector rice milling. It is clear that average recovery rates in Myanmar are well below regional and international standards, and that considerable improvement can be made in efficiency through more modern equipment and better control of operations (e.g. replacement of rollers or use of improved roller materials). These gains could amount to as much as 20 percent for smaller private sector mills, and perhaps 10 percent for larger or more modern private sector ones. Given that the national paddy harvest in 2001/02 was an estimated 22 million tonnes, an average 10 percent increase in recovery alone would yield 2.2 million tonnes of additional rice each year (although there would be a reduction in broken grain and other secondary products). With wholesale rice prices in 2002 ranging

from K80,000 to K150,000 per tonnes, depending upon variety and market, gross total gains could be estimated at K250 billion per annum, or approximately US$250 million at the prevailing market rate of exchange.

5.3.2 Improvements in Edible Oil Milling

A further area of significant potential is in solvent extraction within private sector oilseed milling. Currently, the approximately 1.4 million tonnes of groundnut, sesame and sunflower produced annually in Myanmar are milled entirely mechanically, leaving oilcake which is relatively high in residual oil. If only approximately 60 percent of the cake produced in the central Dry Zone area were subject to further solvent extraction, a further 3 percent of oil (or approximately 5-7 percent of residue in the cake) could be extracted (assuming a high level of mechanical extraction having taken place already). This would contribute a further 20,000 tonnes per annum (or more than 5 percent) to national oil supplies, with a gross value in the region of K15 billion per annum (US$15.5 million at market rates of exchange), without taking into account any possible increase in the value of the de-oiled cake, which in international markets fetches a better price than oilcake.

The development of private sector solvent extraction capacity in Myanmar would have the added advantage of providing a processing capacity for soybean, which is unsuited to expeller extraction. With production of soybean in 2000-01 exceeding 100,000 tonnes, and considerable agronomic potential for the introduction of soybean into delta crop rotations, the processing of soybean offers a major opportunity to reduce the national edible oil deficit.

5.3.3 Improvements in Agricultural Mechanization

While mechanization of agriculture is still extremely limited, most smallholder farms are able to utilize draft power to meet their tillage requirements. However, significant underutilization of land, both in terms of cropping intensity and extensification, is in part due to the lack of mechanization[69]. This is particularly the case with households with land holdings over 2 hectares in size, where double oxen draft power is not sufficient to till the whole land holding. This in turn has significant implications since the 1992/93 Agricultural Census estimates that the average farm size is 2.5 ha and 54 percent of farmers out of a total of 2.72 million agricultural land holdings have less than 2 ha; occupying 21 percent of cultivated land. The potential for mechanization is therefore the potential to reach 46 percent of farmers, covering 79 percent of the 15.5 million acres of cultivated land.

As noted in Section 3.9.1, considering that some 21-24 percent of cultivated land is covered by machinery (around 3.18 million acres), even if in the short to medium term only a modest additional 10 percent of farmers were able to effectively and efficiently use mechanization, and only an additional 10 percent of cultivated land was suitable for mechanized tillage services using power tillers and reapers, this would equate to some 270,000 households, and 1.55 million acres of land. Considering domestic SOE manufacturing capacity for agricultural machinery is only some 21,000 machines per year, it would take nearly 13 years of production for the SOE factories to satisfy this additional demand. There is considerable scope for increased sales of agricultural machinery to farmers for their own crop production or for private sector contract services.

As the country evolves towards a market based economy it would be expected that the commercial activities of the Agricultural Mechanization Department (AMD) to be divested over time to the private sector. The long-term roles of AMD should therefore be to monitor and regulate the sub-sector, provide

[69] The consultant notes that there is considerable interest within MOAI and FAO for donor support for an agricultural mechanization development project. Notwithstanding the views expressed in the ASR Working Paper No. 2 on Crop Production, and the views expressed in Section 3.9.5, this current section outlines the potential for agricultural mechanization with a view to developing an associated investment project.

an incentive framework for increased private sector involvement in manufacture and hire services, and train and support private farmer operators and agricultural contractors in the technical aspects of mechanization and in hire service management.

5.3.4 Improvements in Cotton Production and Processing

While there is some debate about the agroecological suitability of cotton production in Myanmar, particularly in the water scarce Dry Zone area, the importance of the downstream textile industry suggests that improvements in cotton production and efficiency will contribute greatly to the economic profitability of the sector as a whole.

As an example, the export orientated textile industry provides direct employment for over 150,000 people and hundreds of thousands more farmers, traders and millers employed in providing raw material inputs. In the year 2000, Myanmar exported nearly US$404 million worth of garments, illustrating its importance to the economic development of Myanmar. In addition to the export of textiles and garments, there are still significant levels of unmet domestic demand; necessitating a net import of textiles. Per capita consumption of fabrics in Myanmar is around 5.47 yards, of which only 0.65 yards is provided by the SOE sector, 1.42 yards from the cooperative sector and 0.27 yards from imports. This is significantly below the per capita average for regional neighbors; see Table 67. Before the current round of sanctions placed on exports from Myanmar to the US and EU, the retail prices of garments made in Myanmar and sold in the US were price competitive with those from Viet Nam and India. Given the higher cost structure of the garment industry in Myanmar compared with those two countries, there is considerable scope for increased competitiveness if the cost structure could be reduced further. Major constraints to this include the cost of imported raw materials and energy costs.

Improvements in seed quality, fertilizer use and agricultural practices will play a big role in increasing cotton yields. Similarly improvements in marketing through the formulation of quality standards and the sale by quality and weight rather than just weight alone will improve the quality of cotton seed being offered for sale. Modernization of ginning operations will not play an important role in improving cotton industry productivity, as existing gins are grossly under-utilized, most particularly in the SOE sector. Production would have to almost triple before capacity constraints justified a review of ginning operations and their upgrading potential. As such, any upgrade of ginning operations would have to be looked at on a case-by-case basis, and individual entrepreneurs would have to make their own decision. The role for governments and donors would be in providing an enabling environment and access to broad-based credit to facilitate private sector development in the cotton industry.

5.3.5 Reform of State Owned Enterprises

A final significant area of growth potential identified in this report relates to the activities of State Owned Enterprises within the agricultural sector. Due to the restrictions that these entities work under – in terms of pricing, capital investment and business planning – they suffer major losses in operations and have a significant distortionary impact on the market for the commodities in which they deal.

Low government procurement prices for raw material inputs have left SOEs struggling to operate plants at more than 50 percent utilization rates. In some SOE plants processing cotton, for example, utilization rates are under 4 percent. In the private sector capacity utilization rates are higher, but still less than economical in the long run.

The liberalization of SOEs to operate under market conditions offers a significant potential for growth in agro-industry in Myanmar. By eliminating lower than market procurement prices and output sales prices, and by allowing SOEs to structure their operations in accordance with market demands, improved operating efficiencies would be expected in rice milling, cotton ginning, sugarcane milling

and in ancillary, but important, industries such as machinery and fertilizers. Improved operating efficiencies would in turn permit improved prices for producers and so contribute to further sector growth. While quantification of such gains is not possible at this stage, it is noted that the SOEs in the agricultural sector lost some K17.7 billion in 1999/00 and K63.5 billion cumulatively over 1994-2000, see Table 186. If these enterprises were made to breakeven, this would save K17.7 billion per year in government expenditures, based on 1999/00 data. If they became even modestly profitable, say a 10 percent return, this would add nearly K20 billion per year to the economy, based on 1999/00 expenditures. Thus the net benefit would be almost K40 billion per year, or US$40 million based on current exchange rates.

6. A Strategy for Agroindustrial Development

6.1. Background and Rationale

The Government of Myanmar has increasingly stressed the importance of a more diversified agriculture to achieve its goals of modernization and rural industrialization. This is consistent with similar strategies followed by other Asian rice economies during the 1970s and 1980s, where agricultural diversification was seen as a desirable response to changes in supply (the success of the green revolution resulted in food self-sufficiency and declining real rice prices) and demand (rising income and urbanization increased the demand for non-rice food products). Some of these economies have been successful at diversifying the agricultural and rural economy. However, it was also realized that agricultural diversification was a much more complex process than changing the output mix.

Agricultural diversification and rural industrialization as an enabling strategy for rural income growth and poverty reduction in Myanmar will require enormous investment and will take time. The constraints are of staggering complexity: the presence of a large population in rural areas characterized by widespread poverty; low productivity of agricultural labor; low level of infrastructure development; poorly integrated markets (in terms of formalized value chains); poorly functioning factor markets such as land and credit; and an underdeveloped rural industry characterized by a dichotomy between micro enterprises and large (usually SOEs) enterprises. These constraints are aggravated by a still incomplete process of liberalization in the transition from a centrally-planned to a market-oriented system.

There are enormous challenges in pursuing the goal of accelerating agricultural growth in a sustainable and equitable way. Section 4 highlighted the major constraints that any strategy for agricultural and rural development will have to face. Change in policy, investment allocation, and institutional development will have to create the conditions to implement such a strategy.

However, it is important to put Myanmar's current situation within a global perspective. The objective of this section is to highlight first some global trends that to a certain degree affect the formulation of such a strategy. Myanmar will be affected by these global trends as it tries to develop and pursue its own development strategy. As:

1. Agriculture contracts in many countries;
2. Urbanization increases;
3. International trade becomes more liberalized;
4. The interest in redressing inequities grows;
5. The concern for the environment is more widespread;
6. The global agroindustry becomes more concentrated; and
7. Agricultural market structure is increasingly dominated by various forms of vertical integration,

Myanmar will have to compete with many other countries in similar situations. Reflection about these trends will contribute to the development of a more suitable strategy for the specific conditions of Myanmar.

There are three sets of issues that a strategy for agricultural development in Myanmar will have to consider, namely:

1. Increase in agricultural labor productivity,
2. Improved management of natural resources, and
3. Integration of agriculture with rural development.

Firstly, diversification should not imply the abandonment of active support to increase rice productivity, particularly in those areas that have a high potential and comparative advantage in rice production. Rice is and will continue to be the main staple of the population, providing income to the majority of agricultural households and a significant source of foreign exchange in addition to pulses and beans, oilcrops and fisheries. As rice productivity grows, however, the emphasis shifts from an almost complete focus on rice in agricultural policy (as reflected in resources allocated to research, extension, and irrigation) to a more diverse approach. As is the case in other countries, increased rice production is the basic underlying condition for significant diversification of agricultural production to be profitable, see (Hayami 1991). In order to solve the trade-off between food security and the development of high value-added agricultural commodities or agroindustrial activities, market integration between high-potential areas for rice and areas more suitable for non-rice activities will have to be promoted.

While cash crops make an important contribution to the income of the population living in the specific areas where they are grown, with the exception of oilseeds and pulses and beans their impact on total agricultural income, employment, and rural industrialization is likely to remain small. That is not to say that they should not be pursued. The case of coffee in Northern Shan State has important poverty reduction effects that should not be minimized. The success of rice, on the other hand, has much more relevance on a macro level. By involving a large share of the rural population in terms of labor and income, its growth was a powerful engine of growth and poverty reduction. Similarly, sectors such as livestock, fishery, horticultural products, pulses, agroforestry, and roots and tubers processing cover different regions and have broader linkages with the rural economy. That does not imply a strategy of picking the commodity with the highest potential and subsidizing production. The strategy is rather to assess the feasibility of these sectors based on economic and technical criteria, and to promote investments or mechanisms to lower the transactions costs for smallholder farmers and small-scale enterprises to be involved in such activities. Improved infrastructure, appropriate research and extension, access to land and credit markets, information, support to institutional building (market information systems, standards and grades, trade associations) are all different ways to lower transaction costs. It is a different approach than trying to actively subsidize a subsector (for example sugar) through trade protection or by building large factories that face bottlenecks in procuring raw materials and are not labor intensive.

Malhotra (2000) notes that the main export markets for agricultural crops will continue to be S.E. Asian countries, but that in the long run Myanmar should expand and diversify its export markets. The export price of crops is generally substantially below the world market price. While some of this differential can be accounted for by transport cost, the most important factors are poor or inadequate production conditions in terms of seed, cleaning and grading, inappropriate crop varieties, inefficient marketing system and lack of international market intelligence and trading skills. Overriding all of these constraints is the perceived pressing need for the accumulation of foreign exchange, often leading to the export of crops at less than cost.

Successful diversification will imply not only a shift in the agricultural output mix, but also the growing importance of rural non-farm activities such as the food and beverages industry. The linkages between agricultural production and the rest of the economy are enhanced through agro-industry's role in providing inputs and procuring raw materials. For labor productivity in agriculture and rural areas to increase, new job opportunities have to be created. The challenge of creating productive employment is enormous given the size of the rural population. It will be quite difficult for such challenge to be met only by state owned or large commercial enterprises.

A large pool of expertise and human resources are available already in Myanmar for small and medium enterprises to emerge in a more dynamic and sustainable way. The development of micro-enterprises into small and medium enterprises in rural Myanmar is currently hampered by several constraints related to access to credit, distorted land markets, limited business and technical knowledge, confused legislation, and lack of participation at the local level. In the case of Myanmar, small and medium scale enterprises constitute over 90 percent of the food processing industry. Sometimes the presence of small and medium enterprise is considered inefficient on the basis of economies of scale in agroindustrial

activities. However, technical arguments based on economies of scale do not take into account the agrarian structure and the infrastructure development of the economy. In the presence of an agrarian structure characterized by smallholder farmers and a poor level of infrastructure, procurement of raw materials for large enterprises is too costly. The low capacity utilization of large agro-food factories in developing countries is a common experience that nullifies economies of scale. The development of small and medium scale enterprises in the case of rice and starch in Viet Nam is an example of how transaction costs involved in the procurement of raw materials are minimized through intra-industry trade in semi-processed goods transferred along the marketing chain from small-scale to large-scale enterprises (see (IFPRI 1996; Goletti and Rich 1998; Goletti, Rich et al. 2001; Agrifood Consulting International 2002; 2002)).

A large proportion of the resources devoted to meeting the demand for agricultural products in Myanmar have been spent to improve production technology and productivity. Much less attention has been devoted to the chain through which agricultural commodities and products reach final consumers within the country and abroad. This neglect is particularly serious given the enormous value added produced along the marketing chain between producers and consumers. Moreover, if the marketing chain does not function properly, investment in production becomes more costly and more risky, and ends up being wasted. Postharvest losses as well as inadequate handling and transportation facilities are responsible for the wastage of inputs and the expensive investments needed to produce these commodities. This is particularly true in the case of perishables such as fruits, vegetables, and roots and tubers. Moreover, an efficient post-harvest chain can be environmentally friendly by avoiding unnecessary production (not required by final consumers) that utilizes scarce water resources and requires heavy application of chemicals toxic to the health and the soil.

Over the past two decades, global changes in the agro-food industry have affected agriculture dramatically. As the structure of the industry has become more concentrated, demand patterns have shifted towards higher value added products, and supermarkets are increasingly the major actors in the farmer to consumer chain. Yet, in Myanmar, post-harvest systems and agroindustry are still largely characterized by a dichotomy between a multitude of small enterprises, often household businesses with little capital, limited access to modern technology, and poor integration with urban and international markets, and a few large SOEs often inefficient and not well prepared to face the competition from global agroindustry. Under the process of globalization, both small enterprises and SOEs are put under pressure by the entry of large domestic and international agribusinesses. The impacts of agroindustry globalization on rural livelihoods and small enterprises remain unclear. However, there are indications that globalization is compatible with a broad-based approach to agroindustrial development. A broad-based approach implies a balanced structure of expanding small, medium, and large enterprises that can capture different scale economies, niche markets, linkages with urban and international markets, and intra-industry linkages. Institutional arrangements such as contracts between smallholders and large enterprises, farmers and trade associations, and supply chain networks offer promising avenues for reaping the benefits of a dynamic global agroindustry.

Inevitably, the development of a well diversified rural economy will require massive investment in physical infrastructure, such a roads, electrification, irrigation systems, ports, and communication systems (the hardware). However, most of these investments are expensive, take a long time to be implemented, and risk being inadequate, environmentally damaging, and unsustainable, especially when carried out without adequate study and evaluation by policy makers, researchers, and representatives of civil society. In the context of limited resources, it would be more appropriate to shift investment emphasis to capacity building, research, extension, and policy and project analysis (the software). These types of investments are not only less expensive, but also have the potential to identify more suitable and less expensive investment options. The complexity of agricultural diversification and rural industrialization strategy in Myanmar entails policies and measures that affect not only agriculture but also several other aspects of rural society including infrastructure, credit, health, education, and rural institutions. Within the context of a market economy, rural development is not directed from above, as in the former centrally managed system. The state, however, still has an important role to play in providing public goods in which the private sector does not have incentive to invest and in facilitating

the creation of market institutions such as voluntary business associations and cooperatives. This process entails an enormous amount of information gathering, processing, and evaluation. Currently, in Myanmar, many line ministries provide this information function, often in an uncoordinated manner and sometimes without appropriate technical expertise. Policy design and implementation are often conducted without adequate monitoring of markets and without the support of analytical methods that could improve the decision and implementation process.

The link between agricultural and rural development has been already recognized by the government of Myanmar and is embedded in policy guidelines, decisions, and programs. One major challenge in the future will be to effectively promote these linkages in a financially sustainable way. That will require the participation of all stakeholders (rural households, private corporate sector, SOEs, NGOs, and civil service) in order to ensure better coordination.

Effective participation of all stakeholders should result in a mobilization of human and economic resources to attain the goals of rural development. By itself, the state will not be able to attain these goals, given the limited amount of resources available and institutional weaknesses. In fact, the strengthening of the orientation toward the market already offers the opportunity to tap the resources of the country. The state can facilitate this process, but cannot expect to do better than the private sector in the conduct of business. In collaboration with private sector, however, the state should have a leading role in promoting policies and investment in the key areas of:

1. Rural infrastructure,
2. Rural financial system,
3. Poverty reduction, and
4. Social services provision.

Effective participation has to be based on incentives of different stakeholders to contribute to meeting the challenges ahead. The system of incentives largely depends on prices in a market system. However, there are also important incentives deriving from improving governance, transparency, and the accountability of different stakeholders. Whenever these other incentives are neglected, then even the market mechanism will not operate efficiently.

The agroindustry sector has a vital role to play in the further development of Myanmar's rural economy and in the general industrial development of the country. Firstly, experience throughout the world indicates that as economic and agricultural development and prosperity proceed, agro-processing and related industrial services play an increasingly important role in adding value to the 'raw' output of agriculture, and in expanding, upgrading, and diversifying demand for that output. Depending on technical and economic circumstances, this expanded agro-processing may be in rural areas, or in urban areas, or (most commonly) in both.

Secondly, as agricultural incomes increase, there is generally a strong growth of other consumer-demand-driven rural industries, predominantly in the form of rural small industrial enterprises. The development of these enterprises, and of analogous rural non-farm activities in other broad sectors such as trade and services, is extremely important in increasing employment opportunities and the general standard of living in rural areas.

Thirdly, agro-processing is an engine of general industrial and export development in developing countries such as Myanmar. Based on comparative advantage and the use of domestic agricultural output, expansion of agro-processing can help build the national industrial base. It also provides experience with export markets, which facilitates and helps finance the progressive diversification of industry and exports into other sectors such as textiles, engineering, electronics, etc. This was a crucial step in the highly successful industrial development of, for example, Taiwan.

6.2. A Vision for Agroindustry in Myanmar

A vision for agroindustry in Myanmar necessarily implies the development of the industry past the current situation and constraints towards a (realistic) ideal. A vision does not concentrate on short term targets or development plans, but rather identifies the role that the industry will play in the greater context of the agricultural sector and agricultural development. A vision informs and guides the subsequent strategy for the development of the sector. As such, the vision and subsequent strategy for agroindustry in Myanmar needs to incorporate three themes articulated in the above report and the ASR strategy as a whole:

1. A shift from a commodity and sub-sector approach to a market-orientated farming systems and community based approach,
2. A continuation of the move away from centrally planned development towards locally determined priorities and institutions, and
3. A change in the role of government from operations to ensuring an appropriate enabling environment, regulations and infrastructure.

Importantly, the articulation of a vision needs to incorporate the views of the stakeholders in the sector, not only the government, but the private sector and community as well. As part of the ASR project process, a workshop to present the results of Phase I of the project (sectoral reviews and identification of constraints and opportunities), and identification of investment strategies under Phase II, was conducted in Yangon on 9-10th January 2004. Workshop participants included representatives of government departments, the private sector, as well as private sector representative organizations (such as UMFCCI). What is important to note that the subsequent vision articulated by the working group on agroindustry took into consideration the views of government bureaucrats as well as the private sector, and that both groups of people were in complete agreement not only of the vision, but also the subsequent constraints to achieving the vision and the recommended strategies.

The vision for agroindustry in Myanmar articulated by the working group is encapsulated in a single summary statement:

> ***A developed agro-industry and agri-marketing system which gives the farmers the best possible price.***

According to the working group, embedded within this vision are four realizations:

Firstly, there is a realization that agroindustry and marketing systems are best developed by the private sector. Limited government budgets, cumbersome regulations, the lack of knowledge and management capacity in agroindustry, and the experience of failed SOEs lead to the conclusion that the government is unable to play an interventionist role through the active participation in production, processing or marketing of agricultural produce.

Secondly, there is a realization that any development strategy must recognize that investment funds directed to farmers will not achieve poverty alleviation unless there are opportunities for them to sell their products at the best possible price in an unhindered open market. The best possible price given to farmers does not imply that returns to farmers should be artificially inflated or managed through distortionary policies. Rather, the best returns to farmers are those that occur through the proper functioning of the market system so that farmers can make the choice of what crops to grow in order to make the best return.

Thirdly, following on from this is the realization that the best possible price given to farmers should also apply to other actors in the value chain. There is no reason to make interpersonal comparisons of utility, particularly in the case where all actors are reliant on the goodwill of the other actors within the chain. In such a situation, the best framework is the formation of linkages and partnerships within the value

chain in order to increase returns to all actors; while ensuring that imperfectly competitive outcomes and the exertion of market power are suppressed.

Fourthly, as a consequence of the second realization, there is the understanding that targeted commodity programs run counter to the principle that individual decision makers (the farm household, traders, processors and all actors along the marketing or value chain), are in the best position to identify their own opportunities. As such, government intervention in agroindustry (and in agriculture in general) should be confined to what government does best; provision of an enabling environment and regulatory oversight (see Section 5.2).

6.3. Constraints to the Development of Agroindustry in Myanmar

While it is important to articulate a vision for agroindustry in Myanmar, it is also important to be able to identify the constraints to achieving this vision. Coupled with the current constraints facing agroindustry (as articulated in Sections 3 and 4), these constraints will guide the formulation of the strategy for the sector as well as the investment strategies that follow.

The working group on agroindustry identified several constraints to the development of agroindustry in Myanmar which need to be addressed before the vision articulated in Section 6.2 can be achieved. These can be broadly grouped into policy constraints, institutional constraints, and private sector constraints.

6.3.1 Policy Constraints to the Development of Agroindustry

In terms of policy constraints, it is noted that there is a lack of consistency and transparency in policy making, with policy announcements seemingly ad-hoc and subject to constant revision. This is particularly the case with policies affecting the rice sector in particular and exports and imports of agricultural products in general. The lack of clear and consistent policy and regulations impacting on agroindustry imposes a significant financial cost on private enterprises. This has significant effects on the incentives facing private enterprises and their investment decisions. Unless there is a consistent and transparent process for policy formulation, and stability in the policy environment, private enterprise is unlikely to increase investment in agroindustry.

From the government side, there is a lack of resources to articulate the policy questions, analyze the policy options, and make the appropriate policy decisions. These decisions then have to be articulated in an appropriate manner to the policy makers at the political level. There is a perception that decisions are made on the basis of limited information and mechanisms for getting the appropriate information from policy analysts to policy makers are currently limited.

The limitations on an effective mechanism for policy dialogue extend to the private sector as well. The private sector notes that there is an absence of policy dialogue with the government, particularly in areas of direct concern to the private sector in general, and agroindustry in particular. In countries with an effective policy analysis and formulation process, views from the various stakeholders (including the private sector) are elicited in a public consultation process. The development of a participatory planning and policy formulation process has been advocated by the Government itself (in terms of devolving responsibilities down to the Township level), but this needs to be extended to include other stakeholders as well.

It is noted that UMFCCI has the mandate and responsibility to advocate for the commercial private sector, but this role is limited to concerns of the membership (in terms of large scale commercial operations rather than small scale agroindustrial operations). In addition, UMFCCI has found it more effective to lobby government officials on a private and personal level, rather than as an institution as a whole. If private sector organizations such as UMFCCI, and other organizations more specific to

agroindustry, are to take a more proactive and effective role in policy advocacy, the process of public consultation needs to become more transparent and government policy makers themselves need to become more open to receiving policy advice.

From the policy makers' perspective, there is obviously a need for policy advice to be consistent, transparent, and analytically rigorous. In the absence of these characteristics, there is no reason to accept the advice as being sound and policy makers would be justified in rejecting such advice. Thus, the constraints in policy formulation - lack of effective policy analysis and lack of trust in policy advice - appear to be inextricably linked.

6.3.2 Institutional Constraints to the Development of Agroindustry

In terms of institutional constraints, government management of agroindustry enterprises makes it difficult for those enterprises to adapt to rapidly changing market conditions. For example, procurement prices for cotton and sugar are set at the beginning of the season and are not changed despite changes in market conditions as the season progresses. Government bureaucrats in charge of SOEs lack the resources and capacity to conduct efficient business management practices, particularly since SOEs are ultimately not profit maximizing institutions. The operations of SOEs spill over onto the private sector, as subsidized inputs and heavily discounted sale prices impacts on the ability of the private sector to compete. While the rationale behind SOE operational practices is clear - to provide consumers with low priced goods - the effects are somewhat different. Producers face clear disincentives to produce enough output, producers and processors do not have any incentive to provide high quality outputs, and consumers do not get the products that they demand.

The regulatory environment impacting on agroindustry is difficult and Byzantine. While the private sector is forced to comply with many different regulations, there is a lack of transparency on which regulations apply in any particular situation. In terms of some of the more important regulations, like those affecting the export market, no official documentary record of regulations exist; with policy and regulation changes announced only in the mass media.

However, while there are many different regulations governing the operations of agroindustry, the actual number of laws promulgated is surprisingly limited. The State Peace and Development Council only issue a limited number of laws in any particular year (usually less than 10-15). Many laws from the Colonial period are still in effect; giving the possibly incorrect impression that they were exceedingly well drafted and still relevant today. Laws and regulations specifically designed for agroindustry are virtually non-existent, with most being regulated under general company and industrial enterprise laws.

For example, state owned agroindustry enterprises being regulated under the State-Owned Economic Enterprises Law (1989) and the Law Amending the State-Owned Economic Enterprises Law (1997). Agroindustry carried out by cooperatives are regulated under the Law Relating to Forming of Organizations (1988) and the Co-Operative Society Law (1992). Private Industries are regulated under the Private Industrial Enterprise Law (1990) and the Promotion of Cottage Industries Law (1991). Finally, the food processing industry is regulated under the National Food Law (1997).

Participants in the working group on agroindustry noted that there needed to be the formulation and promulgation of laws designed specifically for agroindustry and marketing; an Agroindustry Law, an Investment Law, and a Wholesale Marketing Law as specific examples. More importantly, it was noted that standards and norms pertaining to marketing and quality control are seriously lacking. Weights and measures used in marketing are a combination of Imperial (miles, gallons, pounds), Metric (liters, kilograms, tonnes), and native Myanma (basket, viss, pyi). While most agricultural commodities are sold on a volume basis (basket), and these volume standards vary not only across locations but according to the specific buyer or seller, effective marketing standards cannot be enforced. The creating

of a Quality and Standards Bureau, or the strengthening of those government departments supposedly in charge of these issues, needs to be carried out as a matter of urgency.

6.3.3 Private Sector Constraints to Agroindustry Development

In terms of private sector constraints, it is noted that there are limited examples of partnerships and linkages between different levels of the marketing chain and within each level (vertical and horizontal integration). Contracts between farmers and traders and processors are virtually non-existent, and when they do exist they are more honored in the breach than in compliance. In part this is due to the lack of an effective Contract Law, and the lack of enforcement of contractual obligations. However, it is obvious that the underlying reason is that individual actors find it more profitable (at least in the short run) to renege on contracts rather than adhere to an agreement. Until participants within the value chain see greater benefit from complying with contracts rather than breaking them there will be extremely limited development of agricultural value chains within Myanmar. The evidence from other countries, both developed and developing, indicates that opportunities do exist for the poor to benefit from participation in agricultural value chains, as long as they can be organized into effective marketing groups. The challenge is to find out ways of implementing the creation of trust, partnerships and linkages to form value chains for agricultural products in Myanmar.

Even with the formation of value chains for agricultural products, the private sector in Myanmar find it difficult to leverage these institutional mechanisms to create increased investment within the sector. In part there are serious constraints to the availability of credit, most particularly in the current environment facing the financial sector in Myanmar. Secondly, there are significant restrictions on the ability of the private sector to mobilize Foreign Direct Investment (FDI). Not only is the investment climate in Myanmar ill-suited to attract foreign investors, but rules and regulations are non-transparent or actively a hindrance to FDI. The Agroindustry Working Group participants noted the (relatively) favorable investment climate fostered by the Vietnamese Government, in particular as relating to the Viet Kieu (Overseas Vietnamese).

6.4. Strategy for Agroindustry in Myanmar

The strategic approach to develop agroindustry in Myanmar is consistent with the themes of the Agriculture Sector Development Strategy to promote rural development in general:

1. A shift from a commodity and sub-sector approach to a market-orientated farming systems and community based approach,
2. A continuation of the move away from centrally planned development towards locally determined priorities and institutions, and
3. A change in the role of government from operations to ensuring an appropriate enabling environment, regulations and infrastructure.

This strategic approach will require a combination of policy improvements, institutional and capacity building and investments carried out in a sequenced manner. Broadly speaking, the actions will fall within three categories:

1. Support to Policy Analysis and Policy Reform,
2. Support to Regulatory Reform and Institutional Reform in the SOE sector, and
3. Support to Private Sector Marketing and Agroindustry Development.

The individual strategy actions are detailed in specific **Investment Profiles** contained in Section 7 but are briefly described below.

6.4.1 Support to Policy Analysis and Policy Reform

As noted above, the implementation of policy requires that the formation of policy advice is based on consistent, transparent and analytically rigorous policy analysis. The proposed investment strategy involves the creation of a policy analysis and advice unit within MOAI, the creation of a series of diagnostic tools for policy analysis and commodity forecasting, and the building of capacity within that unit for policy analysis and modeling and policy advice.

The policy analysis unit is designed to deliver high quality policy advice on commodity issues to the Minister of Agriculture and Irrigation and the Minister of Livestock and Fisheries on a regular basis. The support package involves six interrelated components:

1. The establishment of a policy analysis unit within MOAI, including budgetary provision for personnel, equipment and consumables.
2. A training needs assessment study carried out with MOAI staff to tailor a specific capacity building program to the needs of the MOAI in general and the policy analysis unit in particular.
3. The development of a multi-market model of agricultural commodities for Myanmar (e.g. rice, oilcrops, pulses and beans, livestock, forestry products, fruits and vegetables, and industrial crops).
4. The placement of an international advisor within the policy analysis unit for a period of 2-3 years to assist the unit in undertaking high level analysis for agricultural commodities.
5. The provision of short-term capacity building programs in policy modeling techniques (approximately 3 per year) to assist the unit in undertaking high level analysis for agricultural commodities. These programs will strengthen capacity in multi-market modeling as well as other economic and econometric modeling techniques.
6. The establishment of a regular workshop series and publications designed to promote the activities of the policy analysis unit and obtain feedback from various stakeholders (government, private sector) on the desired policy questions to be analyzed.

6.4.2 Support to Regulatory Reform

Regulatory reform includes the creation and strengthening of a Quality and Standards Bureau to implement and enforce marketing standards for the domestic and export markets. In addition, it involves the strengthening of government capacity in the drafting of laws and regulations pertaining to marketing and agroindustry. While it is important to integrate regulatory reform in an overall agroindustry development strategy, it is understood that this issue is cross-cutting with agricultural product marketing and as such the particular investment strategy is contained in the report of the Marketing Specialist in the UNDP/FAO Agricultural Sector Review Final Report.

6.4.3 Support to Institutional Reform in the SOE sector

A diagnostic study and financial audit of all SOEs under MOAI and MOLF should be carried out in order to allow policy makers to make fully informed decisions regarding these SOEs' future operations. It should be noted that the diagnostic study and financial audit is not a punitive exercise, and the purpose is to generate constructive recommendations for future operations. Once a diagnostic study and financial audit has been completed a reform or restructuring plan for SOEs can be designed and implemented, including the development of individual business plans and management capacity strengthening for any SOE retained within government control.

The diagnostic study and financial audit should cover the areas of governance, strategic planning, organizational structure, human resources management, pricing policies and procedures, purchasing and selling policies and procedures, products and demand, compliance review, financial and accounting systems, management information systems, and financial analysis. The financial audit should be

conducted to international accounting standards in order to gain an accurate representation of the individual SOE's financial situation. Full market costing of inputs and outputs, including depreciation of assets should be used. International donor support will be necessary for the diagnostic study and audit of each SOE.

6.4.4 Support to Private Sector Marketing and Agroindustry Development

The objective of the proposed investment strategy is to increase the degree of agricultural commercialization in Myanmar by promoting the development of a network of well-functioning value chains that are competitive and innovative. The goal of the project is to increase the level of commercialization of agriculture in one pilot region in Myanmar in a sustainable manner.

There are several characteristics of the investment strategy:

1. The investment strategy recognizes the key role of networks in the development of value chains. The project facilitates the emergence of a network of well-functioning agricultural value chains and provides institutional mechanisms through which the key stakeholders and their service providers can effectively link to each other by forming partnerships and alliances. Stakeholders participate in a commercial agriculture network when they recognize that participation in the network increases their opportunity to establish mutually beneficial partnerships and alliances.
2. The investment strategy proposes methods for sharing information. Constraints related to limited access to information and access to capital are addressed through improved marketing information services. Sharing information, however, is not going to be translated into higher incomes and more effective services unless complemented by other mechanisms that give stakeholders the means to make investment decisions needed to move to higher levels of commercialization. Demand-driven investments will improve the efficiency of allocation of scarce public resources. The formulation, approval and implementation of demand-driven investments will also contribute to the development of alliances and partnerships between stakeholders and service providers.
3. The investment strategy builds and strengthens existing capacity of service providers to facilitate the development of commercial agriculture. Improved capacity of service providers facilitates the development of commercial agriculture in two ways: by directly providing better services to currently well-organized commercial stakeholders and by mobilizing and organizing currently loosely-organized farmer groups operating at a low-level of commercialization.

In order to achieve the overall objective of moving to a higher level of commercial agriculture in the pilot region, the project is organized into five inter-linked components:

1. The formation of a Commercial Agriculture Network (CAN) to facilitate exchange of information between key stakeholders (producers, traders and processors) and service providers.
2. The formation of a Commercial Agriculture Alliance (CAA) with a properly constituted Board and the formation of a Commercial Agriculture Fund (CAF) to provide a mechanism for different types of key stakeholders (producers, traders and processors) to work together by formulating and selecting investments that move commercialization to a higher level.
3. The Strengthening of the existing Agriculture Market Information Service (AMIS) to provide a strongly needed service to stakeholders involved in commercial agriculture. This service will expand the AMIS role from just providing market information on prices to a limited audience, to include information specifically required by commercial agriculture and agroindustry on a much wider scale.
4. The development of Social Mobilization for Agricultural Commercialization (SMAC) to keeps the process of commercial agriculture continuously moving upwards, by facilitating the transformation of loosely-organized farmer groups already involved in low-level commercialization into better-organized and larger farmer groups operating at a higher-level of commercialization.

5. The formation of a the Institutional Capacity Development for Commercial Agriculture (ICDCA) component strengthens existing capacity and builds new capacity of service providers to adequately understand and respond to the needs of commercial agriculture.

Different components of the investment strategy address market failures related to the formation of commercial organizations, provision of information, and investment in new technology and infrastructure. The CAN, the CAA and the SMAC components address the failure of diverse commercial stakeholders to organize themselves into larger units and to establish mutually beneficial relationships; the AMIS and ICDCA addresses the failure of supplying and disseminating information to improve production and marketing. The CAF and its managing Board address the failure of investing in new technologies and infrastructure providing public good benefits.

The various components of the project are interlinked and reinforce each other. The CAN members will benefit from association with other Network members by developing joint investment proposal for approval by the CAA Board. The institutional capacity development activities will strengthen the capacity of institutions to provide services to CAA members, farmer groups and small and medium agro-enterprises. The investments approved by the Board of the CAA will complement investments made possible by the increased credit disbursed to commercial agriculture made possible by the reform of the rural financial sector as advocated by the investment strategy on rural finance (see the report by the Rural Finance Specialist of the UNDP/FAO Agricultural Sector Review) and the improved information and knowledge disseminated by the AMIS.

6.4.5 Support to Agricultural Machinery Usage

The objective of the proposed strategy is to increase the level of mechanization in agriculture by providing support to the private sector in investment in machinery hire and purchase[70]. The current low level of agricultural mechanization is due in part to the lack of demand for machinery, which in turn is a function of the lack of access to broad-based credit, lack of appropriate machinery technology, lack of fuel, lubricants and spare parts, and the small farm sizes making it uneconomical for individuals to purchase machinery for themselves.

The proposed strategy involves firstly the restructuring of the AMD and the devolving of its responsibilities for contract machinery operations to the private sector. Unless AMD stops subsidizing it contract machinery operations by only charging for operating costs, there is limited chance that the private sector will be able to expand their own contract machinery operations. Secondly, the strategy increases support to private sector operations. The proposed strategy has several interlinked components:

1. The divestment of the commercial contract machinery activities of the AMD to the private sector. Either machinery and equipment are auctioned off piecemeal to local private enterprises (including farmers), or the whole commercial unit is privatized as a contract machinery enterprise.
2. The privatization of the 100 tractor stations (retail outlets) owned and operated by AMD.
3. A review of existing legislation, regulations and practices governing imports of agricultural machinery in order to eliminate any constraints to the import of machinery. Machinery should be seen as an important input into agricultural production, and not restricted in any way.
4. A review of the existing legislation, regulation and practices governing imports of fuel, lubricants and spare parts in order to eliminate any constraints to the import of these components. The private sector should be allowed to obtain import permits for fuel and lubricants for agricultural machinery operations as needed.

[70] This investment strategy is formulated in response to a request from MOAI and FAO for such a strategy to be included as part of the agroindustry investment proposals.

5. Capacity building for AMD operations in monitoring and regulation of the sub-sector, and provision of training and support functions to private farmer operators and agricultural contractors in the technical aspects of mechanization and in hire service management.
6. Provision of an incentive framework for increased private sector involvement in manufacture and hire services, including provision of machinery to private sector enterprises (including farmers) on a hire-purchase

6.5. Priorities and Sequencing of Sectoral Strategies

Within the above strategy categories there are priorities for the government and the agroindustry sector in particular.

Firstly, the international experience is that there is considerable resistance within governments *per se* for broad-based policy reform, particularly of the macroeconomic variety. This is understandable, as the push for policy reform is seen within most governments as an essentially external push. While this may or may not be the case in Myanmar, in the absence of consistent, transparent and analytically rigorous policy analysis and advice from within the bureaucracy in Myanmar there is little chance that theoretical arguments for policy reform from external agencies will have much impact. While it is not the role of the UNDP/FAO Agricultural Sector Review to examine macroeconomic policy effects, it is important to be able to identify **sectoral** policy issues and subject them to rigorous analysis. One of the priorities for the bureaucracy in Myanmar is to develop a capacity for sectoral policy analysis. Policy analysis does not have to be restricted to the analysis of exchange rate controls or export restrictions; there is a significant opportunity for policy analysis of the impacts of domestic price controls, trading restrictions, improvements in agricultural productivity, and increases in cropping intensification and extensification. Without the ability to demonstrate a clear link between policy choices and welfare impacts, the effectiveness of policy advice will continue to be limited.

Secondly, capacity building for policy analysis will need to go hand-in-hand with capacity building for regulatory change. Specific legislation for agroindustry and marketing is lacking, and existing regulations need to be simplified. This will involve support to the bureaucracy for legislative drafting as well as the formulation of standards and norms for marketing and agroindustry. The creation of a Quality and Standards Bureau, or the strengthening of those government departments supposedly in charge of these issues, needs to be carried out as a matter of urgency.

Thirdly, reform of SOEs is an important but difficult task. This does not necessarily mean privatization of all SOEs, but rather a full evaluation of the current situation and constraints in SOE operations and the development of business plans. Long term development of agroindustry in Myanmar will be hampered as long as there are distortionary effects caused by subsidized operations of the SOE sector. Ultimately, targeted commodity programs under the guise of SOEs are incompatible with the principle of a market-orientated economy as advocated by the Government of Myanmar. Currently SOEs under the control of MOAI are being subsidized by an average of K10 billion per year; clearly unsustainable in the long term. Loss making SOEs need to be restructured, or alternatively privatized. A full diagnostic study and financial audit of all SOEs under MOAI and MOLF needs to be carried out before any business plans can be developed.

Fourthly, while the policy, institutional and regulatory reforms identified above will create an enabling environment for the private sector to invest in and develop agroindustry, support to private sector agroindustry development is required to speed up the process of agricultural development within Myanmar. This support takes the form of institutional and mechanism building for the creation of agricultural value chains, as well as provision of funds for the private sector to invest in agroindustry development itself. Importantly, if the poor are to be involved in the process of agricultural development, mechanisms must be put in place that enables their participation in the value chain itself.

These priorities will need to be sequenced in a proper manner in order to ensure the best possible chance for agroindustry development to succeed. It is envisaged that the strategy investments will be phased in over the short (2004-2006) to medium term (2006-2010) and that long term investments should not be necessary; if private sector involvement in agroindustry is to succeed, this will require the phasing out of support as quickly as possible.

Obviously an enabling policy and regulatory environment is needed before the private sector can be convinced of the need to increase investment in the agroindustrial sector. As such, in the short term (2004-2006), capacity building for policy analysis and policy reform is required. This will require some donor input in terms of technical expertise, but large scale investments from the donor community is not required for this phase.

Similarly, a diagnostic study and financial audit of SOE operations could be implemented at an early stage, with the development of business plans and restructuring (if needed) carried out over the medium term (2006-2010).

While the initial feasibility studies and pre-project technical assistance for support to private sector agroindustry development can be carried out over the short term, actual implementation of such a project should be carried out over the medium term after institutional and policy reforms have had a chance to impact on the economy.

6.6. Impacts on Poverty Reduction and Pro-Poor Development

The expected impact on poverty reduction and pro-poor development is expected to derive through four channels:

1. Broad-based policy reform arising from high quality policy advice delivered by a strengthened policy unit within MOAI,
2. Reduction in market distortions arising from privatization of SOEs and the strengthening of economic management of SOEs remaining under government ownership.
3. Employment generation, social mobilization and organization of smallholder farmers into larger groups, and additional income opportunities in a more dynamic rural economy arising from strengthening linkages in commercial agriculture.
4. Increases in agricultural productivity arising from increased mechanization of agriculture.

Poverty reduction through broad-based policy reform is achieved through the strengthening of the policy advice given to government. The alternative to policy making based on rigorous analysis is that inconsistent and unstable policy imposes significant uncertainty on agricultural investment decisions and impacts adversely on farmers. Policies which do not take into account the costs and returns to farmers runs the risk of depressing prices, reducing farm profitability and thus income generated by farming households. This in turn will reduce investment and create further disincentives. If farming becomes unprofitable then the impact on agricultural employment is amplified, particularly for the landless poor. Reduced disposable income for farm households and landless laborers has adverse effects on nutrition and food security, both in terms of quality and quantity.

Similarly, reform of the SOE sector will have significant poverty reduction effects through the removal of distortionary effects on prices and markets. Farmers will be able to obtain higher prices for commodities which had previously been controlled through compulsory procurement policies, and also be able to make investment decisions based on open market prices and demand.

Poverty reduction through employment generation is achieved through increase and diversification of employment opportunities both on the farm and in the post-production system. Increased employment opportunities for the poor derive from increased demand for agricultural products, particularly high

valued crops in labor-intensive activities such as vegetable production and tea gardens. Increased employment opportunities in the post-production system are related to activities such as additional movement of commodities, sorting, grading, packaging, processing and storing.

Poverty reduction via social mobilization is achieved through organization of small-size and dispersed farmer groups into larger and closely-linked farmer organizations such as cooperatives, producer associations and federations. The Support to Private Sector Marketing and Agroindustry Development project will adopt social mobilization approaches that motivate the poor to overcome the barriers to organization into larger units able to better cope with risk and improve access to technology, markets, credit and information.

One of the main features of the Social Mobilization for Agricultural Commercialization (SMAC) component is the linking of farmer groups having a large composition of women and poor with the Commercial Agricultural Network (CAN), including members of the Commercial Agricultural Alliance (CAA). The linkage will provide opportunities for both the farmer groups and the Alliance members. The farmer groups will be able to see what other farmers have been able to achieve through improved organization and therefore will be motivated to undertake similar type of arrangements, as deemed suitable to their circumstances. The Alliance members might see opportunities for further involving more farmers into their operations, either in production, marketing or processing.

As value added post-production activities in agriculture is the main sector of the rural economy, it is expected that a more commercialized economy will increase income and growth of agriculture and the rural economy. Agricultural commercialization will then be an engine of growth of the rural economy, and generate demand for a variety of services and goods. Agricultural growth multipliers are estimated of the order of 3 to 4 in other economies with similar structure as Myanmar. That implies that for each percentage point of growth in the agricultural sector (both production and post-production), 3-4 additional points of growth will be expected in the non-agricultural sector of the rural economy. This will be realized through demand linkages for services (e.g. transportation, accounting, restaurants, tourism, and advertising) and commodities (e.g. equipment, household goods, construction, and spare parts).

The use of agricultural mechanization will have significant poverty effects on farm households, through the increase in agricultural productivity of existing land. Farmers will be able to increase the intensification of their cropping patterns, as well as cultivate increased land areas. In terms of landless laborers, the impact of agricultural mechanization will be significantly negative, as capital intensification of agriculture will reduce the demand for labor. Unless active steps are taken to promote agricultural diversification, and the movement of surplus labor into other activities (such as downstream processing), the increase in agricultural mechanization will be significantly deleterious to the agricultural sector as a whole.

6.7. Impacts on Social and Gender Development

The main theme of the strategy for agroindustry development is to ensure the movement of commercial ventures in agriculture from a low level of commercialization to a higher level of commercialization. However, the conceptualization of the strategy recognizes that the majority of farmers are operating at subsistence level and many are at a very low level of commercialization. Moreover, the core problem for commercialization is that the vulnerability of rural households is one of the main causes for the absence of a network of functional value chains.

Most of the poor and vulnerable groups have few assets (e.g. land, finance, livestock) and little education. As a consequence, their main source of income is low-skill wage labor. However, employment opportunities are limited in rural areas, and the poor and vulnerable often resort to different coping mechanisms (including migration and indebtedness). Their capacity to organize and interact with

other stakeholders in the value chains is limited. Their low education and social status usually prevents them from gaining access to markets (for labor), and to credit and programs that might improve their condition. The limited access to social services (health, education, water) aggravates the plight often arising from their exposure to different types of risk (e.g. disease, natural calamities, and accidents).

Even though women represent a large share of the labor force in agriculture, there is limited active participation of women in commercial agriculture. Women entrepreneurship in commercial agriculture is quite limited and the involvement of women in formal trading is quite rare in Myanmar with only few women playing a leadership role in activities related to trade, marketing, processing and post-production activities. When involved in these activities, usually women are employed as wage labor (in processing plants, in grading produce and storage operations), rather than as managers or entrepreneurs.

In order to analyze how the strategy addresses the problem of poverty and gender imbalance, it is useful to consider:

1. How the strategy will be able to expand opportunities for the poor and women to engage in commercial activities,
2. Reduce vulnerability of disadvantaged groups arising from commercial agriculture, and
3. Enhance capabilities of the poor, disadvantaged groups, and women to engage directly or benefit indirectly in commercial agriculture.

The following sections summarize the analysis along the three dimensions of opportunity, vulnerability and capability.

6.7.1 Improved Opportunity

The strategy envisages increased opportunities for income growth and employment generation for the poor, women and disadvantaged groups. The increased opportunities will be the effect of investment projects conducted by the Support to Private Sector Marketing and Agroindustry Development project to facilitate the access to technology, markets, infrastructure and information. The investments of the project are expected to expand production and marketing of a broad range of agricultural products such as labor-intensive vegetables, tea and sugarcane thus resulting in the promotion of organizations that involve smallholder farmers production and employment of labor both on the farm (production activities) and off-farm (post-production activities). The expansion of broad-based credit to commercial agriculture agro-enterprises (including farmer groups, cooperatives, farmer association and agribusiness) is also expected to expand production and employment opportunities for the poor and women. The expanded opportunities are part of the design of the commercial agriculture information services (reaching through radio most of the rural population) and the Commercial Agriculture Network (CAN). The focus of the social mobilization on targeted groups (women, poor and disadvantaged groups) will also expand opportunities for these groups.

6.7.2 Vulnerability Reduction

The strategy aims at moving the commercialization from the current low level to a higher level. At the higher level of commercialization, stakeholders are better organized as value chains and therefore better able to cope with challenges and risk arising from natural events and markets. The social mobilization activities highlight the importance for the smallholder farmers and the targeted groups of poor, women and disadvantaged people to form larger organizations able to connect to markets, access technology and make larger investments. The promotion of higher level of commercialization implies the greater use of contracts between farmer groups and processors, thus reducing the vagaries of markets and weather. The growth of agribusiness and agro-industry will also stimulate the growth of employment, both at the farm level and off-farm, stabilizing the flow of seasonal labor out of rural areas.

6.7.3 Capability Development

The strategy recognizes that there is a considerable amount of work to do in order to increase capacity to move commercial agriculture to a higher level. To a large extent, the strategy could be regarded as a series of projects that builds capabilities for stakeholders to form value chains and establish mutually profitable linkages among themselves. Capability development within the strategy takes place in all projects, but primarily in the Support to Policy Reform Project and the Support to Private Sector Marketing and Agroindustrial Development Project. Awareness programs, women leadership programs and organizational skills to benefit targeted groups are part of the various modules proposed both in the Social Mobilization and in the Institutional Capacity Development components within the Support to Private Sector Marketing and Agroindustrial Development Project.

An analysis of the effects of various projects within the strategy on poverty and gender suggests that the strategy might in fact play an important role in reducing poverty and redressing gender imbalance. The two objectives will be achieved through an acceleration of broad-based agricultural growth in the country.

Broad-based agricultural growth in the region is a necessity. Given the predominance of small-scale farms in the country (the 1992/93 Agricultural Census estimates that the average farm size is 2.5 ha and 54 percent of farmers out of a total of 2.72 million agricultural land holdings have less than 2 ha; occupying 21 percent of cultivated land), it is quite difficult to envisage growth of the sector without a broad based involvement and sharing by smallholders. The commercial producers targeted by the projects on agricultural mechanization and commercial agricultural development will be primarily smallholder farmers. As long as the poor are well organized into larger commercial organizations their chances of getting out of poverty are higher and their chances of precipitating into abject poverty are lower.

The strategy is formulated under the awareness that many poor farmers and rural households will be able to benefit directly from growth of commercial agriculture primarily as wage earners, either as laborers on farms or as laborers in the post-production system. In some cases, poor households might be able to get out of poverty through sharecropping or through the starting of micro enterprises and provision of services related to agribusiness. Most of the investments considered in the Support to Private Sector Marketing and Agroindustrial Development Project are likely to be labor-intensive. In most cases, the capital is relatively small and oriented to improve infrastructure and increase access to knowledge, markets, information and improved skills.

The strategy envisages a dynamics of the commercialization process that sees the formation of value chain linkages as one step in a continuum of degrees of commercialization ranging from semi-subsistence to sophisticated commercialization. By providing a mechanism to move the groups already commercialized to a higher level, the strategy facilitates the dynamics of social change necessary to commercialization.

7. Investment Profiles for Agroindustrial Development

7.1.1 Support to Policy Analysis and Policy Reform

7.1.1.1 Background and Rationale

The Government of Myanmar has increasingly stressed the importance of a more diversified agriculture to achieve its goals of modernization and rural industrialization. This is consistent with similar strategies followed by other Asian rice economies during the 1970s and 1980s, where agricultural diversification was seen as a desirable response to changes in supply (the success of the green revolution resulted in food self-sufficiency and declining real rice prices) and demand (rising income and urbanization increased the demand for non-rice food products). Some of these economies have been successful at diversifying the agricultural and rural economy. However, it was also realized that agricultural diversification was a much more complex process than changing the output mix.

Agricultural diversification and rural industrialization as an enabling strategy for rural income growth and poverty reduction in Myanmar will require enormous investment and will take time. The constraints are of staggering complexity: the presence of a large population in rural areas characterized by widespread poverty; low productivity of agricultural labor; low level of infrastructure development; poorly integrated markets; poorly functioning factor markets such as land and credit; and an underdeveloped rural industry characterized by a dichotomy between micro enterprises and large (usually SOEs) enterprises. These constraints are aggravated by a still incomplete process of liberalization in the transition from a centrally-planned to a market-oriented system.

There are enormous challenges in pursuing the goal of accelerating agricultural growth in a sustainable and equitable way. Change in policy, investment allocation, and institutional development will have to create the conditions to implement such a strategy.

That does not imply a strategy of picking the commodity with the highest potential and subsidizing production. The strategy is rather to assess the feasibility of these sectors based on economic and technical criteria, and to promote investments or mechanisms to lower the transactions costs for smallholder farmers and small-scale enterprises to be involved in such activities. Improved infrastructure, appropriate research and extension, access to land and credit markets, information, support to institutional building (market information systems, standards and grades, trade associations) are all different ways to lower transaction costs. It is a different approach than trying to actively subsidize a subsector (for example sugar) through trade protection or by building large factories that face bottlenecks in procuring raw materials and are not labor intensive.

Inevitably, the development of a well diversified rural economy will require massive investment in physical infrastructure, such a roads, electrification, irrigation systems, ports, and communication systems (the hardware). However, most of these investments are expensive, take a long time to be implemented, and risk being inadequate, environmentally damaging, and unsustainable, especially when carried out without adequate study and evaluation by policy makers, researchers, and representatives of civil society. In the context of limited resources, it would be more appropriate to shift investment emphasis to capacity building, research, extension, and policy and project analysis (the software). These types of investments are not only less expensive, but also have the potential to identify more suitable and less expensive investment options. The complexity of agricultural diversification and rural industrialization strategy in Myanmar entails policies and measures that affect not only agriculture but also several other aspects of rural society including infrastructure, credit, health, education, and rural institutions. Within the context of a market economy, rural development is not directed from above, as in the former centrally managed system. The state, however, still has an important role to play in providing public goods in which the private sector does not have incentive to invest and in facilitating the creation of market institutions such as voluntary business associations and cooperatives. This

process entails an enormous amount of information gathering, processing, and evaluation. Currently, in Myanmar, many line ministries provide this information function, often in an uncoordinated manner and sometimes without appropriate technical expertise. Policy design and implementation are often conducted without adequate monitoring of markets and without the support of analytical methods that could improve the decision and implementation process.

In terms of policy constraints, it is noted that there is a lack of consistency and transparency in policy making, with policy announcements seemingly ad-hoc and subject to constant revision. This is particularly the case with policies affecting the rice sector in particular and exports and imports of agricultural products in general. The lack of clear policy and regulations impacting on agroindustry imposes a significant financial cost on private enterprises. This has significant effects on the incentives facing private enterprises and their investment decisions. Unless there is a consistent and transparent process for policy formulation, and stability in the policy environment, private enterprise is unlikely to increase investment in agroindustry.

From the government side, it is noted that there is a lack of resources to articulate the policy questions, analyze the policy options, and make the appropriate policy decisions. These decisions then have to be articulated in an appropriate manner to the policy makers at the political level. There is a perception that that decisions are made on the basis of limited information, and that mechanisms for getting the appropriate information from policy analysts to policy makers are currently limited.

The limitations on an effective mechanism for policy dialogue extend to the private sector as well. The private sector notes that there is an absence of policy dialogue with the government, particularly in areas of direct concern to the private sector in general, and agroindustry in particular. In countries with an effective policy analysis and formulation process, views from the various stakeholders (including the private sector) are elicited in a public consultation process. The development of a participatory planning and policy formulation process has been advocated by the Government itself (in terms of devolving responsibilities down to the Township level), but this needs to be extended to include other stakeholders as well.

From the policy makers' perspective, there is obviously a need for policy advice to be consistent, transparent, and analytically rigorous. In the absence of these characteristics, there is no reason to accept the advice as being sound and policy makers would be justified in rejecting such advice. Thus, the constraints in policy formulation - lack of effective policy analysis and lack of trust in policy advice - appear to be inextricably linked.

7.1.1.2 Objectives

As noted above, the implementation of policy requires that the formation of policy advice is based on consistent, transparent and analytically rigorous policy analysis. The proposed investment strategy involves the creation of a policy analysis and advice unit within MOAI (probably under DAP), the creation of a series of diagnostic tools for policy analysis and commodity forecasting, within the context of an overall sector strategy, and the building of capacity within that unit for policy analysis and modeling and policy advice.

The policy analysis unit is designed to deliver high quality policy advice on sectoral and commodity issues to the Minister of Agriculture and Irrigation and the Minister of Livestock and Fisheries on a regular basis. The policy analysis unit would be engaged in (but not limited to) the following activities:

1. Writing reports, reviews and general assessments of sectoral issues and commodities.
2. Consulting services and commodity and policy advice provision to the Minister of Agriculture and Irrigation and the Minister of Livestock and Fisheries,
3. Issuing sectoral and commodity analyses and forecasts,

4. Collecting information on the general agricultural sector and commodities, and the establishment of commodity information database in conjunction with the MIS under DAP, and
5. Developing and maintaining agricultural economic policy models and econometric models of specific agricultural commodities.

7.1.1.3 Principal Components

The project will be implemented over 3 years, depending on the level of capacity building required, and as determined by the training needs assessment exercise carried out in the initial project stages. The support package involves six interrelated components[71]:

1. The establishment of a policy analysis unit within MOAI (probably under DAP), including budgetary provision for personnel (10 staff), equipment and consumables.
2. A training needs assessment study carried out with MOAI staff to tailor a specific capacity building program to the needs of the MOAI in general and the policy analysis unit in particular.
3. The development of a multi-market model of agricultural commodities for Myanmar (e.g. rice, oilcrops, pulses and beans, livestock, forestry products, fruits and vegetables, and industrial crops[72]).
4. The placement of an international advisor within the policy analysis unit for a period of 3 years to assist the unit in undertaking high level analysis for agricultural commodities.
5. The provision of short-term (4 week) capacity building programs in policy modeling techniques to assist the unit in undertaking high level analysis for agricultural commodities. These programs (approximately 4 in total) will strengthen capacity in multi-market modeling as well as other economic and econometric modeling techniques. The international advisor would be assisted by specialist international experts in the appropriate fields.
6. The establishment of a regular workshop series and publications designed to promote the activities of the policy analysis unit and obtain feedback from various stakeholders (government, private sector) on the desired policy questions to be analyzed.

These components will be phased in four phases lasting three years. During the course of the project the activities of the policy analysis unit would be assisted by an international advisor.

In Phase I (3 months) the policy analysis unit would be created, including the assignment of relevant, skilled personnel from DAP and other departments from within MOAI, MOLF and other government ministries. The recruitment of new government staff with the appropriate technical skills may be considered in consultation with MOAI and MOLF. Approximately 10 professional staff should be recruited as the main commodity analysts. Appropriate levels of resources, including infrastructure, equipment and software, will be provided; as determined by the initial project design document. An initial training needs assessment will be carried out to determine priorities for training and capacity building.

In Phase II (6 months) the policy analysis unit will be engaged in the major undertaking of developing a multi-market model of agricultural commodities for Myanmar. This will involve at least 2 international experts, 2 national experts, and the policy analysis unit staff in collecting and collating the data necessary to build and calibrate the model. Extensive surveys of commodity systems are envisaged to provide the relevant and accurate data required. Consideration should be given to the use of external (private sector) survey teams with relevant experience and expertise.

In Phase III (10 months) the policy analysis unit will be involved in four short-term capacity strengthening programs designed to upgrade the skills of the staff and expose them to the latest commodity modeling techniques and market forecasting tools and techniques. Each capacity

[71] Although not included as an integral component, consideration should be given to designing an appropriate monitoring and evaluation system.
[72] A separate fisheries model could be built separately.

strengthening program will be conducted by one international expert in the appropriate field, with the assistance of the international advisor and policy unit staff.

1. The first short-term capacity strengthening program would be a four week training course in economic modeling theory and practice, with an emphasis on agricultural commodity modeling. The course content would be specifically targeted at the economic modeling skills and techniques needed to build, modify and use market forecasting models. Staff would be trained on the use of STATA in statistical analysis and econometric forecasting.
2. The second short-term capacity strengthening program would involve a four week training course on multi-market modeling using GAMS. This course would be specifically targeted at training staff in developing and maintaining the multi-market model developed in Phase II.
3. The third short-term capacity strengthening program would involve a four week training course on econometric modeling and the use of STATA in statistical analysis. This course is specifically designed as an advanced course building on the theory and methodology introduced in the first short-term capacity building program.
4. The final short-term capacity strengthening program would involve a four week training course in the economics of international integration, with a particular focus on the economics of agricultural commodity trade under trade liberalization. This will strengthen the capacity of the policy analysis unit to analyze the impact of trade liberalization, WTO and AFTA on Myanmar's agricultural sector.

In-between the training courses the policy unit staff will be involved in their core activities of research, providing commodity policy advice, and conducting workshops and seminars to disseminate results of their research.

In Phase IV (17 months) the policy analysis unit will be involved in their core activities of research, providing commodity policy advice and conducting workshops and seminars to disseminate results of their research. Assisted by the international adviser the unit would build on the skills and techniques developed in the first 3 phases of the activity and applying these techniques to practical modeling simulations and further developing practical skills through intensive exposure to actual modeling situations. As needed, additional training courses and capacity building exercises could be scheduled to meet the needs of the staff. Ideally, the support activities proposed will enable the policy analysis unit to continue beyond the term of this project without further external assistance.

7.1.1.4 Outputs

Key outputs would include the following:

1. A core network of agricultural commodity professionals fully able to utilize economic models and other techniques for commodity analysis and being able to provide accurate and high quality advice to government and the private sector,
2. Provision of agricultural commodity information and policy advice to government and the private sector,
3. A multi-market model of agricultural commodities in Myanmar, enabling government to access accurate, high quality and timely advice on policy questions of relevance to the government and the private sector,
4. Workshops, seminars and a publication series disseminating information on commodity analysis, forecasting and policy advice to government and the private sector, and
5. Establishment of an agricultural commodity database in conjunction with the MIS.

7.1.1.5 Indicative Costs

Costs for this project would be approximately US$1,000,000. An indicative budget is shown below.

Summary Indicative Budget for Support to Policy Reform Project

Item	Sub-Item	Budget Amount (US$)			
		Year 1	Year 2	Year 3	Total
International Experts	Long Term Advisor	$100,000	$100,000	$100,000	$300,000
	International Expert 1 (Multi-Market Model)	$105,000			$105,000
	International Expert 2 (Multi-Market Model)	$105,000			$105,000
	International Expert 3 (Short Course)		$20,000		$20,000
	International Expert 4 (Short Course)		$20,000		$20,000
	International Expert 5 (Short Course)		$20,000		$20,000
	International Expert 6 (Short Course)		$20,000		$20,000
National Experts	National Expert 1 (Multi-Market Model)	$30,000			$30,000
	National Expert 2 (Multi-Market Model)	$30,000			$30,000
Model Development and Maintenance	Survey and Data Collection, Database Management and Associated Costs	$60,000	$15,000	$15,000	$90,000
Short Term Capacity Building	Training Supplies and Teaching Materials		$8,000		$8,000
Office Equipment	10 Computers, Associated Peripherals, Software, Consumables	$60,000	$6,000	$6,000	$72,000
Office Overheads	Infrastructure and Equipment	$10,000	$5,000	$5,000	$20,000
Workshops, Seminars and Publications	Workshop and Printing Costs	$5,000	$5,000	$5,000	$15,000
Travel	Travel and Associated Costs for Policy Unit Staff	$5,000	$5,000	$5,000	$15,000
Contingency	(15% of Total Costs)	$76,500	$33,600	$20,400	$130,500
Total		$586,500	$257,600	$156,400	$1,000,500

Employment costs valued at total package costs (Honorarium, travel, accommodation etc)

7.1.2 Support to Institutional Reform in the SOE sector

7.1.2.1 Background and Rationale

The Government of Myanmar has increasingly stressed the importance of a more diversified agriculture to achieve its goals of modernization and rural industrialization. This is consistent with similar strategies followed by other Asian rice economies during the 1970s and 1980s, where agricultural diversification was seen as a desirable response to changes in supply (the success of the green revolution resulted in food self-sufficiency and declining real rice prices) and demand (rising income and urbanization increased the demand for non-rice food products). Some of these economies have been successful at diversifying the agricultural and rural economy. However, it was also realized that agricultural diversification was a much more complex process than changing the output mix.

Agricultural diversification and rural industrialization as an enabling strategy for rural income growth and poverty reduction in Myanmar will require enormous investment and will take time. The constraints are of staggering complexity: the presence of a large population in rural areas characterized by widespread poverty; low productivity of agricultural labor; low level of infrastructure development; poorly integrated markets; poorly functioning factor markets such as land and credit; and an underdeveloped rural industry characterized by a dichotomy between micro enterprises and large (usually SOEs) enterprises. These constraints are aggravated by a still incomplete process of liberalization in the transition from a centrally-planned to a market-oriented system.

There are enormous challenges in pursuing the goal of accelerating agricultural growth in a sustainable and equitable way. Change in policy, investment allocation, and institutional development will have to create the conditions to implement such a strategy.

This does not imply a strategy of picking the commodity with the highest potential and subsidizing production. The strategy is rather to assess the feasibility of these sectors based on economic and technical criteria, and to promote investments or mechanisms to lower the transactions costs for smallholder farmers and small-scale enterprises to be involved in such activities. Improved infrastructure, appropriate research and extension, access to land and credit markets, information, support to institutional building (market information systems, standards and grades, trade associations) are all different ways to lower transaction costs. It is a different approach than trying to actively subsidize a subsector (for example sugar) through trade protection or by building large factories that face bottlenecks in procuring raw materials and are not labor intensive.

Over the past two decades, global changes in the agro-food industry have affected agriculture dramatically. As the structure of the industry has become more concentrated, demand patterns have shifted towards higher value added products, and supermarkets are increasingly the major actors in the farmer to consumer chain. Yet, in Myanmar, post-harvest systems and agroindustry are still largely characterized by a dichotomy between a multitude of small enterprises, often household businesses with little capital, limited access to modern technology, and poor integration with urban and international markets, and a few large SOEs often inefficient and not well prepared to face the competition from global agroindustry. Under the process of globalization, both small enterprises and SOEs are put under pressure by the entry of large domestic and international agribusinesses. The impacts of agroindustry globalization on rural livelihoods and small enterprises remain unclear. However, there are indications that globalization is compatible with a broad-based approach to agroindustrial development. A broad-based approach implies a balanced structure of expanding small, medium, and large enterprises that can capture different scale economies, niche markets, linkages with urban and international markets, and intra-industry linkages. Institutional arrangements such as contracts between smallholders and large enterprises, farmers and trade associations, and supply chain networks offer promising avenues for reaping the benefits of a dynamic global agroindustry.

Effective participation of all stakeholders should result in a mobilization of human and economic resources to attain the goals of rural development. By itself, the state will not be able to attain these goals, given the limited amount of resources available and institutional weaknesses. In fact, the strengthening of the orientation toward the market already offers the opportunity to tap the resources of the country. The state can facilitate this process, but cannot expect to do better than the private sector in the conduct of business.

The divergence between the official and market exchange rates creates a situation where there is a large transfer of income to selected groups, and in particular results in significant protection to import-substituting enterprises and the SOEs. The implication is that undertaking an exchange rate realignment would result in significant reductions in the competitiveness of SOEs. Given the parlous state of SOEs, even under the current favorable exchange rate regime, there seems to be little scope for significant investment in SOEs in their current state. This is even more so if macroeconomic reform polices are implemented. Conversely, enterprises which do not receive benefits from the current exchange rate distortion, and which are doing well despite restrictions on their operations, are more likely to benefit from investment, particularly after reform policies are implemented.

Currently there are 6 SOEs under MOAI (Myanmar Farm Enterprise (MFE), Myanmar Cotton and Sericulture Enterprise (MCSE), Myanmar Sugarcane Enterprise (MSE), Myanmar Jute Industries (MJI), Myanmar Perennial Crop Enterprise (MPCE), and Myanmar Agricultural Development Bank (MADB)). Under MOLF there are 2 SOEs (Livestock Feed and Milk Products Enterprise (LFME) and the Livestock and Fisheries Development Bank (LFDB)[73]). Each of these enterprises face their own particular constraints and opportunities, limited budgets, inefficient management, and lack of access to both inputs and output markets.

Due to the restrictions that these entities work under – in terms of pricing, capital investment and business planning – they suffer major losses in operations and have a significant distortionary impact on the market for the commodities in which they deal.

Low government procurement prices for raw material inputs have left SOEs struggling to operate plants at more than 50 percent utilization rates. In some SOE plants processing cotton, for example, utilization rates are under 4 percent. In the private sector capacity utilization rates are higher, but still less than economical in the long run.

The liberalization of SOEs to operate under market conditions offers a significant potential for growth in agro-industry in Myanmar. By eliminating lower than market procurement prices and output sales prices, and by allowing SOEs to structure their operations in accordance with market demands, improved operating efficiencies would be expected in rice milling, cotton ginning, sugarcane milling and in ancillary, but important, industries such as machinery and fertilizers. Improved operating efficiencies would in turn permit improved prices for producers and so contribute to further sector growth. While quantification of such gains is not possible at this stage, it is noted that the SOEs in the agricultural sector lost some K17.7 billion in 1999/00 and K63.5 billion cumulatively over 1994-2000. If these enterprises were made to breakeven, this would save K17.7 billion per year in government expenditures, based on 1999/00 data. If they became even modestly profitable, say a 10 percent return, this would add nearly K20 billion per year to the economy, based on 1999/00 expenditures. Thus the net benefit would be almost K40 billion per year, or US$40 million based on current exchange rates.

[73] There is some debate as to whether LFDB should be classified as an SOE under MOLF. LFDB themselves claim to be a "privately owned" bank, however, with the board of directors being drawn from the government sector, their banking operations not being subject to the same regulations as other private banks, and two centrally initiated development programmes initiated in 2003, it is arguable as to whether they are truly a private sector bank.

7.1.2.2 Objectives

A diagnostic study and financial audit of all SOEs under MOAI and MOLF, with the exception of MADB and LFDB[74], should be carried out in order to allow policy makers to make fully informed decisions regarding these SOEs' future operations. It should be noted that the diagnostic study and financial audit is not a punitive exercise, and the purpose is to generate constructive recommendations for future operations. Once a diagnostic study and financial audit has been completed a reform or restructuring plan for SOEs can be designed and implemented, including the development of individual business plans and management capacity strengthening for any SOE retained within government control.

The diagnostic study and financial audit should cover the areas of governance, strategic planning, organizational structure, human resources management, pricing policies and procedures, purchasing and selling policies and procedures, products and demand, compliance review, financial and accounting systems, management information systems, and financial analysis. The financial audit should be conducted to international accounting standards in order to gain an accurate representation of the individual SOE's financial situation. Full market costing of inputs and outputs, including depreciation of assets should be used. International donor support will be necessary for the diagnostic study and audit of each SOE.

The objectives of the project are to:

1. Provide the government, MOAI, MOLF and SOE management with a thorough understanding of the particular SOE's current operations, policies, and financial situation;
2. Assess the consequences in terms of the particular SOE's financial sustainability and contribution to achieving the Government's economic objectives;
3. Compare the particular SOE's operations and policies with international best practices; and
4. Make recommendations on a set of institutional and policy reforms to transform the particular SOE into a financially self-sustainable, market-orientated enterprise, either still under government ownership or as a privatized enterprise.

7.1.2.3 Principal Components

The diagnostic study for each SOE under MOAI and MOLF will take place over 3 months and include the following[75]:

1. Review of the organizational structure and governance of the SOE, its level of autonomy and decision-making procedures, and its business practices, pricing policies, and business culture;
2. Review of the SOE's operating systems and procedures, including accounting policies and practices that have a significant bearing on its operations and financial health;
3. Assess the situation of supply and demand for SOE inputs and outputs, determine the constraints and opportunities for SOE operations and products;
4. Assess the financial performance of the SOE, including an analysis of its cost structure and the implications for financial viability;
5. Identify the major problems of the SOE concerning governance, autonomy, organizational structure, business culture and practices, operating systems and procedures, accounting policies and practices, management information systems, risk management systems, and staff incentives, motivation, and skills;

[74] It is noted that a separate diagnostic study and financial audit of MADB has already been proposed under the Rural Financial Services component of the UNDP/FAO Agricultural Sector Review.

[75] Although not included as an integral component, consideration should be given to designing an appropriate monitoring and evaluation system.

6. Formulate, in consultation with the SOE, Ministry of Agriculture and Irrigation, Ministry of Livestock and Fisheries and the Ministry of Finance, a comprehensive reform program to address the identified issues with a view to transforming the SOE into a viable institution, including an evaluation of the options for continued operations as an SOE or privatization; and
7. Define the terms of reference to assist the SOE with the introduction of a corporate planning process that will set out the SOE's mission, business conduct, strategies, operational policies, and detailed action plans for the agreed reform program.

Parallel to the diagnostic study, the project will also conduct an external financial audit of the SOE under international accounting standards (IAS) for the financial statements of the previous two years. In accordance with IAS, the audit will examine the financial statements of the SOE and express an opinion on any material items that vary from IAS. The audit will also examine the SOE's accounting policies and procedures and submit to the SOE's management a statement of recommended modifications.

Based on the results of the diagnostic study and financial audit, a restructuring plan will be prepared in relation to the areas studied under the diagnostic. The restructuring plan will include cost estimates for its implementation, recommendations regarding external assistance to assist the SOE to implement it, and recommendations on staff training to accompany restructuring.

MOAI would be the main Government counterpart in the project and contribute staff to assist the consulting team in carrying out project activities. The consulting team will consist of 3 international experts, 6 senior national experts, and 6 junior national experts. Each of the national experts (1 senior and 1 junior) would be responsible for the diagnostic study of 1 SOE, under the guidance of an international expert, who would be responsible for 2 SOEs. The total time for the diagnostic study and financial audit would be 6 months.

7.1.2.4 Outputs

Key outputs would include the following:

1. Diagnostic papers on each SOE's:
    a. governance;
    b. strategic planning;
    c. organizational structure;
    d. human resources management;
    e. pricing policies and procedures;
    f. risk management policies and procedures;
    g. inputs and supply;
    h. products and demand;
    i. financial and accounting systems;
    j. management information systems; and
    k. financial analysis;
2. Financial audit report and management letter; and
3. SOE restructuring plan.

7.1.2.5 Indicative Costs

Costs for this project would be approximately US$950,000. An indicative budget is shown below.

Summary Indicative Budget for Support to SOE Reform Project

Item	Sub-Item	Budget Amount
Myanmar Farm Enterprise (MFE)	International Expert 1 Senior National Expert 1 Junior National Expert 1	$52,000 $15,000 $10,000
Myanmar Cotton and Sericulture Enterprise (MCSE)	International Expert 1 Senior National Expert 2 Junior National Expert 2	$52,000 $15,000 $10,000
Myanmar Sugarcane Enterprise (MSE)	International Expert 2 Senior National Expert 3 Junior National Expert 3	$52,000 $15,000 $10,000
Myanmar Jute Industries (MJI)	International Expert 2 Senior National Expert 4 Junior National Expert 4	$52,000 $15,000 $10,000
Myanmar Perennial Crop Enterprise (MPCE)	International Expert 3 Senior National Expert 5 Junior National Expert 5	$52,000 $15,000 $10,000
Livestock Feed and Milk Products Enterprise (LFME)	International Expert 3 Senior National Expert 6 Junior National Expert 6	$52,000 $15,000 $10,000
Financial Audit	International Financial Expert 1 International Financial Expert 2 National Financial Expert 1 National Financial Expert 2	$105,000 $105,000 $30,000 $30,000
Office Equipment	Computers, Associated Peripherals, Software, Consumables	$50,000
Office Overheads	Infrastructure and Equipment	$10,000
Workshops and Publications	Workshop and Printing Costs	$10,000
Domestic Travel	Travel and Associated Costs for Diagnostic and Audit Teams	$25,000
Contingency	(15% of Total Costs)	$120,300
Total		$947,300

Employment costs valued at total package costs (Honorarium, travel, accommodation etc).

7.1.3 Support to Private Sector Marketing and Agroindustry Development

7.1.3.1 Background and Rationale

The Government of Myanmar has increasingly stressed the importance of a more diversified agriculture to achieve its goals of modernization and rural industrialization. This is consistent with similar strategies followed by other Asian rice economies during the 1970s and 1980s, where agricultural diversification was seen as a desirable response to changes in supply (the success of the green revolution resulted in food self-sufficiency and declining real rice prices) and demand (rising income and urbanization increased the demand for non-rice food products). Some of these economies have been successful at diversifying the agricultural and rural economy. However, it was also realized that agricultural diversification was a much more complex process than changing the output mix.

Agricultural diversification and rural industrialization as an enabling strategy for rural income growth and poverty reduction in Myanmar will require enormous investment and will take time. The constraints are of staggering complexity: the presence of a large population in rural areas characterized by widespread poverty; low productivity of agricultural labor; low level of infrastructure development; poorly integrated markets; poorly functioning factor markets such as land and credit; and an underdeveloped rural industry characterized by a dichotomy between micro enterprises and large (usually SOEs) enterprises. These constraints are aggravated by a still incomplete process of liberalization in the transition from a centrally-planned to a market-oriented system.

There are enormous challenges in pursuing the goal of accelerating agricultural growth in a sustainable and equitable way. Change in policy, investment allocation, and institutional development will have to create the conditions to implement such a strategy.

This does not imply a strategy of picking the commodity with the highest potential and subsidizing production. The strategy is rather to assess the feasibility of these sectors based on economic and technical criteria, and to promote investments or mechanisms to lower the transactions costs for smallholder farmers and small-scale enterprises to be involved in such activities.

A large proportion of the resources devoted to meeting the demand for agricultural products in Myanmar have been spent to improve production technology and productivity. Much less attention has been devoted to the chain through which agricultural commodities and products reach final consumers within the country and abroad. This neglect is particularly serious given the enormous value added produced along the marketing chain between producers and consumers. Moreover, if the marketing chain does not function properly, investment in production becomes more costly and more risky, and ends up being wasted.

Over the past two decades, global changes in the agro-food industry have affected agriculture dramatically. As the structure of the industry has become more concentrated, demand patterns have shifted towards higher value added products, and supermarkets are increasingly the major actors in the farmer to consumer chain. Yet, in Myanmar, post-harvest systems and agroindustry are still largely characterized by a dichotomy between a multitude of small enterprises, often household businesses with little capital, limited access to modern technology, and poor integration with urban and international markets, and a few large SOEs often inefficient and not well prepared to face the competition from global agroindustry. Under the process of globalization, both small enterprises and SOEs are put under pressure by the entry of large domestic and international agribusinesses. The impacts of agroindustry globalization on rural livelihoods and small enterprises remain unclear. However, there are indications that globalization is compatible with a broad-based approach to agroindustrial development. A broad-based approach implies a balanced structure of expanding small, medium, and large enterprises that can

capture different scale economies, niche markets, linkages with urban and international markets, and intra-industry linkages. Institutional arrangements such as contracts between smallholders and large enterprises, farmers and trade associations, and supply chain networks offer promising avenues for reaping the benefits of a dynamic global agroindustry.

The link between agricultural and rural development has been already recognized by the government of Myanmar and is embedded in policy guidelines, decisions, and programs. One major challenge in the future will be to effectively promote these linkages in a financially sustainable way. That will require the participation of all stakeholders (rural households, private corporate sector, SOEs, NGOs, and civil service) in order to ensure better coordination.

Effective participation of all stakeholders should result in a mobilization of human and economic resources to attain the goals of rural development. By itself, the state will not be able to attain these goals, given the limited amount of resources available and institutional weaknesses. In fact, the strengthening of the orientation toward the market already offers the opportunity to tap the resources of the country. The state can facilitate this process, but cannot expect to do better than the private sector in the conduct of business.

Effective participation has to be based on incentives of different stakeholders to contribute to meeting the challenges ahead. The system of incentives largely depends on prices in a market system. However, there are also important incentives deriving from improving governance, transparency, and the accountability of different stakeholders. Whenever these other incentives are neglected, then even the market mechanism will not operate efficiently.

In terms of private sector constraints, it is noted that there are limited examples of partnerships and linkages between different levels of the marketing chain and within each level (vertical and horizontal integration). Contracts between farmers and traders and processors are virtually non-existent, and when they do exist they are more honored in the breach than in compliance. In part this is due to the lack of an effective Contract Law, and the lack of enforcement of contractual obligations. However, it is obvious that the underlying reason is that individual actors find it more profitable (at least in the short run) to renege on contracts rather than adhere to an agreement. Until participants within the value chain see greater benefit from complying with contracts rather than breaking them there will be extremely limited development of agricultural value chains within Myanmar. The evidence from other countries, both developed and developing, indicates that opportunities do exist for the poor to benefit from participation in agricultural value chains, as long as they can be organized into effective marketing groups. The challenge is to find out ways of implementing the creation of trust, partnerships and linkages to form value chains for agricultural products in Myanmar.

Even with the formation of value chains for agricultural products, the private sector in Myanmar find it difficult to leverage these institutional mechanisms to create increased investment within the sector. In part there are serious constraints to the availability of credit, most particularly in the current environment facing the financial sector in Myanmar. Secondly, there are significant restrictions on the ability of the private sector to mobilize Foreign Direct Investment (FDI). Not only is the investment climate in Myanmar ill-suited to attract foreign investors, but rules and regulations are non-transparent or actively a hindrance to FDI.

7.1.3.2 Objectives

The objective of the proposed investment strategy is to increase the degree of agricultural commercialization in Myanmar by promoting the development of a network of well-functioning value chains that are competitive and innovative. The goal of the project is to increase the level of commercialization of agriculture in one pilot region in Myanmar in a sustainable manner.

There are several characteristics of the investment strategy:

1. The investment strategy recognizes the key role of networks in the development of value chains. The project facilitates the emergence of a network of well-functioning agricultural value chains and provides institutional mechanisms through which the key stakeholders and their service providers can effectively link to each other by forming partnerships and alliances. Stakeholders participate in a commercial agriculture network when they recognize that participation in the network increases their opportunity to establish mutually beneficial partnerships and alliances.
2. The investment strategy proposes methods for sharing information. Constraints related to limited access to information and access to capital are addressed through improved marketing information services. Sharing information, however, is not going to be translated into higher incomes and more effective services unless complemented by other mechanisms that give stakeholders the means to make investment decisions needed to move to higher levels of commercialization. Demand-driven investments will improve the efficiency of allocation of scarce public resources. The formulation, approval and implementation of demand-driven investments will also contribute to the development of alliances and partnerships between stakeholders and service providers.
3. The investment strategy builds and strengthens existing capacity of service providers to facilitate the development of commercial agriculture. Improved capacity of service providers facilitates the development of commercial agriculture in two ways: by directly providing better services to currently well-organized commercial stakeholders and by mobilizing and organizing currently loosely-organized farmer groups operating at a low-level of commercialization.

7.1.3.3 Principal Components

In order to achieve the overall objective of moving to a higher level of commercial agriculture in the pilot region, the project is organized into five inter-linked components, to be developed over 5 years[76]:

1. The formation of a Commercial Agriculture Network (CAN) to facilitate exchange of information between key stakeholders (producers, traders and processors) and service providers.
    a. Under this component, it is proposed to develop a mechanism to facilitate communication, information sharing and formation of partnerships among and between commercial stakeholders and service providers.
    b. The rationale for this component is the weakness of existing coordination committees at the district and regional levels and the lack of networking mechanisms between commercial stakeholders (farmers, traders and processors) and service providers (e.g. research and extension organizations, NGOs, financial institutions, line agencies) in the region.
2. The formation of a Commercial Agriculture Alliance (CAA) with a properly constituted Board and the formation of a Commercial Agriculture Fund (CAF) to provide a mechanism for different types of key stakeholders (producers, traders and processors) to work together by formulating and selecting investments that move commercialization to a higher level.
    a. Under this component (the CAA), it is proposed to develop a mechanism to facilitate the formation of effective value chains and the provision of demand-driven services and investments. The members of the Alliance consist of commercial farmers, traders, processors and their organizations. The Alliance will elect a Board of Directors responsible for approval of investment proposals submitted by Alliance members. These investments will be co-financed by the Alliance members and by a CAF provided by the project and managed by the Alliance Board. The proposals will be related to technology, infrastructure, marketing, information and capacity development.
    b. The rationale which defines the activity of the proposed private-sector based mechanism of a CAA, operating a CAF, is the weakness of public sector provision to meet the needs of commercial agriculture stakeholders.

[76] Although not included as an integral component, consideration should be given to designing an appropriate monitoring and evaluation system.

c. Commercial agriculture actors often operate as ineffective agricultural value chains. Most farmers are not organized into entities larger than small groups (of 10-20 farmers); as a result, smallholder farmers, even though engaged in some form of commercial agriculture are unable to achieve the scale economies facilitating technology innovation, and improved access to markets, finance and information. Similar difficulty of organization exists for traders and processors. There is a paucity of service provision by the existing institutions to the main commercial actors. Only relatively weak service and trading linkages exist between these actors themselves.
d. The purpose of setting up the Alliance/CAF is to enable farmer, trader and processor members of CAA to secure effective, market-oriented services or investments of their own choosing. The chosen investments will help them to increase their income, profitability and productivity by strengthening their linkages with each other and with other private and public value chain stakeholders.
e. While strengthening the linkages among the key commercial actors, the Alliance will accelerate the movement from the current low level of agricultural commercialization to a higher level characterized by increased competitiveness and innovation. The success of the Alliance will be a major contributing factor in the growth of regional income and employment and in meeting the challenges and opportunities of increasing urbanization and integration with international markets.

3. The Strengthening of the existing Agriculture Market Information Service (AMIS) to provide a strongly needed service to stakeholders involved in commercial agriculture. This service will expand the AMIS role from just providing market information on prices to a limited audience, to include information specifically required by commercial agriculture and agroindustry on a much wider scale.
    a. Under this component, it is proposed to develop a mechanism to improve access of farmers, traders, processors and service providers to information related to commercial agriculture in the region.
    b. The rationale for this component is the dearth of relevant and organized agricultural market information in the region. Without such information decisions about production, marketing and investment are more difficult and it will be difficult to gain competitive advantage in international or regional markets.
4. The development of Social Mobilization for Agricultural Commercialization (SMAC) to keeps the process of commercial agriculture continuously moving upwards, by facilitating the transformation of loosely-organized farmer groups already involved in low-level commercialization into better-organized and larger farmer groups operating at a higher-level of commercialization.
    a. Under this component, it is proposed a mechanism to facilitate the transformation of farmer groups already involved in commercial agriculture into larger organizations at the higher level of commercialization needed to satisfy the criteria for membership of the CAA.
    b. The rationale for this component is that farmer groups in Myanmar are often small in size, have difficulty in joining with other farmer groups to become larger organizations, and have limited access to markets, information, finance and technology. Some farmer groups have made the transition from subsistence to some form of low level commercialization, particularly in the case of high valued crops such as vegetables, potato and fruits.
    c. NGOs and government agencies have sometimes targeted farmer groups with a large proportion of women, poor and disadvantaged ethnic groups. In order for these targeted farmer groups already involved in commercialization to be able to meet the more demanding criteria of the CAA they will need to organize themselves into larger groups, such as cooperatives and producer associations. The experience of NGOs such as the HDI under UNDP, CARE, GRET, etc. has proved that social mobilization strategies can be sustainable. Farmer Field School experience in Integrated Pest Management is an important lesson for a modality of farmer-to-farmer effective extension and social mobilization.
5. The formation of the Institutional Capacity Development for Commercial Agriculture (ICDCA) component strengthens existing capacity and builds new capacity of service providers to adequately understand and respond to the needs of commercial agriculture.

a. Under this component, it is proposed a mechanism to conduct capacity building and strengthening of institutions involved in providing services to commercial agriculture stakeholders.
b. The rationale for this component is the weak capacity of government agencies, NGOs and private sector institutions to meet the needs of commercial stakeholders. There is a need for service providers to build or strengthen capacity in different thematic areas such as value chain management, agricultural marketing extension, planning and managing market infrastructure, proposal and business plan preparation and female entrepreneurship. However, this component argues that there is little point in building or strengthening capacity of individuals and institutions unless that increased capacity is actually put to use and is evaluated as useful by the very beneficiaries for which it was intended.

Different components of the investment strategy address market failures related to the formation of commercial organizations, provision of information, and investment in new technology and infrastructure. The CAN, the CAA and the SMAC components address the failure of diverse commercial stakeholders to organize themselves into larger units and to establish mutually beneficial relationships; the AMIS and ICDCA addresses the failure of supplying and disseminating information to improve production and marketing. The CAF and its managing Board address the failure of investing in new technologies and infrastructure providing public good benefits.

The various components of the project are interlinked and reinforce each other. The CAN members will benefit from association with other Network members by developing joint investment proposal for approval by the CAA Board. The institutional capacity development activities will strengthen the capacity of institutions to provide services to CAA members, farmer groups and small and medium agro-enterprises. The investments approved by the Board of the CAA will complement investments made possible by the increased credit disbursed to commercial agriculture made possible by the reform of the rural financial sector as advocated by the investment strategy on rural finance (see the report by the Rural Finance Specialist of the UNDP/FAO Agricultural Sector Review) and the improved information and knowledge disseminated by the AMIS.

7.1.3.4 Outputs

The key outputs of the project would include the following:

1. Commercial Agriculture Network (CAN)
    a. The outputs of this component include a database on network members, bi-monthly bulletins distributed to all network members, women agro-entrepreneurship news, semi-annual workshops, a website of the CAN and the formation of partnerships among members of the network.
    b. The institutional framework for this component envisages a network manager whose main responsibility is to coordinate and promote the flow of information between commercial stakeholders and service providers. The network component is closely linked to all the other components of the project.
2. Commercial Agriculture Alliance (CAA)
    a. The outputs of this component include demand-driven investment related to infrastructure, technology, marketing and information, and capacity development. The table below presents some examples of each category, for illustrative purposes only.

Category of Proposal	Example of Proposals
Technology	Development and testing of a farm-level cool storage unit for vegetables Development and testing of early maturing varieties of pulses and beans Production of disease-free seed Control of common plant diseases Development and testing of new packaging material

Category of Proposal	Example of Proposals
	Provision of expertise to upgrade processing practices and processed-product quality for fruits and vegetables
Infrastructure	Specification and construction of a produce collection center for farmers Specification, construction and training to use small irrigation system including channels and drip/sprinkler irrigation Specification and construction of agricultural road connecting main producing area to main road
Marketing and Information	Feasibility study for investment in palm oil Development of facilities and know how for testing and grading various agricultural products, e.g. animal feed ingredients
Capacity and Training	Advisory and training services to strengthen the capacity of a traders' association to specify grading standards for purchasing produce and to arrange services testing such standards Extension and training programs for farmers in farm management Training in quality assurance systems Trip to fairs and exhibitions for food technologies in other countries

b. Qualifying services or investment programs would not normally be financed by a bank, even to borrowers with substantial collateral, good credit ratings and proven commercial track records. These investments in services or infrastructure would either (a) benefit more than one party by their direct implementation; or (b) being risky and innovative in nature, will if successful, probably stimulate imitation by other parties, thus helping to move the commercialization of the agricultural sector upwards to a higher general level. They are 'promotional' or 'developmental' investments or programs, and the CAF co-financing of them will accordingly be in grant form.
c. The institutional framework for this component envisages the creation of the Alliance as a legal entity under the Companies Act – a foundation with its governing Board of Directors and Articles of Associations. The Alliance will have a full-time paid Alliance Secretariat (hereinafter referred to simply as the Secretariat) consisting of a General Manager and a small number of skilled professional staff, plus a small additional number of supporting staff. The Secretariat will ensure that proposals by Alliance members are well formulated and programs are well executed. It will perform professional functions related to briefing the Board of Directors and operating the CAF as a co-financing mechanism. The Board will select the Secretariat staff from among candidates responding to public advertisement.
d. Several criteria for membership in the Alliance, management of the CAF, review and appraisal of proposals, monitoring and evaluation and auditing system, etc. have been proposed to provide effective governance and transparency of the Board.

3. Agriculture Market Information Service (AMIS)
    a. The outputs of this component include radio broadcast of marketing information, database of price, trade and production data that can be accessed via Internet, and enhanced capacity to collect and interpret data.
    b. The institutional framework for this component envisages a service that will work closely with the MIS under DAP in MOAI, the owners of markets in the pilot region and the crop exchanges in Yangon and Mandalay, the radio stations, the UMFCCI and the CSO.

4. Social Mobilization for Agricultural Commercialization (SMAC)
    a. The outputs of this component include awareness programs, commercial learning activities, study tours, information sharing through the CAN and formation of larger farmer organizations.
    b. The institutional framework for this component envisages that in each of the Project Districts about 20 groups of farmers (on average about 20 farmers per group) will be targeted every year (total of 1,100 groups over 5 years). These groups will be selected from those: (a) already involved in commercial agriculture, and (b) with a large component of women, poor and disadvantaged ethnic groups.

c. NGOs and government agencies belonging to CAN and who are participating in relevant capacity strengthening activities will implement the social mobilization component under the supervision of the Project Implementation Unit, i.e. facilitating social mobilization of farmer groups will be an institutional strengthening activity whereby the NGO and extension agency staff involved will 'learn by doing', and develop needed competence in the process.
d. Involvement in other commercial agriculture programs with the targeted groups will be a criterion for selection of NGOs and government agencies for participation in the SMAC.

5. Institutional Capacity Development for Commercial Agriculture (ICDCA)
    a. The outputs of this component include training courses, action research projects and study tours.
    b. The institutional framework for this component envisages a component manager planning, supervising and monitoring the capacity development activities using contract-out services of experts in different thematic areas. Linkages with the agricultural education and training system, MAS, CARI, universities and international organizations will be actively sought. Each trainee will be requested to conduct an action research project together with commercial stakeholders. The action research will provide a practical testing of what has been learned during training and the opportunity of making an actual contribution to the project beneficiaries.

The project would be developed in one pilot region in Myanmar, over a period of 5 years.

7.1.3.5 Indicative Costs

Costs for this project would be approximately US$25,000,000. An indicative budget is shown below.

Summary Indicative Budget for Support to Private Sector Marketing and Agroindustry Development

Item	Budget Amount
Commercial Agricultural Network	$240,000
Commercial Agricultural Alliance/ Commercial Agricultural Fund	$15,000,000
Agricultural Market Information System	$500,000
Social Mobilization	$3,500,000
Institutional Capacity Building	$1,500,000
Project Management	$1,000,000
Contingency (15% of Total Costs)	$3,261,000
Total Cost	$25,001,000

7.1.4 Support to Agricultural Machinery Usage

7.1.4.1 Background and Rationale

The Government of Myanmar has increasingly stressed the importance of a more diversified agriculture to achieve its goals of modernization and rural industrialization. This is consistent with similar strategies followed by other Asian rice economies during the 1970s and 1980s, where agricultural diversification was seen as a desirable response to changes in supply (the success of the green revolution resulted in food self-sufficiency and declining real rice prices) and demand (rising income and urbanization increased the demand for non-rice food products). Some of these economies have been successful at diversifying the agricultural and rural economy. However, it was also realized that agricultural diversification was a much more complex process than changing the output mix.

Agricultural diversification and rural industrialization as an enabling strategy for rural income growth and poverty reduction in Myanmar will require enormous investment and will take time. The constraints are of staggering complexity: the presence of a large population in rural areas characterized by widespread poverty; low productivity of agricultural labor; low level of infrastructure development; poorly integrated markets; poorly functioning factor markets such as land and credit; and an underdeveloped rural industry characterized by a dichotomy between micro enterprises and large (usually SOEs) enterprises. These constraints are aggravated by a still incomplete process of liberalization in the transition from a centrally-planned to a market-oriented system.

There are enormous challenges in pursuing the goal of accelerating agricultural growth in a sustainable and equitable way. Change in policy, investment allocation, and institutional development will have to create the conditions to implement such a strategy.

While mechanization of agriculture is still extremely limited, most smallholder farms are able to utilize draft power to meet their tillage requirements. However, significant underutilization of land, both in terms of cropping intensity and extensification, is in part due to the lack of mechanization. This is particularly the case with households with land holdings over 2 hectares in size, where double oxen draft power is not sufficient to till the whole land holding. This in turn has significant implications since the 1992/93 Agricultural Census estimates that the average farm size is 2.5 ha and 54 percent of farmers out of a total of 2.72 million agricultural land holdings have less than 2 ha; occupying 21 percent of cultivated land. The potential for mechanization is therefore the potential to reach 46 percent of farmers, covering 79 percent of the 15.5 million acres of cultivated land.

Considering that some 21-24 percent of cultivated land is covered by machinery (around 3.18 million acres), even if in the short to medium term only a modest additional 10 percent of farmers were able to effectively and efficiently use mechanization, and only an additional 10 percent of cultivated land was suitable for mechanized tillage services using power tillers and reapers, this would equate to some 270,000 households, and 1.55 million acres of land. Considering domestic SOE manufacturing capacity for agricultural machinery is only some 21,000 machines per year, it would take nearly 13 years of production for the SOE factories to satisfy this additional demand. There is considerable scope for increased sales of agricultural machinery to farmers for their own crop production or for private sector contract services.

7.1.4.2 Objectives

The objective of the proposed strategy is to increase the level of mechanization in agriculture by providing support to the private sector in investment in machinery hire and purchase[77]. The current low level of agricultural mechanization is due in part to the lack of demand for machinery, which in turn is a function of the lack of access to broad-based credit, lack of appropriate machinery technology, lack of fuel, lubricants and spare parts, and the small farm sizes making it uneconomical for individuals to purchase machinery for themselves.

7.1.4.3 Principal Components

The proposed strategy involves firstly the restructuring of the AMD and the devolving of its responsibilities for contract machinery operations to the private sector. Unless AMD stops subsidizing it contract machinery operations by only charging for operating costs, there is limited chance that the private sector will be able to expand their own contract machinery operations. Secondly, the strategy increases support to private sector operations. The proposed strategy has several interlinked components[78]:

1. The development of an action plan, and actual implementation of the divestment of the commercial contract machinery activities of the AMD to the private sector. Either machinery and equipment are auctioned off piecemeal to local private enterprises (including farmers), or the whole commercial unit is privatized as a contract machinery enterprise.
2. The development of an action plan, and actual implementation of the privatization of the 100 tractor stations (retail outlets) owned and operated by AMD.
3. A review of existing legislation, regulations and practices governing agricultural machinery importing in order to eliminate any constraints to the import of machinery. Machinery should be seen as an important input into agricultural production, and not restricted in any way.
4. A review of the existing legislation, regulation and practices governing imports of fuel, lubricants and spare parts in order to eliminated any constraints to the import of these components. In the absence of any broad-based liberalization of the energy and petroleum sector, the private sector should be allowed to obtain import permits for fuel and lubricants for agricultural machinery operations as needed.
5. Capacity building for AMD operations in monitoring and regulation of the sub-sector, and provision of training and support functions to private farmer operators and agricultural contractors in the technical aspects of mechanization and in hire service management.
6. Provision of an incentive framework for increased private sector involvement in manufacture and hire services, including provision of machinery (power tillers and ancillary equipment) to private sector enterprises (including farmers) on a hire-purchase basis, and training and capacity building of private enterprises to run a contract machinery operation.

MOAI would be the main Government counterpart in the project and contribute staff to assist the consulting team in carrying out project activities. The consulting team will consist of 4 international experts, 4 senior national experts, and 4 junior national experts divided into 4 teams. One team would be responsible for components 1-2, one team would be responsible for components 3-4, one team would be responsible for component 5, and the final team would be responsible for component 6. Components 1-4 would take 1 month each, Components 5-6 would take 3 months each, and would be phase sequentially. Total time for the project would be 6 months,

7.1.4.4 Outputs

[77] This investment strategy is formulated in response to a request from MOAI and FAO for such a strategy to be included as part of the agroindustry investment proposals.

[78] Although not included as an integral component, consideration should be given to designing an appropriate monitoring and evaluation system.

The key outputs of the project would include the following:

1. Action plan and actual divestment of the commercial contract machinery activities of AMD,
2. Action plan and actual privatization of the tractor retail outlets owned and operated by AMD,
3. Review paper and action plan for imports of agricultural machinery,
4. Review paper and action plan for imports of fuel, lubricants and spare parts for agricultural machinery,
5. Review paper and action plan for private sector import of fuel for agricultural production,
6. Review of AMD operations and development of restructuring plan for implementation of monitoring and regulatory role of AMD,
7. Development of action plan for AMD support to agricultural machinery training,
8. Development of training program for private sector agricultural machinery hire operations, including financial/business management training, machinery maintenance, and
9. Development of pilot program in 5 townships for private sector agricultural machinery contract operations and hire-purchase plans. 5 power tillers and ancillary equipment (post-hole auger/digger, seeders and fertilizer spreaders, tiller/plowing attachment, sweep cultivator, reaper attachment, cart attachment for transportation hire etc.) should be provided to private enterprises in each township on a hire purchase arrangement.

7.1.4.5 Indicative Costs

Costs for this project would be approximately US$400,000. An indicative budget is shown below.

Summary Indicative Budget for Support to Agricultural Machinery Usage Project

Item	Sub-Item	Budget Amount
Reform of AMD Contract Machinery Activities	International Expert	$20,000
	Senior National Expert	$5,000
	Junior National Expert	$3,000
Review of Import Regulations	International Expert	$20,000
	Senior National Expert	$5,000
	Junior National Expert	$3,000
Capacity Building of AMD	International Expert	$52,000
	Senior National Expert	$15,000
	Junior National Expert	$10,000
	Training Modules and Publications	$5,000
	Training of Staff and Workshops	$5,000
Support to Private Sector Operations	International Expert	$52,000
	Senior National Expert	$15,000
	Junior National Expert	$10,000
	Training Modules and Publications	$5,000
	Training of AMD Staff and Workshops	$5,000
	Training of Private Enterprises and Workshops	$5,000
	Provision of Machinery in 5 pilot townships, 5 power tillers each plus ancillary equipment	$75,000
Office Equipment	Computers, Associated Peripherals, Software, Consumables	$20,000
Office Overheads	Infrastructure and Equipment	$10,000
Domestic Travel	Travel and Associated Costs for Teams	$5,000
Contingency	(15% of Total Costs)	$51,750
Total		$396,750

Employment costs valued at total package costs (Honorarium, travel, accommodation etc).

8. Conclusions

This report has reviewed the status and performance of the agroindustrial sector in Myanmar, concentrating on those agricultural products which undergo further processing after harvest; rice, cotton, edible oils, wheat, pulses, and sugar, as well as inputs such as agricultural machinery and fertilizer.

As Myanmar is in transition from a socialist command economy towards a market-orientated economy there are relatively high levels of government control over various industries, depending on historical factors as well as their perceived importance for food security and other national objectives.

Industries such as rice, cotton and sugarcane; with a large SOE sector, are faced with problems in procurement and capacity utilization that are not faced in other sectors with less government involvement; for example pulses and edible oils. Capacity utilization and efficiency are lower for SOEs than the private sector, due to the latter's ability to rapidly implement changes in their operating procedures and investments in accordance with changes in market conditions. In some sectors the SOEs have recently undergone extensive modernization of plant and equipment, thereby making those enterprises more technically efficient. However, fundamentals of market supply and demand have been left unaddressed; resulting in less capacity utilization than before and higher levels of state indebtedness. Thus while enterprises may be technically efficient in terms of scale and modernization, they are not economically efficient.

Low government procurement prices for raw material inputs have left SOEs struggling to operate plants at more than 50 percent utilization rates. In some SOEs in cotton, for example, utilization rates are under 4 percent. In the private sector capacity utilization rates are higher, but still less than economical in the long run. Most enterprises (state and private) ignore fixed and capital costs when calculating rates of return.

In industries with less government involvement in production and processing, as in pulses and edible oils, capacity utilization and economic returns are much higher. In the case of edible oils the restrictions on exports hampers the industry significantly and reduces potential production.

In all industries reviewed, the major constraints were lack of raw material input and access to reliable supplies of electricity. For the latter constraint, it is noted that the government plans to triple capacity on the national grid between 2003-2006; mainly through hydroelectric schemes. This will go some way to reducing the number of blackouts experienced by households and enterprises but does not address the dilapidated condition of the existing network.

For the former constraint, it is noted that around 40 percent of arable farming land is currently classified as "cultivatable wasteland", mainly in the dry zone area. While the government is embarking on large scale irrigation schemes to address the lack of water in the dry zone area, the choice of cropping patterns (rice, cotton) does not appear to be ideal; considering other crops such as pulses and oilseeds are more agroecologically suited to that area and are less water intensive.

Fundamentally, the lack of raw material for agroindustry is a function on the low procurement prices offered by SOEs and the distortionary marketing policies in place; particularly for the export market. As an example, the ban on oilseed and edible oil exports is purportedly for food security issues; yet the export of high valued edible oils such as sesame and groundnut and the import of low valued palm oil would not only earn valuable foreign exchange but lower the overall price of oil for the poorer sections of the community.

In terms of government interventions, there is a role for the state in supplying essential services such as infrastructure (roads, market access, irrigation and rural electricity) and in applying economic policies

conducive to proper operation of a market-orientated economy. The role of the private sector is in supplying the inputs, production, processing and marketing operations necessary to provide agricultural products to consumers. In other words, the private sector should be involved in the operation of the supply or value chain, while the government provides infrastructure facilities and an enabling and facilitating environment for the proper functioning of that value chain.

Improvements in agricultural productivity, processing efficiency and export opportunities are the desired outcomes of any sectoral development strategy. These should be broad-based and not targeted towards any particular commodity or market, in order to enable the private sector to make the most of their entrepreneurial skills in their investment strategies. There appears to be extremely limited scope for further expansion of state intervention in agricultural production, processing and marketing, a fact recognized by most of the government bureaucracy. With limited capacity and budgetary resources, opportunities for state intervention appear limited to a regulatory and advisory role.

The growth potential for agroindustry lies typically not so much in specific products or processes, as in overall increases in efficiency arising from the removal of sub-sector wide constraints. As such, the vision and subsequent strategy for agroindustry in Myanmar needs to incorporate three themes articulated in the above report and the ASR strategy as a whole:

1. A shift from a commodity and sub-sector approach to a market-orientated farming systems and community based approach,
2. A continuation of the move away from centrally planned development towards locally determined priorities and institutions, and
3. A change in the role of government from operations to ensuring an appropriate enabling environment, regulations and infrastructure.

This strategic approach will require a combination of policy improvements, institutional and capacity building and investments carried out in a sequenced manner. Broadly speaking, the actions will fall within three categories:

1. Support to Policy Analysis and Policy Reform,
2. Support to Regulatory Reform and Institutional Reform in the SOE sector, and
3. Support to Private Sector Marketing and Agroindustry Development.

The expected impact on poverty reduction and pro-poor development is expected to derive through four channels:

1. Broad-based policy reform arising from high quality policy advice delivered by a strengthened policy unit within MOAI,
2. Reduction in market distortions arising from privatization of SOEs and the strengthening of economic management of SOEs remaining under government ownership.
3. Employment generation, social mobilization and organization of smallholder farmers into larger groups, and additional income opportunities in a more dynamic rural economy arising from strengthening linkages in commercial agriculture.
4. Increases in agricultural productivity arising from increased mechanization of agriculture.

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10. Tables

Table 1 Agro-Ecological Zones and Crop Suitability

Agro-Ecological Zone		Monsoon crop	Cold Dry Season crop	Perennial crop
1	R_3,S_1	Paddy, Maize Sugarcane, Jute, Root crops, Fodder	Sunflower, Sesame, Groundnut, Maize, Sorghum, Vegetable, Cow pea, Mung Bean, Black gram, Fodder	Coconut, Areca nut, Rubber, Mango, Guava, Banana, Mangosteen, Durian, Pineapple, Jack fruit, Cashew nut, Toddy palm
2	R_3,S_3	Paddy, Maize, Sugarcane, Sunflower	Sugarcane, Sorghum Wheat, Groundnut, Potato, Sweet, Potato, pulses, Mustard, Sunflower, Tobacco	Tea, Pear, Walnut, Litchi, Olives, Mulberry, Lemon, Lime, Durian, Oil palm, Cashew nut,
3	R_3,S_6	Paddy, Groundnut, Sunflower , Sesame, Soybean, Ramme, Vegetable	Wheat, Pulses, Ramme, Sugarcane, Chilli, Vegetable	Pineapple, Banana, Mango, Jack fruit, papaya, Guava, Mulberry, Rubber Lemon, Lime, Durian, Oil palm, Cashew nut
4	R_4,S_1	Paddy, Maize, Sugarcane Vegetable, Chilli, Sesame, Sorghum, Niger, Maize, Upland Rice	Sugarcane, Tobacco, Groundnut, Pulses, Vegetable	Banana, Lemon, Lime, Mango Guava, Mulberry, Papaya
5	R_4,S_3	Wheat, Potato, Groundnut, Soybean, Ginger, Ramme, Vegetable, Niger Maize, Upland Rice	Vegetable, Tobacco	Orange, Plum, Avocado, Pear
6	R_4,S_5	Sugarcane, Groundnut, Sunflower, Maize, Pigeon pea, Sorghum, Cotton	Pulses, Sugarcane, Vegetable	Cashew nut, Rubber Almond, Toddy palm, Lemon, Lime, Custard apple
7	R_4,S_6	Sorghum, Maize, Groundnut, Sunflower, Pulses, Cassava, Potato, Soybean, Ginger, Ramme, Sugarcane, Vegetable, Upland rice, Niger	Wheat, Chickpea, Pulses, Barley, Virginia Tobacco	Pineapple, Banana, Mango, Apple, Orange, Pear, Plum, Coffee, Mulberry, Guava, Jack fruit, Sebestan palm, Tea
8	R_5,S_1	Groundnut, Sesame, Mung Bean, Butter bean, Maize, Sunflower	Tobacco, Groundnut Pulses, Maize, Vegetable, Potato, Sweet potato, Chilli, Onion	-
9	R_5,S_4	Cotton, Lablab bean, Chilli, Sorghum, Pigeon pea,	Pulses, Fennel, Chickpea	Tamarind, Toddy palm,
10	R_5,S_6	Cotton, Maize, Sorghum	Chickpea, Mung -bean, Black gram	Toddy palm, Tamarind, Mango, Custard apple, Jujube tree
11	R_5,S_5	Cotton, Maize, Sorghum, Pigeon Pea	Chickpea, Mung- bean, Black gram, Butter bean, Castor oil palm,	Toddy palm, Tamarind, Mango, Custard apple, Jujube tree

Source: (Myanmar-Japan Cooperation Program 2002, pp. 20-21)

Table 2 Monthly Rainfall (mm) at Selected Stations (1991 - 2000 Average)

State/Division	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Average	CV*
Kachin State	Myitkyina	16	30	40	30	230	499	612	386	319	153	36	6	2357	196	109.99
	Mohnyin	9	19	36	46	222	237	358	291	344	159	43	8	1772	148	94.61
Kayah State	Loikaw	0	4	14	48	130	116	136	224	201	87	39	9	1008	84	94.45
Kayin State	Hpa-an	1	7	22	42	345	804	1118	1132	591	175	29	12	4278	357	126.74
Chin State	Falam	6	16	45	68	195	197	260	274	241	145	59	11	1517	126	83.42
	Hakha	8	19	54	70	230	231	341	339	312	198	62	17	1881	157	85.94
Sagaing Division	Katha	9	22	13	40	212	214	242	240	247	141	33	3	1416	118	91.90
	Mawlaik	3	7	25	32	182	227	267	321	405	215	29	6	1719	143	102.05
	Monywa	0	2	11	22	48	69	66	113	182	126	37	3	679	57	104.29
	Shwe Bo	0	5	9	12	95	101	105	154	177	123	21	3	805	67	99.60
	Hkamti	9	22	25	36	317	773	1123	846	432	206	21	6	3816	318	125.95
Tanintharyi Division	Dawei	7	13	31	169	517	962	2259	1330	860	236	47	8	6439	537	133.75
	Myeik	24	30	47	124	340	635	861	914	556	332	69	16	3948	329	104.18
Bago Division	Bago	0	6	30	32	286	675	758	752	473	153	48	2	3215	268	118.70
	Pyay	0	2	10	24	127	216	185	222	182	103	42	2	1115	93	98.75
Magway Division	Magway	0	4	10	20	115	118	92	120	149	123	59	7	817	68	85.50
	Gangaw	0	5	25	14	112	114	135	240	167	201	32	11	1056	88	98.13
Mandalay Division	Mandalay	0	7	11	53	125	96	73	143	186	90	36	3	823	69	91.04
	Pyin Oo Lwin	0	12	19	46	188	166	135	167	227	185	49	7	1201	100	86.79
	Pyinmana	1	7	7	27	167	235	244	261	183	146	52	7	1337	111	95.77
	Naung Oo	0	4	9	13	89	68	61	80	132	89	43	3	591	49	90.63
Mon State	Mawlamyine	2	9	37	85	537	910	1272	1197	713	166	39	16	4983	415	120.54
	Ye	5	8	37	129	502	1095	1398	1361	734	224	51	7	5551	463	120.87
Rakhine State	Sittwe	1	18	15	36	365	1060	1287	1008	602	266	134	5	4797	400	120.88
	Thantwe	0	18	8	13	379	1351	1460	1408	742	170	62	8	5619	468	132.05
Yangon Division	Yangon	0	7	14	56	240	539	605	502	396	118	33	3	2513	209	115.27
Shan State	Lashio	2	10	18	45	129	170	232	234	212	158	74	5	1289	107	87.63
	Taunggyi	0	6	14	53	154	171	200	286	298	158	69	10	1419	118	93.35
	Keng Tung	10	13	18	74	143	198	236	193	165	143	132	20	1345	112	74.41
Ayeyarwady Division	Pathein	0	5	4	35	219	654	639	651	410	172	60	9	2858	238	117.72

Population corrected CV=(1+1/(4n))(s/x*100)
Source: (Central Statistical Organization 2001)

Table 3 Area By Type of Land

Land Type	1980-1981	1985-1986	1990-1991	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001
Current Fallows	4697	4589	4724	3448	3042	2851	2922	2437	1900	1695
	2.81%	2.74%	2.83%	2.06%	1.82%	1.71%	1.75%	1.46%	1.14%	1.01%
Net Area Sown	20160	20300	20127	21533	22017	22238	22162	22976	23902	24486
	12.06%	12.14%	12.04%	12.88%	13.17%	13.30%	13.26%	13.74%	14.30%	14.65%
Total Occupied Area	24857	24889	24851	24981	25059	25089	25084	25413	25802	26181
	14.87%	14.89%	14.86%	14.94%	14.99%	15.01%	15.00%	15.20%	15.43%	15.66%
Culturable Waste	21179	21053	20625	19953	19697	19591	19408	18664	18065	17804
	12.67%	12.59%	12.34%	11.93%	11.78%	11.72%	11.61%	11.16%	10.81%	10.65%
Culturable Waste % of Potential Arable Land	46.01%	45.83%	45.35%	44.41%	44.01%	43.85%	43.62%	42.34%	41.18%	40.48%
Reserved Forests	23969	24774	25062	25474	25503	25688	25885	28709	30906	31910
	14.34%	14.82%	14.99%	15.24%	15.25%	15.36%	15.48%	17.17%	18.49%	19.09%
Other Wood Land	55228	54863	54970	54583	54557	54525	54365	51796	50084	48892
	33.03%	32.82%	32.88%	32.65%	32.63%	32.61%	32.52%	30.98%	29.96%	29.24%
Others	41953	41607	41678	42195	42370	42293	42444	42604	42329	42399
	25.09%	24.89%	24.93%	25.24%	25.34%	25.30%	25.39%	25.48%	25.32%	25.36%
Total Area	167186	167186	167186	167186	167186	167186	167186	167186	167186	167186

Thousand Acres
Note: Net Area Sown in Exclusive of Area Trespassed
Source: Settlement and Land Records Department, (Central Statistical Organization 2001)

Table 4 Comparison of Industrial Formation

Country	1970			1980			1993			1997		
	P	S	T	P	S	T	P	S	T	P	S	T
Myanmar	49.5	12.3	38.5	47.9	12.3	39.8	49	12.9	38.2	39.1	12	48.9
Thailand	30.2	25.7	44.1	20.2	30.1	49.7	12.2	40.9	46.9	12.8	41.1	46.1
Indonesia	35	28	37	24.4	41.3	34.3	17.6	42.1	40.9	24.3	43.6	32.1
Philippines	28.2	33.7	38.1	23.5	40.5	36	22.7	34.4	40.3	22.4	34.9	42.7
Singapore	2.2	36.4	61.4	1.1	38.8	60	0.2	36.5	42.9	0.2	37.1	62.7

P=Primary, S=Secondary, T=Tertiary
Source: (Asian Development Bank 1994; 1997; 1998)

Table 5 Industry Breakdown in Myanmar

Sector	1994				1996				1998			
	Establishments		Workers		Establishments		Workers		Establishments		Workers	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Food Products	19335	61.23%	77597	56.28%	22106	62.82%	92922	53.89%	22522	62.04%	98937	53.53%
Tobacco Products	154	0.49%	1125	0.82%	149	0.42%	1726	1.00%	146	0.40%	1913	1.03%
Textiles	2150	6.81%	14163	10.27%	2348	6.67%	17334	10.05%	2337	6.44%	17100	9.25%
Wearing Apparel	22	0.07%	1131	0.82%	69	0.20%	8870	5.14%	98	0.27%	10187	5.51%
Leather and Leather Products	201	0.64%	902	0.65%	231	0.66%	1232	0.71%	294	0.81%	1500	0.81%
Wood Products	2836	8.98%	15179	11.01%	2647	7.52%	16011	9.29%	2763	7.61%	17300	9.36%
Paper and Paper Products	249	0.79%	1052	0.76%	250	0.71%	1333	0.77%	267	0.74%	1290	0.70%
Publishing and Printing	271	0.86%	1126	0.82%	280	0.80%	1223	0.71%	285	0.79%	1268	0.69%
Coke and Petro Products	2	0.01%	7	0.01%	5	0.01%	40	0.02%	5	0.01%	29	0.02%
Chemicals and Chemical Products	379	1.20%	1675	1.21%	392	1.11%	1874	1.09%	415	1.14%	2140	1.16%
Rubber and Plastics	687	2.18%	3147	2.28%	722	2.05%	3951	2.29%	739	2.04%	4804	2.60%
Other Non-Metallic Mineral Products	259	0.82%	1359	0.99%	270	0.77%	1667	0.97%	283	0.78%	2130	1.15%
Basic Metals	523	1.66%	2740	1.99%	581	1.65%	3356	1.95%	608	1.67%	3408	1.84%
Metal Products	821	2.60%	3738	2.71%	1101	3.13%	5380	3.12%	1220	3.36%	6100	3.30%
Machine and Equipment	184	0.58%	719	0.52%	353	1.00%	1580	0.92%	621	1.71%	2561	1.39%
Electrical, Machinery and Apparatus	275	0.87%	792	0.57%	272	0.77%	911	0.53%	257	0.71%	907	0.49%
Radio, TV and Communication Equipment	2	0.01%	6	0.00%	4	0.01%	17	0.01%	6	0.02%	24	0.01%
Medical and Optical Equipment	5	0.02%	28	0.02%	5	0.01%	27	0.02%	7	0.02%	30	0.02%
Motor Vehicles and Trailers	2768	8.77%	9315	6.76%	2871	8.16%	10356	6.01%	2804	7.72%	10003	5.41%
Other Transport Equipment	92	0.29%	368	0.27%	103	0.29%	507	0.29%	119	0.33%	425	0.23%
Furniture	363	1.15%	1697	1.23%	432	1.23%	2105	1.22%	507	1.40%	2775	1.50%
Total	31578	100.00%	137866	100.00%	35191	100.00%	172422	100.00%	36303	100.00%	184831	100.00%

Source: Ministry of Industry No 1., cited in (Kudo 2003)

Table 6 Volume of Production of Selected Commodities by State Owned Enterprises and Cooperatives

Sector	Commodity	Unit	1980-81	1985-86	1990-91	1994-95	1995-96	1996-97	1997-98	1998-1999	1999-2000	2000-2001
Food and Beverages	Sugar	Tonne	44824	53022	19153	38664	44923	50505	55462	48399	53894	92937
	Molasses	Tonne	25305	35465	10437	23342	29469	35004	33001	32958	32206	43365
	Brine salt	(000)Tonne	94	88	42	62	71	72	92	73	75	61
	Biscuits	Tonne	7950	8810	8464	8828	1806	1300	1041	1480	1147	1325
	Noodles	(000)lb	34177	42739	47386	55259	3291	2016	716	980	437	489
	Coffee	(000)lb	444	98	79	100	237	130	75	132	88	93
	Tea	(000)lb	1365	2355	1471	902	1609	1243	1151	2523	3010	1851
	Condensed milk	(000)lb	40200	45306	36159	21156	5709	2729	2471	1888	3279	3621
	Shrimp paste	(000)Viss	43931	49237	53272	53323	1147	1700	1467	771	765	624
	Soft Drink	(000)doz	2118	2856	2207	30875	2658	5848	12216	11646	10131	9306
	Beer	(000)gal	749	1281	494	164	-	-	-	-	-	2237
	Alcohol	(000)gal	4121	3963	2386	3273	2643	2785	3091	3435	3586	3839
Textile (Cotton)	Drill	(000) yd	2888	6149	2623	780	1203	454	-	-	-	-
	Flannel	(000) yd	1075	1172	522	971	2779	2595	79	-	-	-
	Cellular	(000) yd	11497	1652	1159	31	-	-	-	-	-	-
	Poplin	(000) yd	5057	4601	2250	2021	1905	991	2024	1416	2866	4693
	Curtain	(000) yd	53	59	61	30	65	57	44	51	58	22
	Cotton shirting	(000) yd	-	-	14802	6082	7300	5571	5650	8006	15729	16649
	Cotton cloth	(000) yd	5160	1101	15624	435	119	9	7	-	-	-
	Netting Mosquito-Cotton	(000) yd	212	178	1060	1825	1522	1604	3052	3515	2392	4197
	Total Cotton Fabrics	(000) yd	25942	14912	38101	12175	14893	11281	10856	12988	21045	25561
	Cotton yarn	(000) lb	19554	26053	20860	9574	11318	9891	8287	8988	10658	13401
	Cotton thread	(000) doz	1424	658	492	208	366	336	242	759	609	659
Machinery	Pumping sets	Set	5250	4627	1905	3897	2950	2300	3902	1990	2345	2405
	Diesel generating sets	Set	250	170	144	4	96	101	100	101	50	60
	Pesticides equipment	No	410	1145	400	-	-	-	-	-	-	-
	Bicycles	No	9582	11400	6374	-	-	50	2050	2500	167	200
	Tyre & Tube	No	-	-	140175	58649	161000	193269	101014	114175	137880	137412
	Power Tiller	No	809	190	124	273	854	921	256	1015	1075	-
Vehicles	Light vehicles	No	606	1160	380	155	744	305	450	400	590	720
	Heavy vehicles	No	635	1040	203	798	500	800	33	67	176	275
	Tractor	No	1069	513	255	100	130	350	450	242	750	775
	Trailer	No	700	95	9	700	100	850	507	300	276	450
Others	Fertilizer(Urea)	(000)M.T	133	281	133	147	143	117	123	131	139	160

Myanma Textile Industries, Myanma Foodstuff Industries, Myanma Agricultural Machinery Industries, Myanma Automobile & Diesel Engine Industries, Myanma Tyre & Rubber Industries, Myanma Jute Industries, Myanma Sugarcane Enterprise, Myanma Farms Enterprise, Department of Co-operative, Directorate of Supply & Transport, cited in (Central Statistical Organization 2001). 1985-95 data includes private sector.

Table 7 Export of Principal Commodities

Commodity		1980-81	1985-86	1990-91	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001
Agricultural Products	Rice and rice products	1355	763	172	1166	440	126	38	167	65	208
	Pulses	152	238	515	799	1358	1272	1403	1135	1179	1658
	Maize	11	15	13	49	46	107	45	116	54	92
	Oilcakes	46	32	11	12	12	4	#	1	2	#
	Raw rubber	82	56	3	122	180	171	134	100	75	67
	Raw cotton	4	18	#		1	3	26	21	10	11
	Raw jute	99				6	5	8			5
	Other Agricultural Products	12	4	228	330	278	293	298	350	217	271
	Total	1761	1126	942	2478	2321	1981	1952	1890	1602	2312
Animal and Marine Products		95	105	170	622	622	896	953	975	835	971
Timber		793	1046	999	1061	1048	985	853	789	925	803
Base Metal and Ores		190	114	72	61	70	33	30	74	289	324
Precious and Semi-Precious Minerals		105	74	86	105	137	159	207	149	219	363
Gas									5	31	1110
Garments			6	8	343	300	402	436	471	2722	3785
Other Commodities*		281	183	685	735	546	1032	2016	2403	2324	2594
Total Exports		3225	2654	2962	5405	5044	5488	6447	6756	8947	12262

(Kyat million)

* From 1988-89 onward, data include border trade, # Less than 1 unit

Sources: Customs Department, Department of Fisheries, Myanma Agricultural Produce Trading, Myanma Gem Enterprise, Myanma Oil and Gas Enterprise, Myanma Timber Enterprise, Union of Myanmar Economic Holdings Limited, (Central Statistical Organization 2001)

Table 8 Current and Potential Export Markets for Myanma Agricultural Commodities

Commodity	Existing Markets	Potential Markets
Pulses	India, Indonesia, Japan, Bangladesh, Singapore, Hong Kong, Malaysia, Pakistan, Sierra Leone	Algeria, Djibouti, Egypt, Kenya, UAE, Philippines
Rice	Indonesia, Singapore, Bangladesh, China, Thailand, Philippines, Sri Lanka Mauritius, Maldives, Gambia	Malaysia, Korea, Cote d'Ivoire, Nigeria, Sierra Leone
Rubber	India, Singapore, China, Thailand, Korea, Malaysia, Hong Kong	Japan, USA, France, UK, Germany
Sesame	China, Japan, Singapore, Hong Kong, Indonesia, Malaysia	Taiwan, Korea, Israel, Syria, Turkey
Maize	Hong Kong, Singapore, Japan, Malaysia, Thailand	Korea
Jute	China, India, Pakistan, Egypt	Japan, Viet Nam, Cote d'Ivoire
Coffee	Singapore, Indonesia, Thailand	
Green Tea	Japan, Singapore	Malaysia
Cashew Nut	Singapore, China, Malaysia, Hong Kong	Iran
Sugar	Sri Lanka, Singapore, China,	Indonesia, Japan, Malaysia, Korea
Spices	Singapore, UAE, Malaysia, Indonesia, Pakistan, Sri Lanka	
Fruits and Vegetables	Indonesia, Malaysia, Bangladesh, Singapore, China, Thailand	Hong Kong, Iran, Japan
Oilcake	Singapore, Malaysia, Thailand, Netherlands	Korea, Philippines

Source: (Malhotra 2000)

Table 9 Transport and Freight Costs From Mandalay

To	Distance		Commodity	Sep-02	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03
	Mile	Km												
Yangon	430	692	Pulses, Maize	19	23	23	25	25	25	25	25	25	20	20
Muse	205	330	Pulses	30	30	30	32	32	32	32	32	32	32	32
Lashio	175	282	Rice (30viss bag)	500	500	500	500	500	500	500	500	500	500	500
Taunggyi	197	317	Groundnut oil (Barrel)	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
			Split Pea, Wheat Flour	25	25	25	16	16	16	16	16	16	16	16
Shwebo	71	114	Rice (30viss bag)	250	250	250	200	200	200	200	200	200	200	200

Source: (Market Information Service 2003; 2003; 2003)

Table 10 Monthly Highest Prices for Selected Commodities, International Markets

Market	Singapore			Malaysia	India						
Commodity	Rubber	Sugar	Coffee	Palm Oil	Black Gram	Green Gram	Pigeon Pea	Lentil Pea	Rice Bean	Chick Pea	Kidney Bean
Jan-01	572	249	661	218	525	435	320	384	386	359	247
Feb-01	570	234	624	211	487	493	331	365	371	365	387
Mar-01	538	225	591	243	528	494	345	369	377	376	395
Apr-01	552	229	563	242	467	452	321	345	399	379	460
May-01	551	249	564	242	491	452	333	364	403	418	450
Jun-01	594	259	578	244	495	481	351	360	409	437	477
Jul-01	580	266	530	297	478	577	345	361	424	439	469
Aug-01	548	238	475	351	471	496	357	371	422	435	440
Sep-01	531	226	441	287	460	433	366	366	387	438	433
Oct-01	499	214	385	246	422	381	339	379	375	464	403
Nov-01	484	234	379	287	409	402	306	378	332	463	392
Dec-01	456	239	391	328	381	400	305	381	291	442	403
Jan-02	573	244	363	257	379	432	378	296	315	407	490
Feb-02	590	219	396	361	389	465	325	356	338	394	523
Mar-02	623	491	215	329	378	448	321	335	342	342	603
Apr-02	634	197	389	340	399	459	350	361	344	319	612
May-02	655	198	491	359	389	443	379	376	336	328	594
Jun-02	793	155	509	359	376	443	377	400	335	342	523
Jul-02	819	190	504	394	365	460	377	401	343	339	503
Aug-02	814	178	506	425	369	458	388	429	365	361	540
Sep-02	858	195	611	395	348	457	379	437	390	366	452
Oct-02	798	199	648	400	349	485	369	419	414	390	441
Nov-02	807	212	761	441	317	476	436	477	343	382	496
Dec-02	814	211	763	475	278	444	326	417	531	335	451
Jan-03	857	224	834	460	279	446	356	424	521	308	519
Feb-03	927	239	836	454	311	479	383	449	553	320	543
Mar-03	1013	226	745	424	293	446	386	421	533	338	531
Apr-03	961	216	751	416	286	441	390	407	531	354	585
May-03	947	208	754	420	280	415	384	431	521	350	584
Jun-03	993	201	528	442	283	423	393	441	553	343	538
Jul-03	965	203	767	436	265	409	394	453	588	333	514
Average 2001	540	239	515	266	468	458	335	369	381	418	413
CV 2001	7.81	6.41	19.43	16.67	9.72	12.08	5.88	3.04	10.16	9.25	15.12
Average 2002	732	224	513	378	361	456	367	392	366	359	519
CV 2002	14.78	39.56	32.47	15.48	9.74	3.36	9.06	12.92	16.26	8.22	11.66
Average 2003	952	217	745	436	285	437	384	432	543	335	545
CV 2003	5.50	6.61	14.35	4.04	5.15	5.65	3.49	3.94	4.57	5.07	5.49

US$ per tonne

Source: (Market Information Service 2003; 2003; 2003)

Table 11 Sown Acreage, Harvested Acreage and Production of Selected Crops

Crop		Classification	Unit	1980-81	1985-86	1990-91	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001
Cereals	Paddy	Sown	Acre	12668	12114	12220	14643	15166	14518	14294	14230	15528	15713
		Harvested	Acre	11863	11517	11762	14191	14907	14254	13364	13488	15347	15573
		Production	Tonne	13107.1	14090.9	13748.3	17907.7	17669.6	17397	16391.2	16807.8	19808	20986.9
	Wheat	Sown	Acre	307	296	370	270	229	225	218	245	260	198
		Harvested	Acre	260	274	337	264	225	223	217	237	260	198
		Production	Tonne	114.9	186.9	121.5	87.7	76.7	85.4	90.7	92	115.3	92.1
	Maize (a)	Sown	Acre	374	492	348	424	413	412	401	465	519	537
		Harvested	Acre	357	422	309	411	399	408	397	453	503	520
		Production	Tonne	163.7	294.1	184.1	279.9	270.4	281.4	303.4	297.9	343.6	358.9
Oilseeds	Groundnut (Rainfed)	Sown	Acre	527	739	747	611	607	569	463	487	601	624
		Harvested	Acre	486	659	709	598	579	568	456	465	589	615
		Production	Tonne	119.1	206.3	196.8	184.4	206.2	222.1	177.9	163.9	212.7	241.6
	Groundnut (winter)	Sown	Acre	745	732	622	641	696	615	648	754	799	834
		Harvested	Acre	724	697	599	629	693	613	646	747	795	833
		Production	Tonne	311.6	344.9	267.8	308.4	377.2	328.4	353.4	389	411.1	477.9
	Sesame (Early)	Sown	Acre	2610	2651	2532	2695	2459	2477	2154	2411	2728	2763
		Harvested	Acre	1318	1764	1808	2229	1572	2168	1521	1199	1940	2528
		Production	Tonne	108.1	159.6	148	223.4	187.9	295.8	221.9	115.8	189.4	286.5
	Sesame (Late)	Sown	Acre	621	838	739	593	694	353	276	327	445	545
		Harvested	Acre	444	710	646	568	662	341	268	322	441	536
		Production	Tonne	46.5	84.7	64.4	75.9	110.9	42.9	36.8	44.2	63.8	89.3
Pulses	Matpe (Black Gram)	Sown	Acre	210	251	362	896	1172	1013	1215	1306	1371	1532
		Harvested	Acre	194	233	337	894	1170	1011	1192	1291	1327	1510
		Production	Tonne	58	92.9	98.7	280.8	365.4	323.2	413	437.1	420.7	523.3
	Pedisein (Green Gram)	Sown	Acre	102	155	288	947	1137	1111	1349	1747	1839	1834
		Harvested	Acre	75	130	269	931	1128	1097	1341	1662	1754	1744
		Production	Tonne	10.3	29.9	61.9	267.6	332.1	327.9	441.6	456.9	470.9	511
	Pesingon (Pigeon Pea)	Sown	Acre	169	204	175	637	617	705	622	666	761	895
		Harvested	Acre	151	191	170	578	592	688	600	635	739	884
		Production	Tonne	26.2	50.7	41.7	143	142.3	183.9	173.5	157	181.6	315.3
	Pegyi (Lablab Bean)	Sown	Acre	217	195	189	177	189	179	167	199	196	219
		Harvested	Acre	186	172	178	173	179	177	160	195	194	217
		Production	Tonne	39.1	43.7	40	38.7	44.5	45.1	43	50.3	54.4	63
	Gram (Chickpea)	Sown	Acre	408	539	442	322	410	344	297	279	323	411
		Harvested	Acre	369	463	391	301	391	330	270	250	320	406
		Production	Tonne	100.7	167.7	102	76	91.4	88.9	88.9	66.8	82.9	117.4
	Peboke (Soybean)	Sown	Acre	63	73	81	150	177	169	195	258	267	282
		Harvested	Acre	61	69	78	148	177	169	192	251	266	282
		Production	Tonne	16.9	22.5	25.4	48.9	64.7	61.5	73.4	83.9	97.4	108.5

Table 12 Sown Acreage, Harvested Acreage and Production of Selected Crops (Cont'd.)

Crop		Classification	Unit	1980-81	1985-86	1990-91	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001
Beverages	Tea	Sown	Acre	131	138	145	151	154	155	169	168	175	181
		Harvested	Acre	129	136	142	147	148	151	168	155	165	166
		Production	Tonne	41.8	49.6	35.9	51.9	52.4	54.6	65.8	60.5	61.7	63
	Coffee	Sown	Acre	7	10	26	16	14	14	14	15	16	19
		Harvested	Acre	6	7	8	9	9	10	10	10	10	11
		Production	Tonne	1	1.4	1.4	1.5	1.5	1.7	1.9	1.7	1.8	2.1
	Sugarcane (b)	Sown	Acre	118	165	118	130	165	204	266	311	333	343
		Harvested	Acre	103	149	110	123	157	202	255	303	310	328
		Production	Tonne	1899.9	3668.1	1930.7	2218.5	3199.2	3978.7	5055.9	5343.9	5363.2	5800.5
	Toddy Palm (c)	Sown	Acre	37	41	43	46	45	44	44	50	54	60
		Harvested	Acre	35	36	40	44	43	42	42	50	54	60
		Production	Tonne	73.4	161.9	203.5	227.6	213.7	236.6	241.4	263.8	258.3	271.6
	Vegetables	Sown	Acre	301	351	343	416	445	463	514	524	657	732
		Harvested	Acre	287	342	339	414	444	462	513	522	657	732
	Fruits	Sown	Acre	406	435	481	557	569	627	662	721	776	848
		Harvested	Acre	396	422	454	481	492	557	573	601	644	687
Fibre	Cotton (wagyi)	Sown	Acre	134	143	108	101	124	103	86	84	104	110
		Harvested	Acre	119	135	104	97	119	101	85	83	103	110
		Production	Tonne	15.2	21.5	15.9	12.9	16.8	14.9	12.7	12.4	14.5	15.7
	Cotton(Mahlaing 5./6) (d)	Sown	Acre	216	246	203	200	175	138	61	83	111	116
		Harvested	Acre	203	234	189	183	140	128	59	75	106	110
		Production	Tonne	19.7	38.2	27.7	22.7	16.8	14.6	6.9	8.1	12	11.6
	Cotton (Long Staple)	Sown	Acre	197	143	76	204	638	583	512	637	627	575
		Harvested	Acre	153	127	64	159	542	508	464	558	587	522
		Production	Tonne	37.9	38.5	17.7	49.2	128.8	135.8	141.5	135.1	146.3	123
Miscellaneous	Rubber	Sown	Acre	200	190	191	220	259	294	333	369	419	446
		Harvested	Acre	115	100	97	129	120	113	118	117	130	153
		Production	Tonne	15.6	14.8	14.3	27.1	25.3	25.6	26.6	22.6	26.2	35.1
	Coconut	Sown	Acre	59	73	79	80	80	81	82	83	89	102
		Harvested	Acre	52	65	71	75	76	77	78	79	84	92
		Production	No	112161	178669	187499	203365	200746	236947	245805	250261	225310	288519

(In Thousand)
(a) Only for seeds (b) Only for sugar production (c) Only for jaggery production (d) Includes cotton (wagale) up to 1985-86.
Source: Settlement and Land Records Department. (Central Statistical Organization 2001)

Table 13 Statistics for Market Prices for Selected Commodities, Yangon and Mandalay Markets, 2000-2001

Market	Item	Units	2000					2001					2000-2001				
			Max	Min	Mean	SD	CV	Max	Min	Mean	SD	CV	Max	Min	Mean	SD	CV
Mandalay (Kaingtan Market)	Apple	10 pce						1099	455	763	188	25	1099	455	763	188	25
	Avocado	10 pce	117	86	95	9	10	167	79	122	23	19	167	79	110	23	21
	Banana (Phe-gyan)	Hand	80	53	71	4	6	117	71	84	9	10	117	53	77	9	12
	Banana (Thee-mhwe)	Hand	74	46	57	5	10	75	58	66	5	7	75	46	61	7	11
	Banana (Ya-khine)	Hand	71	35	48	6	12	63	46	55	5	9	71	35	51	6	13
	Broad bean	viss	81	31	60	10	18	135	46	90	18	20	135	31	75	21	28
	Cabbage (Northern Shan)	pce						99	23	46	16	34	99	23	46	16	34
	Cabbage (Southern Shan)	pce	34	9	20	7	36	94	19	54	16	30	94	9	34	20	59
	Cabbage (lowland)	pce	60	8	22	9	41	73	12	35	18	54	73	8	26	14	54
	Carrot (Northern Shan)	viss						105	28	61	22	36	105	28	61	22	36
	Carrot (Southern Shan)	viss	99	25	51	23	44	164	25	79	41	52	164	25	65	36	55
	Carrot (lowland)	viss						66	18	30	16	53	66	18	30	16	53
	Cauliflower (lowland)	pce	62	12	35	13	37	64	11	33	14	42	64	11	34	13	39
	Cauliflower (Northern Shan)	pce						98	31	63	19	31	98	31	63	19	31
	Cauliflower (Southern Shan)	pce	68	17	38	12	32	113	15	70	25	37	113	15	50	24	48
	Choko	10 pce	45	16	27	9	34	170	28	84	39	47	170	16	64	42	66
	Cucumber (Medium)	100 pce	2247	600	1200	485	41	2848	530	1412	483	34	2848	530	1303	493	38
	Custard apple	10 pce	55	49	51	3	6	761	467	634	85	14	761	49	440	295	69
	Djenkol Bean (without shell)	10 pce						67	45	57	7	13	67	45	57	7	13
	Dried chili (long)	100 viss	38222	20873	29705	4670	16	121905	35127	67290	18294	27	121905	20873	48497	23092	48
	Dried chili (medium)	100 viss	43445	26667	37579	4347	12	180952	39667	78533	33048	42	180952	26667	58056	31200	54
	Dried chili (round)	100 viss	59500	30000	47038	9699	21	196667	42000	93464	37625	41	196667	30000	70831	36157	51
	Durian (local)	pce	250	233	242	12	6						250	233	242	12	6
	Eggplant (Medium)	viss	112	24	36	13	36	119	24	52	20	38	119	24	44	19	42
	Garlic (Kyukoke)	100 viss	26722	13111	19640	4199	21	55611	22556	37027	8332	23	55611	13111	28333	10929	39
	Garlic (lowland)	100 viss	30000	12136	22585	4728	21	15000	14500	14663	236	2	30000	12136	21704	5116	24
	Garlic (Shan)	100 viss	40200	13271	20468	7792	38	53619	13267	28724	11553	40	53619	13267	24596	10644	43
	Ginger	viss	136	44	81	28	34	116	38	63	20	31	136	38	72	25	35
	Grape (Green)	viss						401	148	293	105	37	401	148	293	105	37
	Grape (Reddish brown)	viss						579	257	434	130	31	579	257	434	130	31
	Green chili (long)	viss	90	37	62	11	18	283	82	133	42	32	283	37	97	47	49
	Green chili (Medium)	viss	173	78	135	27	20	350	109	208	58	28	350	78	172	58	34
	Green chili (Round)	viss	157	71	115	23	20	273	88	156	38	24	273	71	136	37	28
	Lime	10 pce	67	23	39	14	36	14800	34	374	2127	571	14800	23	243	1659	686
	Maize cob	100 pce	867	337	545	142	26	1314	472	828	210	26	1314	337	672	225	34
	Mandarin	10 pce	516	147	268	106	40	378	146	247	85	35	516	146	258	97	38
	Mango (Aung din)	10 pce	56	48	53	4	7	111	69	86	17	21	111	48	72	22	31
	Mango (Sein-ta-lone)	10 pce	342	337	340	4	1	488	283	397	70	18	488	283	386	66	18
	Mango (Yin kawe)	10 pce	483	65	188	149	81	365	138	240	75	32	483	65	213	120	57
	Mangosteen	10 pce	93	54	78	13	18						93	54	78	13	18
	Muskmelon	pce	128	79	103	14	14	243	67	105	35	34	243	67	105	30	29
	Okra	viss	166	62	102	22	22	255	77	118	37	31	255	62	112	32	29
	Onion (medium)	100 viss	7667	2583	5185	1159	22	39428	5361	14337	10284	72	39428	2583	9761	8611	88

Table 13 Statistics for Market Prices for Selected Commodities, Yangon and Mandalay Markets, 2000-2001

Market	Item	Units	2000					2001					2000-2001				
			Max	Min	Mean	SD	CV	Max	Min	Mean	SD	CV	Max	Min	Mean	SD	CV
	Onion (Small)	100 viss	7889	1583	3547	1050	30	33472	3528	10463	7937	76	33472	1583	7079	6667	94
	Onion (Special)	100 viss	10556	4583	6971	1441	21	47143	6695	17145	11964	70	47143	4583	12058	9899	82
	Orange	10 pce	84	60	68	7	10	133	45	87	19	22	133	45	80	18	23
	Papaya	pce						51	30	42	5	12	51	30	42	5	12
	Pear	10 pce	140	51	97	34	36						140	51	97	34	36
	Pineapple	pce	48	23	31	6	21	65	20	48	11	24	65	20	39	12	31
	Plum	Crate						1350	714	911	147	16	1350	714	911	147	16
	Pomelo	pce	152	32	103	51	53	38	38	38			152	32	90	53	62
	Potato (A1)	100 viss						15167	4375	7725	2582	34	15167	4375	7725	2582	34
	Potato (Medium)	100 viss	10067	2500	6706	2196	33						10067	2500	6706	2196	33
	Potato (OK)	100 viss						17250	5792	9273	2877	31	17250	5792	9273	2877	31
	Potato (Special)	100 viss	13334	5000	9441	2635	28						13334	5000	9441	2635	28
	Potato (Swethee)	100 viss						11917	3042	6046	2014	33	11917	3042	6046	2014	33
	Pumpkin	pce						138	48	84	29	34	138	48	84	29	34
	Radish	10 pce	53	10	29	12	42	73	15	32	16	49	73	10	30	14	46
	Rice (Manawthukha)	30 viss	30328	1633	3483	3983	115	3586	1517	2822	596	21	30328	1517	3153	2852	91
	Rice(Nga-sein)	30 viss	2844	1228	2269	449	20	2697	1183	2097	351	17	2844	1183	2183	410	19
	Rice(Paw-san)	30 viss	4908	2978	4017	458	11	4489	2817	3824	553	15	4908	2817	3913	518	13
	Rice(Shwebo Manaw)	30 viss	3876	2257	3481	349	10	3920	1792	3206	598	19	3920	1792	3344	506	15
	Strawberry	Basket						40	20	29	6	22	40	20	29	6	22
	Tomato (Northern Shan)	18 viss						3775	667	1632	911	57	3775	667	1632	911	57
	Tomato (Southern Shan)	20 viss	2100	533	967	329	34	3817	600	1807	1018	57	3817	533	1397	869	62
	Tomato (lowland)	18 viss	1726	365	778	401	52	3660	335	1524	1077	71	3660	335	1187	915	77
	Watermelon	pce	198	67	147	32	22	192	36	98	53	55	198	36	114	52	46
Mandalay (Mandalay Exchange Center)	Black gram (Domestic)	60 viss	22092	9263	14274	3428	24	21567	12617	17934	2705	15	22092	9263	16104	3580	22
	Butter bean	56.25 viss						12833	8028	10497	1081	10	12833	8028	10497	1081	10
	Chick pea (split/yellow)	viss	347	205	256	30	12	366	193	262	49	19	366	193	259	41	16
	Chick pea (whole/white/big)	57.25 viss	40133	8500	13229	4285	33	23583	8400	16688	3332	20	40133	8400	14884	4213	28
	Chick pea (whole/white/small)	57.25 viss	16250	9030	12053	1710	14	19631	7900	13773	3100	23	19631	7900	13001	2697	21
	Chick pea (whole/yellow)	56.25 viss	14342	7828	10171	1386	14	21083	7280	10732	2464	23	21083	7280	10451	2008	19
	Cow pea (blue)	60 viss	7800	4450	5889	1004	17	14750	5975	10880	2587	24	14750	4450	8385	3186	38
	Cow pea (White)	60 viss	12540	5000	8986	1827	21	30000	10300	15827	6543	42	30000	5000	12514	5934	48
	Garden pea	59.25 viss	14575	11156	12808	757	6	30079	12733	21157	6174	29	30079	11156	17117	6111	36
	Green gram	56.25 viss	12367	7233	9536	1190	13	20167	11200	16355	2018	12	20167	7233	12982	3805	29
	Groundnut	100 viss	31994	23642	27447	2099	8	59867	23942	40428	12837	32	59867	23642	33937	11237	33
	Groundnut oil	viss	581	476	522	24	5	1103	523	771	221	29	1103	476	648	201	31
	Kidney bean	54 viss						14643	9750	12649	1570	13	14643	9750	12649	1570	13
	Lablab bean	55.25 viss						16014	10739	13552	1791	13	16014	10739	13552	1791	13
	Maize	54 viss	3038	1950	2397	234	10	6570	2675	4733	1001	21	6570	1950	3565	1379	39
	Niger	45 viss	11788	7000	9068	1083	12	18333	7875	12298	3468	28	18333	7000	10700	3037	28
	Palm oil	viss	457	373	416	24	6	915	390	608	178	29	915	373	508	156	31
	Pigeon pea	60 viss	11767	6179	8380	1411	17	15367	6940	11962	2482	21	15367	6179	10171	2697	27
	Rice bean	60 viss						8519	6929	7786	534	7	8519	6929	7786	534	7
	Sesame (Brown)	45 viss	12925	7621	8794	848	10	22283	9300	15808	3952	25	22283	7621	12225	4511	37
	Sesame (White)	45 viss	11257	8367	9405	634	7	23100	9660	16388	4024	25	23100	8367	12896	4531	35

Table 13 Statistics for Market Prices for Selected Commodities, Yangon and Mandalay Markets, 2000-2001

Market	Item	Units	2000					2001					2000-2001				
			Max	Min	Mean	SD	CV	Max	Min	Mean	SD	CV	Max	Min	Mean	SD	CV
	Sesame oil	viss	486	383	419	25	6	958	440	702	176	25	958	383	562	190	34
	Soybean	53.25 viss	8539	3100	5707	1581	28	26292	7358	15671	6292	40	26292	3100	10689	6775	64
	Sunflower	27 viss	4783	2675	3844	404	11	9796	4033	6546	1933	30	9796	2675	5195	1943	37
	Wheat (Monywa)	60 viss	7739	5542	6452	703	11	21033	8140	15207	4339	29	21033	5542	10830	5378	50
	Wheat (Myaung)	60 viss	14467	4608	6901	1357	20	21267	8350	15613	4430	29	21267	4608	11257	5459	49
	Wheat (Myinmu)	60 viss	8122	5427	6938	686	10	21275	8340	15651	4410	28	21275	5427	11295	5388	48
	Wheat (Shan)	60 viss	7339	4475	5643	833	15	16022	7183	12514	3199	26	16022	4475	9078	4163	46
Yangon (Bayintnaung Market)	a&TuRef;yJMuD;	60 viss						12000	11000	11500	707	7	12000	11000	11500	707	7
	Black gram (Domestic)	60 viss	25000	9813	14707	3766	26	24416	12994	18434	2666	15	25000	9813	16570	3747	23
	Black gram (Ready Cargo)	MT	298000	73333	155707	40100	26	253898	22000	194293	40680	21	298000	22000	170307	44253	26
	Bocake	60 viss						20000	8500	11736	4628	41	20000	8500	11736	4628	41
	Chick pea (whole/yellow)	100 viss	27000	13143	18251	3341	18	52815	12350	18523	6916	38	52815	12350	18386	5386	29
	Chick pea(split/yellow)	100 viss	47288	21950	26212	4791	18	37800	2214	24613	5859	24	47288	2214	25505	5317	21
	Cow pea	60 viss	12400	6000	9166	1090	12	24800	10000	13964	3922	28	24800	6000	10997	3460	32
	Dried chili (long)	100 viss	41429	20100	29084	5690	20	120118	38500	74134	23546	32	120118	20100	51609	28338	55
	Dried chili (medium)	100 viss	38695	22458	29895	4607	15	106875	36917	68792	17345	25	106875	22458	49344	23271	47
	Dried chili (round)	100 viss	85000	44878	58770	12201	21	256667	47163	101658	46374	46	256667	44878	80214	40029	50
	Garden pea	60 viss						23000	18500	21000	2121	11	23000	18500	21000	2121	11
	Garlic (Kyukoke)	100 viss	36000	16250	23772	4289	18	67500	17563	45785	11164	25	67500	16250	34778	13899	40
	Garlic (Lowland)	100 viss	17700	12000	14400	2955	22						17700	12000	14400	2955	22
	Garlic (Shan)	100 viss	33500	15750	20738	5380	26	55750	17167	31183	11009	35	55750	15750	25961	10092	39
	Green gram	60 viss	14083	7708	10593	1606	15	29047	12167	17648	3023	17	29047	7708	14083	4282	30
	Green gram (Special)	60 viss	15000	7900	11327	1754	16	18500	17100	17713	716	4	18500	7900	12239	2813	23
	Green gram (Ready Cargo)	MT	130000	97000	110606	13127	12	214000	190000	204619	7811	4	214000	97000	147167	48445	33
	Groundnut	100 viss	33000	25060	27861	1655	6	30000	25000	26982	1642	6	33000	25000	27648	1682	6
	Groundnut oil (ordinary)	1 viss	537	421	463	21	5	1082	445	658	210	32	1082	421	551	172	31
	Groundnut oil (Special)	1 viss	683	500	541	45	8	1255	493	784	238	30	1255	493	662	209	32
	Groundnut oil (Yangon)	1 viss						1415	439	849	267	32	1415	439	849	267	32
	Maize	54 viss	3131	2180	2679	246	9	13512	2913	5109	1628	32	13512	2180	3881	1679	43
	Onion (Medium)	100 viss	9833	3350	5674	1548	27	44313	5671	16281	12425	77	44313	3350	10978	10295	94
	Onion (Small)	100 viss	7417	2058	4160	1159	28	37708	4400	13410	10041	75	37708	2058	8785	8495	97
	Onion (Special)	100 viss	12958	3800	7335	2067	28	49750	6525	17903	13441	75	49750	3800	12619	10941	87
	Palm oil (ordinary)	viss	380	350	354	9	2	350	330	334	8	2	380	330	344	13	4
	Pigeon pea (Ready Cargo))	MT	125000	68400	91739	14393	16	439607	89500	140626	52558	38	439607	68400	115662	45221	39
	Potato(A1)	100 viss	9720	3010	6395	1639	26	16167	3917	8363	3047	37	16167	3010	7379	2627	36
	Potato(OK)	100 viss						18083	563	9629	3464	36	18083	563	9629	3464	36
	Potato(Swethee)	100 viss	7858	2064	5084	1303	26	19250	2750	6799	3081	46	19250	2064	5941	2506	42
	Rice (Nga-kywe)	30 viss	3350	1900	2678	480	18	3344	1590	2438	504	21	3350	1590	2558	504	20
	Rice (Nga-sein)	30 viss	2425	940	1564	423	27	2941	1065	2018	531	26	2941	940	1791	529	30
	Rice(Ematha)	30 viss	2289	1075	1692	358	21	2596	1018	1800	423	24	2596	1018	1746	394	23
	Rice(pawsan)	30 viss	4389	2071	3418	609	18	4576	2063	3191	620	20	4576	2063	3304	622	19
	Sesame oil (Ordinary)	viss	484	387	412	26	6	1057	411	668	190	29	1057	387	534	184	35
	Sesame oil (Special)	viss	517	403	435	29	7	1104	426	712	199	28	1104	403	573	198	35
	Soybean	60 viss	9300	4667	7320	1018	14	21250	9040	13863	4004	29	21250	4667	9619	4006	42
	ukef;yJBuD;	61 viss						15500	6000	10750	6718	70	15500	6000	10750	6718	70

Table 13 Statistics for Market Prices for Selected Commodities, Yangon and Mandalay Markets, 2000-2001

Market	Item	Units	2000					2001					2000-2001				
			Max	Min	Mean	SD	CV	Max	Min	Mean	SD	CV	Max	Min	Mean	SD	CV
	Wheat (flour)	25 viss						39974	18200	30069	6085	20	39974	18200	30069	6085	20
Yangon (Thiriminganlar Market)	Apple(Chin)	vis	280	195	242	22	9	555	367	439	62	15	555	195	321	108	34
	Apple(China)	vis	4150	3233	3593	244	7	8333	3193	5944	1550	26	8333	3193	5272	1695	32
	Avocado	10pce	222	124	174	27	16	360	119	205	61	30	360	119	197	56	29
	Banana (ya-khine)	Hand	137	62	85	13	15	227	67	121	44	37	227	62	103	37	36
	Banana(Phe-gyan)	Hand	156	58	77	18	24	256	62	133	54	41	256	58	105	49	47
	Banana(Shwe-ni)	Hand	357	197	260	41	16	386	227	305	52	17	386	197	282	52	18
	Banana(Thee-mwe)	Hand	205	98	139	28	20	323	93	178	62	35	323	93	158	52	33
	Bitter gourd (medium)	100 pce						1048	481	792	140	18	1048	481	792	140	18
	Cabbage (Lowland)	pce	47	11	25	10	41	113	29	64	25	40	113	11	41	26	65
	Cabbage (Pyin Oo Lwin)	pce						94	35	57	23	41	94	35	57	23	41
	Cabbage (Shan)	pce	71	14	39	11	27	138	35	79	27	35	138	14	57	28	49
	Carrot(Shan)	viss	149	82	112	17	15	244	98	150	44	30	244	82	131	38	29
	Cauliflower (Lowland)	pce	35	12	27	7	26	78	46	53	11	21	78	12	35	15	43
	Cauliflower (Shan)	pce	99	36	59	13	22	184	35	109	37	34	184	35	82	36	45
	Cauliflower (Shan)	pce						184	35	109	37	34	184	35	109	37	34
	Cauliflower (Shan)	pce						177	97	138	29	22	177	97	138	29	22
	Choko	10 pce	66	37	49	8	17	153	64	104	25	24	153	37	78	33	43
	Cucumber	100 pce	807	354	572	107	19	1100	586	789	122	16	1100	354	680	158	23
	Custard Apple	100pce	568	568	568			1045	395	630	226	37	1045	395	622	210	35
	Djenkol Bean (with shell)	basket						4905	2728	3392	560	17	4905	2728	3392	560	17
	Djenkol Bean (without shell)	basket	3967	2476	3247	742	24	10643	8357	9510	624	7	10643	2476	7299	3152	44
	Durian (local)	pce	1442	177	390	302	78	622	164	277	110	40	1442	164	343	245	72
	Durian (Thai)	pce	1313	500	957	292	31						1313	500	957	292	31
	Eggplant	100 pce	842	190	509	181	36	1113	545	797	168	21	1113	190	651	226	35
	Ginger	viss	145	70	87	12	14	146	62	87	23	26	146	62	87	18	21
	Gourd	pce	155	87	122	24	21						155	87	122	24	21
	Grape (green)	viss	133	99	116	11	10	392	192	274	95	36	392	99	189	103	55
	Grape (red)	viss	662	320	436	100	23	867	379	597	195	34	867	320	503	165	33
	Green chili (medium)	viss	501	95	221	101	46	740	166	413	155	38	740	95	312	160	52
	Green chili(long)	viss	177	47	91	26	29	361	87	189	70	37	361	47	140	72	51
	Indian leek	viss						140	140	140			140	140	140		
	Long bean	Bundle						96	63	76	8	11	96	63	76	8	11
	Maize cob	100 pce	1026	295	593	165	28	1224	526	748	146	20	1224	295	669	173	26
	Mandarin	viss	469	119	258	90	35	360	170	256	54	21	469	119	257	74	29
	Mango (Bangkok)	10 pce	406	118	212	99	48						406	118	212	99	48
	Mango (Ma Chitsu)	10 pce	542	91	203	115	58	778	352	570	137	25	778	91	386	224	59
	Mango (Yin Kawe)	10 pce	288	53	119	73	62	867	159	389	206	54	867	53	276	211	77
	Mangosteen	10 pce	555	50	179	174	99	567	133	235	132	57	567	50	207	155	75
	Marrow	pce	79	79	79			244	71	138	52	38	244	71	136	52	39
	Okra	viss						185	87	136	30	23	185	87	136	30	23
	Orange	10 pce	226	70	107	34	32	343	112	166	54	33	343	70	129	51	40
	Pear	vis	197	111	151	30	21	376	258	309	35	11	376	111	237	87	37
	Pineapple	pce	124	63	88	15	18	155	84	109	19	17	155	63	99	20	20
	Plum	Crate	714	667	691	33	5	4000	606	1264	769	62	4000	606	1216	752	63

Table 13 Statistics for Market Prices for Selected Commodities, Yangon and Mandalay Markets, 2000-2001

Market	Item	Units	2000					2001					2000-2001				
			Max	Min	Mean	SD	CV	Max	Min	Mean	SD	CV	Max	Min	Mean	SD	CV
	Pomelo	pce	306	130	216	64	30	359	120	214	62	29	359	120	215	62	29
	Pumpkin	pce						198	63	133	33	25	198	63	133	33	25
	Radish	bundle	12	12	12			25	8	14	4	33	25	8	14	4	32
	Rambutam	100 pce	970	431	618	175	29	892	567	743	93	13	970	431	683	149	22
	Snake gourd	bundle (20 pce)						268	118	191	43	23	268	118	191	43	23
	Snow pea	viss						471	403	447	28	7	471	403	447	28	7
	Tomato (Lowland)	18 viss	1972	362	839	468	56	3480	512	1175	854	74	3480	362	991	683	69
	Tomato (Shan)	18 viss	2181	481	1079	348	32	4626	833	2108	1062	51	4626	481	1570	928	59

Source: Market Information Service, MAS

Table 14 Myanmar 30 Year Plan for Agriculture

Crop	Area (000ha)			Production (000mt)			Yield (t/ha)		
	2000	2030	% Increase	2000	2030	% Increase	2000	2030	% Increase
Paddy	6359	8903	28.57%	21324	45904	53.55%	3.35	5.16	34.96%
Pulses	2934	4047	27.50%	2263	4763	52.49%	0.77	1.18	34.46%
Edible Oil	2676	3378	20.78%	1120	3097	63.84%	0.42	0.92	54.35%
Cotton	324	809	59.95%	153	980	84.39%	0.47	1.21	61.02%
Sugarcane	139	405	65.68%	5894	25401	76.80%	42.40	62.72	32.39%
Jute	45	61	26.23%	42	73	42.47%	0.93	1.20	22.01%
Rubber	181	607	70.18%	36	227	84.14%	0.20	0.37	46.82%
Oil Palm	19	280	93.21%	114	711	83.97%	6.00	2.54	-136.29%
Culinary Crops	209	305	31.48%	1287	2067	37.74%	6.16	6.78	9.14%
Vegetables	296	376	21.28%	3256	4650	29.98%	11.00	12.37	11.05%
Fruits	343	526	34.79%	5544	5200	-6.62%	16.16	9.89	-63.50%
Total	13525	19697	31.33%	41033	93073	55.91%	3.03	4.73	35.79%

Source: (Anonymous 2001, pg. 6)

Table 15 Net Output of Agriculture Sector

Year	Value of Total Net Output	Contribution of Agricultural Sector	
	Million Kyats	Million Kyats	Percent
1985/86	55989.3	22243.5	39.7%
1986/87	55396.8	22343.3	40.3%
1987/88	53177.8	20906.8	39.3%
1988/89	47141.1	18137.6	38.5%
1989/90	48883.1	19088.8	39.0%
1990/91	50259.5	19470.6	38.7%
1991/92	49933.3	18708.6	37.5%
1992/93	54756.6	21028.6	38.4%
1993/94	58063.9	22008.7	37.9%
1994/95	62406.1	23483.3	37.6%
1995/96	66741.6	24764.7	37.1%
1996/97	71042	25697.6	36.2%
1997/98	75123.1	26480.4	35.2%
1998/99	79460.2	27417.3	34.5%
1999/00	88157	30297.3	34.4%

1985-86 Constant Producers' Prices
Source: (Myanma Agriculture Service 2002)

Table 16 Pulse Production (1990-2003)

Year	Sown Area (million ha)	Average Yield	Production
	Total	mt/ha	(000 mt)
1990/91	0.99	0.60	596
1991/92	1.27	0.59	755
1992/93	1.5	0.62	923
1993/94	1.52	0.60	906
1994/95	1.75	0.65	1129
1995/96	2.05	0.67	1375
1996/97	1.96	0.70	1370
1997/98	2.09	0.76	1597
1998/99	2.46	0.68	1685
1999/00	2.67	0.68	1828
2000/01	2.93	0.77	2263
2001/02 (Provisional)	3.09	0.82	2522
2002/03 (Planned)	3.12	0.87	2701

Source: (Myanma Agriculture Service 2002)

Table 17 Rice Production (1990-2003)

Year	Rice Sown Area (million ha)			Average Yield	Paddy Production	Equivalent Rice	Recovery Rate
	Monsoon	Dry-Season	Total	mt/ha	(million mt)	(million mt)	Percent
1990/91	4.94		4.94	2.83	13.97	8.37	59.91%
1991/92	4.83		4.83	2.73	13.2	7.91	59.92%
1992/93	4.8	0.33	5.13	2.89	14.83	8.89	59.95%
1993/94	4.8	0.87	5.67	2.96	16.76	10.04	59.90%
1994/95	4.85	1.08	5.93	3.07	18.19	10.9	59.92%
1995/96	4.92	1.22	6.14	2.92	17.95	10.76	59.94%
1996/97	5.02	0.85	5.87	3.01	17.67	10.59	59.93%
1997/98	4.9	0.88	5.78	2.88	16.65	9.98	59.94%
1998/99	4.83	0.93	5.76	2.96	17.07	10.23	59.93%
1999/00	5.15	1.13	6.28	3.20	20.12	12.06	59.94%
2000/01	5.26	1.1	6.36	3.35	21.32	12.77	59.90%
2001/02 (Provisional)	5.29	1.21	6.5	3.42	22.26	13.13	58.98%
2002/03 (Planned)	5.41	1.23	6.64	3.58	23.76	14.24	59.93%

Source: (Myanma Agriculture Service 2002)

Table 18 Maize Production (1995-2003)

Year	Sown Area (million ha)	Average Yield	Production
	Total	mt/ha	(000 mt)
1995/96	0.167	1.62	270
1996/97	0.167	1.74	290
1997/98	0.162	1.91	310
1998/99	0.188	1.60	300
1999/00	0.21	1.67	350
2000/01	0.217	1.66	360
2001/02 (Provisional)	0.253	2.06	520
2002/03 (Planned)	0.309	2.17	670

Source: (Myanma Agriculture Service 2002)

Table 19 Fruits and Vegetables Production (1995-2003)

Year	Sown Area (000 ha)		
	Vegetables	Fruits	Total
1995/96	180	335.00	515
1996/97	187	363.00	550
1997/98	208	376.00	584
1998/99	212	383.00	595
1999/00	266	407.00	673
2000/01	296	432.00	728
2001/02 (Provisional)	284	522.00	806
2002/03 (Planned)	245	472.00	717

Source: (Myanma Agriculture Service 2002)

Table 20 Status of Crop Production 2001-2002

Crops		Sown Area (000) ha	Sown Area Percent	Production (000) mt	Average Yield mt/ha
Cereal Crops	Paddy	6357	40.49%	21909	3.45
	Wheat	79	0.50%	96	1.22
	Maize (seed)	251	1.60%	539	2.15
	Other Cereals	452	2.88%	174	0.38
	Total	7139	45.47%	22718	3.18
Oil Seed Crops	Groundnut	568	3.62%	723	1.27
	Sesame	1332	8.48%	345	0.26
	Sunflower	498	3.17%	279	0.56
	Oil Palm	29	0.18%	74	2.55
	Other Oil Seed Crops	152	0.97%	2.2	0.01
	Total	2579	16.43%	1423.2	0.55
Pulses	Black Gram	722	4.60%	636	0.88
	Butter Bean	51	0.32%	51	1.00
	Green Gram	747	4.76%	578	0.77
	Sultani/Sultapya	66	0.42%	59	0.89
	Cow Pea	129	0.82%	104	0.81
	Chick Pea	196	1.25%	194	0.99
	Pigeon Pea	484	3.08%	466	0.96
	Other Pulses	801	5.10%	568	0.71
	Total	3196	20.36%	2656	0.83
Industrial Crops	Cotton	295	1.88%	141	0.48
	Jute	51	0.32%	47	0.92
	Sugarcane	163	1.04%	7116	43.66
	Rubber	186	1.18%	37	0.20
	Virginia Tobacco	4	0.03%	5	1.25
	Total	699	4.45%	7346	10.51
Vegetables	Potato	30	0.19%	329	10.97
	Onion/Garlic	75	0.48%	744	9.92
	Chilli	113	0.72%	69	0.61
	Other Vegetables	299	1.90%		0.00
	Spices	17	0.11%		0.00
	Total	534	3.40%	1142	2.14
Plantation Crops	Tea	73	0.46%	68	0.93
	Coffee	9	0.06%	2	0.22
	Coconut	45	0.29%		0.00
	Toddy	37	0.24%	306	8.27
	Fruit Trees	382	2.43%		0.00
	Mulberry	2	0.01%	2	1.00
	Other Fruit Trees	54	0.34%		0.00
	Total	602	3.83%	378	0.63
Miscellaneous	Non-edible crops (flowers, thatch, etc)	952	6.06%		0.00
	Total	952	6.06%	0	0.00
Total		15701	100.00%	35663.2	2.27

Source: (Myanma Agriculture Service 2002)

Table 21 Control and Management of SOEs in Myanmar

Supervising Ministry	Agroindustry Type
Ministry of Agriculture and Irrigation	Cotton gins Cotton seed oil mill Sugar mill Alcohol plant Jute factories Small scale Jute-based paper mill Carpet factory Palm oil and Other vegetable oil mills Fruits and Vegetables canning factory Coffee factory Silk yarn factory Rubber crump factory Rubber glove factory Organic pesticide plant Pesticide formulation plant Small agricultural machinery and equipment factory
Ministry of Commerce	Rice mills Rice mill and spare parts manufacturing works Rice bran oil mills Animal feed mills Pulses and beans splitting and cleaning plants
Ministry of Industry (1)	Textile spinning and weaving mills Blanket and towel weaving factories Knitting mills Garment factories Soft drink and beverages Noodle factories Biscuit factories Tapioca starch plants MS glutamate plants Oil hydrogenation plants Brewery and distilleries
Ministry of Industry (2)	Tractor, power tiller, water pump, agricultural machinery, equipments and implements factory Tire factory
Ministry of Defense	Canning factory Tea factory Cotton yarn and textile mills
Ministry of Livestock and Fisheries	Animal feed mills

Source: (Kudo 2003, pg 63)

Table 22 Classification of Agroindustry by Size

Size	Power Installed (hp)	Investment (Million Kyat)	Labor (Number)	Annual Production Value (Million Kyat)
Small	<=25	1	50	2.5
Medium	26-50	1-50	51-100	2.5-10
Large	>50	>50	>100	>10

Source: (Asian Development Bank 1994; 1997; 1998)

Table 23 Types of Agroindustry

• Rice Mills	• Jaggery Industries
• Rice Noodles and Flour Mills	• Cigar and Cheroot Industries
• Pea Noodle and Flour Mills	• Preserved and Dehydrated Fruit and Vegetable Industries
• Bean Splitting and Cleaning Plants	• Sauce and Pickle Industries
• Mini Sugar Plants	• Bean Sprout and Curd Industries
• Small-Scale Alcohol Plants	• Mushroom Industries
• Traditional Textile Looms	• Indigenous Medicine Industries
• Traditional Oil Presses	• Small-Scale Farm Machinery and Implements Industries

Source: (Kudo 2003, pg 63)

Table 24 Relative Importance of Industries

Industry	1988-89		1996-97		1998-99	
	Number	Percent	Number	Percent	Number	Percent
Food and Beverages	13759	39.90%	28836	55.18%	28519	51.36%
Clothing and Wearing Apparel	5700	16.53%	3842	7.35%	4337	7.81%
Construction Materials	1306	3.79%	3689	7.06%	3620	6.52%
Personal Goods	3593	10.42%	1365	2.61%	1724	3.11%
Household Goods	876	2.54%	243	0.46%	503	0.91%
Printing and Publishing	109	0.32%	382	0.73%	464	0.84%
Industrial Raw Material	1960	5.68%	2586	4.95%	2658	4.79%
Mineral and Petroleum Products	2613	7.58%	2682	5.13%	3253	5.86%
Agricultural Equipment	10	0.03%	85	0.16%	148	0.27%
Machinery and Equipment	27	0.08%	330	0.63%	655	1.18%
Transport Vehicle	369	1.07%	196	0.38%	288	0.52%
Workshop and Dockyard	305	0.88%	305	0.58%	305	0.55%
Miscellaneous	3857	11.18%	7718	14.77%	9049	16.30%
Total	34484	100.00%	52259	100.00%	55523	100.00%

Source: (Kudo 2003, pg 63)

Table 25 Value of Production in Current Prices

Industry	1961-62	1971-72	1981-82	1991-92	1998-99
Food and Beverages	60.06%	61.10%	65.41%	79.39%	84.97%
Clothing and Wearing Apparel	14.76%	10.29%	8.22%	3.13%	1.47%
Personal Goods	3.60%	2.90%	3.03%	1.57%	0.92%
Household Goods	0.20%	0.37%	0.61%	0.49%	0.16%
Printing and Publishing	0.70%	0.87%	0.88%	0.59%	0.11%
Industrial Raw Material	3.40%	4.73%	6.31%	4.38%	4.34%
Mineral and Petroleum Products	5.86%	7.48%	5.00%	4.04%	5.42%
Agricultural Equipment	0.00%	0.26%	0.62%	0.11%	0.28%
Machinery and Equipment	0.08%	0.15%	0.03%	0.02%	0.04%
Transport Vehicle	0.53%	1.97%	2.02%	0.49%	0.52%
Electrical Goods	0.25%	0.60%	0.89%	0.69%	0.10%
Miscellaneous	2.87%	2.27%	2.85%	1.26%	0.61%
Total	92.31%	92.99%	95.87%	96.16%	98.94%

Source: (Kudo 2003, pg 63)

Table 26 Change in Ownership Patterns in Food Processing Industries

Industry	1989-90		1996-97		1997-98	
	Number	Percent	Number	Percent	Number	Percent
State	242	1.76%	209	1.00%	209	0.71%
Cooperative	322	2.34%	219	1.05%	220	0.75%
Private	13194	95.90%	20408	97.95%	28816	98.53%
Total	13758	100.00%	20836	100.00%	29245	100.00%

Source: (Kudo 2003, pg 63)

Table 27 Types and Number of Food Industries, 2000

Industries	Number	Percent
Rice Mills	12397	54.77%
Oil Mills	3434	15.17%
Powder Processing	1723	7.61%
Sugar Mills	819	3.62%
Confectionary	496	2.19%
Pulses and Beans Processing	492	2.17%
Ice Factory	474	2.09%
Popsicle Factory	441	1.95%
Rice Noodle Factory	437	1.93%
Wheat Flour Mills	328	1.45%
Other Processed Foods	287	1.27%
Noodle Factory	259	1.14%
Tapioca	187	0.83%
Alcoholic Products	125	0.55%
Dried Tea	114	0.50%
Vermicelli	114	0.50%
Salt	109	0.48%
Soft Drinks	107	0.47%
Others	292	1.29%
Total	22635	100.00%

Source: Ministry of Industry No 1.

Table 28 Type and Number of Private Sector Food Industries, 2000

Type	Number	Type	Number
Rice Milling	12397	Refrigeration	42
Oil Milling	3434	Toffee	42
Powder Processing	1723	Purified Water	41
Pulses and Beans Processing	500	Meat Products	29
Confectionary	496	Condensed Milk	27
Ice Factory	474	Candy	27
Sugar	819	Sauces	19
Popsicle Factory	441	Cheroot	16
Monghingar Factory	437	Tea (Fresh)	11
Wheat	328	Cigarattes	9
Processed Food (Others)	287	Ginger	6
Noodle Factory	259	Agri-Product Cleaning	5
Tapioca	187	Canned Food	4
Alcoholic Products	125	Dried Shrimp	3
Tea (Dried)	114	Wine	1
Vermicelli	114	Marine Products	1
Salt	109	Sausage	1
Soft Drinks	107		

Source: (Anonymous 2001)

Table 29 Scale of Industries in Industrial Zones

Industry	Large		Medium		Small		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Food Processing	7	13.73%	18	31.58%	1784	38.99%	1809	38.62%
Textile	21	41.18%	8	14.04%	136	2.97%	165	3.52%
Wood-based	7	13.73%	5	8.77%	310	6.77%	322	6.87%
Personal Goods	12	23.53%	19	33.33%	501	10.95%	532	11.36%
Other	4	7.84%	7	12.28%	1845	40.32%	1856	39.62%
Total	51	100.00%	57	100.00%	4576	100.00%	4684	100.00%
Food Processing	7	0.39%	18	1.00%	1784	98.62%	1809	100.00%
Textile Industries	21	12.73%	8	4.85%	136	82.42%	165	100.00%
Wood-based	7	2.17%	5	1.55%	310	96.27%	322	100.00%
Personal Goods	12	2.26%	19	3.57%	501	94.17%	532	100.00%
Other Industries	4	0.22%	7	0.38%	1845	99.41%	1856	100.00%
Total	51	1.09%	57	1.22%	4576	97.69%	4684	100.00%

Source: Ministry of Industry No 1.

Table 30 Paddy Production

Year	Paddy Sown area ('000acre)			Harvested Area ('000 acre)			Yield per acre (baskets/acre)			Production (' 000 mt)		
	Monsoon	Summer	Total	Monsoon	Summer	Total	Monsoon	Summer	Total	Monsoon	Summer	Total
1988-89	11,807		11,807	11,185		11,185	56.4		56.4	13,162		13,162
1992-93	11,863	821	12,684	11,697	797	12,494	56.51	62.78	56.91	13,791	1,044	14,835
1993-94	11,871	2,150	14,021	11,533	2,025	13,558	57.53	68.98	59.24	13,843	2,914	16,757
1994-95	11,981	2,662	14,643	11,596	2,593	14191	59.48	70.26	61.45	14,391	3,801	18,192
1995-96	12,149	3,017	15,166	11,924	2,981	14907	55.67	65.92	57.72	13,850	4,100	17,950
1996-97	12,413	2,105	14,518	12,168	2,084	14254	57.52	70.58	59.43	14,603	3,070	17,673
1997-98	12,104	2,190	14,294	11,279	2,083	13364	58.31	67.42	59.73	13,721	2,930	16,651
1998-99	11,928	2,302	14,230	11,210	2,277	13488	58.88	69.54	60.68	13,771	3,304	17,075
1999-00	12,732	2,796	15,528	12,569	2,776	15347	61.05	71	62.85	16,010	4,112	20,122
2000-01	12,992	2,721	15,713	12,861	2,711	15573	63.35	76.39	65.62	16,999	4,321	21,320
2001-02	13,066	2,875	15,941	12,968	2,874	15,843	64.16	75.9	66.29	17,360	4,552	21,912

Source: Settlement and Land Record Department, MOAI

Table 31 Regional Rice Production, Domestic Utilization, Rice Surplus and Deficit in 2000-2001

Region	Paddy Production			Seed and	Consumption		Domestic	Surplus/
	Sown Acreage	Yield	Production	Waste	Population	Quantity	Utilization	Deficit
Delta Region	9,736	68.07	660,966	38,944	20,416	306,240	345,184	(+) 315782
Coastal Region	1,188	61.94	73,270	4,752	4,200	63,000	67,752	(+) 5518
Central Dry Zone Region	2,795	65.11	175,539	11,180	17,028	255,420	266,600	(-) 91061
Hilly Region	1,994	56.58	112,195	7,976	8,481	127,215	135,191	(-) 22996
Total	15,713	65.62	1,021,970	62,852	50,125	751,875	814,727	(+) 207243

('000 baskets)
Seed Utilization: 2 baskets per acre, Post-Harvest Loss: 2 baskets per acre
Per Capita Consumption: 15 baskets
Source: MAS, Cited in (U Tin Htut Oo and Kudo 2003)

Table 32 Myanmar Rice Balance

		Units	1988-89	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02
Cultivated Area	Wet Season	('000) ha	4782	4805	4808	4852	4920	5027	4902	4831	5156	5262	5292
	Dry Season	('000) ha	0	333	871	1078	1222	853	887	932	1132	1102	1164
	Total	('000) ha	4782	5137	5679	5930	6142	5880	5789	5763	6289	6364	6456
Destroyed Area	Wet Season	('000) ha	252	67	137	156	91	99	334	291	66	53	40
	Dry Season	('000) ha	0	10	51	28	15	8	43	10	8	4	0
	Total	('000) ha	252	77	188	184	106	107	378	301	74	57	40
Yield	Wet Season	t/ha	2.91	2.91	2.96	3.06	2.87	2.96	3.00	3.03	3.15	3.26	3.31
	Dry Season	t/ha	0.00	3.23	3.55	3.62	3.40	3.64	3.47	3.58	3.66	3.94	3.91
	Total	t/ha	2.91	2.93	3.05	3.17	2.97	3.06	3.08	3.13	3.24	3.38	3.42
Harvested Area	Wet Season	('000) ha	4530	4737	4671	4696	4829	4928	4568	4540	5090	5209	5252
	Dry Season	('000) ha	0	323	820	1050	1207	844	843	922	1124	1098	1164
	Total	('000) ha	4530	5060	5491	5747	6037	5772	5411	5462	6215	6307	6416
Production	Wet Season	('000) mt	13162	13791	13843	14391	13850	14603	13721	13771	16010	16999	17360
	Dry Season	('000) mt	0	1044	2914	3801	4100	3070	2930	3304	4112	4321	4552
	Total	('000) mt	13162	14835	16757	18192	17950	17673	16651	17075	20122	21320	21912
Supply	Seed Retention	('000) mt	493	529	585	611	633	606	596	594	648	656	665
	Post-Harvest Losses	('000) mt	467	521	566	592	622	595	558	563	640	650	661
	Paddy	('000) mt	12,203	13,784	15,606	16,989	16,695	16,472	15,497	15,918	18,834	20,015	20,586
	Milling Conversion Factor	Percent	59.75%	61.49%	62.08%	60.24%	60.66%	61.75%	61.36%	62.33%	60.96%	61.49%	61.50%
	Rice	('000) mt	7,291	8,476	9,688	10,234	10,127	10,171	9,508	9,923	11,482	12,306	12,660
Population		Million Person	39.29	42.33	43.92	44.74	45.57	46.40	47.26	48.21	49.13	50.13	51.41
Per Capita Food Requirement		mt/hd/yr	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
Consumption	Paddy	('000) mt	12,777	13,766	14,283	14,550	14,820	15,089	15,369	15,678	15,977	16,302	16,719
	Rice	('000) mt	7,858	8,466	8,784	8,948	9,114	9,280	9,452	9,642	9,826	10,026	10,282
Surplus	Rice	('000) mt	-567	10	904	1,286	1,013	891	56	281	1,656	2,280	2,378
	Paddy	('000) mt	-575	19	1,323	2,439	1,876	1,383	128	240	2,856	3,712	3,867
Export	Rice	('000) mt	24	195	261	1,041	354	93	28	120	55	251	939
Difference (stocks)	Rice	('000) mt	-591	-185	643	245	659	798	28	161	1,601	2,029	1,439

Table 33 Marketing Costs and Margins for Cambodian Rice, 2002

	Inputs	Farmer	Collector	Miller	Transporter	Wholesaler	Retailer	Total
Transport Cost			15		26.5	10.00		
Operating Cost				34.22		6.03		
Input Cost		355.02	453.24	469.74	526.72	561.72	605.06	
Total Costs		**355**	**468**	**503.96**	**553.22**	**577.75**	**605.06**	
Price Received	355.02	453.24	469.74	526.72	561.72	605.06	625.06	
Value of By-Product				65.52				
Total Revenue	355.02	453.24	469.74	592.24	561.72	605.06	625.06	
Profit	**355**	**98**	**1.5**	**88.3**	**8.5**	**27.3**	**20.0**	243.81
		21.7%	**0.32%**	**14.9%**	**1.5%**	**4.5%**	**3.2%**	
Percent of Total Profit		**40%**	**0.62%**	**36%**	**3%**	**11%**	**8%**	100%
Marketing Margins	56.80%	15.71%	2.64%	9.12%	5.60%	6.93%	3.20%	27.49%
Markup over Farm Gate Price		0%	3.6%	31%	24%	33%	38%	

2 tonnes/ha yield, transport from Battambang to Phnom Penh
Riel per kg of Paddy Rice. Milling Recovery 0.64
Source: Derived from data colleted by World Bank Study Team July 2002, (Agrifood Consulting International 2002)

Table 34 Marketing Costs and Margins for Viet Nam Export Rice, 2002

	Inputs	Farmer	Collector/Husker	Large Miller	Transporter	Exporter	VINAFOOD	Total
Transport Cost			32	4.62	2.64			
Operating Cost			37	47.52	14.3	13.00		
Input Cost		1000	1600.00	1717.10	1716.00	1742.37	1727.88	
Total Costs		**1000**	**1669**	**1769.24**	**1732.94**	**1755.37**	**1727.88**	
Price Received	1000	1600.00	1717.10	1716.00	1742.37	1727.88	1736.86	
Value of By-Product				144.10				
Total Revenue	1000.00	1600.00	1717.10	1860.10	1742.37	1727.88	1736.86	
Profit	**1000**	**600**	**48.1**	**90.9**	**9.4**	**-27.5**	**9.0**	729.88
		37.5%	**2.80%**	**4.9%**	**0.5%**	**-1.6%**	**0.5%**	
Percent of Total Profit		**82%**	**6.59%**	**12%**	**1%**	**-4%**	**1%**	100%
Marketing Margins	57.58%	34.55%	6.74%	-0.06%	1.52%	-0.83%	0.52%	7.88%
Markup over Farm Gate Price		0%	7.3%	16%	9%	8%	9%	

Dong/kg Paddy Equivalent
Milling Recovery Brown Rice 0.77, White Rice from Brown Rice 0.85, White Rice from Paddy 0.66
Negative profitability of Exporters is due to temporary difficulties associated with fulfilling export contracts with falling fob prices in July 2002.
Export Price 15% broken rice US$172/tonne = 2632 dong/kg
Source: Derived from data colleted by World Bank Study Team July 2002, (Agrifood Consulting International 2002)

Table 35 MAPT Processing of Rice

Year Ending	Procurement	MAPT Owned Mills			Private Contractors			Total			State:Private Ratios		
		Paddy	Rice	Recovery Rate	Paddy	Rice	Recovery Rate	Paddy	Rice	Recovery Rate	Paddy	Rice	Recovery
1989	1.776	0.307	0.175	0.571	0.962	0.583	0.606	1.269	0.758	0.598	31.89%	30.02%	94.14%
1990	1.314	0.399	0.240	0.602	1.235	0.776	0.628	1.634	1.016	0.622	32.26%	30.93%	95.86%
1991	1.504	0.409	0.243	0.594	0.843	0.528	0.626	1.252	0.771	0.616	48.51%	46.02%	94.86%
1992	1.559	0.424	0.248	0.586	0.958	0.590	0.616	1.381	0.838	0.607	44.23%	42.03%	95.04%
1993	1.596	0.522	0.313	0.600	1.204	0.748	0.621	1.725	1.061	0.615	43.33%	41.84%	96.58%
1994	1.926	0.563	0.343	0.609	1.062	0.666	0.627	1.625	1.009	0.621	53.05%	51.50%	97.09%
1995	2.030	0.670	0.399	0.596	1.596	0.966	0.605	2.266	1.365	0.602	41.96%	41.30%	98.44%
1996	1.938	0.572	0.346	0.605	1.400	0.850	0.607	1.972	1.196	0.607	40.83%	40.71%	99.68%
1997	1.523	0.472	0.284	0.602	1.041	0.650	0.624	1.513	0.934	0.617	45.29%	43.69%	96.47%
1998	0.933	0.453	0.270	0.596	0.776	0.484	0.624	1.229	0.754	0.614	58.33%	55.79%	95.63%
1999	2.197	0.547	0.332	0.607	0.960	0.607	0.632	1.506	0.939	0.623	56.96%	54.70%	96.03%
2000	2.208	0.645	0.378	0.586	1.112	0.693	0.623	1.757	1.071	0.610	57.97%	54.55%	94.09%
2001	2.123	0.586	0.352	0.600	1.081	0.673	0.623	1.667	1.025	0.615	54.25%	52.30%	96.42%

million metric tonnes
Procurement not milled is kept for stocks
Source: MAPT, cited in (U Tin Htut Oo and Kudo 2003, pg 114)

Table 36 Myanmar's Implicit Rice Export Tax

Item	1998-99			2002-03					
	Procured Paddy			Procured Paddy			Free Market Paddy		
	Paddy Kyat/Bskt	Milled Rice Kyat/mt	Export Rice US$/mt	Paddy Kyat/Bskt	Milled Rice Kyat/mt	Export Rice US$/mt	Paddy Kyat/Bskt	Milled Rice Kyat/mt	Export Rice US$/mt
Farmgate Price	500	40000		320	25600		1700	136000	
Transport, Milling and Handling		4400			9000			9000	
Total Cost at Port		44400	130.59		34600	34.60		145000	145.00
FOB Export Rice			210			160			145
Implicit Export Tax			37.8%			78.4%			0.0%

80 basket of paddy = 1 tonne rice, assumes 60 percent recovery ratio for export rice
Exchange Rate 1999 = K340/US$, 2003 = K1000/US$
Source: 1999 Calculations (World Bank 1999, pg. 48), 2003 Calculations, ASR Field Team

Table 37 Calculation of Rice Recovery

Stage	Item	Units	Amount	Total lbs	Total kg
Paddy Cleaning	Paddy	Baskets	100	4600	2086
	Foreign matter	lbs/basket	0.5	50	23
	Clean Paddy			4550	2064
Husking	Husk	Percentage	22.42%	1020	463
	Cow Bran	Percentage	2.42%	110	50
	Points	Percentage	0.66%	30	14
	Brown Rice			3390	1538
Rice Milling	Broken Rice	Baskets	4	288	131
	Rice Bran	Baskets	8	360	163
	Rice 25% Broken	Baskets	36.56	2742	1244
	Total Rice Recovery Rate	Percentage	66.59%	3030	1374
	Head Rice Recovery	Percentage	36.16%	1645	746

1 paddy basket=46 lbs, 1 rice basket=75 lbs, 1 basket broken rice=72 lbs, 1 basket rice bran=45 lbs
Source: MAPT, cited in (U Tin Htut Oo and Kudo 2003, pg 63)

Table 38 Throughput of Paddy to Obtain 1 tonne of 25% Broken Rice, 1999-2000

Location	Paddy Throughput				Rice Outturn			
	Local		Export		Local		Export	
	kg/t	Percent	kg/t	Percent	kg/t	Percent	kg/t	Percent
Ayeyarwaddy	1548	64.59%	1759	56.86%	1371	72.94%	1204	83.04%
Bago (East)	1625	61.53%	1849	54.10%	1303	76.75%	1146	87.23%
Bago (West)	1598	62.57%	1824	54.84%	1334	74.99%	1163	85.95%
Yangon	1590	62.90%	1725	57.96%	1334	74.99%	1228	81.43%
Mon	1523	65.66%	1813	55.15%	1385	72.23%	1272	78.60%
Rakhine	1575	63.48%			1344	74.42%	1167	85.70%
Kachin	1586	63.06%			1337	74.80%		
Mandalay	1531	65.30%	1669	59.91%	1385	72.23%		
Sagaing	1544	64.77%			1361	73.49%	1269	78.81%
Magway	1523	65.66%			1385	72.23%		
Kayin	1577	63.40%			1344	74.42%		
Kayah								
Taninthayi	1546	64.68%			1371	72.94%		
Shan (South)	1548	64.59%			1361	73.49%		
Shan (North)	1548	64.59%			1361	73.49%		
Shan (East)	1548	64.59%			1361	73.49%		

Source: MAPT, cited in (U Tin Htut Oo and Kudo 2003, pg 117)

Table 39 Milling Process Recovery Rates

Component	Percentage
Rice	45 - 69
Excess broken	0 - 20
Rice Barns	8-11
Husks & other waste products	23 -25

Source: MAPT, cited in (U Tin Htut Oo and Kudo 2003, pg 65)

Table 40 Performance of Cambodian Rice Mills 1999

Criteria	Units	Custom Mills	Medium and Large Mills	Range
Capacity	kg/hr paddy	231	713	90-960
Fuel Consumption	litres/tonne	15	17	6-26
Whole Kernels	%	29	29	22-37
Broken Kernels	%	28	31	13-43
Total White Rice	%	57	60	45-68
Bran/Meal	%	21	21	12-29
Husk	%	22	19	15-28
Maintenance (re-facing stones)	(days)		11	8-12
Replacing Rollers	(days)	31	15	6-90

Source: (Cambodia-IRRI-Australia Project 1999, pg. 157)

Table 41 Recovery Rates by Types of Milling Machines, Viet Nam 1996

Type of machine	Recovery rate	Head rice
Steel-roller machine	69	45
Rubber-roller machine	72	55
Manual mill	71	50

Percentage
Source (IFPRI 1996)

Table 42 Milling Recovery from Village Level Mills, Viet Nam 1999

Rice (25% Broken)	64%
Small Broken Rice	6%
Bran	8%
Husk	20%
Loss	2%

Source (PHTI-HCMC 1999, pg. 38)

Table 43 Recommended Per Capita Consumption of Rice

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

Source: (National Nutrition Center 1990)

Table 44 Actual Quantity of Paddy Milled by MAPT & Private Owned Rice Mills

Year	2000-01	2001-02
Production (Summer + Monsoon)	1021.2	1050.33
MAPT rice mills	29.2	26.5
Private owned rice mills registered with MAPT	51.6	79.1
Village rice mills	940.4	944.73

million baskets
Source: MAPT, cited in (U Tin Htut Oo and Kudo 2003, pg 65)

Table 45 MAS Procurement Prices for Agricultural Commodities, 2000-01

Commodity	Price (Kyats/mt)
Paddy	43134-59909
Rice	47927-64701
Black Gram	147200
Pigeon Pea	86000-168000
Green Gram	113500-130000

Source: (Central Bank of Myanmar 2002, pg. 4)

Table 46 Procurement Prices of Paddy, 2000-01

Group	Ayeyawady, Bago, Yangon, Rakhine	Kachin, Kayah, Kayin, Sagaing, Taninthati, Magwe, Mandalay,Mon, Shan
Ngasein	300	350
Emata	320	360
Special Emata	350	
Meedon	350	400
Ngakywe	400	400
Kayauknyin	400	400

Source: (Central Bank of Myanmar 2002, pg. 4)

Table 47 List of Rice Mills Owned and Contracted by MAPT, 2000-2001

Location	Mill Ownership						Power Classification									
	State Owned		Private Contractor		Total		Boiler Driven		Electric Driven		Boiler and Electric		Diesel		Total	
	Number	Capacity	Number	Capacity	Number	Capacity	Number	Capacity	Number	Capacity	Number	Capacity	Number	Capacity	Number	Capacity
Ayeyarwaddy	20	1890	138	4500	158	6390	119	3831	31	1809	8	750	0	0	158	6390
Bago (East)	7	500	51	1444	58	1944	29	894	28	1026	0	0	1	24	58	1944
Bago (West)	8	705	38	1059	46	1764	13	483	31	1242	0	0	2	39	46	1764
Yangon	12	1610	43	1156	55	2766	24	736	23	1730	2	200	6	100	55	2766
Rakhine	11	403	0	0	11	403	6	215	0	0	2	150	3	38	11	403
Sagaing	6	120	68	1610	74	1730	62	1486	6	139	0	0	6	105	74	1730
Mandalay	0	0	39	590	39	590	4	132	14	241	0	0	21	217	39	590
Mon	0	0	39	1212	39	1212	37	1182	1	15	0	0	1	15	39	1212
Magwe	2	40	15	270	17	310	7	150	1	20	0	0	9	140	17	310
Taninthayi	0	0	17	260	17	260	0	0	0	0	0	0	17	260	17	260
Kachin	0	0	14	246	14	246	14	246	0	0	0	0	0	0	14	246
Kayar	1	20	0	0	1	20	0	0	1	20	0	0	0	0	1	20
Kayin	1	20	0	0	1	20	1	20	0	0	0	0	0	0	1	20
Total	68	5308	462	12347	530	17655	316	9375	136	6242	12	1100	66	938	530	17655

Capacity=t/8hrs
Source: MAPT, cited in (U Tin Htut Oo and Kudo 2003, pg 115)

Table 48 List of Custom Rice Mills, 2000-2001

Location	Power Classification											
	Boiler Driven		Electric Driven		Boiler and Electric		Diesel		Diesel and Electric		Total	
	Number	Capacity	Number	Capacity	Number	Capacity	Number	Capacity	Number	Capacity	Number	Capacity
Ayeyarwaddy	196	4770	19	425	3	156	150	2423	1	16	369	7790
Bago (East)	11	243	27	497	0	0	7	111	0	0	45	851
Bago (West)	22	531	34	627	0	0	32	519	0	0	88	1677
Yangon	11	350	13	215	0	0	45	714	0	0	69	1279
Rakhine	0	0	0	0	0	0	4	60	0	0	4	60
Sagaing	28	660	2	42	0	0	11	168	0	0	41	870
Mandalay	0	0	10	210	0	0	1	25	0	0	11	235
Mon	17	329	2	30	0	0	13	195	0	0	32	554
Taninthayi	0	0	0	0	0	0	2	30	0	0	2	30
Kachin	0	0	0	0	0	0	10	76	0	0	10	76
Kayar	0	0	16	315	0	0	0	0	0	0	16	315
Total	285	6883	123	2361	3	156	275	4321	1	16	687	13737

Capacity=t/8hrs
Source: MAPT, cited in (U Tin Htut Oo and Kudo 2003, pg 116)

Table 49 Procurement and Sales Prices of Rice by MAPT, 2001-2002

Variety Group	Procurement Prices		Category 1 Sale Prices		Category 2 Sale Prices	
	Ayeyawady, Bago, Yangon, Rakhine	Kachin, Kayar, Kayin, Sagaing, Taninthayi, Magway, Mandalay, Mon, Shan	Individual	Bulk	Individual	Bulk
Boiled Bran						8.6
Boiled Broken Rice 1,2						18
Boiled Broken Rice 2,3,4						16.2
Boiled Broken Rice 5,6						10.8
Broken Rice 5,6 & Points						10.8
Broken Rice B 1,2						18.4
Broken Rice B2,3,4						18
Broken Rice Ordinary 1,2						18.4
Broken Rice Ordinary 2,3,4						16
Cow Bran						3
Cyclone						4
Emata 25%			22	7	79	26
Emata 35%			20	7	77	25
Emata Paddy	15	17				
Emata Special Paddy	17	0				
Kaukhnyin (glutenous) Paddy	19	19				
Meedone 15%				8	95	31
Meedone 25%			24	8	89	30
Meedone 38%			23	8	86	29
Meedone Paddy	17	19				
Ngakywe 15%				8		37
Ngakywe 25%			24	8		32
Ngakywe Paddy	19	19				
Ngasein 25%			21	7	78	26
Ngasein 35%			19	6	75	25
Ngasein Paddy	14	17				
Ordinary Rice Bran						8.6
Special Rice Bran						9.4

Kyats per kg
Individual = price per Pyi converted to per kg basis, Bulk = price per 50kg bag converted to per kg basis
Source: MAPT, cited in (U Tin Htut Oo and Kudo 2003, 116,121)

Table 50 Monthly Milling at No. 639 Rice Mill (250 TPD), Letpadan, 2002-2003

Month	Paddy	Rice		Broken Rice			Rice Bran		Husk&Dust	
				B 1-2	B 2-3-4	Broken				
	Basket	Tonnes	Recovery	Tonnes	Tonnes	Recovery	Tonnes	Recovery	Tonnes	Recovery
April	118299	1044.86	42.33%	288.29	190.42	19.40%	261.51	10.60%	683.14	27.68%
May	144202	1204.43	40.03%	422.90	230.07	21.70%	332.17	11.04%	819.10	27.22%
June	124024	1066.32	41.21%	326.02	198.34	20.26%	292.18	11.29%	704.82	27.24%
July	118200	941.40	38.17%	368.81	18.20	15.69%	300.99	12.20%	836.75	33.93%
August	142206	1312.66	44.24%	315.31	206.98	17.60%	324.00	10.92%	808.07	27.23%
September	144547	1413.51	46.87%	229.39	232.03	15.30%	319.26	10.59%	821.68	27.25%
October	128561	1186.76	44.24%	274.59	206.54	17.94%	284.06	10.59%	730.38	27.23%
November										
December	107521	1027.72	45.81%	199.02	167.29	16.33%	238.45	10.63%	610.88	27.23%
January	259897	2495.70	46.02%	486.38	401.49	16.37%	562.80	10.38%	1476.21	27.22%
February	210381	2012.70	45.85%	378.98	337.76	16.33%	364.76	8.31%	1295.24	29.51%
March	218274	2005.42	44.04%	475.67	350.68	18.15%	482.20	10.59%	1240.17	27.23%
Total	1716112	15711.48	43.88%	3765.36	2539.80	17.61%	3762.36	10.51%	10026.44	28.00%
Ngasein	43127	348.57	38.74%	141.59	69.22	23.43%	95.28	10.59%	245.15	27.24%
Emata	1672985	15362.92	44.01%	3623.77	2470.58	17.46%	3667.08	10.51%	9781.29	28.02%

Source: ASR Field Team Interview, 8 September 2003

Table 51 Processing Data for No. 639 Rice Mill (250 TPD), Letpadan

		Units	2000-2001	2001-2002	2002-2003	Total
Plan	Rice CMT (A)		31250	46875	46875	125000
	Rice CMT (B)		22500	23200	18275	63975
	Paddy	Basket	1445484	1742084	1716112	4903680
	Recovery Ratio	%	47.61%	42.84%	43.88%	44.61%
Actual	Rice	Tonnes	14358.1	15572.02	15711.183	45641.308
	RC/RM Rice	Tonnes	5970.46	4023.575	23.871	10017.902
	Total Rice	Tonnes	20328.6	19595.59	15735.054	55659.21

Source: ASR Field Team Interview, 8 September 2003

Table 52 Processing of Rice by MAPT Mill No 639 (250 TPD), Letpadan

Year	Minister's Guidance	Plan	Actual
2000-2001	31250	27900	20248
2001-2002	46875	23100	19595
2002-2003	56250	17200	15735

Tonnes of Rice

Source: ASR Field Team Interview, 8 September 2003

Table 53 State Paddy Purchasing Volume

Year	1999-00	2000-01	2001-02
Sown acre (mil acres	15.53	15.71	15.94
Yield (baskets /acre)	62.85	65.62	66.29
Paddy Production (mil baskets)	964.46	1021.97	1050.33
State purchasing amount (mil baskets)	105.83	101.74	101.38
% of total production	10.97	9.96	9.65
Rice supplied to target groups (mil mt)	0.685	0.594	0.589
National reserve (mil mt)	0.05	0.01	0.15
Rice & rice products export (mil mt)	0.069	0.257	1.034

Source: MAPT, Cited in (U Tin Htut Oo and Kudo 2003, pg 80)

Table 54 Export of Rice and Rice Products

Commodities	1999-2000		2000-2001		2001-2002	
	Amount (mt)	Value (mil USD)	Amount (mt)	Value (mil USD)	Amount (mt)	Value (mil USD)
Rice	57,702	12	215,493	32.38	848,494	105.49
Rice broken	11,097	1.18	41,376	3.1	82,485	6.57
Paddy	18,246	3.39	81,826	7.87	96,079	14.71
equivalent rice (in million basket)			7.686		2.249	

Source: MAPT, Cited in (U Tin Htut Oo and Kudo 2003, pg 83)

Table 55 Monthly Rice Exports

Date		Rice		Broken Rice		Bran	
		Quantity (t)	Price (US$/t)	Quantity (t)	Price (US$/t)	Quantity (t)	Price (US$/t)
Jan-01		28710	134.98	12472	67.78		
Feb-01		24047.31	97.8	13492.36	69.23		
Mar-01		35015	154.84	12843.773	73.09		
Apr-01		18079.5	132.45	9158	80.82		
May-01		3400	160.65	7712	57.28		
Jun-01		44400	135	3901	76.41		
Jul-01		50024.5	166.11	1328	68.55		
Aug-01		68607.373	121.25	11482	79.54		
Sep-01		83173.88	135.05	6022.835	67.95		
Oct-01		106160.87	126.3	11424	68.35		
Nov-01		47606.17	127.69	14490	77.91	470	46.5
Dec-01		59361.3	131.41	13388.439	98.74		
Jan-02		104111.16	127.11	3516.4	105.02		
Feb-02		112395.45	124.1	6000	91.58		
Mar-02		135043.65	129.63	1150	75.75		
Apr-02		80680.19	124.6	1845	69.5		
May-02		89070.125	167.93	4047	84		
Jun-02		79340.486	134.7	1466	93.54		
Jul-02		30829	148.19	18130	90.07		
Aug-02		53031.386	161.09	11336.75	81.89		
Sep-02		57990.294	144.04	26290.48	96.66	214.2	50
Oct-02		28461	138.59	5028.1	87.71	300	50
Nov-02		20423.36	144.2	2564	99.63	3514.2	48.67
Dec-02		17114	146.59	18996.35	97.13	16107.4	50.49
Jan-03		65871	135.73	6981	93		
Feb-03		63159.5	136.75	3173.157	105.33	499.79	50
Mar-03		98646.04	138.61	1150	96.92		
Apr-03		51922.535	141.28	690	95		
May-03		21645	151.56	3719	104.76	7688.029	49.33
Jun-03		14406.93	183.15	34725	100.6	8615.77	50
Jul-03		550	236	4240.45	111.4	4301.9	50.86
Aug-03		330	273.33	4561	102.5		
2001	Mean	47382.15858	135.2941667	9809.533917	73.80416667	470	46.5
	CV	62.25665143	13.91238284	43.92631715	14.14228328		
2002	Mean	67374.17508	140.8975	8364.173333	89.37333333	5033.95	49.79
	CV	58.8964538	10.13721267	102.3270041	11.70003344	159.1520642	1.667861663
2003	Mean	39566.37563	174.55125	7404.950875	101.18875	5276.37225	50.0475
	CV	92.97557809	31.15878605	156.1805378	6.208936728	74.20037175	1.331160105
Total	Mean	52925.21903	147.2096875	8666.377938	86.48875	4634.587667	49.53888889
	CV	67.55415259	22.51405102	90.53917864	16.64223404	119.1479585	2.698480422

Source: Custon Department, cited in (Thein 2003)

Table 56 Chemical Fertilizer Price Ratios

Type of Chemical Fertilizer	Chemical Fertilizer Selling price (Kyat) 50kg bag	1kg	Paddy Purchasing price (Kyat) (1basket)	(1kg)	Paddy/fertilizer price ratio
	Centrally Planned Market				
Urea	18	0.36	9	0.43	1.19
Triple Super Phosphate	62.2	1.24	9	0.43	0.35
Muriate of Potash	29.9	0.6	9	0.43	0.72
	Free Market (Official Rates)				
Urea	7200	144	1600	77	0.53
Triple Super Phosphate	4700	94	1600	77	0.82
Muriate of Potash	4200	84	1600	77	0.92

Source: MAS, cited in (U Tin Htut Oo and Kudo 2003, pg 53,99)

Table 57 Partial Budget for Private Rice Miller in Pathein Township, Ayeyarwady Division

Commercial Milling	Baskets of Paddy	5000				
Custom Milling	Baskets of Paddy	10000				
15tonne per day mill, 2 diesel engines, 65hp each						
Item			Unit	Quantity	Unit Cost	Value (Kyat)
Input Cost	Commercial Milling	Dec-00	Basket	500	800	400000
		Jan-01	Basket	2000	550	1100000
		Feb-01	Basket	2100	500	1050000
		Mar-01	Basket	400	750	300000
		Total	Basket	5000	570	2850000
	Transport and Packing Cost	Hired Boat	Basket	5000	30	150000
		Unloading	Basket	5000	6	30000
		Bagging (2bskt/bag)	30 viss bag	2500	45	112500
		Total				292500
	Milling Cost	Paddy Milling Cost	Basket	5000	40	200000
		Bagging Rice	30 viss bag	1500	45	67500
	Total					3410000
Mill Operating Cost	Permanent Labour	(K12000/month, 4 months, 2 labourers)	Basket	15000	6.40	96000
	Daily Labour	(K370/day, 120 days, 3 labourers)	Basket	15000	8.88	133200
	Capital Investment	(K6million, 15%p.a. interest, 4 months)	Basket	15000	20.00	300000
	Own Working Capital	(K2million, 15%p.a., 4 months)	Basket	15000	6.67	100000
	Loaned Working Capital	(Asia Wealth Bank K2million, 15%p.a., 4 months)	Basket	15000	6.67	100000
	Telephone Charges	(K1200/month, 4 months)	Basket	15000	0.32	4800
	Taxes	(K12500/month, 4 months)	Basket	15000	3.33	50000
	Fuel Cost	Diesel (510gal, 4 months, K520/gal)	Basket	15000	17.68	265200
		Lubricant (5gal, 4 months, K1200/gal)	Basket	15000	0.40	6000
	Maintenance Cost	(K3000/day, 4 months)	Basket	15000	24.00	360000
	Total		Basket	15000	94.35	1415200
Revenue	Commercial Milling	Milled Rice	30 viss bag	1500	3350	5025000
		Broken Rice No 1-2	30 viss bag	250	800	200000
		Broken Rice No 2-3	30 viss bag	150	800	120000
		Broken Rice No 5-6	30 viss bag	50	700	35000
		Coarse Bran	Basket	200	50	10000
		Fine Bran	30 viss bag	400	300	120000
	Custom Milling	Broken Rice No 5-6	30 viss bag	100	700	70000
		Milling Fee	Basket	10000	40	400000
Total Revenue	Commercial Milling		Basket	5000	1102	5510000
	Custom Milling		Basket	10000	47	470000
	Total		Basket	15000	399	5980000
Total Cost	Input Cost		Basket	5000	682	3410000
	Operating Cost		Basket	15000	94	1415200
	Total		Basket	15000	322	4825200
Gross Margin	Commercial Milling		Basket	5000	326	1628267
	Custom Milling		Basket	10000	-47	-473467
	Total		Basket	15000	77	1154800

Source: (Department of Agricultural Planning 2001)

Table 58 Partial Budget for Private Rice Wholesaler in Baying Naung Market, Yangon

Annual Sales	30 viss Bags	216000			
Item		Unit	Quantity	Unit Cost	Value (Kyat)
Taxes	License	30 viss bag	216000	0.185	40000
	Signboard	30 viss bag	216000	0.028	6000
	Sunshade	30 viss bag	216000	0.009	2000
	Garbage Collection	30 viss bag	216000	0.033	7200
	Building	30 viss bag	216000	0.028	6000
	Land	30 viss bag	216000	0.019	4000
	Income	30 viss bag	216000	0.185	40000
	Commercial	30 viss bag	216000	0.278	60000
Other Costs	Telephone	30 viss bag	216000	1.111	240000
	Rent	30 viss bag	216000	16.667	3600000
	Opportunity Cost (K30million/month, 15%p.a.)	30 viss bag	216000	20.833	4500000
Labor	Female Staff	30 viss bag	216000	0.278	60000
	Male Staff	30 viss bag	216000	2.222	480000
	Food and Lodging	30 viss bag	216000	2.500	540000
	Temporary Labor	30 viss bag	216000	0.347	75000
Trading Costs	Ship Transport	30 viss bag	216000	60	12960000
	Handling Charges	30 viss bag	216000	60	12960000
	Re-bagging	30 viss bag	216000	10	2160000
	Packaging Material	30 viss bag	216000	15	3240000
	Rice Purchase	30 viss bag	216000	1390	300240000
Total Costs		30 viss bag	216000	1579.723	341220200
Revenue	Rice Sales	30 viss bag	216000	1600	345600000
Marketing Margin		30 viss bag	216000	210	45360000
Gross Margin		30 viss bag	216000	20.277	4379800

Source: (Department of Agricultural Planning 2001)

Table 59 Structure of Textile Mills under Myanmar Textile Industries

Type of Mills	Number	Employment	Main Machinery Type	Main Machinery Number	Product
Spinning and Weaving	4	10700	Spindles Looms Dyeing Printing	124800 2100 28 2	Yarn, Gray Fabrics
Only Weaving	6	3537	Looms Dyeing Knitting	1316 51 49	Gray Fabrics
Garment	4	1901	Sewing Machines	1358	Shirts, Mosquito Nets
Blanket	1	1066	Spindles Looms Knitting	1000 136 50	Blanket, Vest
Towel	1	808	Looms	164	Towel
Medicinal Textile	1	432	Looms Kiers	164 4	Cotton Wool, Bandages
Sewing Thread	1	287	Twisting Machines	10	Thread

Source: MTI cited in (U Tin Htut Oo and Kudo 2003, pg. 291)

Table 60 Raw Material Requirements for Myanmar Textile Industries

Type of Mill	Type of Raw Material	Units	Requirement	Supply			Percentage Supplied
				Domestic	Imported	Total	
Spinning and Weaving	Lint	tonnes	5922	3338	390.92	3728.92	62.97%
	Yarn	000 lbs	0			0	0.00%
	Polyester	000 lbs	424.9		548.7	548.7	129.14%
Weaving	Yarn	000 lbs	2183	1896		1896	86.85%
	Polyester	000 lbs	220.5		220.5	220.5	100.00%
Garment	Grey Cloth	000 yds	76.6	88.47		88.47	115.50%
	Cotton Lace	000 yds	17.59	17.67		17.67	100.45%
	Nylon Lace	000 yds	2.52	4.98		4.98	197.62%
Blanket	Lint	tonnes	41.64	26.78		26.78	64.31%
	Acrylic	tonnes	50		25.13	25.13	50.26%
Towel	Yarn	000 lbs	529.2	463.1		463.1	87.51%
Medicinal Textile	Lint	tonnes	186.97	26.45		26.45	14.15%
	Yarn	000 lbs	485.1	132.3		132.3	27.27%
Sewing Thread	Polyester	tonnes	0.22		0.16	0.16	72.73%

Source: MTI cited in (U Tin Htut Oo and Kudo 2003, pg. 293)

Table 61 Textile Production by Myanmar Textile Industries

Type of Mills	Product	Unit	Installed Capacity	Production	Utilization	Value (million Kyats)
Spinning and Weaving	Yarn	000 lbs	10419	7005	67.23%	1785.9
	Grey Cloth	000 yds		11464		
	Cotton	000 yds	30981	11464	74.01%	
	Blended	000 yds				
Weaving	Grey Cloth	000 yds		6323		590.66
	Cotton	000 yds	16577	5933	76.29%	
	Blended	000 yds		390		
Garment	Shirt	000 pieces	2023	1683	83.19%	566.15
	Robe	000 pair	296	55	18.58%	
	Mosquito Net	000 pieces	107	501	468.22%	
Blanket	Yarn	000 lbs	1327	752	56.67%	159.94
	Blanket	000 pieces	1410	225	15.96%	
	Vest	000 pieces	1479	1083	73.23%	
Towel	Towel	000 pieces	3442	3076	89.37%	151.52
Medicinal Textile	Cotton Wool	000 lbs	360	323	89.72%	65.86
	Bandage	Square yds	6719	3040	45.24%	
Sewing Thread	Thread	000 pieces	17626	8074	45.81%	46.81

Source: MTI cited in (U Tin Htut Oo and Kudo 2003, pg. 293)

Table 62 Textile Production by Cooperative Sector

Type of Mills	Number	Main Machinery		Estimated Production	
		Type	Number	Yarn ('000 lbs)	Fabric ('000 yds)
Spinning	NA	Spindles	300	180	
Weaving	NA	Powerloom	235		2500
	NA	Handloom	131898		68500
Total			132433	180	71000

Source: MTI cited in (U Tin Htut Oo and Kudo 2003, pg. 296)

Table 63 Textile Production by Private Sector

Type of Mills		Number	Main Machinery		Estimated Production	
			Type	Number	Yarn ('000 lbs)	Fabric ('000 yds)
Spinning	Large Mills	6	Spindles	48152	7410	
	Cottage Spinning	NA	Revolving Cups	70000	3660	
	Hand Spinning	45000	Spinning Wheels	45000	6750	
Weaving		NA	Hand Looms	200000		136900
			Power Looms	1870		19800
Total				365022	17820	156700

Source: Survey by U Tin Htut Oo (2003, pg. 298)

Table 64 Registered Private Enterprises involved in Textiles

Type of Firms	Number
Spinning	162
Weaving	1417
Sewing Thread	10
Dyeing and Printing	9
Blanket	8
Vest	11
Medicinal Textile	1
Garment	270
Total	1888

Source: MTI cited in (U Tin Htut Oo and Kudo 2003, pg. 301)

Table 65 Partial Budget for Locally Made Fabrics

Item	Input	Value
Yarn from Revolving Cup Spinning (2 spinning frames, 240 cups total)	Lint Cotton (10 viss)	13000
	Labour Wages, Fluffing Lint	10
	Labour Wages, Preparing Slivers	20
	Labour Wages, Spinning	320
	Labour Wages, Winding Yarn on Bobbins	72
	Power	70
	Total	13492
	Income, Yarn (9 Viss)	14400
	Profit	908 6.73%
Hand Woven Blankets (10 pieces)	Cotton (50 viss)	17500
	Spinning Cost (12.5 viss of clean lint)	2500
	Dyeing	2500
	Starching Skeins	500
	Transferring Yarn from the Swift to Bobbins	2000
	Preparing the Warp	100
	Winding Thread on Bobbins	750
	Weaving	5000
	Total	30850
	Income (10 Blankets)	33000
	Profit	2150 6.97%
Hand Woven Coarse Yarn Longyis (1 piece)	Yarn and Dyes	987
	Labour	300
	Total	1287
	Income (1 Longyi)	1400
	Profit	113 8.78%

Source: Survey by U Tin Htut Oo (2003, pg. 300)

Table 66 Export Garment Production

Item	Foreign	Joint-Venture	Local	Total
Number of Firms	12	26	272	310
Production (Pieces per month)	1103000	2540000	12300000	15943000
Number of Sewing Machines	8290	11896	56134	76320
Number of Workers	14231	19083	86758	120072
Export Value (US$ per month)	5515000	7620000	2525000	15660000
Unit Value (US$ per piece)	5	3	0.2052846	0.9822493

Source: MMRD, cited in (U Tin Htut Oo and Kudo 2003, pg. 302)

Table 67 Per Capita Consumption of Fabrics in Selected Asian Countries

Country	Consumption (yds)
Bangladesh	16.72
India	18.48
Philippines	26.4
Thailand	27.82
Pakistan	49.28
South Korea	71.28
Developing Countries of Asia (average)	24.64
World Average	58
Myanmar	5.47

Source: (U Tin Htut Oo and Kudo 2003, pg. 306)

Table 68 Area and Production of Cotton

Item		1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	Average Growth Rate
Sown Area (ha)	Long Staple	30945	82663	258493	236181	207126	257810	253925	232617	53.4%
	Short Staple	113104	121988	120921	97399	59638	67698	87089	91579	-0.6%
	Mahlaing	74466	40874	50085	41518	24833	33500	44995	46887	-0.9%
	Wagyi	38639	81113	70836	55881	34805	34199	42094	44692	9.4%
	Total	257154	326638	500335	430979	326402	393207	428103	415775	9.8%
Harvested Area (ha)	Long Staple	26242	64381	219506	205501	188025	238185	237794	211409	55.3%
	Short Staple	95727	113401	104798	92941	58100	63868	84469	89172	1.4%
	Mahlaing	61086	74282	56535	51947	23697	30276	42845	44581	1.2%
	Wagyi	34640	39119	48263	40994	34403	33593	41625	44591	4.8%
	Total	217695	291183	429102	391383	304225	365922	406733	389753	11.0%
Seed Cotton Yield (kg/ha)	Long Staple	706.08	776.56	596.34	671.65	764.65	576.37	624.96	591.07	-1.2%
	Short Staple	254.52	318.22	325.76	323.28	343.60	325.31	318.89	311.01	3.3%
	Mahlaing	211.33	309.97	302.64	286.14	295.86	270.68	284.21	263.34	4.5%
	Wagyi	330.66	333.88	352.84	370.35	376.48	374.54	354.57	358.66	1.2%
	Total	308.95	419.56	464.18	506.19	603.83	488.73	497.83	462.92	7.2%
Production (tonnes)	Long Staple	18529	49996	130901	138024	143773	137283	148612	124958	47.0%
	Short Staple	24364	36086	34139	30046	19963	20777	26936	27733	4.8%
	Mahlaing	12909	23025	17110	14864	7011	8195	12177	11740	6.9%
	Wagyi	11454	13061	17029	15182	12952	12582	14759	15993	6.0%
	Total	67256	122168	199179	198116	183699	178837	202484	180424	19.5%

Source: MCSE, cited in (U Tin Htut Oo and Kudo 2003, pg. 314)

Table 69 Supply and Distribution of Cotton

Year	Production	Imports	Exports	Total Domestic Consumption	Per Capita Consumption (kg)
1990-91	20.8	5		25.8	0.63
1991-92	21.1	1		22.1	0.53
1992-93	22.8	0.5		23.3	0.55
1993-94	14.3	0.5		14.8	0.34
1994-95	28.6	1	0.3	29.3	0.68
1995-96	55	1		56	1.25
1996-97	56	1	0.5	56.5	1.26
1997-98	54.6		3.3	51.3	1.11
1998-99	52.7		3.7	49	1.04
1999-00	58.5		1.9	56.6	1.18
2000-01	50.9	0.28	2.1	49.08	0.98

('000 tonnes)
Source: MSCE, cited in (U Tin Htut Oo and Kudo 2003, pg. 315)

Table 70 Procurement of Seed Cotton by Government Agencies

Year	Total Production	Total Procurement	Percent	Agency
1980-81	74	38.7	52.30%	
1981-82	95.2	37.7	39.60%	
1982-83	97.5	40.8	41.85%	
1983-84	103.7	35	33.75%	
1984-85	125.7	43.4	34.53%	
1985-86	99.7	36.9	37.01%	
1986-87	79.8	23.3	29.20%	Textile Industries
1987-88	73	16.8	23.01%	Corporation
1988-89	60.3	11.6	19.24%	
1989-90	62.9	10	15.90%	
1990-91	62.2	12.5	20.10%	
1991-92	63.2	22.9	36.23%	
1992-93	68.3	8.9	13.03%	
1993-94	42.9	8.3	19.35%	
1994-95	86.1	21	24.39%	
1995-96	165	34.5	20.91%	
1996-97	168.1	31	18.44%	
1997-98	163.7	26.6	16.25%	Myanma Cotton and
1998-99	158.1	24.6	15.56%	Sericulture Enterprise
1999-00	175.5	24.6	14.02%	
2000-01	152.7	22.1	14.47%	
2001-02	139.1	20.2	14.52%	

('000 tonnes)
Source: MSCE, cited in (U Tin Htut Oo and Kudo 2003, pg. 320)

Table 71 Procurement Prices for Cotton

Period		Price of Cotton (Kyat per viss)				
From	To	Long Staple		Mahlaing	Wagyi	Wagale
		First Grade	Second Grade			
1962-63	12/03/1971	1.55		1.2	1	1
13/03/1971	26/01/1974	1.8		1.6	1.6	1.5
27/01/1974	29/02/1976	3.5		3	2.75	2.25
1/03/1976	17/12/1976	5.5		5	4.5	4
18/12/1976	1987-88	7		6	4.5	4
1988-89	18/06/1990	8		7	5.5	4
19/06/1990	25/09/1990	13.3		12	10	
26/09/1990	29/08/1993	28		26	22	
30/08/1993	30/05/1994	30		28	24	
1/06/1994	31/03/1995	40	36	35	35	
1/04/1995	31/07/1997	50	45	40	40	
1/08/1997	24/10/1997	90	80	65	65	
25/10/1997	14/01/2002	100	85	70	70	
15/01/2002	to date	110+(70)	100+(60)	70+(70)/70+(40)	70+(70)/70+(40)	

Figures in Brackets refer to Premium for Cleaned Cotton
Source: MSCE, cited in (U Tin Htut Oo and Kudo 2003, pg. 321)

Table 72 Selected Current Prices for Cotton Products

Item	Unit	Price (Kyat)	Remarks
Seed Cotton - Seed	viss	200	market price 2002
Seed Cotton - Oil	viss	130-150	market price 2002
Spun Cotton	pound	45	MCSE Price 2003
Spun Cotton	pound	650	market price 2003
Spun Cotton	pound	450	market price 2002
Cotton Seed	viss	400	MCSE Price 2003
Cotton Seed	viss	500	market price 2003
Cotton Seed	viss	250	market price 2002
Cotton Seed	viss	180	MCSE Price 2002
Seed Cotton - Seed	viss	500	market price 2003
Cotton Seed	viss	400, plus soap (cotton seed oil by-product)	MOI(1) price for MTI mills and MOD factories

Source: ASR Field Team Interviews, August-October 2003

Table 73 Registered Private Cotton Traders and Ginners

Year	Traders	Ginners		
		Ginneries	Gin Stands	Average
1998-99	527	361	579	1.60
1999-2000	379	287	655	2.28
2000-01	421	370	845	2.28

Source: MSCE, cited in (U Tin Htut Oo and Kudo 2003, pg. 324)

Table 74 Ginning Capacities In Myanmar

Sector	Type of Gin	Number	viss per shift	Shifts	Annual Capacity		
					viss per year	Tonnes Seed Cotton	Percent
Public	Single Roller Gin	479	150	2	109500	85648	27.52%
	Double Roller Gin*	34	600	2	438000	24318	7.81%
	141 Saw Gin**	1	40000	2	29200000	47682	15.32%
	40 Saw Gin	3	700	2	511000	2503	0.80%
Private	Single Roller Gin	845	150	2	109500	151091	48.54%
Total	Public	517			30258500	160150.65	51.46%
	Private	845			109500	151091.14	48.54%
	Combined	1362			30368000	311241.8	100%

* MSCE notes 18 double roller gins in 2002. ASR Field Team visited Aung Lan Gin which just installed 16 additional ones.

** MCSE notes that the capacity of the 141 Saw Gin is 9400 tonnes of seed cotton per year. However, ASR Field Interviews indicate that the installed capacity is 7000 tonnes of lint, or 9350 bales (50 viss). This is single shift for 357 days per year. Assuming a 30 percent recovery for Cotton and 5 percent for Linter, this equates to 47682 tonnes of cotton seed based on 2 shifts per day.

Source: MCSE, cited in (U Tin Htut Oo and Kudo 2003, pg. 326), Revised Estimates from ASR Field Team Interviews

Table 75 Estimated Capacity Utilization for Ginning Industry in Myanmar

Year	Production	Capacity	Utilization
1997-98	183699	311242	59.0%
1998-99	178837	311242	57.5%
1999-00	202484	311242	65.1%
2000-01	180424	311242	58.0%

Tonnes of Cotton Seed

Based on Ginning Capacities 2002-2003

Table 76 Factory Capacities in State Owned Sector

Type of Factory	Number	Unit	Capacity
Cotton Baling	13	360lb bale	216960
Delinting	2	tonnes cotton seed	17540
Oil Crushing - Public	6	tonnes cotton seed	17870
Oil Crushing - Private	30	tonnes cotton seed	n.a.

Source: MSCE, cited in (U Tin Htut Oo and Kudo 2003, pg. 327)

Table 77 State Sector Cotton-Seed By-Products

Cotton Component	Units	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
Seed Cotton	Tonnes	8300	21000	34500	31000	26600	24600	24600	22100
Lint*	Tonnes	2490	6300	10350	9300	7980	7380	7380	6630
	Percent	30%	30%	30%	30%	30%	30%	30%	30%
Waste*	Tonnes	705	1939	3313	2970	2516	2297	2343	2002
	Percent	8.49%	9.24%	9.60%	9.58%	9.46%	9.34%	9.53%	9.06%
Linter	Tonnes	125	161	137	130	144	163	117	208
	Percent	1.51%	0.76%	0.40%	0.42%	0.54%	0.66%	0.47%	0.94%
Cotton Seed*	Tonnes	4980	12600	20700	18600	15960	14760	14760	13260
	Percent	60%	60%	60%	60%	60%	60%	60%	60%
Cotton Seed for Planting*	Tonnes	1499	12136	19551	15859	12449	12760	12774	11050
	Percent	18.06%	57.79%	56.67%	51.16%	46.80%	51.87%	51.93%	50.00%
Cotton Seed for Oil*	Tonnes	3481	464	1149	2741	3511	2000	1986	2210
	Percent	41.94%	2.21%	3.33%	8.84%	13.20%	8.13%	8.07%	10.00%
Refined Oil	Tonnes	233	42	102	215	363	294	162	236
	Percent	2.81%	0.20%	0.30%	0.69%	1.36%	1.20%	0.66%	1.07%
Soap Stock	Tonnes	152	24	43	80	142	101	57	85
	Percent	1.83%	0.11%	0.12%	0.26%	0.53%	0.41%	0.23%	0.38%
Seed Cake	Tonnes	3096	398	1004	2446	3006	1605	1767	1889
	Percent	37.30%	1.90%	2.91%	7.89%	11.30%	6.52%	7.18%	8.55%

Source: MCSE, Cited in (U Tin Htut Oo and Kudo 2003, pg. 327) and (*)Estimated Ratios from ASR Field Team Interviews

Table 78 Financial Returns for Cotton and Competing Crops

Crop	Units	Yield	Production Cost	Revenue	Net Profit	Return on Investment
Pigeon Pea	72 lb basket	12	10190	51600	41410	4.06
Green Gram	72 lb basket	13	13870	47489	33619	2.42
Sesame	54 lb basket	4	9900	13908	4008	0.40
Summer Rice	46 lb basket	80	26395	30000	3605	0.14
Cotton	viss	200	16300	20000	3700	0.23

per Acre Basis, Kyats
Note: Based on Government Procurement Prices, so returns higher if above-quota sales at market prices are considered
Source: (U Tin Htut Oo and Kudo 2003, pg. 338)

Table 79 Domestic Resource Cost Ratios for Selected Crops in Myanmar

Crop	DRC
Cotton	0.48
Rice	0.33
Sugarcane	0.91
Green Gram	0.29
Maize	0.43

Note: DRC above 1.0 indicates crop is not competitive
Source: (Thien and Oppen 2002), cited in (U Tin Htut Oo and Kudo 2003, pg 339)

Table 80 Selected Details of MCSE Cotton Gins

Name	Location	Area (acres)	Year of Establishment	Capacity (per shift)
Pyay Cotton Gin	Pyay – Yangon High Way Road Aung Sang Quarter Pyay.	1.80	1972	Cotton Gin, Single Rollers
Aung Lan ginning factory	Lan Ma Daw Street , Factory Quarter, Aung Lan City	22.094	1960	14100 viss
Aung Lan Cotton seed oil mill				15000 viss
Aung Lan Cotton Baling mill	Ywar Taung Quarter, Ayeyarwaddy River Bank, Aung Lan City	6.27	1987	90 bales (John Shaw balers) 180 bales (Henry Berry Balers), 360lbs per bale
Tha Yet Cotton Gin	Pyi Daw Aye Quarter, Kan Daw Min Road. Tha Yet Myo	5.505	1958	9450
Myit-Thar Cotton Gin	Myit-Thar township, Kyauk Se District , Mandalay Division Mandalay –Myinchan High way road. Near Mile 53 , East of Myit-Thar	59.39	1985	36000 viss 225 bales, 180 lbs per bale
Myit-Thar Cotton Linter Gin			1989	14600 viss cotton seed
Myit-Thar Cotton Seed Oil Mill			1989	

Source: ASR Field Interviews September 2003

Table 81 Yearly Production of Cotton, Selected MCSE Gins (Viss)

Year	Myit Tha Cotton Gin	Tha Yet Cotton Gin	Pyay Cotton Gin	Aung Lan Cotton Gin
1994-95	22670000	432400	280907	824579
1995-96	31570000	675635	613320	1146805
1996-97	18820000	859729	687899	1381967
1997-98	27750000	736595	789063	875356
1998-99	21960000	228381	442261	1063032
1999-00	22700000	185596	389423	526836
2000-01	15750000	815566	622970	1633602
2001-02	14740000	211315	387107	490218
2002-03		477884	491989	660552

Source: ASR Field Interviews September 2003

Table 82 Yearly Production of Cotton from Aung Lan Cotton Gin

Year	Ginned Cotton (viss)	360 lb Bales	Used Cotton Seed (viss)				
			Cotton Seed	Raw Oil	Cotton Cake	Refined Oil	Waste
1994-95	824579	5566	274800	18160	84958	13150	6000
1995-96	1146805	9123	198980	11993	61920	-	-
1996-97	1381967	13561	665612	35810	188620	650	300
1997-98	875356	8588	739838	50470	222811	33470	13580
1998-99	1063032	7163	757720	47735	237940	40400	14400
1999-00	526836	5180	691700	45105	221520	17100	6330
2000-01	1633602	11643	484182	74250	335083	35850	13560
2001-02	490218	8451	781755	51805	216950	27000	10350
2002-03	660552	8505	751945	47843	213422	47650	23270

Source: ASR Field Interview 9 September 2003

Table 83 Yearly Ginning for Pyaw Bwe Gin

Year	Received	Ginned		Baled			Seed	
	Viss	Viss	%	50viss Bales	Viss	%	Viss	%
1988-1989	287435	277374	96.5%	1988	99400	35.84%	177974	64.16%
1989-1990	414540	412540	99.5%	3477	173850	42.14%	238690	57.86%
1990-1991	269121	291740	108.4%	2484	124200	42.57%	167540	57.43%
1991-1992	1018234	902727	88.7%	5108	255400	28.29%	647327	71.71%
1992-1993	782093	778509	99.5%	5172	258600	33.22%	519909	66.78%
1993-1994	648293	604174	93.2%	4330	216500	35.83%	387674	64.17%
1994-1995	660250	817432	123.8%	4475	223750	27.37%	593682	72.63%
1995-1996	555452	633818	114.1%	4132	206600	32.60%	427218	67.40%
1996-1997	1104922	1406775	127.3%	7728	386400	27.47%	1020375	72.53%
1997-1998	1246699	1718132	137.8%	10501	525050	30.56%	1193082	69.44%
1998-1999	943147	1205206	127.8%	10729	536450	44.51%	668756	55.49%
1999-2000	741211	938368	126.6%	7603	380150	40.51%	558218	59.49%
2000-2001	685751	689811	100.6%	6599	329950	47.83%	359861	52.17%
2001-2002	438139	407466	93.0%	3428	171400	42.06%	236066	57.94%
2002-2003	485664	511440	105.3%	3751	187550	36.67%	323890	63.33%

Source: ASR Field Team Interview, 17 September 2003

Table 84 Capacity of MCSE Saw Gin, Myittha

Item	Units	8 hr Shift	24 hour Shift
Cotton Lint	Viss	12000	36000
Bales	180lb (50viss) Bale	225	675
Seed	Viss	4867	14600
Oil	Viss	6000	18000

Source: ASR Field Team Interview 11 September 2003

Table 85 Procurement of Cotton in Magwe, MCSE

District	Year	Sown Area Acre	Procurement Viss
Magwe Division	2000-01	319141	5200057
	2001-02	258603	9120544
	2002-03	260225	2242121
Tha Yet District	2000-01	102022	2323006
	2001-02	100590	1988975
	2002-03	100466	1133672

Source: ASR Field Team Interview, September 2003

Table 86 Comparison of Output from Single and Double Roller Cotton Ginning Machines, Aung Lan Gin, MCSE

	Double-Roller Machine	Single-Roller Machine
Machine Power(8 hrs shift)	(580) viss	(150) viss
Motor Used	5-HP	5-HP
Labor Requirement	30	190

Source: ASR Field Interview 9 September 2003

Table 87 Partial Budget for Private Ginnery, Meiktila

Item	Quantity (viss)	Unit Cost (Kyat)	Value (Kyat)
Purchase of Cotton Seed	20000	500	10000000
Cost of Ginning	15000	15	225000
Cost of Purchasing Spun Cotton from MOD Factory*	5180	162	839160
Total Cost			11064160
Sale of Cotton Seed to MCSE	5000	400	2000000
Sale of Lint to MOD Factory	5250	162	850500
Sale of Spun Cotton*	5180	2340	12121200
Sale of Seed for Planting	2700	200	540000
Sale of Seed for Oil	6300	150	945000
Total Revenue			16456700
Profit			5392540 48.74%

* Ginnery delivers lint to MOD spinning factory, receives 74% of product back as spun cotton and pays K45/lb, they then sell on open market for K650/lb

ASR Field Team Interview 11 September 2003

Table 88 Production Data for MCSE Saw Gin, Myittha

Year		1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003
Seed Cotton	Viss	2267000	3157000	1882000	2775000	2196000	2270000	1575000	1437000	
Cotton	Viss	679100	961900	483300	489350	632700	307775	467500	436650	
	%	29.96%	30.47%	25.68%	17.63%	28.81%	13.56%	29.68%	30.39%	
Linter	Viss	96850	80350	79500	83950	97350	59500	99050	66200	
	%	4.27%	2.55%	4.22%	3.03%	4.43%	2.62%	6.29%	4.61%	
Seed	Viss	1491050	2114750	1319200	2201700	1465950	1902725	1008450	934150	
	%	65.77%	66.99%	70.10%	79.34%	66.76%	83.82%	64.03%	65.01%	
Cotton Seed	Viss	1194050	1231750	-347800	944700	919950	1199725	184450	24150	
	% of Seed	80.08%	58.25%	-26.36%	42.91%	62.75%	63.05%	18.29%	2.59%	
Oil Seed	Viss	297000	883000	1667000	1257000	546000	703000	824000	910000	711000
	% of Seed	19.92%	41.75%	126.36%	57.09%	37.25%	36.95%	81.71%	97.41%	
Crude Oil	Tonnes	44.1	124	233	170	83.3	91.5	125.8	137.2	98
Refined Oil	Tonnes	19.6	93.1	129	130.7	130.8	81.7	124.1	140.5	81.7
Seed Cake	Viss	134000	367000	638000	548000	254000	323000	370000	415000	315000
	% of Seed	45.12%	41.56%	38.27%	43.60%	46.52%	45.95%	44.90%	45.60%	44.30%

MCSE gins also obtain intermediate inputs from other gins, therefore, intermediate recovery rates may be higher/lower than expected.
Source: ASR Field Team Interview 11 September 2003

Table 89 Capacity Utilization for Selected Ginning Mills

Mill	Aung Lan Gin		Meiktila Gin		Meiktila Gin	141 Saw Gin, Myittha	Pyaw Bwe Gin
Sector	Public		Public		Private	Public	Public
Machines	Single Roller	Double Roller	Single Roller	Double Roller	Single Roller	141 Saw Gin	Single Roller
Number	30	16	52	10	7	1	20
Capacity Per Shift (viss)	150	600	150	600	150	40000	150
Yearly Capacity (viss)	3285000	7008000	5694000	4380000	766500	29200000	2190000
2002-03 Production (viss)	660000		794500		15000	1437000	511440
Utilization	6.41%		7.89%		1.96%	4.92%	23.35%
Effective Utilization	25.65%		23.68%		23.81%	59.88%	63.14%
Remarks	Only operate single shift for 6 months of year due to weather and season length		Only operate single shift for 8 months of year due to weather and season length		Only operate single shift for 2 months of year due to government permit restrictions	Only operate double shift for 1 month of year due to limited raw material	Only operate single shift for 9 months of year due to weather and season length

Source: ASR Field Team Interviews, August-October 2003

Table 90 Oilseeds Growing and Harvesting Profiles

Crop	Production Area	Season	Sowing	Harvesting
Groundnut	Central Myanmar	Rainy	May-June	Sept-Nov
	Central Myanmar	Cool	Oct-Dec	Jan-March
	Lower Myanmar	Cool	Nov-Dec	Feb-March
Sesame	Central Myanmar	Rainy	May-June	Aug-Sept
	Central Myanmar	Cool	Sept-Nov	Dec-Feb
	Central Myanmar	Summer	Feb-March	May-June
	Lower Myanmar	Cool	Nov-Dec	Feb-March
Sunflower	Central Myanmar	Cool	Oct-Dec	Jan-March
	Central Myanmar	Rainy	May-June	Aug-Sept
	Lower Myanmar	Cool	Oct-Dec	Jan-March

Source: (Food and Agriculture Organization and Ministry of Agriculture and Irrigation 2000)

Table 91 International Prices for Edible Oil

Palm Olein RBD	Soybean Oil	Cotton Oil	Sunflower Oil	Groundnut Oil	Sesame Oil
US$ 304/tonne	US$321/tonne	US$439/tonne	US$420/tonne	US$686/tonne	US$600-650/t

In the absence of international price quotes for sesame oil, prices are estimated based on comparative wholesale prices. Other Prices are: Palm Olein, FOB Malaysia; Soybean Oil, FOB U.S.; Cottonseed Oil, FOB U.S.; Sunflower oil, FOB Argentina; Groundnut oil, any origin CIF, Rotterdam
Source: (Food and Agriculture Organization 2003)

Table 92 Oilseed Recovery Rates, Survey of 11 Mills, Myanmar

Crop	Oilseed Input	Edible Oil Output	% Recovery
Groundnut	100	35-38	35-38%
Sesame (100% clean)	15	7.1	47.3%
Sesame (uncleaned)	15	6.75	45.0%
Sunflower	9	2.75	30.6%

Viss, all except groundnut equivalent of 1 basket input.
Source: (Food and Agriculture Organization and Ministry of Agriculture and Irrigation 2000)

Table 93 Standardized Recovery Rates for Oilseeds

Crop	Oil Content of Seed		Best Practice			Average		
	International	Myanmar	Recovery Rate	Country	Myanmar	Recovery Rate	Country	Myanmar
Groundnut	46-48%	46-48%	47.70%	India	44-45%	47.00%	India	43%
Sesame	52-55%	50-52%	54.70%	India	47-49%	54%	India	46%
Sunflower	40-45%	36-38%	44.60%	Argentina	33-34%	44.40%	Argentina	32%
Oil Palm	23-25%	17-22%	22.50%	Malaysia	18%	22%	Malaysia	15%

Source: Personal Communication, Dr. Vivek Vadke, FAO Consultant, Myanmar Oil Crop Sector Development Project, October 2003

Table 94 Estimated Sesame Oil Prices, Yangon, Based on Export Values

Calculated Sesame Oil Value	Current Price	Break-Even Price
Assumed Japanese Import Price	$1,700	$1,112
Assumed Insurance and Freight Cost	$35	$35
Estimated FOB Cost	$1,665	$1,077
Estimated Yangon Loading Cost	$15	$15
Government Export Tax (10%)	$150	$97
Yangon Wholesale Price	$1,500	$965

US$/Tonne
Based on Average CIF values for Vietnamese Imports
Source: (Food and Agriculture Organization, 2003b, pg. 31)

Table 95 Relative International and Domestic Prices of Edible Oils, 2000-2003

Year	Commodity	Palm Oil	Groundnut	Sesame	Ratio Palm Oil / Groundnut	Ratio Palm Oil / Sesame
2000	International Price	309	744	1887	0.42	0.16
	Domestic Price	637	792	730	0.80	0.87
	Price Ratio	2.06	1.06	0.39		
2001	International Price	235	685	1701	0.34	0.14
	Domestic Price	348	740	684	0.47	0.51
	Price Ratio	1.48	1.08	0.40		
2002	International Price	329	659	1668	0.50	0.20
	Domestic Price	371	962	849	0.39	0.44
	Price Ratio	1.13	1.46	0.51		
2003	International Price	421	1139	1533	0.37	0.27
	Domestic Price	920	1103	965	0.83	0.95
	Price Ratio	2.19	0.97	0.63		
Average 2000-03	International Price	324	807	1697	0.40	0.19
	Domestic Price	569	899	807	0.63	0.71
	Price Ratio	1.76	1.11	0.48		

International Prices are: Palm Oil - FOB Malaysia, Groundnut - CIF Rotterdam, Sesame - Vietnamese Import to Japan. International Price for Sesame in 2003 Estimated from Linear Trend. National Prices are wholesale Yangon Market, averaged for grade in the case of sesame and groundnut. Converted to US$ at the average annual exchange rate for the year. Prices for 2003 are to September (international) and April (Yangon)
Source: (Food and Agriculture Organization, 2003b, pg. 30)

Table 96 List of Oil Crushing Mills and Their Location

Division	District	Large (>50hp)	Medium (25-50hp)	Small (<25 hp)	Total
Sagaing	Sagaing	6	5	101	112
	Shwebo	4	31	81	116
	Monwya	6	23	153	182
	Katha		9	90	99
	Kalay	1	7	67	75
	Tamu			5	5
	Mawlite		1	25	26
	Kanti		3	74	77
	Total	17	79	596	692
Magway	Pakokku	5	52	121	178
	Magway	3	25	109	137
	Minbu		7	113	120
	Thayat	4	8	53	65
	Gangaw			37	37
	Total	12	92	433	537
Mandalay	Mandalay	5	20	153	178
	Pyin Oo Lwin	3		4	7
	Kyaukse	1	12	83	96
	Meiktila	7	6	45	58
	Myingyan		28	219	247
	Nyaung Oo		1	11	12
	Yamethin	5	31	157	193
	Total	21	98	672	791
Total		50	269	1701	2020

Source: MOI(1), cited in (U Tin Htut Oo and Kudo 2003, pg. 227)

Table 97 Mills Distribution through Major Centres in Myanmar

Division/State	District	No. of Mills				Crushing T/month (Yearly averages)				Cake Produced T/month (avg.)
		Small	Medium	Large	Total	GN	Sesame	Sunflower	Total	
Sagaing	Sagaing	101	5	6	112					
	Shwebo	81	31	4	116					
	Monwya	153	23	6	182					
	Katha	90	9	-	99					
	Kalay	67	7	1	75					
	Kanti	74	3	-	77					
Mandalay	Mandalay	170	30	20	220	5200	4100	1300	10600	6370
	Myingyan	219	28	7	254					
	Kyaukse	83	12	3	98					
	Yamethin	157	31	5	193					
	Meiktila	45	6	1	52					
Magway	Magway	109	25	20	154	3900	3900	1200	9000	5460
	Pakokku	121	52	5	178					
	Minbu	113	7		120					
	Thayat	53	8	4	65					
Bago (west)	Pyay	10	3	27	40	2500	2500	-	5000	3000
South Shan	Taung Gyi	13	12	5	30	600	150	150	900	525

No. of Mills - Statistical Year Book, CSO, Year 2000.
For no. of Mills in Mandalay, Magway, Pyay & Taung Gyi - Respective Oil Millers Associations (approx. numbers)
For Crushing Capacities - Discussion with Respective Oil Millers Associations (approximate figures).
Source: (Food and Agriculture Organization, 2003)

Table 98 Large Oil Mills in Myanmar - Expeller Configurations & Performance

Location	Mandalay			Myintha	Magway		Aunglan	Pyay	Taung Gyi
Name of Mill	U Ko Ko	Mandalay Oil		SAW (Govt)	Soe	Other	Govt. Mill	Ayeyarwaddy	U Hpier
Seed	Sesame	Groundnut	Sesame	Cotton	Sesame	Sesame	Cotton	Groundnut	Groundnut
T/shift	3.6	4	4	8	2 x 3	2.7	8	20	8
T/h	0.45	0.5	0.5	1	0.75	0.34	1	2.5	1
No. of Expellers	3	3	3	2	12	5	4	12	10
Installed hp per Expeller				2 x 50 hp	8x20+4x10		4 x 30 hp	12 x50 hp	10 x30 hp
Total hp	50	100	100	100	200	85	120	600	300
Other Equipment	20	20	20	40	15	-	40	50	50
Total Consumption	60	84	73	88	140	63.8	120	312	175
kWh/T	99	126	108	65	139	141	90	93	131
No. of Crush	3	3	3	1	6	5	2	4	4
Steam Yes/No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
OIC	7-8 %			7-8 %	7-8 %		11-12 %	11-12 %	
Remark				Modern (Rosedown)	Largest Crusher			Largest Mill but low utilization, too much oil lost	Largest in Shan

Source: (Food and Agriculture Organization, 2003)

Table 99 Oil and Cake Quality from Groundnut and Sesame

Location	Mill	Seed	Steam Yes/No	Expeller Passes	Oil-in-Cake	Oil FFA	Oil Colour (1 inch)			Remark
							Yellow	Red	Blue	
Mandalay	U Ko Gyi	Sesame	Yes	1		2.30%	20	8.1	2	'Black' oil
				2						
				3		7.40%	21	20	10	
Magway	Soe	Sesame	No	1						'Black' oil
				2	25.48%	2.16%	21	10.1	4	
				3						
				4	11.16%	2.62%	20	12	4.6	
				5						
				6	7.37%	2.93%	21.1	13	8.4	
Pyay	Ayeyarwaddy	Groundnut	Yes	1	34.94%	0.77%	34.2 *	2.6	0	* Error ?
				2	23.34%	0.77%	20	4.3	2.4	
				3	12.38%	1.54%	21	4.2	4.4	
				4	11.38%	2.46%	20	6	4.9	

Source: (Food and Agriculture Organization, 2003)

Table 100 Crude Palm Oil Mills and Refineries

Type	Mill	Location	Capacity (FFB t/hr)	Owner	Construction
CPO	Pagawzun	Yebyu	7.5	MPCE	Imported
	Longlon	Longlon	1.5	MPCE	Imported
	Ingabo	Kayaikto	1.5	MPCE	Local
	Padonmar	Kawthaung	1.5	Private	Local
	Tet Nay	Kawthaung	1.5	Private	Local
	Tet Nay	Kawthaung	1.5	Private	Local
	CKB	Nyaung bin Kwin	1	Private	Local
	Aungzinmar	Bokepyin	1	Private	Local
Refinery	Thingangyun	Thiingangyun	6	MPCE	
	O-3	Insein	1	MAPT	

Source: MPCE, Cited in (U Tin Htut Oo and Kudo 2003, pg. 235)

Table 101 Processing of Rice Bran Oil by MAPT Mills

Year Ending		1998	1999	2000	2001	2002
Rice Bran	Fresh	21741	35306	41765	37130	53793
	Old	13594	2722	222	189	421
	Total	35335	38028	41987	37319	54214
Finished Products	OERB	27312	29581	32078	28523	41266
	Industrial Crude Oil	1113	178	23	17	
	Edible Crude Oil	2081	3348	3880	3591	5335
	Total	30506	33107	35981	32131	46601
Crude Oil Refining	Crude Oil	1956	3024	3922	2975	
	Edible Oil	740	1130	1515	1198	2118
Recovery	Edible Crude Oil	5.89%	8.80%	9.24%	9.62%	9.84%
	Edible Oil	35.56%	33.75%	39.05%	33.36%	39.70%

metric tonnes
Source: MAPT, cited in (U Tin Htut Oo and Kudo 2003, pg 114)

Table 102 Processing and Distribution of Edible Rice Bran Oil

Year Ending	Opening Stocks	Processing	Total	Distribution	Closing Balance
2000	100	1515	1615	1242	373
2001	373	1198	1571	1549	22
2002	22	2118	2140	2127	13
2003	13	1637	1650	1587	63

metric tonnes
Source: MAPT, cited in (U Tin Htut Oo and Kudo 2003, pg 115)

Table 103 Rice Bran Oil Mills Owned by MAPT

Location	Crude Oil Plant Capacity (t/day of rice bran)	Origin	Refinery Plant Capacity (t/day crude oil)	Origin
Yangon, Hlaing Township	20	Myanmar	10	Germany
Yangon, Isein Township	25	Germany	6	Germany
Bago, Paungde Township	25	Japan	10	Japan
Bago, Lepadan Township	25	Japan	10	Japan
Bago, Nyaunglebin Township	25	Germany	10	Germany
Bago, Bago Township	25	Germany	6	Germany
Bago, Zeegon Township	15	Myanmar		
Bago, Phyu Township	12	Myanmar		
Ayeyawady, Henzada Township	25	Japan	10	Japan
Ayeyawady, Phyapon Township	15	Myanmar		
Ayeyawady, Kyeiklat Township	15	Myanmar		
Ayeyawady, Bogale Township	15	Myanmar		
Ayeyawady, Myaungmya Township	15	Myanmar		
Ayeyawady, Mawla Myaingun Township	15	Myanmar		
Ayeyawady, Pathein Township	40	Germany	10	Italy
Mon, Mawlamyaing Township	25	Myanmar	6	Japan
Rakhine, Sittway Township	25	Japan	6	Japan
Mandalay, Kyankse Township	50	India	10	India
Total	18		11	

Source: MAPT, cited in (U Tin Htut Oo and Kudo 2003, pg 118)

Table 104 Yearly Production from No 4 Rice Bran Oil Mill, Paungde, Bago West MAPT

Year			2000-2001	2000-2002	2000-2003
Bran	Minister's Guidance	Tonnes	5625	5625	5625
	Plan	Tonnes	3560	4855	4040
	Actual	Tonnes	3392	3768	5017
Cake	Minister's Guidance	Tonnes	4668	4668	4668
		Recovery %	82.99%	82.99%	82.99%
	Plan	Tonnes	3035	3966	3395
		Recovery %	85.25%	81.69%	84.03%
	Actual	Tonnes	2480	2815	3789
		Recovery %	73.11%	74.71%	75.52%
Crude Oil	Minister's Guidance	Tonnes	562	562	562
		Recovery %	9.99%	9.99%	9.99%
	Plan	Tonnes	356	485	404
		Recovery %	10.00%	9.99%	10.00%
	Actual	Tonnes	302	384	512
		Recovery %	8.90%	10.19%	10.21%
Refined Oil	Minister's Guidance	Tonnes	540	540	540
		Recovery %	9.60%	9.60%	9.60%
	Plan	Tonnes	205	213	237
		Recovery %	5.76%	4.39%	5.87%
	Actual	Tonnes	202	162	323
		Recovery %	5.96%	4.30%	6.44%

Source: ASR Field Team Interview 8 September 2003

Table 105 2002-2003 Monthly Bran Processing, No 4 Rice Bran Oil Mill, Paungde, Bago West

Month	Bran		Cake				Crude Oil				Refined Oil			
	Plan	Actual	Plan		Actual		Plan		Actual		Plan		Actual	
	Tonnes	Tonnes	Tonnes	%	Tonnes	%	Tonnes	%	Tonnes	%	Tonnes	%	Tonnes	%
April	310	416	260	83.87%	311	74.76%	31	10.00%	42	10.10%	17	5.48%	21	5.05%
May	420	476	350	83.33%	362	76.05%	42	10.00%	52	10.92%	24	5.71%	32	6.72%
June	410	619	340	82.93%	458	73.99%	41	10.00%	62	10.02%	24	5.85%	36	5.82%
July	370	568	310	83.78%	425	74.82%	37	10.00%	57	10.04%	23	6.22%	30	5.28%
August	370	464	310	83.78%	349	75.22%	37	10.00%	46	9.91%	24	6.49%	30	6.47%
September	310	190	260	83.87%	147	77.37%	31	10.00%	19	10.00%	18	5.81%	35	18.42%
October	260	121	220	84.62%	95	78.51%	26	10.00%	12	9.92%	15	5.77%	24	19.83%
November	260	0	220	84.62%		0.00%	26	10.00%	0	0.00%	14	5.38%	0	0.00%
December	0	184	0	0.00%	140	76.09%	0	0.00%	19	10.33%	0	0.00%	0	0.00%
January	420	538	350	83.33%	410	76.21%	42	10.00%	56	10.41%	24	5.71%	24	4.46%
February	450	633	380	84.44%	480	75.83%	45	10.00%	66	10.43%	27	6.00%	41	6.48%
March	460	808	395	85.87%	612	75.74%	46	10.00%	81	10.02%	27	5.87%	50	6.19%
Total	4040.001	5017.001	3395	84.03%	3789	75.52%	404	10.00%	512	10.21%	237	5.87%	323	6.44%

Source: ASR Field Team Interview 8 September 2003

Table 106 Purchases and Sales of Sesame Oil, Oil Miller, Magway Township, Magway Division

Date			Jan-00	Feb-00	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Sep-00	Oct-00	Nov-00	Dec-00	Total
Purchase of Sesame Seed	Purchase Volume	Baskets	6000	5867	6933	6400	6266	6800	6400	6133	5889	5269	6933	6533	75423
		Kgs	147000	143742	169859	156800	153517	166600	156800	150259	144281	129091	169859	160059	1847863.5
	Purchase Price	Kyat/Basket	3030	3100	3130	4400	4067	4083	3120	3067	2917	3000	3067	3300	3368
		Kyat/Kg	124	127	128	180	166	167	127	125	119	122	125	135	137
	Purchase Value	Kyat	18180000	18187700	21700290	28160000	25483822	27764400	19968000	18809911	17178213	15807000	21263511	21558900	254061747
Recovery Ratio		Oil	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
		Cake	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
		Loss	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Sale of Sesame Oil	Sale Volume	Viss	45000	44000	52000	48000	47000	51000	48000	46000	44165	39518	52000	49000	565683
		Kg	73482	71849	84912	78381	76748	83280	78381	75115	72118	64530	84912	80014	923722
	Sale Price	Kyat/viss	465	435	430	395	410	430	435	415	420	430	475	455	433
		Kyat/kg	285	266	263	242	251	263	266	254	257	263	291	279	265
	Sale Value	Kyat	20925000	19140000	22360000	18960000	19270000	21930000	20880000	19090000	18549300	16992740	24700000	22295000	245092040
Sale of Sesame Cake	Sale Volume	Viss	40501	39605	46796	43201	42292	45901	43201	41396	39754	35566	46796	44096	509105
		Kg	66135	64673	76415	70544	69060	74953	70544	67597	64915	58077	76415	72006	831334.0063
	Sale Price	Kyat/viss	57	57	57	57	57	57	57	57	57	57	57	57	57
		Kyat/kg	35	35	35	35	35	35	35	35	35	35	35	35	35
	Sale Value	Kyat	2308542	2257497	2667392	2462444	2410631	2616347	2462444	2359586	2265962	2027259	2667392	2513489	29018985
Total Revenue	Total	Kyat	23233542	21397497	25027392	21422444	21680631	24546347	23342444	21449586	20815262	19019999	27367392	24808489	274111025
	Sesame Seed	Kyat/basket	3872	3647	3610	3347	3460	3610	3647	3497	3535	3610	3947	3797	3634
		Kyat/Kg	158	149	147	137	141	147	149	143	144	147	161	155	148

Source: (Department of Agricultural Planning 2001)

Table 107 Partial Budget for Oil Miller, Magway Township, Magway Division

Annual Sales	Viss	565683			
Item		Unit	Quantity	Unit Cost	Value (Kyat)
Taxes	License	Viss of Oil	565683	0.027	15000
	Income	Viss of Oil	565683	0.053	30000
Other Costs	Telephone	Viss of Oil	565683	0.088	50000
	Charity	Viss of Oil	565683	0.354	200000
	Interest (K8million, 15% p.a., 10 months)	Viss of Oil	565683	1.768	1000000
	Opportunity Cost (K4million, 15%p.a.)	Viss of Oil	565683	1.061	600000
Milling Costs	Oil Barrels	Viss of Oil	565683	2.263	1280000
	Truck Opportunity Cost (K30000/month)	Viss of Oil	565683	0.636	360000
	Milling Cost	Viss of Oil	565683	22	12445026
	Seed Purchase	Viss of Oil	565683	449.124	254061747
Total Costs		Viss of Oil	565683	477.373	270041773
Revenue	Oil Sales	Viss of Oil	565683	433.267	245092040
	Cake Sales	Viss of Oil	565683	51.299	29018985
Marketing Margin		Viss of Oil	565683	35.4426	20049278
Gross Margin		Viss of Oil	565683	7.194	4069252

Source: (Department of Agricultural Planning 2001)

Table 108 Cropping Patterns in Upper Myanmar and Shan State

Number	Upper Myanmar			Shan State	
	Pre Monsoon	Monsoon	Winter	Monsoon	Winter
1	Long Staple Cotton	Paddy		Paddy	Wheat
2	Paddy	Sesame		Paddy	Pulses
3	Sesame	Paddy	Wheat	Groundnut	Wheat or Potato
4		Paddy	Wheat	Maize	Wheat or oilseeds or potato
5		Maize	Wheat	Soybean	Wheat or oilseeds
6		Sesame	Wheat	Potato	Wheat
7		Groundnut	Wheat		
8			Wheat		
9		Paddy	Pulses		
10		Paddy	Long Staple Cotton		
11		Paddy	Onions and Chillies		

Source: (U Tin Htut Oo and Kudo 2003, pp 133-134)

Table 109 Area of Major Wheat Varieties and Yield in Myanmar

State/Division	Varieties Grown	Sown area (ha)	Yield (kg/ha)	Production (mt)
Sagaing	Monywa - white	47119	979	46130
	Yenzin wheat -3 (V-1287)	8084	1080	8731
	Total	**55203**	**994**	**54860**
Mandalay	Monywa - white	9437	1528	14420
	Maxipak	139	1230	171
	Yenzin wheat -3 (V-1287)	834	1657	1382
	Chinese 98-15	135	3252	439
	Others	975	693	676
	Total	**11520**	**1483**	**17087**
Magway	Monywa - white	543	1180	641
	Total	**543**	**1180**	**641**
Shan (south)	Yenzin wheat - 2 (SA-75)	575	1696	975
	Shan white (WC-4)	1929	1531	2953
	Yenzin wheat -3 (V-1287)	1422	1712	2434
	Maxipak	1934	1650	3191
	Monywa - white	579	953	552
	Total	**6439**	**1569**	**10106**
Shan (north)	Monywa - white	3821	1871	7149
	Maxipak	1304	2306	3007
	Total	**5125**	**1982**	**10156**
Other regions	Total	**865**	**818**	**708**
Total		**79695**	**1174**	**93558**

Source: MAS, cited in (U Tin Htut Oo and Kudo 2003, pg 133)

Table 110 Production and Yield of Wheat

Year	Irrigated				Non-Irrigated			Yield Ratio
	Number of Townships	Sown Area (ha)	Yield (kg/ha)	Production (mt)	Sown Area (ha)	Yield (kg/ha)	Production (mt)	
1979-80	26	13018	2911	36208	69614	786	54286	3.70
1980-81	34	16917	2933	46710	106256	788	79689	3.72
1981-82	36	12523	2940	34612	90688	1108	89081	2.65
1982-83	37	16298	2896	44088	93824	987	85804	2.93
1983-84	40	21611	2883	59344	120119	1369	154645	2.11

Source: MAS, cited in (U Tin Htut Oo and Kudo 2003, pg 135)

Table 111 Wheat Area and Production

Year	Sown Area	Harvested Area	Production	Yield (t/ha)
1980-81	124.335	105.3	114.9	1.13
1985-86	119.88	110.97	186.9	1.69
1990-91	149.85	136.49	121.5	0.89
1994-95	109.35	106.92	87.7	0.81
1995-96	92.745	91.125	76.7	0.89
1996-97	91.125	90.315	85.4	0.97
1997-98	88.29	87.885	90.7	1.05
1998-99	99.225	95.985	92	0.97
1999-2000	105.3	105.3	115.3	1.13
2000-2001	80.19	80.19	92.1	1.13

Source: (Central Statistical Organization 2001)

Table 112 Supply and Distribution of Wheat

Year	Production ('000 mt)	Imports				Total ('000 mt)	Seed and Post Harvest Losses ('000 mt)	Domestic Consumption ('000 mt)	Population ('000)	Per capita Consumption (kg/hd)
		Wheat Grain ('000 mt)		Wheat Flour ('000 mt)	Imports of Wheat Flour ('000 mt)					
		Whole Grain	Flour Equivalent							
1971	28	19	12	0	12	40	7	33	27637	1.19
1972	19	4	3	0	3	22	6	16	28262	0.57
1973	19	1	1	0	1	20	6	14	28886	0.48
1974	18	0	0	0	0	18	6	12	29521	0.41
1975	45	18	12	0	12	57	9	48	29778	1.61
1976	40	10	7	0	7	47	9	38	30389	1.25
1977	53	3	2	0	2	55	10	45	31009	1.45
1978	66	3	2	0	2	68	10	58	31642	1.83
1979	29	5	3	0	3	32	8	24	32284	0.74
1980	64	5	3	0	3	67	9	58	32939	1.76
1981	82	7	5	0	5	87	13	74	33608	2.20
1982	87	22	14	0	14	101	11	90	34287	2.62
1983	91	0	0	0	0	91	12	79	34976	2.26
1984	149	47	31	0	31	180	17	163	35663	4.57
1985	144	0	0	0	0	144	15	129	86361	1.49
1986	133	0	0	0	0	133	14	119	37073	3.21
1987	134	0	0	0	0	134	14	120	37800	3.17
1988	110	0	0	0	0	110	14	96	38540	2.49
1989	91	0	0	0	0	91	14	77	39290	1.96
1990	87	0	0	0	0	87	15	72	40034	1.80
1991	86	0	0	4	4	90	15	75	40786	1.84
1992	100	0	0	0	0	100	16	84	41552	2.02
1993	97	0	0	2	2	99	15	84	42333	1.98
1994	76	0	0	2	2	78	13	65	43116	1.51
1995	62	0	0	58	58	120	11	109	43922	2.48
1996	65	0	0	54	54	119	10	109	44744	2.44
1997	61	0	0	26	26	87	10	77	45565	1.69
1998	64	0	0	25	25	89	9	80	46402	1.72
1999	65	0	0	41	41	106	11	95	47200	2.01
2000	82	0	0	72	72	154	11	143	49133	2.91
2001	66	0	0	67	67	133	9	124	50125	2.47

Source: (Central Statistical Organization 2001)

Table 113 Comparison of Cost of Production and Farm-gate Price of Wheat Grain

Year	Cost of production	Farm gate price
1978-79	47.06	69.00
1989-90	70.55	317.34
1990-91	134.43	390.80
1991-92	na	429.11
1992-93	288.8	432.05
1993-94	na	665.71
1994-95	385.54	710.11
1995-96	na	850.11
1996-97	na	1418.75
1997-98	799.88	1483.00
1998-99	na	1658.00
1999-00	884.48	3127.00
2000-01	na	3500.00
2001-02	na	6500.00

cost per basket, basket = 32.65 kg
Source: MAS, cited in (U Tin Htut Oo and Kudo 2003, pg 148)

Table 114 Government Owned Foodstuff Industries

Mill	Year	Capacity	Actual Production	Percent Utilization
Hlaing Noodle Mill (Yangon)	1999-00	1,474	152	10.31%
	2000-01	1,474	186	12.62%
	2001-02	1,474	193	13.09%
	2002-03	1,474	164	11.13%
Magyisin Noodle Mill (Sagaing)	1999-00	74	47	63.51%
	2000-01	74	33	44.59%
	2001-02	74	13	17.57%
	2002-03	74	12	16.22%
Okkala Biscuit Factory(Yangon)	1999-00	522	504	96.55%
	2000-01	522	634	121.46%
	2001-02	522	800	153.26%
	2002-03	522	571	109.39%
Padethar Biscuit Factory (Yangon)	1999-00	274	165	60.22%
	2000-01	274	237	86.50%
	2001-02	274	235	85.77%
Wheat Flour Mills (Roller)	1999-00	4,800	411	8.56%
	2000-01	4,800	737	15.35%
Dagon Wheat Flour Mills (Yangon)	1999-00	4,800	2,133	44.44%
	2000-01	4,800	1,507	31.40%
	2001-02	4,800	1,472	30.67%

mt per annum

Source: Foodstuffs Industries, Ministry of Industries No. 1, cited in (U Tin Htut Oo and Kudo 2003, pg 149)

Table 115 Pulses Sown Area in 1999-2000

Type	Sown area in 1999-2000	Percent of total
Black gram	555	20.7%
Green gram	744	27.8%
Pigeon pea	308	11.5%
Chick pea	131	4.9%
Cowpea	106	4.0%
Soybean	108	4.0%
Others	728	27.2%
Total	2,680	100.0%

('000 ha)
Source: MAS, cited in (U Tin Htut Oo and Kudo 2003, pg 157)

Table 116 Exports of Agricultural Products to China - 105 Gate, Muse

Item	Price (US$/t)	Tonnes	Value (US$)
Watermelon	67	2,607	174,682
Mango	180	10,620	1,911,686
Maskmelon	200	664	132,737
Green Gram (FAQ)	270	2,126	574,074
Lab lab bean	300	24	7,305
Maize (FAQ)	100	769	76,850
Black Eye Bean	300	33	9,975
Soybean	180	2,449	440,901
Green Gram (Split)	380	66	25,080
Black Gram (FAQ)	165	39	6,509
Green Gram Split (FAQ)	430	135	58,050
Cow Pea (White)	300	376	112,695
Horse Gram	220	499	109,681
Lab lab bean	300	81	24,330
Green Gram (Split, Husk)	380	33	12,540
Total	179	20,522	3,677,095

Exports April-August 2003
Source: ASR Field Team Interviews, 14 September 2003

Table 117 Myanmar Pulses and Bean

Myanmar Name	Trade Name	Scientific Name
Kala Bean Sin Guang Pea	Gram Whole Bengal Gram	Cicer arietinum L.
Pesington	Pigeon Pea Toor Whole	Cajanus cajan L.
Matpe	Black Gram Urd, Urad	Vigna mungo L.
Pedesein Gawya Pea Pedeshwewar/Penauk Penauk Sein	Green Gram Golden Gram Mung Bean	Vigna radiata L.
Pelun	Cow Pea	Vigna unguiculata L.
Pelun Phyu/Ni	Black Eyed Bean	Vigna unguiculata L. spp. Cylindrica
Bocate Pea	Cow Pea	Vigna unguiculata L. spp. Unguiculata
Htaw Putt Pea	Butter Bean	Phaseolus lunatus L.
Pea Phyu Lay Nylon Pea Pea Sa Oo	Lima Bean	Phaseolus lunatus L.
Sultani/Sultapya	Sultani/Sultapya	Phaseolus lunatus L.
Pegyi	Hyacinth Bean Indian Bean Lab Lab Bean Dilichos Bean	Lablab purpureus L.
Pepoke	Soybean	Glycine max L.
Sadawpea	Garden Pea	Pisum sativum L.
Peyazar Pe ni lay	Lentil Rice Bean	Lensculinaris Medic
Peyin	Rice Bean Red Bean The Lobia	Bignaumbellata Thumb Phaseolus calcaratus Roxb
Myay Htiauk Pea	Kidney Bean Haricot Bean	Phaseolus vulgaris
Pegya	Lima Bean Burma Bean	Phaseolus lunatus L. Phaseolus inamoenus L.
Pe ni pya	Red Flat Bean	Phaseolus spp.
Pe ni war/War Pe	Red Bamboo Bean	
Pe Saung Lyar Pe Myit	Winged Bean Four angled bean	Psophocartus tetragonolobus L.
Bo Sar Pea	Haricot Bean Kidney Bean	Phaseolus vulgaris L.
Myay Pea	Groundnut Peanut	Arachis hypogea
Kala Pea Phyu Lone gyi	Chickpea	Cicer aritinum L
Pebisus	Horse Gram	Macrotyloma uniflorum

(Myanma Agriculture Produce Trading circa 2002)

Table 118 List of Export Commodities from MAPT

Commodity	Item	Grade
Rice	Emata Super	5%, 10% 100%
	Emata Myanmar	15%, 25%
	Zeera Myanmar	15%, 25%
	Zeera Super	5%, 10% 100%
	Ngasein Super	10%
	Ngasein Myanmar	15%, 25%
	Ngakywe Super	100%
	Long Boiled	10%, 100%
Rice Brokens	A Extra	
	A1	
	A2	
	A1 & Extra Mixed	
	A1 & 2 Mixed	
	A2, 3 & 4 Mixed	
	B Extra	
	B1	
	B2	
	B1 & Extra Mixed	
	B1 & 2 Mixed	
	B2, 3 & Mixed	
Bran	Oil Extracted Rice Bran	FAQ
Oil Cakes	Expellered Groundnut Cake/Flake	FAQ
	Expellered Sesame Cake/Flake	FAQ
Maize	Myanmar Yellow Maize	FAQ
Pulses and Beans	Myanmar Black Matpe	FAQ, FQ, SQ
	Myanmar Red Flat Bean	FAQ
	Myanmar Butter Bean	FAQ
	Myanmar Sultani/Pya Bean	FAQ
	Myanmar Bocate Bean	FAQ
	Myanmar Black Eyed Bean (Pelun)	FAQ
	Myanmar Toorwhole	FAQ
	Myanmar Soya Bean	FAQ
	Myanmar Kidney Bean	FAQ
	Myanmar Green Mung Bean (Pedesein)	FAQ
	Myanmar Gram Whole	FAQ
	Myanmar Gram Dhall	FAQ
	Myanmar Satawpe	FAQ
	Myanmar Green Mung Bean (Pedeshwewar)	FAQ
Oil Seeds	Myanmar Red/Brown/Black Sesame Seeds	FAQ
	Myanmar White Sesame Seeds	FAQ
	Myanmar Mixed Colour Sesame Seeds	FAQ
	Myanmar Mustard Seeds	
	Myanmar Coriander Seeds	
	Myanmar Niger Seeds	FAQ
Other Items	Myanmar Cattle and Goat	
	Brown Slab Sugar	
	Brown Sugar	
	Cattle Hides and Skins	

Source: (Ministry of Commerce circa 2002)

Table 119 Standard Specifications for Beans, Pulses, Maize, Oil Seeds and Oil Cakes

Specification	Foreign Matter	Damaged Insect	Damaged Otherwise	Brown / Other Colour Seeds	Sister Seeds	Small Seeds	Big Seeds	Foreign Seeds	Brokens	Moisture Content	Oil Content	Free Fatty Acid	Unhusked	Oil and Albuminoids	Sand and Silica	Impurities
Product	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Min	Max	Max	Min	Max	Max
Black Matpe (FAQ)	1.0%	1.5%	4.0%	3.0%	3.0%											
Black Matpe (FQ)	1.0%	1.0%	2.5%	3.0%	3.0%	6.0%	15.0%									
Black Matpe (SQ)	1.0%	0.5%	2.0%	2.5%		6.0%										
Yellow Maize (FAQ)	1.0%	5.0%	6.0%	6.0%					2.0%	14.0%						
Butter Beans (FAQ)	1.0%	3.0%	3.0%		1.0%			0.5%	1.0%							
Peyin Beans (FAQ)	1.0%	1.0%	3.0%		1.0%			0.5%	1.0%							
Red Flat Beans (FAQ)	1.0%	3.0%	3.0%					0.5%	1.0%							
Sultani/Sutapya Beans (FAQ)	1.0%	3.0%	3.0%					0.5%	1.0%							
Bocate Beans (FAQ)	1.0%	3.0%	3.0%					0.5%	1.0%							
Black Eyed Beans (FAQ)	1.0%	3.0%	3.0%		2.0%			1.0%	1.0%							
Pigeon Pea (FAQ)	1.0%	3.0%	3.0%					0.5%	2.0%							
Soya Beans FAQ)	1.0%	3.0%	3.0%		1.0%			0.5%	0.5%	14.0%						
Kidney Beans (FAQ)	0.5%	3.0%	2.0%		1.0%			0.5%	0.5%							
Green Mung Bean (Pedesein and Pedeshwewa)	1.0%	2.0%	4.0%		2.0%			1.0%								
Red/Brown/Black Sesame Seeds (FAQ)	2.0%		2.0%	1.0%						8.0%	48.0%	2.0%				
White Sesame Seeds (Grade 1)	2.0%		2.0%	5.0%						8.0%	48.0%	2.0%				
White Sesame Seeds (Grade 2)	2.0%		2.0%	10.0%						8.0%	48.0%	2.0%				
Mixed Colour Sesame Seeds (FAQ)	2.0%		2.0%							8.0%	48.0%	2.0%				
Sorghum (FAQ)	1.8%	2.0%	2.0%	5.0%				1.8%	2.3%	14.0%			6.5%			
Oil Extracted Rice Bran (FAQ)														16.0%	5.0%	
Expeller Groundnut, Sesame Cakes/Flakes (FAQ)														48.0%	5.0%	
Gram Whole, Chickpeas, Satawpe (FAQ)	1.0%	3.0%	5.0%					0.5%	3.0%							
Gram Dhall (FAQ)	1.0%	3.0%	2.0%										5.0%			
Coriander Seeds	2.0%	1.5%	1.0%													
Mustard Seeds																4.0%
Niger Seeds FAQ)																1.5%

(1) Foreign Matter includes dust, sand and other admixtures
(2) Damaged by insect includes grains bitten/bored and infested
(3) Damaged otherwise includes immature, shrivelled, heated, fungi and discoloured grains.
(4) Foreign beans are other than specified quality
(5) Sister beans are as follows: (a) Butter Beans and White Beans, (b) White Pelun and Rose Pelun, (c) Black Matpe and Green Matpe, (d) Pedesein and Pedinet, (e) Yellow Peyin, Red Peyin and Black Peyin.
(6) In determining damaged (handpicking) the entire surface of every kernel is inspected exposing doubtful areas.
(7) Analysis percentage results are to be obtained by weight as per attached specifications of different qualities.
(Myanma Agriculture Produce Trading circa 2002)

Table 120 Volume of Pulses Imported by Japan

Year	Total import volume	Thailand		Myanmar		China		Other	
		Volume (mt)	Percent	Volume (mt)	Percent	Volume (mt)	Percent	Volume (mt)	Percent
1962	24,885	1,002	4.0%	22,230	89.3%	1,234	5.0%	419	1.7%
1966	28,954	14,511	50.1%	12,996	44.9%	582	2.0%	865	3.0%
1970	36,770	27,758	75.5%	8,622	23.4%	301	0.8%	89	0.2%
1974	39,747	25,346	63.8%	14,083	35.4%	26	0.1%	292	0.7%
1978	48,042	42,286	88.0%	3,257	6.8%	0	0.0%	2,499	5.2%
1982	58,809	39,666	67.4%	17,952	30.5%	197	0.3%	994	1.7%
1986	57,652	35,856	62.2%	12,665	22.0%	8,400	14.6%	731	1.3%
1990	52,336	28,884	55.2%	3,593	6.9%	19,519	37.3%	340	0.6%
1996	49,376	3,816	7.7%	6,902	14.0%	38,104	77.2%	554	1.1%

Source: U Tin Mg Shwe Deputy Director, DAP and U Sein Win Hlaing, CEC, UMFCCI, cited in (U Tin Htut Oo and Kudo 2003, pg 159)

Table 121 Major Exporters of Pulses, 1998

Country	Export Volume (mt)
Canada	1,688,668
France	1,122,938
Myanmar	800,000
USA	713,278
Australia	513,638
China	472,864
Turkey	354,509
Britain	185,540

Source: (Food and Agriculture Organization 1998)

Table 122 Peas and Beans Area Harvested in ASEAN Countries

Country	1989	1996	1997	1998	1999	Average annual growth rate (%) (1989-99)
Cambodia	26	26.8	27.1	25	25	0.2
Indonesia	467	534	543	563	563	1.36
Laos	15	14.7	15.5	15.6	15.2	-0.2
Myanmar	518	1,852	1,726	1,838	2,190	14.3
Philippines	65.9	76	76	76	76	2
Thailand	651.4	415.4	385.4	423	428	-4.3
Vietnam	290	325	340	357.5	357.5	2.2

('000 ha)
Source: (U Tin Htut Oo and Kudo 2003, pg 168)

Table 123 Exportable Pulses of Myanmar

Type of pulses	FOB Yangon, FAQ price
Black gram	250
Green gram	290
Pigeon pea	260
Cowpea (white)	300
Cowpea (red)	270
Butter bean	230
Lablab bean	210
Kidney bean	250
Sultani and Sultapya	220
Rice bean	170
Duffin bean	230
Soybean	180
White chickpea(Bold seeded)	260

USD per mt, August 2002
Source: Pulses Traders Association, cited in (U Tin Htut Oo and Kudo 2003, pg 161)

Table 124 Usage of Pulses

Type of pulses	Usage
Chick pea	Flour, Vermicelli, Tofu, Curry, Snack
Black gram	Bean sprout, Vermicelli
Pigeon pea	Curry, Crispy
Green gram	Vermicelli, Sprout, Curry
Cowpea	Sweet paste, Snack
Soybean	Tofu, Sauce, Fermented bean curd, Fermented grain, Soya milk
Lablab bean	Crispy, Curry

Source: (U Tin Htut Oo and Kudo 2003, pg 165)

Table 125 Export Price of Processed Pulses

Type of Pulse	Whole Grain	Split with Husk	Split without Husk
Black Gram	250	415	465
Green Gram	330	430	480
Pigeon Pea	260		390

US$/mt, Fair Average Quality, FOB Yangon
Source: Pulses Traders Association, cited in (U Tin Htut Oo and Kudo 2003, 162)

Table 126 Milling Recovery Rates for Gram

Process	Fraction	Recovery Rate (percent)
Gram	Split Gram	75-78
	Seed Coat	10-15
	Broken Gram and Powder	10-12
	Total	100
Split Gram	High Quality Flour	70
	Low Quality Flour	20
	Bran and Waste	10
	Total	100

Source: (U Tin Htut Oo and Kudo 2003, pg 164)

Table 127 Milling Recovery Rates, Chickpea Miller, Meiktila

Item	Amount		
	Viss	Kg	Percent
Whole Chick Pea	57	93	100.0%
Split Chick Pea	43	70	75.4%
Skin	6	10	10.5%
Bran	4	7	7.0%
Foreign Matter	4	7	7.0%

Source: (Food and Agriculture Organization and Ministry of Agriculture and Irrigation 2000, pg. 78)

Table 128 Mini Vacuum Pan Sugar Plants and Mini-Centrifugal Sugar Plants, 1997-98

Area	Factories Number of Plants	Investment Value ('000 Kyat)	Sugar Output Tonnes	Employees Number
Mandalay	389	596417.6	22763	2174
Sagaing	31	26892.5	200	137
Shan	316	80499.5	637	3832
Bago	17	47441	110	140
Magway	2	24000	13	15
Yangon	2	1848	12	9
Ayerwaddy	2	2213	12	15
Mon	1	886	6	5
Rakhine	1	62	4	3
Total	761	780259.6	23757	6330

Source: Industrial Supervision and Inspection Department, MOI(1), cited in (U Tin Htut Oo and Kudo 2003, pg. 259)

Table 129 Profile of Myanmar Sugar Industry

Criteria	State	Private
Ownership	SOEs	Private Owned
Production (2001-02), mt	115655	127774
Market Share	47.5%	52.5%
Incentive Structure	Target Driven	Profit Motive
Production Technology	Vacuum Pan and Centrifugal	Open Pan
Process	Process directly from cane to sugar. Cane purchase at cane collection centers and transport to factory	Process cane to syrup and then to sugar. Transform perishable cane to semi-perishable sugar
Sugar Recovery	8%	4%
Cane Procurement	Compulsory Delivery system with fixed price. Advance payment system to farmers	Market Price
Terms of Trade	Command Economy	Market Economy
Unit Production Cost	K104/viss	K250/viss
Raw Material	Sugarcane	Sugarcane and Palm Toddy sugar
Marketing	Dual Pricing System	Market System
Market Position	Upper	Lower
Export	Exportable	Not Allowed
Response to Market Signals	Slow	Quick

Source: (U Tin Htut Oo and Kudo 2003, pg. 284)

Table 130 Number of Sugar Plants in Mandalay 2001

Type and Size		Number	Sugar Output tonnes/day	Season Days	Sugar Production tonnes/yr
Vacuum Pan and Centrifugal	Large	5	24.1	180	21699
	Medium	58	9.7	180	100746
	Small	15	3.9	180	10422
Centrifugal Only		720	1.3	150	67500

Source: (Thein, Kudo, Hlaing, Than, Zan and Thuza 2001)

Table 131 Sugarcane Area under State and Private Sector

		Private Owned								
		Sagaing Division				Mandalay Division	Northern Shan State			
Year	State Owned	Kanbalu, Shwebo, Wetlet, KhinU	Kathar, Htigaint	Other Townships	Total	Thabeikkyin, Singu Madaya	Kyaukmee, Thibaw, Naungcho	Koekant, Laukai	Total	Total	Total
1989-90	51164	8874	6858	1315	17047	4770	3984		3984	25801	76965
1990-91	68958	15424	7963	1454	24841	5471	1750		1750	32062	101020
1991-92	81186	21772	9785	2029	33586	6355	3429		3429	43370	124556
1992-93	96750	27109	9651	2157	38917	8352	3730		3730	50999	147749
1993-94	83428	12389	10067	2424	24880	10169	5511		5511	40560	123988
1994-95	74225	20037	9418	2389	31844	13606	4262		4262	49712	123937
1995-96	77841	20507	10121	2603	33231	15485	4584	20	4604	53320	131161
1996-97	98474	19063	12371	3386	34820	19395	7093	1446	8539	62754	161228
1997-98	155804	17186	26312	4239	47737	22644	8413	4146	12559	82940	238744
1998-99	118623	23591	25476	5848	54915	23175	10477	6605	17082	95172	213795
1999-00	128685	22675	26457	7370	56502	21375	19769	9685	29454	107331	236016
2000-01	140305	21650	42882	6609	71141	21444	21861	9531	31392	123977	264282
2001-02	171909	32318	69638	6750	108706	25147	21346	9232	30578	164431	336340
2002-03	171363	30583	73095	5794	109472	25895	21094	7828	28922	164289	335652

Acres

Source: (U Tin Htut Oo and Kudo 2003, pg. 263)

Table 132 State and Private Sugar Production

Year	Private	State
1994-95	45623	37117
1995-96	48052	41240
1996-97	63254	49115
1997-98	96803	53797
1998-99	74870	48201
1999-00	77396	54759
2000-01	93902	94429
2001-02	127774	115655

Tonnes

Source: (U Tin Htut Oo and Kudo 2003, pg. 265)

Table 133 Sugarcane Area and Production

Year		1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-01
Planted (acre)	Myanmar	129650	164658	203743	266111	311286	332094	350268
	MSE	55425	86817	105269	96414	182114	194429	168553
	% Total	42.7%	52.7%	51.7%	36.2%	58.5%	58.5%	48.1%
Matured (acre)	Myanmar	123072	156977	202116	255346	303427	314358	317633
	MSE	50388	81931	103798	91744	175499	176693	141102
	% Total	40.9%	52.2%	51.4%	35.9%	57.8%	56.2%	44.4%
Yield (tonnes/acre)	Myanmar	18.03	20.38	19.69	19.8	17.61	17.95	18.4
	MSE	19.6	21.61	20.2	21.51	18.84	19.73	19.77
Cane Production (tonnes)	Myanmar	2219164	3199191	3978741	5055850	5343915	5641726	5844727
	MSE	987749	1770908	2160818	1973479	3306560	3485430	2789767
	% Total	44.5%	55.4%	54.3%	39.0%	61.9%	61.8%	47.7%

Source: (Kudo 2003, pg. 109)

Table 134 Characteristics of State Sugar Mills

Characteristics		Pyinmana Sugar Mill No.2	Pyinmana Sugar Mill No.3	Yedashe Sugar Mill	Zeyawady Sugar Mill	Bilin Sugar Mill	Kyauktaw Sugar Mill	Shwenyaung Sugar Mill	Namti Sugar Mill
Location	Village	Thanatpin	Thanatpin	Indaing	Zeyawady		Sankar	Taunglelone	Mogaung
	Township	Pyinmana	Pyinmana	Yedashe	Phyu	Bilin	Kyauktaw	Taunggyi	Mogaung
	State/Division	Mandalay	Mandalay	Bago	Bago	Mon	Rakhine	Shan	Kachin
Distance from Yangon (miles)		244	244	203	146	120	440	436	686
Year Established		1981	1955	1986	1983	1964	1981	1982	1953
Year Commissioned		1984	1957	1991	1986-87	1966	1983	1983	1956
Country of Origin		Japan	Japan	Japan	Czechoslovakia	China		Netherlands	Netherlands
Contractor		Hitachi Zosen	Hitachi Zosen	Tsuki Shimakikai	Techno Export	China National Complete Plant		Stock Werk Spoor	Stock Werk Spoor
Cost of Establishment (millions)	Kyats	240.6	20.04	251.2	259.12	60.7	318.23	71.98	9.287
	US Dollar	30.4	6.35	27.53	18.64	8.94	8.18	4.44	8.825
Crushing Capacity (t/day)		1500	1500	1500	1500	1000	300	300	100
Production Process		Carbonation, Sulphitation	Double Carbonation	Double Sulphitation	Double Sulphitation	Carbonation, Double Sulphitation	Double Sulphitation	Sulphitation	Sulphitation
Type of Sugar Produced		White Sugar & Refined Sugar	White Sugar	White Sugar	White Sugar	White Sugar	White Sugar	White Sugar	White Sugar

Source: (Kudo 2003, pg. 106)

Table 135 Characteristics of State Sugar Mills, Continued

Characteristics		Pyay Nawaday Sugar Mill	Dahatkone Sugar Mill	Taung Zin Aye Sugar Mill	Duyingabo Sugar Mill	Pauk Khaung Sugar Mill	Oktwin Sugar Mill	Myohla Tabhla Sugar Mill	Okkan Sugar Mill	Yoneseik Sugar Mill
Location	Village	Myaywa	Dahatkone	Taung Zin Aye	Duyingabo	In Nga Gwa	Bawdikone	Myohla	Gongintan	Yoneseik
	Township	Pyay	Tatkone	Leiwe	Aunglan	Pauk Kaung	Oaktwin	Yedashe	Taikkyi	Aunglan
	State/Division	Bago	Mandalay	Mandalay	Magway	Bago	Bago	Bago	Yangon	Magway
Year Established		1997	1997	1997	1997	1997	1997	1997	1997	1997
Year Commissioned		1999-2000	1999-2000	1999-2000	1999-2000	1999-2000	1999-2000	1999-2000	1999-2000	1999-2000
Country of Origin		Thailand	China	China	China	China	China	China	China	China
Contractor		Sutech Engineering Company	Guang Dong New Technology Import and Export Zhuhai Company	Guang Dong New Technology Import and Export Zhuhai Company	China National Complete Plant Import and Export Yunan Corporation	China National Complete Plant Import and Export Yunan Corporation	China National Heavy Machinery Corporation	China National Heavy Machinery Corporation	China National Construction and Agriculture Machinery Import and Export Corporation	China National Construction and Agriculture Machinery Import and Export Corporation
Cost of Establishment (US$ millions)		23.4	16.4361	16.4356	20.8	20.8	20.8	20.8	20.8	20.7
Crushing Capacity (t/day)		2000	2000	1500	2000	2000	2000	2000	2000	2000
Production Process		CO2, Fuel Gas Carbonation	Double Sulphitation	Double Sulphitation	Double Sulphitation	Double Sulphitation	Double Sulphitation	Double Sulphitation	Double Sulphitation	Double Sulphitation
Type of Sugar Produced		White & Refined Sugar	White Sugar	White Sugar	White Sugar	White Sugar	White Sugar	White Sugar	White Sugar	White Sugar

Source: (Kudo 2003, pg. 111)

Table 136 Price of Syrup, Zaygyo Market, Mandalay

Year	Low	High	Year	Low	High	Year	Low	High	Year	Low	High	Year	Low	High	Year	Low	High
Jan-91	14	15	Jan-92	20	21.5	Jan-93	8.5	18.5	Jan-94	19.5	22.5	Jan-95	36	48	Jan-96	52	63
Feb-91	13.5	15.5	Feb-92	20.5	25	Feb-93	14.5	17	Feb-94	18.5	21	Feb-95	55	62	Feb-96	53	54
Mar-91	14.5	16.5	Mar-92	24	26	Mar-93	14.5	45.5	Mar-94	21	26	Mar-95			Mar-96	52	53
Apr-91	15.5	20	Apr-92	24	26	Apr-93	14	15	Apr-94	23	33	Apr-95	58	59.25	Apr-96	53	56
May-91	16.5	20	May-92	22	25	May-93	16	17	May-94	27	30	May-95	54	57	May-96	51	53
Jun-91	18	19	Jun-92	23	25.5	Jun-93	17.5	19.5	Jun-94	27	35	Jun-95			Jun-96	52	53
Jul-91	19	22	Jul-92			Jul-93	21	24	Jul-94		38	Jul-95			Jul-96	53	67
Aug-91	20	28	Aug-92		26	Aug-93	23	27	Aug-94	42	43	Aug-95			Aug-96	67	75
Sep-91	26	31	Sep-92	22.5	26	Sep-93	24	29	Sep-94			Sep-95			Sep-96	69	75
Oct-91	30	31	Oct-92	5	25	Oct-93	25	29	Oct-94		50	Oct-95			Oct-96	67	70
Nov-91	25	30	Nov-92	17	24	Nov-93	23	25	Nov-94			Nov-95			Nov-96	65	68
Dec-91	21	27	Dec-92			Dec-93	23	24.5	Dec-94	45	51.5	Dec-95	68.5	71	Dec-96	40	58
Average	19.4	22.9		19.8	25.0		18.7	24.3		27.9	35.0		54.3	59.5		56.2	62.1
	21.2			22.5			21.5			31.8			56.9			59.1	
CV	27.6	27.4		31.0	5.7		28.5	34.8		37.6	31.4		22.7	14.7		16.0	14.2
	28.0			22.0			34.5			34.4			18.0			15.5	
Year	Low	High	Year	Low	High	Year	Low	High	Year	Low	High	Year	Low	High	Year	Low	High
Jan-97	36	44	Jan-98	44	55	Jan-99	57	68	Jan-00	80	110	Jan-01	64	68	Jan-02	133	156
Feb-97	36	40	Feb-98	37	44	Feb-99	60	70	Feb-00	83	95	Feb-01	69	85	Feb-02	135	170
Mar-97	35	37	Mar-98	38	45	Mar-99	71	77	Mar-00	90	95	Mar-01	75	80	Mar-02	130	148
Apr-97	34	35	Apr-98	40	45	Apr-99	73	75	Apr-00	94	104	Apr-01	80	100	Apr-02	140	150
May-97	31	35	May-98	44	50	May-99	77	78	May-00	95	103	May-01	98	103			
Jun-97	35	37	Jun-98	50	63	Jun-99	72	83	Jun-00	90	93	Jun-01	100	104			
Jul-97	37	50	Jul-98	63	80	Jul-99	83	85	Jul-00	93	106	Jul-01	118	120			
Aug-97	52	55	Aug-98	73	80	Aug-99	88	97	Aug-00	106	124	Aug-01	125	142			
Sep-97	53	60	Sep-98	80	86	Sep-99	100	120	Sep-00	107	110	Sep-01	140	143			
Oct-97		60	Oct-98	83	85	Oct-99	140	150	Oct-00	75	90	Oct-01	145	150			
Nov-97	58	67	Nov-98	58	55	Nov-99	80	83	Nov-00	140	150	Nov-01	75	83			
Dec-97	53	58	Dec-98	67	70	Dec-99	110	138	Dec-00	80	90	Dec-01	150	157			
Average	41.8	48.2		56.4	63.2		84.3	93.7		94.4	105.8		103.3	111.3		134.5	156.0
	45.1			59.8			89.0			100.1			107.3			145.3	
CV	24.2	24.4		30.0	26.4		28.0	29.8		18.8	16.5		31.1	28.0		3.3	6.8
	24.7			27.9			28.7			18.0			28.8			9.6	

Kyat/Viss
Source: (U Tin Htut Oo and Kudo 2003, pg. 269)

Table 137 Price of VP White Sugar (Paung), Zaygyo Market, Mandalay

Month	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Jan		36	42	43	47	80	95	106	135	150	180	175
Feb		36	46	41	47	92	98	106	115	160	172	195
Mar		40	49	42	48	95	98	104	110	165	170	210
Apr		41	48	45	60	100	99	110	110	158	196	210
May	30	48	45	40	68	94	98	112	130	153	185	265
Jun	32	45	44	48	89	94	100	94	135	154	175	265
Jul	34	46	45	52	70	102	102	120	136	154	180	275
Aug	36	51	44	56	76	112	112	130	156	115	215	295
Sep	37	50	45	55	84	114	112	124	158	178	210	295
Oct	37	49	45	55	89	118	116	140		210	195	
Nov	37	50	50	52		122	119	145	154	210	180	207
Dec	39.5	48	50	49		118	105	150	138	202	190	207
Average	35	45	46	48	68	103	105	120	134	167	187	236
CV	9.1	12.3	5.7	12.4	25.5	13.0	8.0	15.2	13.2	17.2	7.8	18.7

Kyat/Viss
Source: (U Tin Htut Oo and Kudo 2003, pg. 269)

Table 138 Private and Government Sugar Prices

Year	Private					Government
	Syrup		Khandsari (Khar) Sugar	VP White Sugar (Paung)		Plantation White Sugar
	Low	High		Low	High	
1990	9	12.3	23.6	30	37	52
1991	14	24	34.4	36	49	58
1992	21	25	35	44	54	60
1993	15	24	31.8	43	55	63
1994	25	48	54	47	84	95
1995	47	61	90.4	80	110	118
1996	52	70		95	116	119.5
1997	35	60		106	140	133
1998	40	80		110	150	175
1999	60	130		150	210	180
2000	80	124		172	195	210
2001	70	140		175	265	305
2002	130	185		310	365	355
Average	46.0	75.6	44.9	107.5	140.8	148.0
CV	74.6	72.3	56.7	75.1	70.1	66.0

Source: (U Tin Htut Oo and Kudo 2003, pg. 272)

Table 139 Government and Free Market Prices for Cane, Sugar and Jaggery

Year	Government Fixed Price		Free Market Price	Retail Price	Jaggery Price
	Cane	Sugar	Sugar	Sugar	
	Kyat/tonne	Kyat/viss	Kyat/viss	Kyat/viss	Kyat/viss
1953	51	1.50			
1954	45	1.37			
1955	40	1.49		2.19	
1956	40	1.60		2.57	
1957	42	1.60		2.57	
1958	42	1.56		2.48	
1959	40	1.56		2.03	1.02
1960	30	1.56		2.00	1.02
1961	35	1.56		2.00	1.07
1962	35	1.60		2.00	1.60
1963	35	1.64	2.00	1.94	1.60
1964	35	1.64	1.94	1.91	1.70
1965	35	1.64	1.91	1.90	1.70
1966	35	1.64	1.90	1.90	1.66
1967	35	1.64	1.90	1.95	1.40
1968	35	1.89	1.95	2.10	3.00
1969	35	1.89	2.10	2.10	3.10
1970	35	1.89	2.10	2.10	3.30
1971	35-40	1.89	5.32	6.70	3.41
1972	40	1.93	6.70	6.54	3.47
1973	40	1.96	6.54	8.15	3.29
1974	60	1.96	8.15	13.33	4.08
1975	60	3.25	13.33	29.74	5.70
1976	60	3.25	29.74	27.44	5.60
1977	100	4.25	27.44	24.88	6.00
1978	100	5.32	24.88	16.16	6.50
1979	100	5.32	16.16	18.00	7.00
1980	100	5.32	18.00	20.93	7.78
1981	100	5.32	20.93	21.94	10.74
1982	100	5.32	21.94	23.22	9.61
1983	100	5.56	23.22	23.58	9.20
1984	100	5.56	23.58	24.69	9.74
1985	100	6.60	24.69	17.67	12.54
1986	100	6.60	17.67	24.69	9.91
1987	100	6.60	24.69	37.03	10.12
1988	100	6.60	37.03	43.68	17.16
1989	150	18.00	43.68	40.43	20.55
1990	150	18.00	40.43	42.10	19.74
1991	270	20.00	42.10	56.93	24.97
1992	paid in kind	21.00	56.93	57.78	35.58
1993	paid in kind	21.00	57.78	58.85	45.12
1994	paid in kind	23.00	58.85	81.64	48.12
1995	1000	36.00	81.64	115.70	65.73
1996	1000-4000	36.00	115.72	125.93	92.22
1997	1500	90.00	125.93	148.89	111.47
1998	1850	90.00	130.00	174.01	130.00
1999	2500	100.00	178.00	199.02	162.84
2000	2500	100.00	196.00	219.74	176.73
2001	2500	120.00	275.00	323.58	237.75
2002		120.00	369.00		

Free Market Prices Quotes from CSO. MIS indicates that these prices are below actual wholesale prices
In 2002-03 Cane is procured at K3500/tonne plus 3 viss of sugar paid in Kind by MSE
Source: (U Tin Htut Oo and Kudo 2003, pg. 273)

Table 140 Sugarcane Area, Production and Consumption

Year			1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
Sugarcane Area	Mill Area	Acres	55425	86817	105269	96414	182214	194429	168553
		Percent	42.7%	52.7%	51.7%	36.2%	58.5%	58.5%	50.7%
	Private	Acres	74225	77841	98474	169697	129072	137665	163820
		Percent	57.3%	47.3%	48.3%	63.8%	41.5%	41.5%	49.3%
	Total	Acres	129650	164658	203743	266111	311286	332094	332373
Sugar Production	State	Tonnes	36577	41438	48949	54126	48419	54826	80047
		Percent	48.6%	50.5%	47.8%	37.7%	37.3%	38.4%	43.0%
	Private	Tonnes	38627	40684	53555	89269	81528	87796	106076
		Percent	51.4%	49.5%	52.2%	62.3%	62.7%	61.6%	57.0%
	Total	Tonnes	75204	82122	102504	143395	129947	142622	186123
Consumption (kg/capita)			1.71	1.84	2.25	3.09	2.75	2.96	3.79

Private Sector Production Estimate based on sugarcane production and processing ratio
Source: (Kudo 2003, pg. 110)

Table 141 Sugar Production from MSE Mills

Year	Cane Procurement	Cane Crushed	Percentage Crushed	Sugar Production		Molasses Production	
	Tonnes	Tonnes	Percent	Output (tonnes)	Yield (%)	Output (tonnes)	Yield (%)
1994-95	451437	450290	99.75%	36577	8.12%		
1995-96	594413	593927	99.92%	41438	6.98%	26802	4.51%
1996-97	682497	666445	97.65%	48949	7.34%	35004	5.25%
1997-98	701771	702295	100.07%	54126	7.71%	31174	4.44%
1998-99	705207	705131	99.99%	48419	6.87%	32006	4.54%
1999-00	779337	772351	99.10%	54826	7.10%	32723	4.24%
2000-01	1108622	1106613	99.82%	94429	8.53%	44061	3.98%

Source: (Kudo 2003, pg. 113)

Table 142 Performance of MSE Mills, 2000-01

Factories	Cane Crushed		Season Capacity		Sugar Production		Molasses Production	
	Tonnes	% of Target	Tonnes	% Utilization	Tonnes	Yield (%)	Tonnes	Yield (%)
Dahatkone Sugar Mill	52420	30	320000	16.38%	3726	7.11%	2033	3.88%
Pyinmana Sugar Mill No. 2	122830	65	240000	51.18%	10371	8.44%	5749	4.68%
Pyinmana Sugar Mill No. 3	82446	55	240000	34.35%	6652	8.07%	2680	3.25%
Taung Zin Aye Sugar Mill	54323	31	240000	22.63%	5128	9.44%	1618	2.98%
Myohla Sugar Mill	85595	34	320000	26.75%	7042	8.23%	3007	3.51%
Yedashe Sugar Mill	141655	64	240000	59.02%	12749	9.00%	5455	3.85%
Oktwin Sugar Mill	91008	36	320000	28.44%	7307	8.03%	3640	4.00%
Zeyawaddy Sugar Mill	50209	39	240000	20.92%	3264	6.50%	2063	4.11%
Yoneseik Sugar Mill	87481	35	320000	27.34%	8805	10.07%	3586	4.10%
Duyingabo Sugar Mill	74518	30	320000	23.29%	6817	9.15%	3089	4.15%
Pauk Khaung Sugar Mill	84534	34	320000	26.42%	8039	9.51%	3400	4.02%
Pyay Myayar Sugar Mill	79530	37	320000	24.85%	7034	8.84%	3616	4.55%
Okkak Tabula Sugar Mill	40194	16	320000	12.56%	3505	8.72%	1530	3.81%
Bilin Sugar Mill	57478	48	160000	35.92%	3866	6.73%	2482	4.32%
Kyauktaw Sugar Mill	2385	12	48000	4.97%	119	4.99%	108	4.53%
Total	1106606	38	3968000	27.89%	94424	8.53%	44056	3.98%

Source: (Kudo 2003, pg. 113)

Table 143 Performance of Private Sector Sugar Processing Plants in Mandalay, 2000-2001

Criteria	Units	Mean	Mode	Median
Minimum Daily Output of Sugar	Tonnes	15.3	16	15.25
Maximum Operating Season	Days	261	300	300
Regular Operating Season	Days	204	180	180
Raw Material Inputs (Jaggery or Syrup)	Tonnes	3548	3215	2340
Processing Ratio (Syrup to White Sugar)	Percent	50.4	50	50
Processing Ratio (Rub Sugar to White Sugar)	Percent	65.1	69	69
Processing Ratio (Palm Jaggery to White Sugar)	Percent	50.4	50.5	50.5
Employees (Permanent)	Number	19.6	15	15
Employees (Seasonal)	Number	28.1	40	25
Capacity of Vacuum Pan	Tonnes	13.6	24	12
Centrifugal Machines	Number	3.7	3	3

Vacuum Pan and Centrifugal Technology Sugar Processing Plants
Survey Size is 25 plants
Source: Mandalay Sugar and Syrup's Merchants Religious Association and Regional Industrial Supervision Department, MOI(1), Cited in (Kudo 2003, pg. 117)

Table 144 Cost of Production for Private SME Sugar Processing Plant, 2001

Item	Price Kyat/Viss	Quantity Viss	Cost Kyat	Output of White Sugar Viss
Sugar Refining (Brown Sugar or Massaecuite)	168	6900	1159200	
Seed Feeding	165	510	84150	
A Sugar	167	3000	501000	3390
Seed Feeding	165	600	99000	
B Sugar	167	3000	501000	3090
Seed Feeding	165	780	128700	
C Sugar	117	2940	343980	2970
Processing Cost	4 Strikes	70000	280000	
Gross Cost			3097030	9450
Final Molasses	53	3500	185500	
Seed Sugar	165	3210	529650	
Net Cost			2381880	
Gross Unit Cost			328	
Net Unit Cost			252	
Total Quantity Inputs		17730		
Total Quantity Outputs		16160		
White Sugar Recovery %		53.30%		
Molasses Recovery %		19.74%		
Seed Sugar Recovery %		18.10%		
Net Loss %		8.86%		

Survey of 25 plants, Mandalay, July 2001
Source: (Kudo 2003, pg. 135)

Table 145 Cost of Production for State Sugar Mills, 2000-01

Item	Pyinmana Sugar Mill No. 2	Pyinmana Sugar Mill No. 3	Yedashe Sugar Mill	Zeyawaddy Sugar Mill	Bilin Sugar Mill	Dahatkone Sugar Mill	Taung Zin Aye Sugar Mill	Myohla Sugar Mill	Oktwin Sugar Mill	Yoneseik Sugar Mill	Duyingabo Sugar Mill	Pauk Khaung Sugar Mill	Okkak Tabula Sugar Mill	Average	Standard Deviation
Raw Material Cost	50.68	46.9	52.9	38.24	48.1	42.53	38.08	47.84	42.91	38.45	46.07	43.25	35.44	43.95	5.36
Cane Transport Cost	13.46	7.84	14.3	17.72	5.82	15.75	14.6	14.28	22	30.78	11.12	11.76	12.76	14.78	6.29
Factory Maintenance	10.1	14.06	3.62	7.48	8.92	4.48	3.96	1.37	1.41	1.21	5.99	12.47	2.48	5.97	4.32
Other Variable Costs	11.22	16.61	10.52		15.08		12.53	14.29	9.95	10.68	11.96	10.27	13.19	12.39	2.18
Other Fixed Costs	3.76	2.49	4.52		4.91		8.22	8	11.45	9.41	11.44	12.37	22.57	9.01	5.62
Overhead Costs	3.15	4.35	4.6	7.85	8.48	6.7	15.61	8.92	5.87	3.24	5.3	4.95	6.61	6.59	3.28
Distribution and Sale	2.2	1.5	4.8	0.1	0.62	0.27	0.91	1.11	0.55	2.49	3.85	0.93	0.39	1.52	1.45
Wages	3.21	3.76	3.12	1.39	4.46	3.74	3.1	2.65	2.1	1.42	2.32	3.08	3.59	2.92	0.92
Direct Labor Cost	2.21	2.47	1.16	6.75	3.53	1.92	3	1.55	1.93	2.3	1.93	0.97	2.96	2.51	1.46
Financial Cost			0.5								0.1	0.004		0.20	0.26
Total Costs	99.99	99.98	100.04	79.53	99.92	75.39	100.01	100.01	98.17	99.98	100.08	100.054	99.99	96.40	8.46
Sale of Molasses	11.39	7.32	9.62	7.58	9.98									9.18	1.71
Net Cost	88.6	92.66	90.42	71.95	89.94	75.39	100.01	100.01	98.17	99.98	100.08	100.054	99.99	92.87	9.62
Unit Cost of Sugar (Kyat/viss)	84.52	99.7	78.77	140.39	113.54	124.9	105.05	93.33	109.62	97.32	88.32	91.57	123.41	103.88	17.92
Unit Cost of Sugar (Kyat/kg)	137.77	162.95	128.4	228.83	185.07	203.59	171.23	152.13	178.68	158.63	143.96	149.26	201.16	169.36	29.20
Cane Purchase Cost / Total Cost	60.0%	47.0%	67.2%	27.2%	42.4%	34.1%	36.2%	51.3%	39.1%	39.5%	52.2%	47.2%	28.7%	44.0%	11.7%
Transport Cost / Total Cost	15.9%	7.9%	18.2%	12.6%	5.1%	12.6%	13.9%	15.3%	20.1%	31.6%	12.6%	12.8%	10.3%	14.5%	6.5%
Sugar Production (tonnes)	10371	61221	12749	3097	3867	3669	5128.2	7043	7307	88.05	6818	8039	3505	10223	15679

Source: (Kudo 2003, pp. 133-134)

Table 146 Pyinmana Sugar Mill No. 2 Periodical Manufacturing Report (Extract)

Date: 9/4/2003
Run Number 11, Season 2002-2003

Period Reporting	From	1/03/2003
	To	7/04/2003
To-Date	From	29/10/2002
	To	7/04/2003

Tonnes Cane Crushed	Period	11108.36
	To Date	83813.56
Recovery	Period	7.62 (8.61)
	To Date	8.08 (8.08)

Account	Item	Units	This Season				Last Season's Corresponding			
			Period		To Date		Period		To Date	
			Number	%	Number	%	Number	%	Number	%
Cane Account	Carts Cane	Tonnes	0	0.00%	0	0.00%	0	0.00%	1808.89	1.24%
	Rail Cane	Tonnes	5725.77	51.54%	20752.61	24.76%	0	0.00%	41896.84	28.82%
	Truck Cane	Tonnes	5382.59	48.46%	63060.95	75.24%	178.82	100.00%	101653.46	69.93%
	Total Cane	Tonnes	11108.36	100.00%	83813.56	100.00%	178.82	100.00%	145359.19	100.00%
Sugar Production	Big Size Crystal ISS Grain A	20kg Bag								
	Big Size Crystal ISS Grain B	20kg Bag								
	Medium Size Crystal ISS Grain C	20kg Bag	19114		135443		309		250600	
	Medium Size Crystal ISS Grain D	20kg Bag								
	Small Size Crystal ISS Grain E	20kg Bag								
	Small Size Crystal ISS Grain F	20kg Bag								
	Dust ISS Grain G	20kg Bag								
	Other Quality	20kg Bag								
	Total Sugar Bagged	Tonnes	955.7	8.60%	6772.15	8.08%	15.45	8.64%	12530	8.62%
	Last Year's Taken Back in Process	Tonnes	106.75		0		0		0	
	Net Sugar Production	Tonnes	848.95	7.64%	6772.15	8.08%	15.45	8.64%	12530	8.62%
	Available Sugar in Process	Tonnes								
Crushing Capacity	Season Length	Hours	897.5		3849		271.33		4107.66	
	Stoppage Due to Cleaning	Hours			294.5				353.33	
	Stoppage Due to Cane Shortage	Hours	690.34		1890.17		268		1026.08	
	Stoppage Due to Poor Feeding	Hours								
	Stoppage Due to Holidays	Hours								
	Available Hours For Crushing	Hours	207.16		1664.33		3.33		2728.25	
	Stoppage Hours (Cane Carrier Breakdown)	Hours			24.17				29	
	Crushing Hours	Hours	207.16		1640.16		3.33		2699.25	
	Hours Crushed Per Season Hours	%	23.08%		42.61%		1.23%		65.71%	
	Hours Crushed Per Available Hours	%	100.00%		98.55%		100.00%		98.94%	
	Cane Crushed Per 24 Season Hours	Tonnes	297.05		522.61		15.82		849.30	
	Cane Crushed Per 24 Available Hours	Tonnes	1286.93		1208.61		1288.79		1278.70	
	Cane Crushed Per 24 Crushing Hours	Tonnes	1286.93		1226.42		1288.79		1292.44	

Source: Pyinmana Sugar Mill No. 2 Mill Report, ASR Field Team Interview 18 September 2003

Table 147 International Production and Consumption of Sugar, Selected Countries

Country	Year	Beginning Stocks	Production	Imports	Total Supply	Exports	Domestic Consumption	Ending Stocks	Population	Per Capita Consumption (kg)
United States	1999/2000	1487	8203	1484	11174	112	9049	2013	276621040	32.71
	2000/2001	2013	7956	1443	11412	128	9306	1978	279064404	33.35
	2001/2002	1978	7172	1385	10535	124	9249	1162	281484331	32.86
	2002/2003	1162	7620	1510	10292	141	8699	1452	283886620	30.64
Canada	1999/2000	115	73	1207	1395	13	1235	147	29866968	41.35
	2000/2001	147	48	1211	1406	13	1240	153	30128631	41.16
	2001/2002	153	50	1239	1442	14	1245	183	30383725	40.98
	2002/2003	183	50	1190	1423	14	1245	164	30633284	40.64
Mexico	1999/2000	941	4979	37	5957	318	4576	1063	102912263	44.47
	2000/2001	1063	5220	43	6326	155	4623	1548	104679556	44.16
	2001/2002	1548	5168	58	6774	406	5082	1286	106441839	47.74
	2002/2003	1286	5038	100	6424	100	5266	1058	108194565	48.67
Cuba	1999/2000	488	4060	0	4548	3400	710	438	11272041	62.99
	2000/2001	438	3500	0	3938	2980	720	238	11333975	63.53
	2001/2002	238	3700	0	3938	3100	710	128	11393440	62.32
	2002/2003	128	2200	0	2328	1550	700	78	11451201	61.13
Brazil	1999/2000	1010	20100	0	21110	11300	9100	710	169543216	53.67
	2000/2001	710	17100	0	17810	7700	9250	860	171068407	54.07
	2001/2002	860	20400	0	21260	11600	9450	210	172575103	54.76
	2002/2003	210	23760	0	23970	14230	9640	100	174060743	55.38
European Union	1999/2000	3107	19498	1786	24391	6138	14523	3730	356244138	40.77
	2000/2001	3730	18519	1839	24088	6607	14061	3420	357051324	39.38
	2001/2002	3420	16185	2087	21692	4459	14332	2901	357788543	40.06
	2002/2003	2901	18664	2100	23665	6094	14458	3113	358461462	40.33
India	1999/2000	7374	20219	438	28031	25	17296	10710	1018105184	16.99
	2000/2001	10710	20480	0	31190	1360	17845	11985	1034005696	17.26
	2001/2002	11985	20475	100	32560	1130	19760	11670	1049836181	18.82
	2002/2003	11670	20100	20	31790	1700	20750	9340	1065575612	19.47
China	1999/2000	2548	7525	687	10760	433	8476	1851	1260154088	6.73
	2000/2001	1851	6849	1083	9783	129	8650	1004	1270004863	6.81
	2001/2002	1004	8305	1375	10684	492	9050	1142	1279460073	7.07
	2002/2003	1142	9488	540	11170	510	9122	1538	1288593263	7.08
Thailand	1999/2000	684	5721	0	6405	4147	1650	608	63619820	25.94
	2000/2001	608	5107	0	5715	3394	1750	571	64153304	27.28
	2001/2002	571	6397	0	6968	4157	1832	979	64589773	28.36
	2002/2003	979	6813	0	7792	5100	1900	792	64924557	29.26
Australia	1999/2000	183	5448	5	5636	4123	995	518	19385921	51.33
	2000/2001	518	4162	5	4685	3056	995	634	19576007	50.83
	2001/2002	634	4662	5	5301	3594	1050	657	19762749	53.13
	2002/2003	657	5350	5	6012	4219	1050	743	19946010	52.64
Pakistan	1999/2000	552	2595	280	3427	0	3300	127	148540031	22.22
	2000/2001	127	2648	1100	3875	0	3450	425	152738546	22.59
	2001/2002	425	3453	32	3910	0	3450	460	157027137	21.97
	2002/2003	460	3670	0	4130	300	3500	330	161416951	21.68
Indonesia	1999/2000	908	1690	1949	4547	17	3200	1330	219496296	14.58
	2000/2001	1330	1800	1591	4721	6	3300	1415	222665944	14.82
	2001/2002	1415	1725	1600	4740	5	3350	1385	225827887	14.83
	2002/2003	1385	1755	1600	4740	0	3400	1340	228973601	14.85
Philippines	1999/2000	454	1620	280	2354	94	1930	330	81594281	23.65
	2000/2001	330	1805	215	2350	88	1940	322	83289735	23.29
	2001/2002	322	1900	109	2331	142	1950	239	84992967	22.94
	2002/2003	239	2000	80	2319	142	1980	197	86701698	22.84
Japan	1999/2000	164	795	1650	2609	7	2142	460	127553883	16.79
	2000/2001	460	722	1486	2668	10	2293	365	127939299	17.92
	2001/2002	365	833	1407	2605	10	2277	318	128294947	17.75
	2002/2003	318	870	1466	2654	10	2314	330	128610190	17.99

Thousand Tonnes
Source: USDA ERS - PSD Database

Table 148 Mechanization of Cropping, 1997-98

Crop	% of Sown Area	Sown Area	Mechanized Area
Jute	69.15%	94000	65001
Sugar Cane	40.98%	266000	109006.8
Monsoon Paddy	10.96%	4900000	537040
Summer Paddy	28.78%	880000	253264
Oil Crops	12.50%	3591000	448875
Pulses	28.33%	4914000	1392136.2
Cotton	9.73%	659000	64120.7
Total	18.75%	15304000	2869443.7

Percentage of Area Ploughed for Land Preparation, (Acres)
Source: unknown, cited in (Myanmar-Japan Cooperation Program 2002, pg. 147)

Table 149 Number of Agricultural Machines Used by Private and State Sector

Type	Number
Four Wheel Tractor	8801
Two Wheel Tractor	42412
Water Pumps	65000
Paddy Thresher	6000

circa 1997-98
Source: unknown, cited in (Myanmar-Japan Cooperation Program 2002, pg. 147)

Table 150 Agricultural Equipment in Myanmar

Description		1980-81	1985-86	1990-91	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
Implements	Ploughs	2059	2478	2634	2722	2758	2774	2780	2801	2836	2873
	Harrows	2263	2631	2762	2810	2834	2841	2850	2904	2952	2987
	Mamooties and Spades	2487	3291	3524	3717	3758	3802	3841	3910	3981	4092
	Total	6809	8400	8920	9249	9350	9417	9471	9615	9769	9952
Machines	Seed Drills (Harrow)	46	62	69	71	71	80	81	80	80	83
	Seed Drills (Plough)	13	12	12	14	14	14	14	14	15	17
	Rotary Harrows	302	368	399	430	435	445	457	478	514	518
	Water Pumps	28	45	46	62	72	85	97	108	123	142
	Tractors	9	12	10	8	9	8	9	10	10	11
	Total	398	499	536	585	601	632	658	690	742	771
Vehicles	Carts	1433	1580	1638	1670	1674	1684	1689	1720	1740	1759
	Total	1433	1580	1638	1670	1674	1684	1689	1720	1740	1759

Thousand Units
Source: Settlement and Land Records Department, (Central Statistical Organization 2001)

Table 151 Production of Power Threshers, 1995

Enterprise	Numbers	Percent
Dawbon Cooperative	1	0.1%
Mandalay Industry Zone	100	6.1%
Sagaing Industry Zone	160	9.7%
Agricultural Mechanization Department	630	38.3%
Ka Sa La (Ministry of Industry 2)	150	9.1%
Irrigation Department	200	12.2%
Jute Department	137	8.3%
Private	268	16.3%
Total	1646	100.0%

Source: (Kudo 2001, pg. 171)

Table 152 Farm Machinery Produced and Distributed by the State Sector

Type	Pre 1991-92	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	Total
Tractor	4391	238	246	1573	1381	144	385	334	8692
Power Tiller	9168	117	153	1977	7186	2431	4952	10800	36784
Water Pump	44246	1305	2936	2842	5821	2337	3773	1481	64741
Thresher	2159	58	1426	104	472	271	583	823	5896
Seeder	0	0	0	0	0	0	815	557	1372

Source: "Great Agricultural Plan, Agricultural Mechanization Paper" Agricultural Mechanization Department, Cited in (Kudo 2001, pg. 164)

Table 153 Production Capacity for AMD

Farm Machinery Factory	Power Tiller	Reaper	Thresher	Hydro-Tiller	Farm Trailer	Engines	Gear Boxes	Power Tiller Shafts and Gears	Power Tiller Rotary
No 1	2021	500	32	107	R&D				
No 2	1975		10						
No 3						250/month	450/month		
No 4								10000	10000
Kyaukse	10000	5000							
Total	13996	5500	42	107	R&D	250/month	450/month	10000	10000

Source: (Kudo 2001,pg. 166)

Table 154 Urea Factories in Myanmar

Location	Township	Establishment Year	Capacity ('000 t/year)	% Utilization (1993-94
Sale	Chauk	Plant A 1970	70	65
		Plant B 1984	85	65
Kyunchaung	Pakukku	1970	70	57
Kyawzwa	Myede	1985	200	59
Total			425	46

Capacity Utilization Based on 330 days
Source: (U Nyi Nyi 2002)

Table 155 MAS Fertilizer Usage and Yields for Rice

Year	Sown Area	MAS Fertilizer Rates		Nutrient ('000 t)						National Average Yield
	('000 ha)	('000 t)	(kg/ha)	N2	P_2O_5	K_2O	Total	Ratio (N:P:K)	(kg/ha)	(t/ha)
1977-78	5129	106	20.7	39	8	2	49	19:4:1	9.6	1.95
1980-81	5130	205	40.0	68	24	3	95	22:8:1	18.5	2.78
1983-84	4835	332	68.7	105	37	13	155	8:3:1	32.1	3.07
1985-86	4907	325	66.2	105	35	11	151	9:3:1	30.8	3.08
1994-95	5930	298	50.2	104	31	2	137	52:16:1	23.1	3.17
1995-96	6142	305	49.7	95	35	11	141	9:3:1	23.0	2.97
1996-97	5880	262	44.6	79	27	16	122	5:1.5:1	20.7	3.06
1997-98	5789	150	25.9	43	9	1	53	43:9:1	9.2	3.08
1998-99	5763	203	35.2	57	4	2	63	28:2:1	10.9	3.13

Source: MAS Planning Division 1999, cited in (U Nyi Nyi 2002)

Table 156 Utilization of Fertilizers by Type

Year	Urea	Superphosphate	Potash	Compound	Total
1975-75					103,673
1984-85	254,732	93,463	23,252		371,447
1989-90	138,409	38,342	2,908		179,659
1990-91	115,324	31,714	4,527		151,565
1991-92	108,452	15,389	2,086	16,809	142,736
1992-93	144,939	24,029	4,402	5,191	178,561
1993-94	205,482	49,364	6,580		261,426
1994-95	240,571	71,006	3,874		315,451
1995-96	235,397	99,960	17,514	16,618	369,489
1996-97	200,016	63,834	28,917	28,515	321,282
1997-98	145,524	30,916	7,704	4,816	188,960
1998-99	215,483	11,802	5,884	547	233,716
1999-2000	96,757	4,085	5,788	147	106,777

Tonnes
Source: (Central Statistical Organization 2001)

Table 157 MAS Chemical Fertilizer Utilization

Year	Urea	TSP	Potash	Total
1998-99	196265	8472	5259	209996
1999-2000	100996	3745	5974	110715
2000-2001	219101	11796	6269	237166
2001-2002	56000	34272	6086	96358
2002-03	9878	44763	8618	63259

2001-2003 provisional, Metric Tonnes
Source: MAS

Table 158 Urea Supply and Utilization for MAS

Year	Plan	Domestic Production	Imports	Total	Utilization	Difference
1974-1975	80000	93543		93543	83269	10274
1975-1976	100000	102945		102945	92327	10618
1976-1977	110000	131176		131176	93388	37788
1977-1978	130000	115662		115662	108636	7026
1978-1979	176870	125053		125053	156743	-31690
1979-1980	205566	133945	9000	142945	155161	-12216
1980-1981	172236	122224	80700	202924	173165	29759
1981-1982	207000	132419	101050	233469	200296	33173
1982-1983	262218	100559	172200	272759	234025	38734
1983-1984	326478	116532	93837	210369	276828	-66459
1984-1985	305000	150396	86858	237254	254680	-17426
1985-1986	350000	230774	47874	278648	287941	-9293
1986-1987	370000	208824		208824	250089	-41265
1987-1988	320784	197215	2321	199536	200062	-526
1988-1989	274688	156093		156093	145311	10782
1989-1990	249996	139882		139882	139249	633
1990-1991	250000	135355	10000	145355	125549	19806
1991-1992	112200	105083	44125	149208	131321	17887
1992-1993	197300	117400	24100	141500	162634	-21134
1993-1994	486750	173500	162100	335600	235282	100318
1994-1995	500000	145800	55500	201300	241271	-39971
1995-1996	624200	144500	74500	219000	236197	-17197
1996-1997	669900	114800	83500	198300	200616	-2316
1997-1998	709500	121200	148000	269200	153200	116000
1998-1999	529999	121000		121000	200500	-79500
1999-2000	552513	120000	42900	162900	155400	7500

Tonnes
Source: (U Nyi Nyi 2002)

Table 159 Utilization of Chemical Fertilizer by Crops, 2002-2003

Crops		Urea	TSP	Potash	Total
Rice	Wet Season	9434	38239	5369	53042
	Dry Season		3602	2569	6171
	Total	9434	41841	7938	59213
Maize		25	88	27	140
Groundnut		23			23
Sesame		109	80	11	200
Sunflower		24	15		39
Pulses		68	62	40	170
Culinary		5	11		16
Others		190	2666	602	3458
Total		9878	44763	8618	63259

Provisional, Metric Tonnes
Source: MAS

Table 160 Raw Material Needed for 1 Million Bottles of 500cc Bio-Super Foliar Fertilizer

Item	**Unit**	**Amount**
Peanut Cake	Tonnes	50
Urea	Tonnes	410
Potash	Tonnes	73
OrthoPhosphoric Acid	ML	30
Ferrous Sulfate	Tonnes	5
Zinc Sulfate	Tonnes	0.4
Magnesium Sulfate	Tonnes	1
Manganese Sulfate	Tonnes	0.4
Boric Acid	Tonnes	2
Copper Sulfate	Tonnes	0.4
Ammonium Molybdate	Tonnes	0.95

Source: ASR Field Team Interview, 17 September 2003

Table 161 Rhizobium Inoculation Plant, CARI

Crops Inoculated	Area (acres)	(hectares)	Percent
Black Gram	88500	35816	35.4%
Green Gram	55000	22259	22.0%
Pigeon Pea	27000	10927	10.8%
Chickpea	7500	3035.3	3.0%
Groundnut	4500	1821.2	1.8%
Other	67500	27317	27.0%
Total	250000	101175	100.0%

Source: Oilcrop Sector Development Project Formulation Mission, September 2003

Table 162 Fertilizer Rates distributed by MAS for Prioritized Crops, 1999-2000

Crops	Urea		TSP		Potash	
	lb/ac	N, kg/ac	lb/ac	P_2O_5, kg/ac	lb/ac	K_2O, kg/ha
HYV Rice, Monsoon	112	57	56	27.8	28	18.5
LYV Rice, Monsoon	56	28.4				
HYV Rice, Summer	112	56.8	56	27.8		
LYV Rice, Summer	56	28.4				
Pulses	56	28.4	56	27.8		
Groundnut, Irrigated	28	14.2	112	55.6	56	37
Groundnut, Rainfed	28	14.2	56	27.8	28	18.5
Sesame	112	56.8	28	13.9	28	18.5
Sunflower	112	56.8	56	27.8	28	18.5
Hybrid Maize	224	113.6	224	112.2	56	37
Normal Maize	224	113.6	112	55.6		
Wheat	84	42.6	28	13.9		
Sorghum	28	14.2				
Canola	28	14.2				

Urea=46%N, TSP=45% P_2O_5, Potash=60%K_2O
Source: MAS Planning Division, cited in (U Nyi Nyi 2002)

Table 163 Rhizobium Distribution from CARI Inoculation Facility

Division & State	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03
Kachin	0	0	0	1800	0	1020	1600	1500	3119	1500	1000	0
Kayar	1700	3900	800	1450	500	0	50	1050	2000	0	0	1500
Kayin	400	0	1500	0	0	1000	910	1945	2500	389	1500	1200
Chin	0	0	0	0	0	0	0	0	0	0	0	0
Saggaing	30870	26400	19690	15700	19120	14659	2657	50405	50000	30000	5400	57800
Bago	52400	93250	61450	38150	55853	33570	30214	8125	6295	63025	55210	45520
Magwe	49650	59100	31570	13398	9490	5055	3078	15981	26490	49584	63850	50700
Mandalay	86500	46823	31230	13305	32593	8484	16437	19724	13641	19200	11456	18991
Mon	1200	3550	0	3225	3852	3100	900	5500	3000	3000	7000	10000
Rakhaing	0	0	0	2200	10	0	0	3000	10000	20000	30500	10000
Shan	6100	5280	4582	7909	1555	300	2040	31633	690	8210	200	1052
Yangon	342624	56740	72200	21700	19925	14600	20800	15234	1500	15000	5450	3000
Tanintharyi	0	0	0	0	0	0	0	1110	0	0	800	1000
Ayayarwaddy	16300	9945	9912	4725	37900	4728	42306	21302	31200	28700	100020	47000
Total	587744	304988	232934	123562	180798	86516	120992	176509	150435	238608	282386	247763

Source: ASR Field Team Interviews 17 September 2003

Table 164 CARI Estimates of Farm Fertilizer Usage

Usage	Crop	Urea (bags/acre)	Urea (kg/ha)	TSP (bags/acre)	TSP (kg/ha)	Potash (bags/acre)	Potash (kg/ha)	Manure (bullock carts)	Remarks
Farmer	Maize	1	123.6					6	
	Rice	1	123.6	0.5	61.8				
	Sesame	1	123.6						
	Cotton	1	123.6	1	123.6				
	Sesame (early)	0.5	61.8	0-0.25	0-30.9	0.25	30.9		TSP and Potash only sometimes
	Groundnut			0.5	61.8				
CARI Recommendation	Soybean (Shan State)	0.25	30.9	1	123.6	1	123.6		Plus 1 Bag Lime
	Groundnut	0.5	61.8	0.5-1	61.8-123.6	0.5	61.8		
	Sesame	0.5-1	61.8-123.6	0.5	61.8	0.25	30.9		
	Cotton	0.5	61.8			0.75	92.7		

Source: Oilcrop Sector Development Project Formulation Mission, September 2003

Table 165 Fertilizer Use by Crop, 2001

Crop	Area ('000ha)	% Area Fertilized	Rate (kg/ha)			Consumption ('000t)			
			N	P_2O_5	K_2O	N	P_2O_5	K_2O	Total
Cassava	8	0	0	0	0	0	0	0	0
Coconut	32	0	0	0	0	0	0	0	0
Coffee	4	10	45	20	10	0	0	0	0
Fruits	286	20	45	20	10	2.6	0.9	0.4	3.9
Groundnut	530	10	10	5	0	0.5	0.3	0	0.8
Maize	205	30	35	10	0	2.2	4	0	6.2
Rice	6000	60	35	12	4	126	36	2.4	164.4
Rubber	47	0	0	0	0	0	0	0	0
Soybean	102	0	0	0	0	0	0	0	0
Sugarcane	158	50	35	15	10	2.8	0.6	0.1	3.5
Tea	63	20	45	15	0	0.6	0.1	0	0.7
Tobacco	30	30	25	15	15	0.2	0.1	0	0.3
Vegetables	275	35	45	30	25	4.3	2.5	2.1	8.9
Total	7740					139.2	44.5	5	188.7
Overall Consumption Estimate						150	44	6	200

Source: (Food and Agriculture Organization 2002)

Table 166 Fertilizer Usage By Crop and Fertilizer Supply

Crop	1980-81	1985-86	1990-91	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001
Paddy	205330	324972	109098	298488	305109	262480	149922	203094	88489	187213
Wheat	6767	8925	1155	5108	4	-	-	-	-	-
Maize	2890	8987	5150	2859	7	435	166	46	19	-
Millet	147	1714	331	-	-	-	-	-	-	-
Groundnut	9356	15662	2970	-	6000	1810	817	273	64	-
Sesame	608	12925	2753	1031	7300	2419	1313	874	253	-
Oil Palm	120	1105	214	-	794	398	357	88	162	1295
Sunflower	857	9447	2808	862	5300	1849	837	440	92	-
Cotton	5640	8469	1667	913	14751	16077	9324	9792	4266	10136
Jute	4528	6066	7462	2583	7656	7944	5347	3798	4024	3830
Rubber	841	2173	1111	214	1698	2051	886	979	1135	3830
Pulses	1537	5103	9098	612	7002	1895	2639	1521	387	-
Potato	1227	1204	-	-	-	-	-	-	-	-
Tobacco	-	33	267	-	-	-	-	-	-	-
Sugarcane	5163	7115	1358	438	13244	14038	6798	7013	4314	6287
Fruits and Vegetables	35	20	1212	1054	-	290	178	74	36	20
Others	1493	1310	4911	1289	624	9586	10376	4550	3991	13826
Total	246539	415230	151565	315451	369489	321272	188960	232542	107232	226437
Urea Production	133000	281000	133000	147000	143000	117000	123000	131000	139000	160000
Imports of Urea			10000	76000	75000	10000	70000	0	39000	0
Imports of Superphosphate			20000	116000	55000	29000	31000	1000	58000	32000
Imports of Potash			6000	10000	58000	6000	0	0	0	27000
Imports of Ammonium			22000	0	0	0	0	0	0	0
Total Imports			58000	202000	188000	45000	101000	1000	97000	59000
Total Fertilizer Supply	133000	281000	191000	349000	331000	162000	224000	132000	236000	219000
Difference (Usage - Supply)	113539	134230	-39435	-33549	38489	159272	-35040	100542	-128768	7437

Metric Tonnes
Source: (Central Statistical Organization 2001; Asian Development Bank 2002)

Table 167 MAS Prices and Cost of Fertilizers

Item		1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02
Urea	Domestic Sales Price	2160	2160	2160	12000	12000	16000	30000	40000	40000	40000	40000	40000
	Domestic Production Cost	1728	1936	2068	2280	2271	12000	26000	36000	36000	36000	36000	36000
	Domestic Distribution Cost	1520	1763	2004	2130	2142	4000	4000	4000	4000	4000	4000	4000
	Total Production and Distribution Cost	3248	3699	4072	4410	4413	16000	30000	40000	40000	40000	40000	40000
	Implicit Subsidy	1088	1539	1912	-7590	-7587	0	0	0	0	0	0	0
Triple Superphosphate	Domestic Sales Price	3400	5000	5000	8000	8000	12000	20000	44000	70000	70000	70000	70000
	Import Cost	2123	0	1680	1670	1886	1313	1375	45000	64000	66000	66000	66000
	Distribution Cost	1852	0	2127	2301	2300	4000	4000	4000	4000	4000	4000	4000
	Total Import and Distribution Cost	3975	0	3807	3971	4186	5313	5375	49000	68000	70000	70000	70000
	Implicit Subsidy	575	-5000	-1193	-4029	-3814	-6687	-14625	5000	-2000	0	0	0
Muriate of Potash	Domestic Sales Price	1500	4000	4000	4000	4000	7000	7000	33000	33000	33000	68000	68000
	Import Cost	1352	0	1339	0	1753	953	3000	29000	29000	29000	64000	64000
	Distribution Cost	1780	0	2107	0	2292	4032	4000	4000	4000	4000	4000	4000
	Total Import and Distribution Cost	3132	0	3446	0	4045	4985	7000	33000	33000	33000	68000	68000
	Implicit Subsidy	1632	-4000	-554	-4000	45	-2015	0	0	0	0	0	0

Kyat per tonne
Valued at official exchange rate; import cost very low over 1995-1997 due to exchange rate $1=K6
Source: Data provided by MAS, cited in (Asian Development Bank 2002, pg 75)

Table 168 MAS Fertilizer Distribution Prices

Year	Urea	TSP	MOP	Ammonium Phosphate	Compound	Year	Urea	TSP	MOP	Ammonium Phosphate	Compound
1963-1964	800	590	480			1982-1983	360	1244	598		
1964-1965	768	526	480			1983-1984	360	1244	598		
1965-1966	768	526	480			1984-1985	360	1244	598		
1966-1967	600	526	480			1985-1986	360	1244	598		
1967-1968	600	526	480			1986-1987	360	1244	598		
1968-1969	600	526	480			1987-1988	360	1244	598		
1969-1970	550	463	277			1988-1989	2160	1900	1000		
1970-1971	550	463	277			1989-1990	2160	1900	1000		
1971-1972	440	463	277			1990-1991	2160	3400	1500		
1972-1973	360	463	277			1991-1992	2160	5000	4000	8000	
1973-1974	360	1244	598			1992-1993	12000	8000	4000	8000	
1974-1975	360	1244	598			1993-1994	12000	8000	4000		
1975-1976	360	1244	598			1994-1995	12000	8000	4000		
1976-1977	360	1244	598			1995-1996	16000/24000	12000	7000		26000
1977-1978	360	1244	598			1996-1997	30000	20000	7000		26000
1978-1979	360	1244	598			1997-1998	40000	44000	33000		26000
1979-1980	360	1244	598			1998-1999	40000	44000	33000		26000
1980-1981	360	1244	598			1999-2000	40000	44000	33000		26000
1981-1982	360	1244	598			2000-2001	40000	70000	68000		26000

Kyats per Tonne
Source: (U Nyi Nyi 2002)

Table 169 Market Fertilizer Prices, 2003

Fertilizer	Source	Nutrient Content (%)	Wholesale Price Yangon Market				Wholesale Price Mandalay Market			
			March	April	May	June	March	April	May	June
Urea	Carter	46%					11950	10625	11900	11900
	Saudi Arabia	46%				11000	11125	9500	10500	10500
	UAE	46%	10850	12000	11500	11250	12775	12300		12960
	Bangladesh	46%			11425	10488				
	Indonesia	46%								
Potash			4625	4767	4625	4700	4500	4550	5000	5000
TSP	China	46%								
	GTSP	46%	9450	9200	9000	9500	7725	8150	9000	9000
	GSSP		5100	4883	4950	4900				
	Arrow (orange)	18%					5575	5800	6500	6500
	Golden Elephant						7725	8150	9000	9000
Compound	Armo	16:16:8:13					14400	13500	14240	14240
	Armo	16:16:8					13325	13200	12600	12600
	Golden Lion	16:16:8	12800	12800	12800	12800	12800	12800	12800	12800
	Golden Lion	15:7:8	9800	9800	9800	9800	9800	9800	9800	9800
	Golden Lion	N:P_2O_5	8250	8250	8250	8250	9800	9800	9800	9800
	Golden Lion	12:8:10	12800	12800	12800	12800	12800	12800	12800	12800
	Silver Gong	10:5:5:2	7750	7750	7750	8013				
	Silver Gong	20:10:5:2	9900	9900	9900	10425				
	Silver Gong	12:10:5:2	9000	9000	9000	9000				
	Three Chain	25%								
	Five Chain	25%					8000	8250	9000	9000
	Kimila	15:15:15					15090	15140	15140	15140

Kyat/50kg bag
Source: (Market Information Service 2003; 2003)

Table 170 Utilization of Chemical Fertilizer for Different Regions

Region	1975-76	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99 (PA)	1999-2000(Pv)
Delta Region	60828	235371	213767	164121	118207	113236	92321	81156	111698	185138	223152	232308	219177	128453	128347	103615
Ayeyarwady Division	27602	96883	84847	56888	47555	43425	34047	26750	54399	85025	99579	85955	99017	62455	57974	53486
Bago Division	17983	55882	74250	71754	47391	42186	36017	33980	35467	57617	70461	84927	62830	37864	36408	22392
Yangon Division	9879	63385	33691	24554	13104	21896	15820	13305	16030	29851	34913	40735	38558	21399	23825	21676
Mon State	5364	19221	20979	10925	10157	5729	6437	7121	5802	12645	18199	20691	18772	6735	10140	6061
Central Dy Zone Region	44582	128482	110102	61607	43320	48691	43150	40012	46306	50207	63145	99465	78520	43472	57609	59271
Sagaing Division	15940	56495	45544	24436	15832	17378	13283	11757	13435	22045	22121	32368	25076	15629	18460	22815
Mandalay Division	20587	44712	39207	26312	17974	20131	21320	16834	23014	17562	29192	44692	35105	21129	26384	22321
Magway Division	8055	27275	25351	10859	9514	11182	8547	11421	9857	10600	11832	22405	18339	6714	12765	14135
Coastal Region	2566	20546	28634	16026	9749	5205	4546	8308	9084	8415	10491	16101	8312	5033	8072	17625
Tanintharyi Division	987	6469	5302	4494	2602	1827	2038	2362	2815	2426	3049	3686	2908	1643	2066	6965
Rakhine State	1579	14077	23332	11532	7147	3378	2508	5946	6269	5989	7442	12415	5404	3390	6006	10660
Mountainous Region	12310	30709	28679	18461	12766	12527	11548	13260	11473	17666	18663	21615	15263	12003	16021	17866
Kachin State	2622	3696	2401	3620	2551	2142	2394	1461	1486	1513	1552	2435	1674	2100	3812	4928
Kayah State	412	1834	1506	818	889	602	631	1367	1316	1939	1755	1230	983	759	735	792
Kayin State	1361	3272	2498	2169	1385	1303	1702	1691	1768	3785	3161	7088	4736	1337	2530	3938
Chin State	335	1153	1294	579	756	1257	1446	1715	825	75	488	733	313	156	198	629
Shan State	7580	20754	20980	11275	7185	7223	5375	7026	6078	10354	11707	10129	7557	7651	8746	7579
Union	120286	415108	381182	260215	184042	179659	151565	142736	178561	261426	315451	369489	321272	188961	210049	198377

Total (Metric Tonne)
Source: (U Nyi Nyi 2002)

Table 171 Utilization of Urea Fertilizer for Different Regions

	1975-76	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99 (PA)	1999-2000(Pv)
Delta Region	50339	167213	144876	132740	93256	88428	69037	61957	94306	146517	170389	155550	133073	99222	120276	80352
Ayeyarwady Division	24016	68616	57265	46605	37201	34529	25989	22519	47806	68353	76476	65426	63423	48569	53044	38317
Bago Division	13467	40981	50912	57666	36669	31501	25052	22723	29091	44748	51159	54398	34755	29542	34953	19190
Yangon Division	8247	44743	23276	19903	10635	17868	12822	10263	13313	23369	28692	23270	22612	15900	23130	18072
Mon State	4609	12873	13423	8566	8751	4530	5174	6452	4096	10047	14062	12456	12283	5211	9149	4773
Central Dy Zone Region	31252	84462	67440	41589	32767	35909	32075	28088	33981	38469	47385	54859	49795	32429	52544	46606
Sagaing Division	12932	38334	29758	17797	13828	14527	11234	9529	10110	16994	17489	21424	17642	11312	16955	17981
Mandalay Division	12504	27489	21781	16495	12307	12779	15034	10725	15984	13491	20530	20848	20561	16320	25043	16900
Magway Division	5816	18639	15901	7297	6632	8603	5807	7834	7887	7984	9366	12587	11592	4797	10546	11725
Coastal Region	2263	14476	19709	12934	8164	3305	3657	7224	8224	6762	8369	9446	6428	4194	7515	13615
Tanintharyi Division	763	3147	3357	3142	1343	1098	1854	2211	2661	1929	2210	2260	2104	1406	1835	5561
Rakhine State	1500	11329	16352	9792	6821	2207	1803	5013	5563	4833	6159	7186	4324	2788	5680	8054
Mountainous Region	8473	21790	18064	12799	11097	10767	10555	11183	8428	13734	14428	15542	10720	9679	14987	14771
Kachin State	1937	2769	1912	2586	2185	1764	2222	1298	1281	1241	1249	1895	1263	1546	3554	3967
Kayah State	265	1053	1018	626	850	523	631	1000	935	1385	1257	817	694	657	684	658
Kayin State	1323	2512	1759	1514	1288	1134	1545	1513	1497	3040	2039	4633	3597	1028	2383	3195
Chin State	295	1000	1000	382	568	1096	1248	1394	733	63	397	591	218	128	182	525
Shan State	4653	14456	12375	7691	6206	6250	4909	5978	3982	8005	9486	7606	4948	6320	8184	6426
Union	92327	287941	250089	200062	145284	138409	115324	108452	144939	205482	240571	235397	200016	145524	195322	155344

Total (Metric Tonne)
Source: (U Nyi Nyi 2002)

Table 172 Utilization of TSP Fertilizer for Different Regions

	1975-76	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99 (PA)	1999-2000(Pv)
Delta Region	8117	52589	53020	21568	23201	23468	20402	5619	14534	33550	50567	53023	41761	22012	6152	18425
Ayeyarwady Division	2648	20873	21689	7065	9837	8641	6649	3697	6485	14488	22458	13717	20243	10406	4008	11818
Bago Division	3676	11393	17271	10023	9648	9647	10036	1304	5224	10750	18113	20899	10506	7139	1146	2433
Yangon Division	1404	15262	8239	2908	2469	4019	2539		1982	6029	5982	12208	8031	3388	325	3213
Mon State	389	5061	5821	1572	1247	1161	1178	618	843	2283	4014	6199	2981	1079	673	961
Central Dy Zone Region	12608	39616	37884	16960	9795	11703	9686	7009	11287	10785	14847	37245	18810	6884	3474	9442
Sagaing Division	2588	16338	14390	5619	1924	2727	1861	1050	3100	4693	4443	9066	5019	2771	913	3797
Mandalay Division	7949	15495	14793	8352	5093	6414	5231	3658	6542	3759	8066	19625	8906	2958	633	3894
Magway Division	2071	7783	8701	2989	2778	2562	2594	2301	1645	2333	2338	8554	4885	1155	1928	1751
Coastal Region	244	4164	6811	2185	1330	1722	859	1015	860	1554	1935	5192	939	612	369	3108
Tanintharyi Division	171	1814	1301	1061	1025	561	177	151	154	412	680	614	411	112	108	1093
Rakhine State	73	2350	5510	1124	305	1161	682	864	706	1142	1255	4578	528	500	261	2015
Mountainous Region	2986	7211	9177	4730	1326	1449	767	1746	2539	3475	3657	4500	2324	1408	633	2572
Kachin State	58	738	411	748	363	365	164	154	185	233	259	372	211	101	165	769
Kayah State	147	670	438	170	14	50		323	373	487	389	236	117	90	45	117
Kayin State	38	708	646	505	71	73	103	139	255	672	1102	1654	574	267	72	657
Chin State	38	85	147	125	94	122	138	254	63	9	66	120	82	24	12	60
Shan State	2705	5010	7535	3182	784	839	362	876	1663	2074	1841	2118	1340	926	339	969
Union	23955	103580	106892	45443	35652	38342	31714	15389	29220	49364	71006	99960	63834	30916	10628	33547

Total (Metric Tonne)
Source: (U Nyi Nyi 2002)

Table 173 Utilization of Potash Fertilizer for Different Regions

	1975-76	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99 (PA)	1999-2000(Pv)
Delta Region	1439	15569	15871	9813	1750	1340	2882	1130	2858	5071	2196	10376	19111	3802	1895	4813
Ayeyarwady Division	112	7394	5893	3218	517	255	1409	534	108	2184	645	3261	5115	903	910	3351
Bago Division	840	3508	6067	4065	1074	1038	929	545	1152	2119	1189	3745	8380	669	309	744
Yangon Division	228	3380	2176	1743		9	459		735	453	239	1462	3041	1895	359	391
Mon State	259	1287	1735	787	159	38	85	51	863	315	123	1908	2575	335	317	327
Central Dy Zone Region	722	4404	4778	3058	758	1079	1389	556	1038	953	913	4781	7500	3133	1221	2613
Sagaing Division	420	1823	1396	1020	80	124	188	166	225	358	189	1333	1916	1095	476	901
Mandalay Division	134	1728	2633	1465	574	938	1055	323	488	312	596	2613	4082	1580	485	1252
Magway Division	168	853	749	573	104	17	146	67	325	283	128	835	1502	458	260	460
Coastal Region	8	1631	2114	907	255	178	30	69	0	99	187	1370	539	173	178	902
Tanintharyi Division	2	1233	644	291	234	168	7			85	159	812	309	114	119	311
Rakhine State	6	398	1470	616	21	10	23	69		14	28	558	230	59	59	591
Mountainous Region	290	1708	1438	932	343	311	226	331	506	457	578	987	1757	596	387	523
Kachin State	67	189	78	286	3	13	8	9	20	39	44	168	95	163	79	192
Kayah State		111	50	22	25	29		44	8	67	109	130	82	11	6	17
Kayin State		52	93	150	26	96	54	39	16	73	20	416	478	25	75	86
Chin State	1	68	147	72	94	39	60	67	29	3	25	22	13	4	4	44
Shan State	222	1288	1070	402	195	134	104	172	433	275	380	251	1089	393	223	184
Union	2459	23312	24201	14710	3106	2908	4527	2086	4402	6580	3874	17514	28907	7704	3681	8851

Total (Metric Tonne)
Source: (U Nyi Nyi 2002)

Table 174 Utilization of Other Fertilizer for Different Regions

	1975-76	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99 (PA)	1999-2000(Pv)
Delta Region	933	0	0	0	0	0	0	12450	0	0	0	13359	25232	3417	24	25
Ayeyarwady Division	826											3551	10236	2577	12	
Bago Division								9408				5885	9189	514		25
Yangon Division								3042				3795	4874	216	11	
Mon State	107											128	933	110	1	
Central Dy Zone Region	0	0	0	0	0	0	0	4359	0	0	0	2580	2415	1026	370	610
Sagaing Division								1012				545	499	451	116	136
Mandalay Division								2128				1606	1556	271	223	275
Magway Division								1219				429	360	304	31	199
Coastal Region	51	275	0	0	0	0	0	0	0	0	0	93	406	54	10	0
Tanintharyi Division	51	275											84	11	4	
Rakhine State												93	322	43	6	
Mountainous Region	561	0	0	0	0	0	0	0	0	0	0	586	462	320	14	0
Kachin State	560												105	290	14	
Kayah State												47	90	1		
Kayin State												385	87	17		
Chin State	1															
Shan State												154	180	12		
Union	1545	275	0	0	0	0	0	16809	0	0	0	16618	28515	4817	418	635

Total (Metric Tonne)
Source: (U Nyi Nyi 2002)

Table 175 Chemical Fertilizer Supply and Utilization

Year	Supply											
	Urea Production	Imports					Total	Government Plan				
		Urea	TSP	M.O.P	Other	Total		Urea	TSP	M.O.P	Other	Total
1974-75	93543		15000	67		15067	108610	80000	50000	10000	0	140000
1975-76	102945		20000			20000	122945	100000	62160	11509	0	173669
1976-77	131176		30000	4500		34500	165676	110000	62000		11471	183471
1977-78	115662		19000	6200		25200	140862	130000	78933	10311	0	219244
1978-79	125053		38000	2350		40350	165403	176870	46201	7345	0	230416
1979-80	133945	9000	54000	4000		67000	200945	205566	54829	9012	0	269407
1980-81	122224	80700	62850	18000		161550	283774	172236	70129	6255	0	248620
1981-82	132419	101050	106140	24780		231970	364389	207000	73760	7790	0	288550
1982-83	100559	172200	87500	23500		283200	383759	262218	87957	25083	0	375258
1983-84	116532	93837	61500	17000		172337	288869	326478	117286		36010	479774
1984-85	150396	86858	130128	21800		238786	389182	305000	104280	28450	0	437730
1985-86	230774	47874	98461	30000		176335	407109	350000	150000	50288	0	550288
1986-87	208824		95407	18000		113407	322231	370000	160000	51206	0	581206
1987-88	197215	2321	49868	792		52981	250196	320784	140587	50888	0	512259
1988-89	156093		23745			23745	179838	274688	125000	30000	0	429688
1989-90	139882		32900	2500		35400	175282	249996	44124	5897	0	300017
1990-91	135355	10000	42000	5500		57500	192855	250000	35000	3500	0	288500
1991-92	105083	44125				44125	149208	112200	15000	19100	0	146300
1992-93	117400	24100	46700	10900		81700	199100	197300	50000	5000	0	252300
1993-94	173500	162100	31300			193400	366900	486750	191125	30250	0	708125
1994-95	145800	55500	71400			126900	272700	500000	200000	30500	0	730500
1995-96	144500	74500	153000	73200	50000	350700	495200	624200	289400	86400	0	1000000
1996-97	114800	83500	51700			135200	250000	669900	340800	89300	0	1100000
1997-98	121200	148000	30100		1000	179100	300300	709500	385300	105200	0	1200000
1998-99	121000	2000	200		700	2900	123900	529999	265312	72900	43	868254
1999-2000	123200	38900	57600			96500	219700	552513	230966	84775	0	868254
2000-2001	154700		32200	26800	5500	64500	219200	570740	236471	89770	546	897527
2001-2002(PA)	66500	30300	12000		4300	46600	113100	570740			326787	897527

Source: Procurement and Distribution Division, MAS; Ministry of Agriculture and Irrigation and Private Sector (1990/91 to 1994/95)., Report to the Pyithu Hluttaw (1974-75 to 1986-87), Review of the Financial, Economic and Social Conditions (1991-92 to 1997-98), National Planning, Data from state sector, not including private sector from 1979/80 to 2000/01.

Urea = 46% N_2; TSP = 45% P_2O_5; MOP = 60% K_2O; Compound Fertilizer = N_2 16%, P_2O_5 16%, K_2O 8%; Ammonium Phosphate N_2 16%, P_2O_5 20%

Table 176 Chemical Fertilizer Supply and Utilization (Cont'd)

Year	Utilization							
	Fertilizer				Chemical Composition			
	Urea	TSP	M.O.P	Total	N_2	P_2O_5	K_2O	Total
1974-75	83269	17518	2886	103673	38304	7883	1732	47919
1975-76	92327	23955	4004	120286	42470	10780	2402	55652
1976-77	93388	14937	4642	112967	42958	6722	2785	52465
1977-78	108636	23727	3480	135843	49973	10677	2088	62738
1978-79	156743	29252	6226	192221	72102	13163	3736	89001
1979-80	155161	49947	3864	208972	71374	22476	2318	96168
1980-81	173165	67720	5654	246539	79656	30474	3392	113522
1981-82	200296	64202	8140	272638	92136	28891	4884	125911
1982-83	234025	85169	17797	336991	107652	38326	10678	156656
1983-84	276828	104659	25169	406656	127341	47097	15101	189539
1984-85	254680	93391	23376	371447	117153	42026	14026	173205
1985-86	287941	103580	23587	415108	132453	46611	14152	193216
1986-87	250089	106892	24201	381182	115041	48101	14521	177663
1987-88	200062	45443	14710	260215	92029	20449	8826	121304
1988-89	145311	35652	3106	184069	66843	16043	1864	84750
1989-90	139249	38342	3908	181499	64055	17254	2345	83654
1990-91	125549	31714	4527	161790	57753	14271	2716	74740
1991-92	131321	32198	2086	165605	63097	10287	1252	74636
1992-93	162634	29220	4402	196256	75642	11851	2641	90134
1993-94	235282	49364	6580	291226	108230	22214	3948	134392
1994-95	241271	71006	3874	316151	110985	31953	2324	145262
1995-96	236197	116575	17514	370289	111311	47641	11838	170790
1996-97	200616	92349	28907	321872	96838	33288	19625	149751
1997-98	153200	35800	7700	196700	71240	14718	5004	90962
1998-99	266900	11200	5900	284000	122870	4866	3588	131324
1999-2000	114400	5300	7100	126800	52624	2385	4260	59269
2000-2001	239700	16700	9300	265700	110262	7515	5580	123357
2001-2002(PA)	64900	30200	8100	103200	29854	13590	4860	48304

Source: Procurement and Distribution Division, MAS; Ministry of Agriculture and Irrigation and Private Sector (1990/91 to 1994/95)., Report to the Pyithu Hluttaw (1974-75 to 1986-87), Review of the Financial, Economic and Social Conditions (1991-92 to 1997-98), National Planning, Data from state sector, not including private sector from 1979/80 to 2000/01.

Urea = 46% N_2; TSP = 45% P_2O_5; MOP = 60% K_2O; Compound Fertilizer = N_2 16%, P_2O_5 16%, K_2O 8%; Ammonium Phosphate N_2 16%, P_2O_5 20%

Table 177 Chemical Fertilizer Supply and Utilization (Cont'd)

Year	MAS Utilization of Chemical Fertilizer by Crops (tonnes)						Fertilizer Prices (Kyat/mt)				
	Paddy	Oil seed	Pulses	Industrial	Other	Total	Urea	TSP	MOP	Ammonium Phosphate	Compound Fertilizer
1974-75	74492	5938	1151	13426	8666	103673	360	1244	598		
1975-76	87950	7114	1446	15249	8527	120286	360	1244	598		
1976-77	92146	4124	769	12857	3071	112967	360	1244	598		
1977-78	106412	6231	757	18353	4090	135843	360	1244	598		
1978-79	161618	7419	690	17752	4742	192221	360	1244	598		
1979-80	173904	10667	1509	17862	5030	208972	360	1244	598		
1980-81	205330	10941	1537	16172	12559	246539	360	1244	598		
1981-82	227167	15665	1846	13705	14255	272638	360	1244	598		
1982-83	282066	17302	2944	20334	14345	336991	360	1244	598		
1983-84	332203	30042	5123	23423	15865	406656	360	1244	598		
1984-85	304687	25004	3155	21686	16915	371447	360	1244	598		
1985-86	324972	39139	5103	23823	22071	415108	360	1244	598		
1986-87	304317	33821	4213	20309	18522	381182	360	1244	598		
1987-88	202815	24908	2662	17359	12471	260215	360	1244	598		
1988-89	153565	10509	1545	13484	4939	184042	2160	1900	1000		
1989-90	131888	13005	11418	14128	9220	179659	2160	1900	1000		
1990-91	109098	8745	9103	11598	13021	151565	2160	3400	1500		
1991-92	99802	10086	5531	10389	16928	142736	2160	5000	4000	8000	
1992-93	149745	4943	2080	8094	13699	178561	12000	8000	4000	8000	
1993-94	248423	1338	486	3502	7677	261426	12000	8000	4000		
1994-95	298488	1893	612	4148	10310	315451	12000	8000	4000		
1995-96	305109	19394	7002	37349	635	369489	16000	12000	7000		26000
1996-97	262480	6476	1895	40111	10310	321272	30000	20000	7000		26000
1997-98	149922	2967	2639	22355	11077	188960	40000	44000	33000		26000
1998-99	203094	1587	1521	21758	4596	232556	40000	44000	33000		26000
1999-2000	101568	1626	1779	14830	6799	126602	40000	44000	33000		26000
2000-2001	215176	4340	5210	27404	13365	265495	40000	70000	68000		26000
2001-2002(PA)	68419	2383	2547	24322	5246	102917	40000	70000	68000		26000

Source: Procurement and Distribution Division, MAS; Ministry of Agriculture and Irrigation and Private Sector (1990/91 to 1994/95)., Report to the Pyithu Hluttaw (1974-75 to 1986-87), Review of the Financial, Economic and Social Conditions (1991-92 to 1997-98), National Planning, Data from state sector, not including private sector from 1979/80 to 2000/01.

Urea = 46% N_2; TSP = 45% P_2O_5; MOP = 60% K_2O; Compound Fertilizer = N_2 16%, P_2O_5 16%, K_2O 8%; Ammonium Phosphate N_2 16%, P_2O_5 20%

Table 178 Chemical Fertilizer Supply and Utilization (Cont'd)

Year	Use of Chemical Fertilizers in Rice Production										
	Paddy Sown Acre	Use of Chemical Fertilizer (MT)	Equivalent Nutrient Content (tonnes)				Average Use of Nutrient (lb/acre)	Yield per acre (bsk/acre)	Fertilizer		
			N2	P2O5	K2O	Total			Urea	TSP	MOP
1974-75	12792644	74492	27677	5494	0	33171	5.7175088	34.09	60167	12209	1399
1975-76	12857779	87950	30018	8908	0	38926	6.6754787	35.51	65256	19796	1908
1976-77	12547450	92146	35083	5326	0	40409	7.1011915	36.8	76267	11835	1527
1977-78	12690318	106412	39403	8145	0	47548	8.2616795	37.73	85659	18099	2133
1978-79	12956552	161618	60447	11179	0	71626	12.189611	40.75	131407	24842	4270
1979-80	12419552	173904	59726	18380	0	78106	13.867145	45.62	129840	40845	2846
1980-81	12667696	205330	67665	24326	0	91991	16.012395	53.8	147098	54057	4160
1981-82	12610189	227167	77802	22847	0	100649	17.599343	57.06	169134	50772	5826
1982-83	12064122	282066	91282	30703	0	121985	22.295607	61.1	198440	68228	15163
1983-84	11938008	332203	105267	37052	0	142319	26.286914	59.48	228842	82337	20790
1984-85	12150612	304687	97242	32961	0	130203	23.628243	60.09	211396	73246	19929
1985-86	12114404	324972	105359	34612	0	139971	25.476784	59.58	229041	76916	19015
1986-87	11967844	304317	96004	34017	0	130021	23.955552	58.72	208704	75594	20019
1987-88	11530946	202815	74699	12798	0	87497	16.731575	59	162390	28439	11986
1988-89	11807160	153565	56752	13307	0	70059	13.083595	56.4	123373	29572	620
1989-90	12056995	131888	47061	12937	0	59998	10.972518	56.57	102307	28748	833
1990-91	12219754	109098	39858	9405	0	49263	8.8892882	56.92	86647	20899	1552
1991-92	11934809	99802	38005	5929	0	43934	8.1169686	55.97	77025	6027	665
1992-93	12684202	149745	1296	0	1691	2987	0.519255	56.91	2818		2818
1993-94	14020649	248423	89549	21477	0	111026	17.460842	59.24	194672	47727	6024
1994-95	14643406	298488	104347	30790	0	135137	20.348892	61.45	226841	68423	3224
1995-96	15165965	305109	94513	35594	10704	140811	20.4727	57.72	199690	73195	15626
1996-97	14518493	262480	79158	26593	16141	121892	18.51238	59.43	162707	49512	23307
1997-98	14294069	149922	55758	11991	908	68657	10.591014	59.73	120048	25456	1066
1998-99	14229839	203094	87232	3776	3040	94048	14.573309	60.68	170484	8392	3076
1999-2000	15527665	101568	42826	1437	3164	47427	6.7348526	62.85			
2000-2001	15713214	215176	91555	4684	3441	99680	13.98787	62.85	170484	8392	3076
2001-2002(PA)	15940567	82556	22213	13015	3206	38434	5.3164339	66.29	131314	31455	5864

Source: Procurement and Distribution Division, MAS; Ministry of Agriculture and Irrigation and Private Sector (1990/91 to 1994/95)., Report to the Pyithu Hluttaw (1974-75 to 1986-87), Review of the Financial, Economic and Social Conditions (1991-92 to 1997-98), National Planning, Data from state sector, not including private sector from 1979/80 to 2000/01.
Urea = 46% N_2; TSP = 45% P_2O_5; MOP = 60% K_2O; Compound Fertilizer = N_2 16%, P_2O_5 16%, K_2O 8%; Ammonium Phosphate N_2 16%, P_2O_5 20%

Table 179 Fertilizer Arriving in Yangon Port

Vessel Name	Date of Arrival	Urea	TSP	Fertilizer
Lester Lynk	3/04/1999	10000		
Ocean Prayer Ceynowa	21/04/1999	10000		
Rosta	1/05/1999	9900		
Leamthong Glory	9/05/1999	11435		
Faarabi	9/05/1999	10000		
Santa Suna	17/05/1999	10000		
Emprees	29/06/1999	5000		
Valea Asre	14/07/1999	9500		
Sittwe	16/07/1999	9400		
Chin Shwe Haw	31/07/1999	2850		
Bago	15/08/1999			9100
An Kang Jaing	25/08/1999	11000		
Dawe	6/09/1999			10305
Ocean Prayer Ceynowa	8/09/1999			5020
Huai Yang	9/09/1999	11500		
Pathein	10/09/1999	7200		
An Kang Jaing	10/09/1999		10000	
Chalothorunaree	11/09/1999	5000		
Ava	13/09/1999	7800		
Novazs	18/09/1999	4950		
Al Pine	28/09/1999	10000		
Luc Nam	11/10/1999	12155		
Hun Jaing	11/10/1999	10000		
Yasmina	15/10/1999	10000		
Jubilant	21/10/1999	4700		
Bago	23/10/1999	10000		
Hebei-2	1/11/1999	12500		
Fu Qing Shan	2/11/1999	10000		
Feng Kang Shan	3/11/1999	10000		
Bravo	6/11/1999	11000		
Fu Xin Shan	10/11/1999	13125		
Fajar Pacific	11/11/1999	5000		
Faarabi	13/11/1999	12500		
Yanglin	19/11/1999		9795	
Femas Proton	23/11/1999	4518		
Dumronglarp	18/12/1999	5500		
Ad Jud	21/12/1999	12000		
Hanuman	23/12/1999	13125		
Yong Shun	26/12/1999	10373		
Keng Tung	26/12/1999	10375		
Pacific Star	17/01/2000		4000	
Ping Quan	21/01/2000		10000	
UAE AGI	12/02/2000	12600		
Mykola Movckan	3/03/2000	10000		
Cien Kiewcz	18/03/2000	12500		
Sagaing	25/03/2000			10267
Yasmina	6/04/2000	10460		
Yong Shun	25/04/2000	12600		
Diamond Deer	1/05/2000	7868		
Sea New Ace	6/05/2000			5100
Jing Yang	7/06/2000		9500	
Tang Quan	15/06/2000		10060	
Dacheng	14/06/2000	11791		
Otsuranus	16/06/2000			6078
Hebei-3	19/06/2000	12600		
Yasmina	5/07/2000	10460		
Mongia	31/07/2000			2800
Yang Feng	19/07/2000			11128
AGI	2/08/2000			12000
Chang Ping	4/08/2000		13784	
Ping Quan	13/08/2000		10030	
Hebei-3	27/08/2000		10030	
Puaspirapion	4/09/2000		11899	
Chi Yun	27/09/2000	6594		
Sea New Ace	18/10/2000	5500		
Total		435379	99098	71798
Total FY99-00		357506	33795	34692
Total FY00-01		77873	65303	37106

Tonnes
Source: (U Nyi Nyi 2002)

Table 180 Imports of Fertilizer and Tractors from China - 105 Gate, Muse

Item	Price (US$/t)	Tonnes	Value (US$)
Urea Fertilizer	125	20,027	2,503,329
Phosphate Fertilizer (P2O5)	40	31,749	1,269,942
TSP Fertilizer, Seed	85	3,495	297,077
Compound Fertilizer, Seed P2O5, N, K2O	64.7	7,743	500,949
Calcium Superphosphate Fertilizer, Granular	40	98	3,920
Potash Fertilizer	90	126	11,340
Compound Fertilizer, (NPK 24%, Ca+Mg+S 17%Cu)	150	4	600
Compound Fertilizer, (NPK 30%, Zn, B, Fe, Mg, S, Cl, Mn >20%)	150	0.6	90
TSP Fertilizer, Powder	60	1	60
Total Fertilizer	73	63,242	4,587,307
Two Wheel Tractor Only, W/O Engine	185	782	144,670
Two Wheel Tractor, W/O Engine, Plough, Harrow, Rotary, Tillers Attached)	250	209	52,250
Total Machinery	199	991	196,920

Imports April-August 2003
Source: ASR Field Team Interview, 14 September 2003

Table 181 Constraints Affecting Agroindustry in Myanmar

Constraints/Factors	Enterprise Type		Level of Marketing Chain Affected by Constraints				
	Government	Private	Raw Material Inputs and Supply	Factory Operations	Factory Maintenance and Investment	Factory Output	Marketing of Products
Budgetary Support from Government	X			X	X		
Bureaucratic Inertia in Decision Making and Price Setting	XX		X	X	X	X	X
Capital Constraints	X	XX	X	X	X		
Cost of Electricity		X	X	X		X	
Cost of Fuel	X	XX	X	X		X	
Credit Constraints		XX	X	X	X		
Expensive Spare Parts	XX	XX	X		X		
Export Restrictions	X	XX					X
Government Policies For Domestic Market	X	XX	X				X
Government Policies For Export Market	XX	XX					X
High Cost of Production	XX	X				X	X
Import of Spare Parts, Raw Materials	XX	XX	X				
Import Restrictions		XX	X				
Inappropriate Crop Choice for Processing Investment	X						X
Inefficient Management	XX		X	X	X	X	X
Investment Lags	X				X		
Lack of Quality Control	XX	X					X
Limited Domestic Market Information	XX	X	X				X
Limited Export Market Information	X	XX					X
Low Demand For Products	XX						X
Low Levels of Production	XX	X				X	X
Low Prices Received	X	X					X
Low Quality Inputs	XX	X	X			X	
Low Quality Output	XX	X				X	X
Low Recovery Rates	X	XX		X		X	
Obsolete Machinery	X	XX		X	X	X	
Operations Running Below Capacity	XX	X		X		X	
Reliability of Electricity	X	XX	X	X		X	
Shortage of Raw Materials	XX	X	X				
Shortage of Spare Parts	XX	X	X		X		
Technology Low	X	XX		X		X	

Table 182 Problems Faced By Foodstuff Industries - Survey Results

Area	Specific Problem	Percentage of Respondents	Remarks
Infrastructure	Electricity	74.68%	Detailed Study Required, Other Infrastructure also needs to be studied
	Shortage of Fuel or High Cost	47.74%	
	Transportation Problem	10.32%	
Procurement of Raw Materials	Difficulty Due to Price Changes	80.65%	Both Local and Foreign Raw Material Procurement Difficulty
	Irregular Supply	14.84%	
	Bad Quality	29.35%	
Foreign Currency	Lack of foreign exchange leads to a difficulty in purchase of raw materials, machinery and spares	Majority	Modernization is difficult and have to depend on importers
Supportive Government Policies and Regulations	Stability of Policy	7.30%	Financial, Tax and Import/Export Policies and Regulations. Financial Supports. Favorable support policies and regulations to create conditions for growth.
	Raw Materials Supply	6.80%	
	Financial Supports	46.94%	
	Government Technical Assistance	5.30%	
Technologies and Machinery	Technology	16.13%	Lack of Access to modern technology, need modern machinery and equipment. Government has policy to supply machinery on hire purchase. Technology transfer activities should be increased.
	Machinery	16.45%	
Skilled Labor	Lack of Skilled Workers with Good Work Attitudes	1.13%	Mostly micro-scale enterprises do not require qualified workers. Only some medium scale ones need them. Other labor problems like job hopping.
Management including marketing and productivity	Entrepreneurs and Graduates	29.60%	Management by experience only. Management training including marketing and productivity courses required.
	High School Graduates	16.90%	
Research and development and innovations	Old Machines	33.00%	Percentage of respondents using machines of various types. There is no R&D as agro-industries are mainly cottage industries using labor intensive processes. There is no R&D and no linkage with government research organizations including universities
	Standard Machines	43.60%	
	Modern Machines	61.55%	

Total Number of Respondents = 620
Source: (Myanmar-Japan Cooperation Program 2002, pp 128-129)

Table 183 Planned Electricity Generation Projects

Name of Project	Location	Installed Capacity (MW)			Annual Energy (GWh)	Status	Commission Year
		Number of Units	Capacity	Total			
Paunglaung Hydropower Project (Underground Power Station)	Mandalay Division	4	70	280	911	Diversion Tunnels by Kajima and Newjec. Implementation signed with YMEC, China on (6-10-98 and 11-11-98). Drilling Intake, Surge Chamber, Spiral, P/S and S/S approach Tunnels.	2003
Mone Hydropower Project	Magwe Division	3	25	75	330	Implementation Contract signed with CITIC, China on 20-11-98. Design completed. Implementation started from September 2001	2004
Thapanzeik Hydropower Project	Sagaing Division	3	10	30	117	Implementation Contract signed with CITIC, China on 20-11-98. Installing Machines and Equipment	2002
Yeywa Hydropower Project	Mandalay Division	4	195	780	3550	Detailed Design Contract signed with COLENCO, Switzerland on 3-5-2001. Construction of infrastructure works	2006
Tigyit Coal-Fired Power Station Project (1st Stage)	Shan State	2	60	120	800	Design, Supply and Supervision Contract with CHMC on 27-8-2001. Construction of Infrastructure Works	2003
Kun Hydropower Project	Bago Division	3	20	60	190	Feasibility study and detailed design contract with NEPS, Myanmar on 26-2-2001. Construction of infrastructure works	2005
Yenwe Hydropower Project	Bago Division	3	25	75	123	Under feasibility study and design by Kansai Electric Power Co. Japan with MEPE. (In-house consultant for MEPE).	2006
Thaukyegat Hydropower Project	Bago Division	2	50	100	780	Preliminary study by TEPSCO, Japan	2006
Khabaung Hydropower Project	Bago Division	1	15	15	120	Under feasibility study and design by Kansai Electric Power Co. Japan with MEPE. (In-house consultant for MEPE).	2004
Pyu Hydropower Project	Bago Division	1	65	65	260	Under feasibility study and design by Kansai Electric Power Co. Japan with MEPE. (In-house consultant for MEPE).	2005
Shweli Hydropower Project	Shan State	1	200	200	1600	Preliminary survey completed by YMEC, China jointly with MEPE in 1999	2004
Bawgata Hydropower Project	Bago Division	1	160	160	500	Under feasibility study and design by Kansai Electric Power Co. Japan with MEPE. (In-house consultant for MEPE).	2006
Shwe Kyin Hydropower Project	Bago Division	1	75	75	400	Under feasibility study and design by Kansai Electric Power Co. Japan with MEPE. (In-house consultant for MEPE).	2006
Kayaingtawn Hydropower Project	Shan State	1	20	20	130	Pre feasibility study by MEPE	2006
South Nawin Hydropower Project	Bago Division	1	2	2	10	Dam construction completed. Procurement of turbine generator and equipment are under way	2003
Pathi Hydropower Project	Bago Division	1	2	2	10	Dam construction completed. Procurement of turbine generator and equipment are under way	2003
Total				2059	9831		

Source: (Central Bank of Myanmar 2002, pp. 13-14)

Table 184 Electric Power Production and Utilization

	Year	1980-1981	1985-1986	1990-1991	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001
Installed Electric Power (Megawatts)	Thermal	74	80	92	61	61	96	96	96	216	216
	Diesel	81	79	97	78	81	86	82	65	65	66
	Hydro	169	226	258	299	317	327	328	340	360	360
	Gas	177	300	357	399	523	523	530	530	530	530
	Total	501	685	804	837	982	1032	1036	1031	1171	1172
Generated Electric Power (Million Kwh)	Thermal	79.1	55.01	28.11	79.01	62.49	59.32	212.53	224.84	798.50	912.00
	Diesel	52.98	64.50	73.89	41.84	43.21	40.11	47.79	43.63	44.15	43.83
	Hydro	720.19	1003.48	1248.45	1658.95	1595.46	1621.72	1747.45	948.47	758.86	919.40
	Gas	375.55	996.38	1271.38	1852.04	2061.17	2409.16	2542.69	2922.50	3186.80	3145.20
	Total	1227.82	2119.37	2621.83	3631.84	3762.33	4130.31	4550.46	4139.44	4788.31	5020.43
	Unit Loss	345.25	630.86	934.28	1374.57	1437.21	1598.43	1735.52	1283.13	1314.97	1225.32
	% Unit Loss	28.1%	29.8%	35.6%	37.8%	38.2%	38.7%	38.1%	31.0%	27.5%	24.4%
	Departmental Use	29.09	28.98	33.57	59.26	62.75	98.08	138.86	139.92	106.86	80.00
	Net Production	853.48	1459.53	1653.98	2198.01	2262.37	2433.8	2676.08	2716.39	3366.48	3715.11
Cost of Production	(Million Kyats)	172.532	385.195	812.892	1357.693	1771.341	2003.952	2757.986	5355	20869	20609
Unit Cost	Kyats/Kwh	0.2022	0.2639	0.4915	0.6177	0.7830	0.8234	1.0306	1.9713	6.1992	5.5473
Sales of Electric Power (Million Kwh)	General Purpose	242.29	408.66	628.91	982.36	972.29	1089.24	1206.46	1132.33	1327.13	1464.50
	Industrial	457.10	882.34	787.50	862.90	875.67	875.65	914.02	956.06	1342.61	1482.70
	Bulk	122.23	128.48	214.03	302.35	340.21	392.51	472.90	537.26	590.95	652.00
	Other	31.86	40.05	23.54	50.4	74.2	76.4	82.7	90.74	105.79	115.91
Revenue (Million Kyat)	General Purpose	104.38	175.48	328.52	1129.84	1670.57	1836.29	2056.17	2100.16	8017.73	8844.75
	Industrial	64.85	160.51	372.54	639.81	843.69	875.24	946.44	1269.66	8125.15	9155.71
	Bulk	33.97	43.30	98.17	175.49	235.96	288.34	434.68	604.66	3286.42	3629.66
	Other	11.65	18.16	22.96	55.90	77.08	86.46	92.70	110.29	314.10	346.07
	Total	214.85	397.45	822.19	2001.04	2827.3	3086.33	3529.99	4084.77	19743.4	21976.19

General Purpose = General Purpose and Domestic Power, Industrial Power = Industrial and Small Power, Bulk = Commercial Power, Other = Temporary and Street Lighting
Electric Loss = Units Generated - Consumption by Station Auxiliaries - Units Sold
Source: Myanma Electric Power Enterprise (Central Statistical Organization 2001)

Table 185 Functions of the State in Economic Development

Functions	**Addressing Market Failure**			**Improving Equity**
Minimal Functions	**Providing Pure Public Goods** • Defense • Law and Order • Property Rights • Macroeconomic Management • Public Health			**Protecting the Poor** • Antipoverty Programmes • Disaster Relief
Intermediate Functions	**Addressing Externalities** • Basic Education • Environmental Protection	**Regulating Monopoly** • Utility Regulation • Antitrust Policy	**Overcoming Imperfect Information** • Insurance (health, life, pensions) • Financial Regulation • Consumer Protection	**Providing Social Insurance** • Redistributive Pensions • Family Allowances • Unemployment Insurance
Activist Functions	**Coordinating Private Activity** • Fostering Markets • Clustering Initiatives			**Redistribution** • Asset Redistribution

Source: (World Bank 1998)

Table 186 Current Cash Budget of State Economic Enterprises

Year	Item	State Economic Enterprises						
		Agriculture and Forestry			Livestock Breeding and Fisheries			GRAND TOTAL, Government of Myanmar
		Agricultural Enterprises	Myanma Timber Enterprise	Total	Myanma Fisheries Enterprise	Livestock, Foodstuff and Milk Products Enterprise	Total	
1980-81	Receipts	333.3	877.5	1210.8	238.4	25.8	264.2	17946.2
	Expenditure	748.1	771.8	1519.9	262.2	36.9	299.1	18121.6
	Surplus	-414.8	105.7	-309.1	-23.8	-11.1	-34.9	-175.4
1985-86	Receipts	384.2	1080.2	1464.4	359.5	154.8	514.3	22335.0
	Expenditure	1179.6	878.7	2058.3	389.6	191.7	581.3	22503.3
	Surplus	-795.4	201.5	-593.9	-30.1	-36.9	-67.0	-168.3
1990-91	Receipts	518.3	1363.1	1881.4	357.0	237.6	594.6	31327.4
	Expenditure	1238.6	1594.1	2832.7	307.7	259.7	567.4	32219.1
	Surplus	-720.3	-231.0	-951.3	49.3	-22.1	27.2	-891.7
1994-95	Receipts	13021.8	2147.8	15169.6	85.5	708.5	794.0	72399.8
	Expenditure	13860.5	2727.5	16588.0	125.9	776.1	902.0	80977.5
	Surplus	-838.7	-579.7	-1418.4	-40.4	-67.6	-108.0	-8577.7
1995-96	Receipts	15594.1	2783.7	18377.8		807.5	807.5	87185.1
	Expenditure	18037.5	3577.9	21615.4		927.0	927.0	91624.6
	Surplus	-2443.4	-794.2	-3237.6	0.0	-119.5	-119.5	-4439.5
1996-97	Receipts	19111.7	2866.2	21977.9		931.8	931.8	108555.0
	Expenditure	24197.4	4925.3	29122.7		824.5	824.5	119936.5
	Surplus	-5085.7	-2059.1	-7144.8	0.0	107.3	107.3	-11381.5
1997-98	Receipts	15304.2	3884.8	19189.0		822.0	822.0	184921.2
	Expenditure	26834.2	6281.2	33115.4		921.8	921.8	214639.7
	Surplus	-11530.0	-2396.4	-13926.4	0.0	-99.8	-99.8	-29718.5
1998-99	Receipts	18252.1	3603.4	21855.5		863.7	863.7	242155.5
	Expenditure	33096.6	8789.1	41885.7		890.3	890.3	309587.1
	Surplus	-14844.5	-5185.7	-20030.2	0.0	-26.6	-26.6	-67431.6
1999-2000	Receipts	34851.3	4835.4	39686.7		1212.9	1212.9	315141.7
	Expenditure	46512.1	10883.1	57395.2		1235.7	1235.7	365695.2
	Surplus	-11660.8	-6047.7	-17708.5	0.0	-22.8	-22.8	-50553.5
1994-2000	Receipts	116135.2	20121.3	136256.5	85.5	5346.4	5431.9	1010358.3
	Expenditure	162538.3	37184.1	199722.4	125.9	5575.4	5701.3	1182460.6
	Surplus	-46403.1	-17062.8	-63465.9	-40.4	-229.0	-269.4	-172102.3

Million Kyats

Source: (Central Statistical Organization 2001)

11. Figures

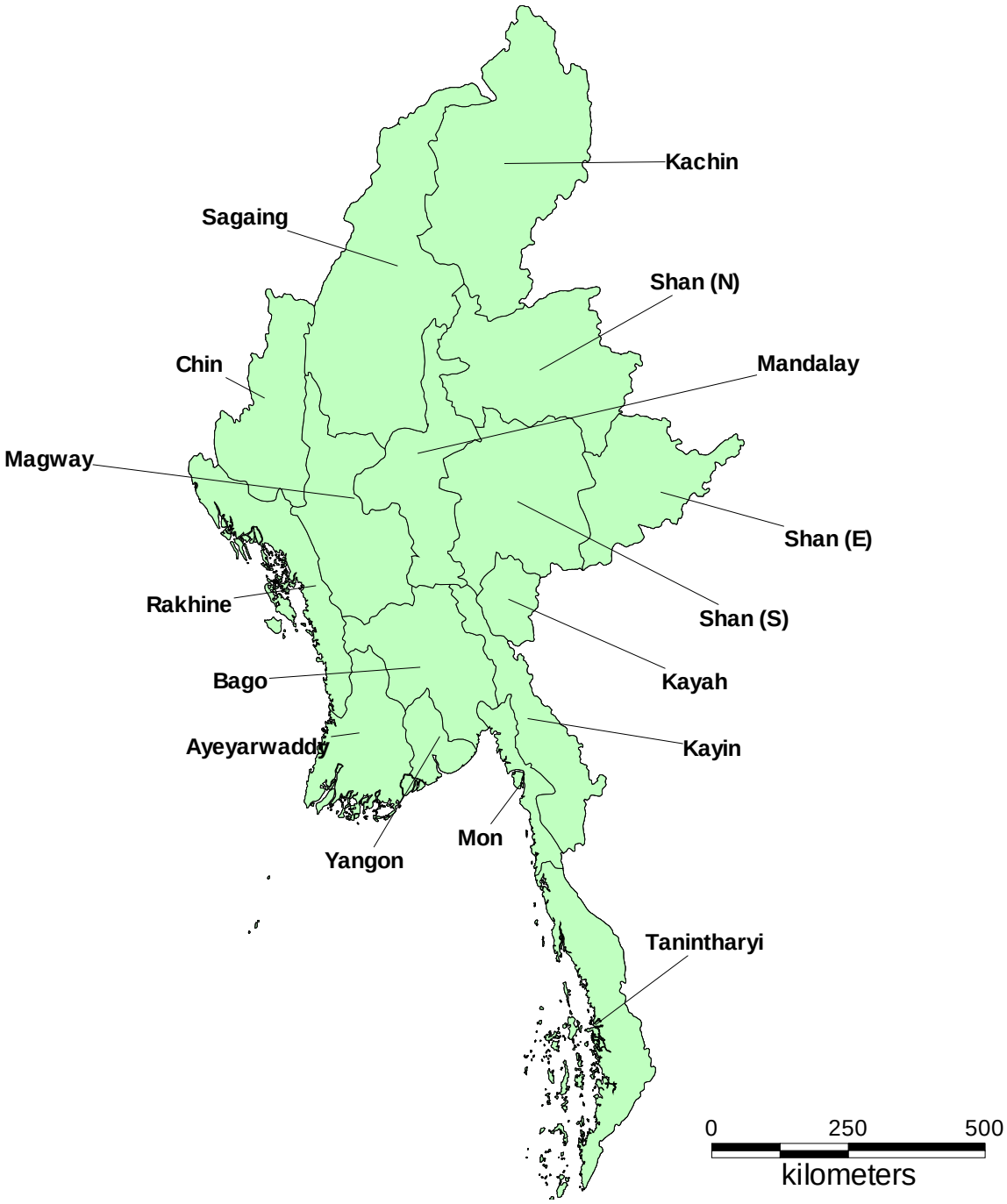
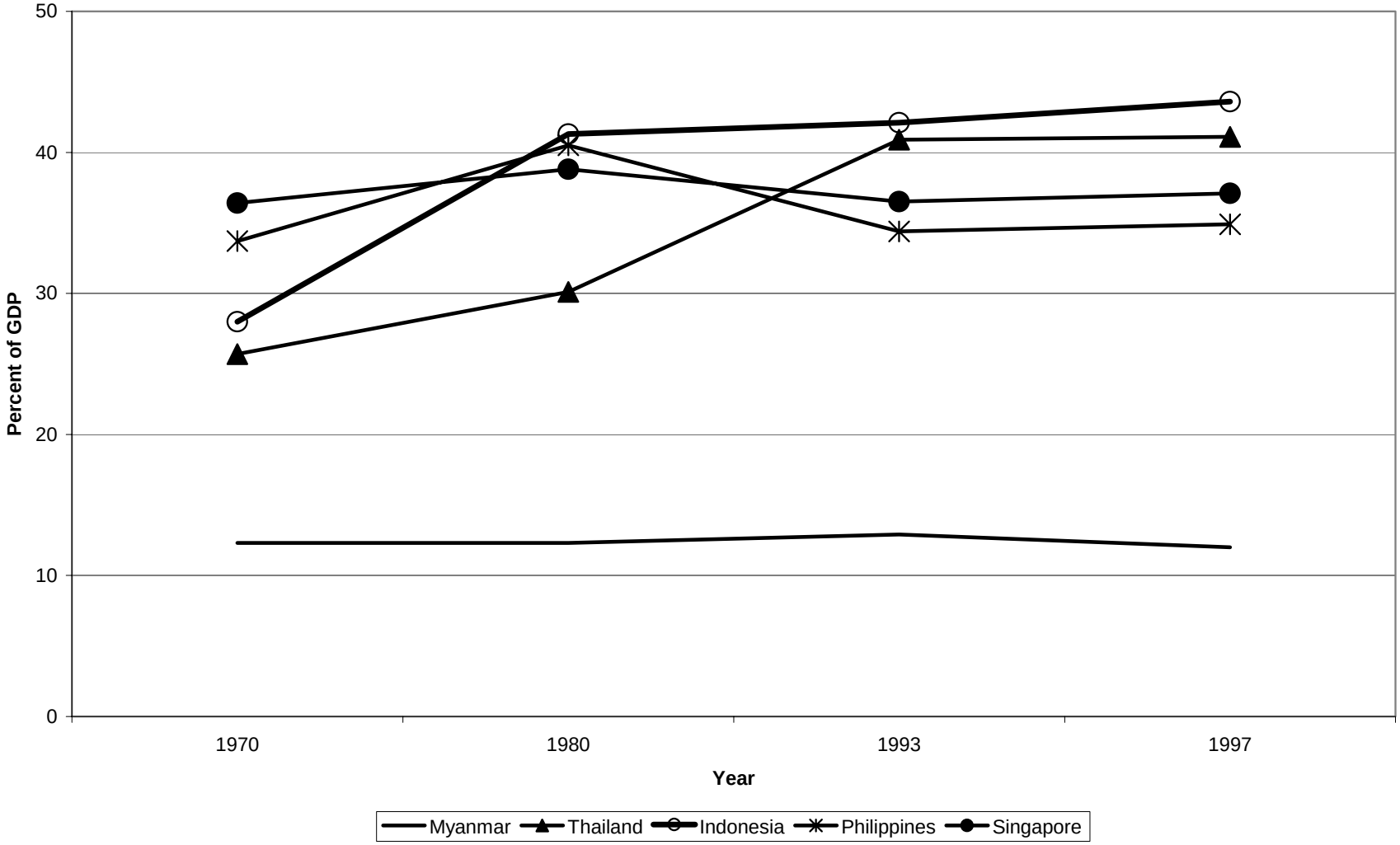
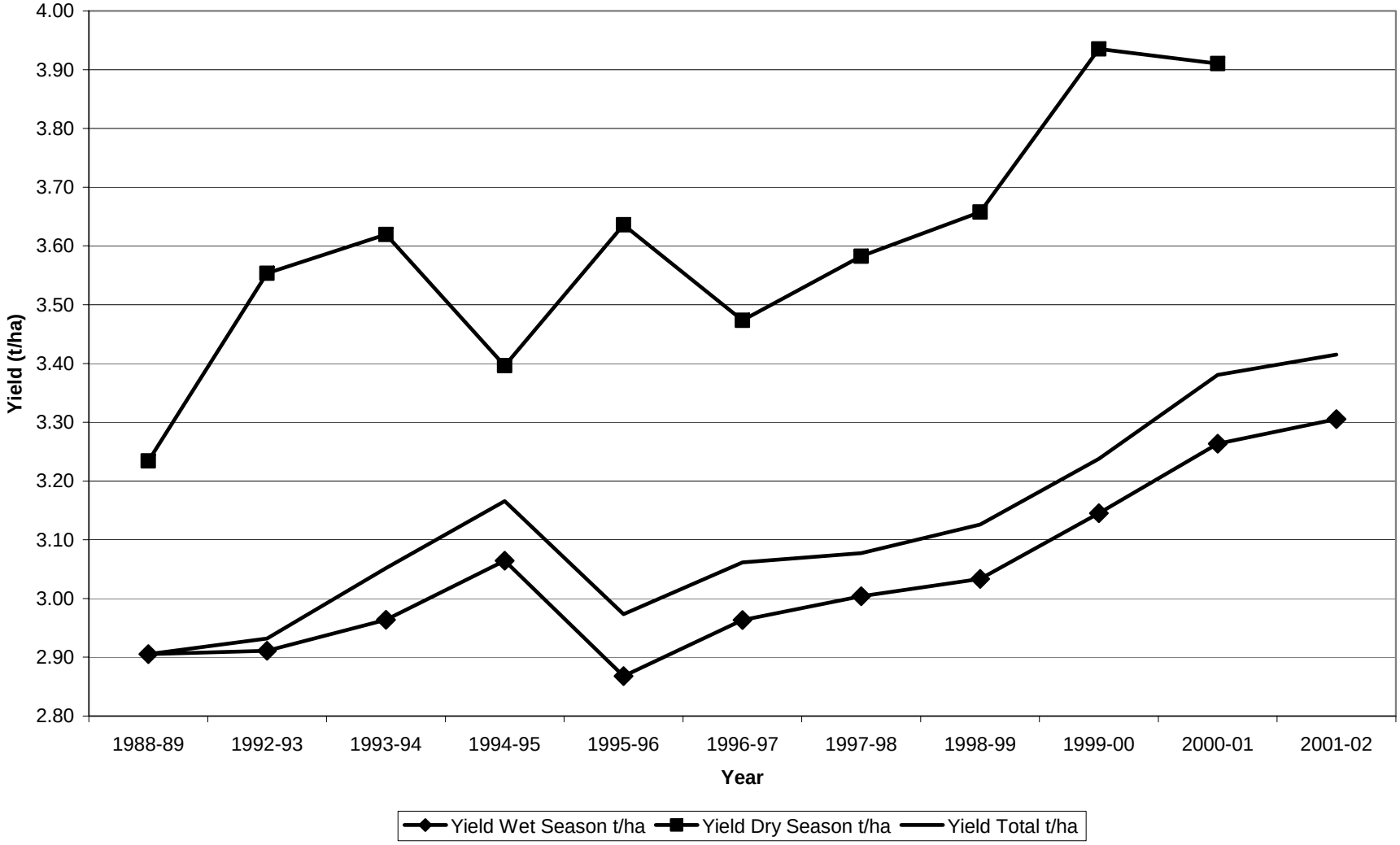


Figure 1 States and Divisions of Myanmar



Source:(Asian Development Bank 1994; 1997; 1998)

Figure 2 Level of Industrialization in South East Asia, 1970-1997



Source: (Central Statistical Organization 2001)

Figure 3 Rice Yields in Myanmar, 1988-2002

Figure 4 Rice Prices in Mandalay Market

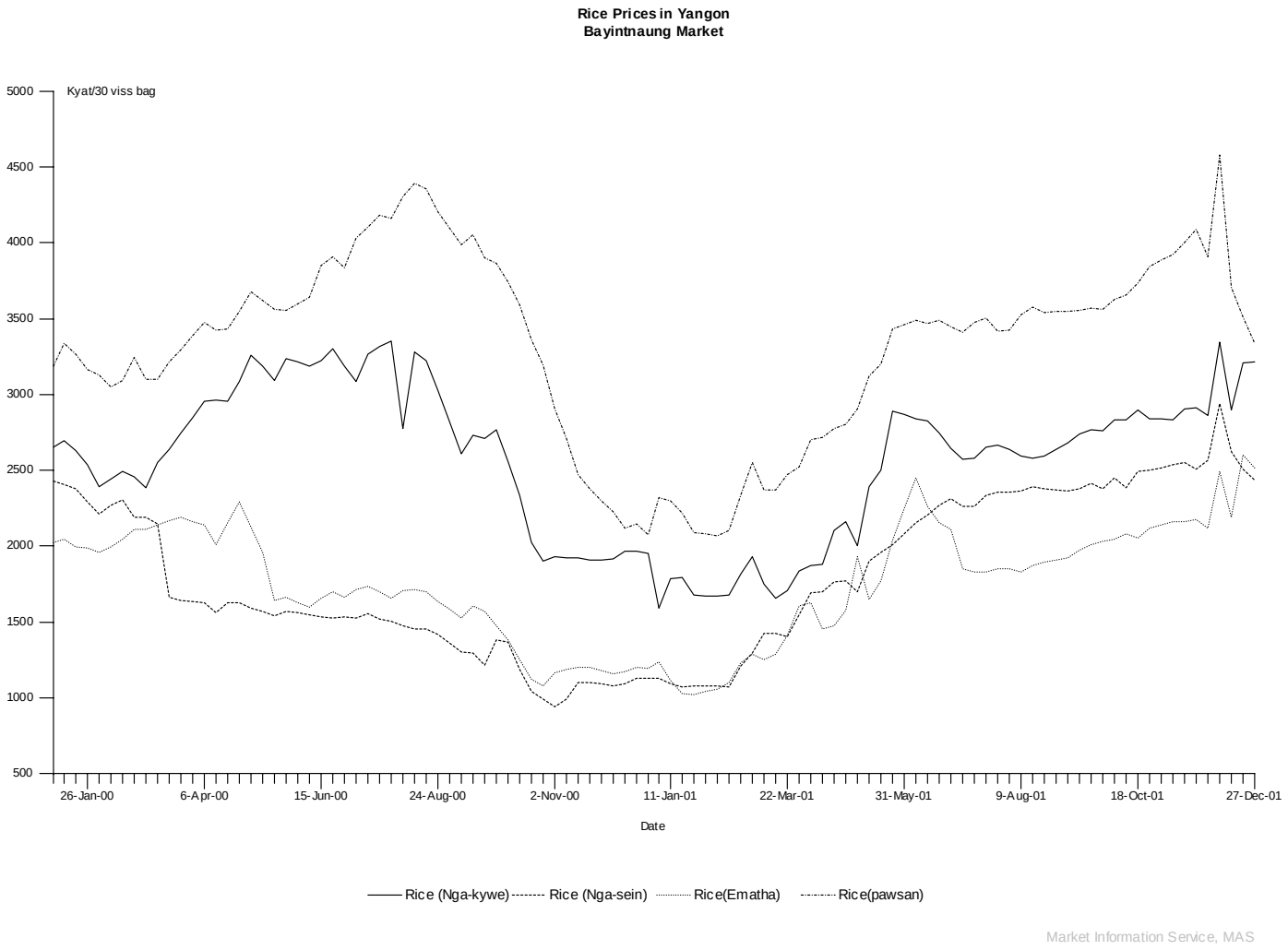


Figure 5 Rice Prices in Yangon Market

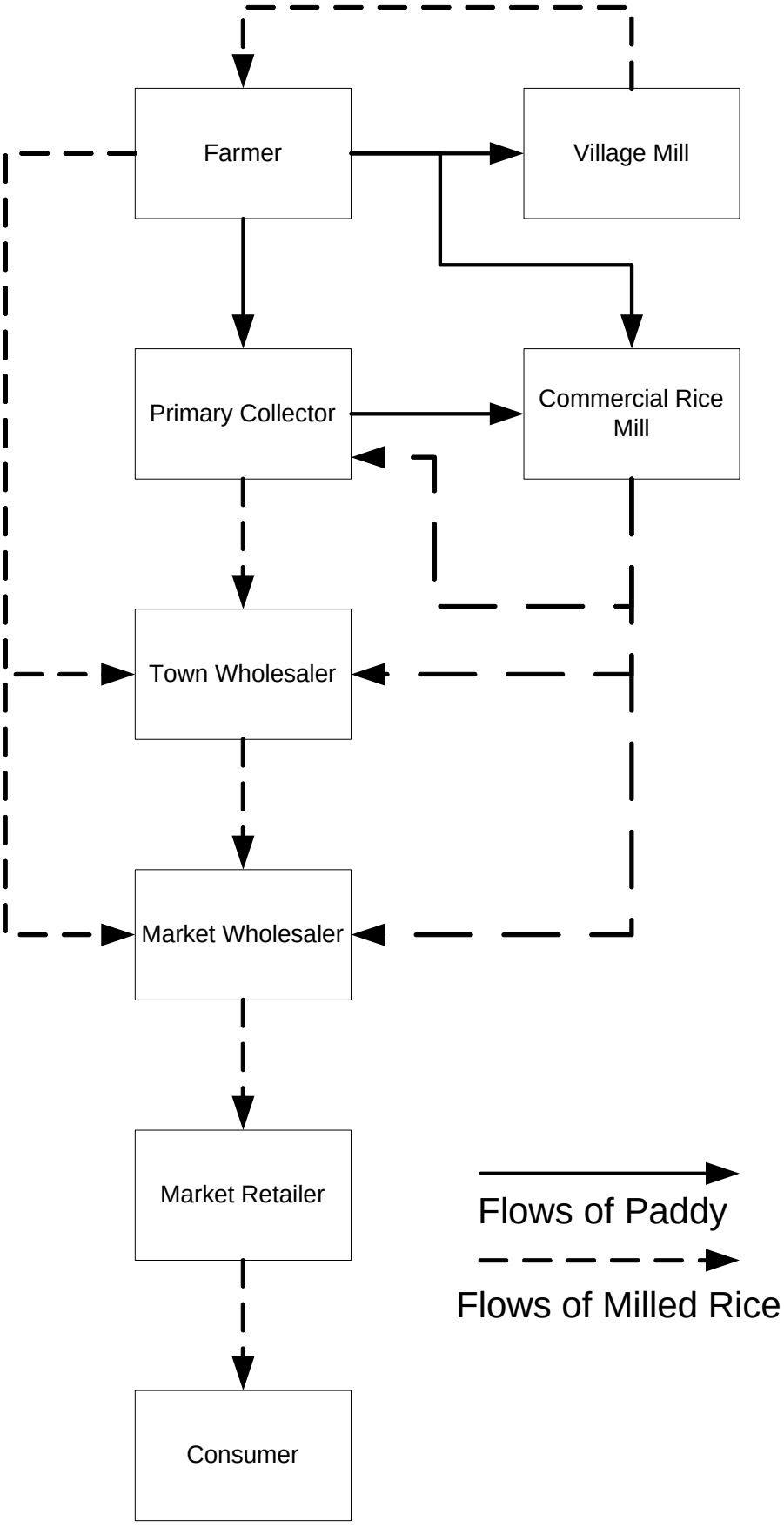
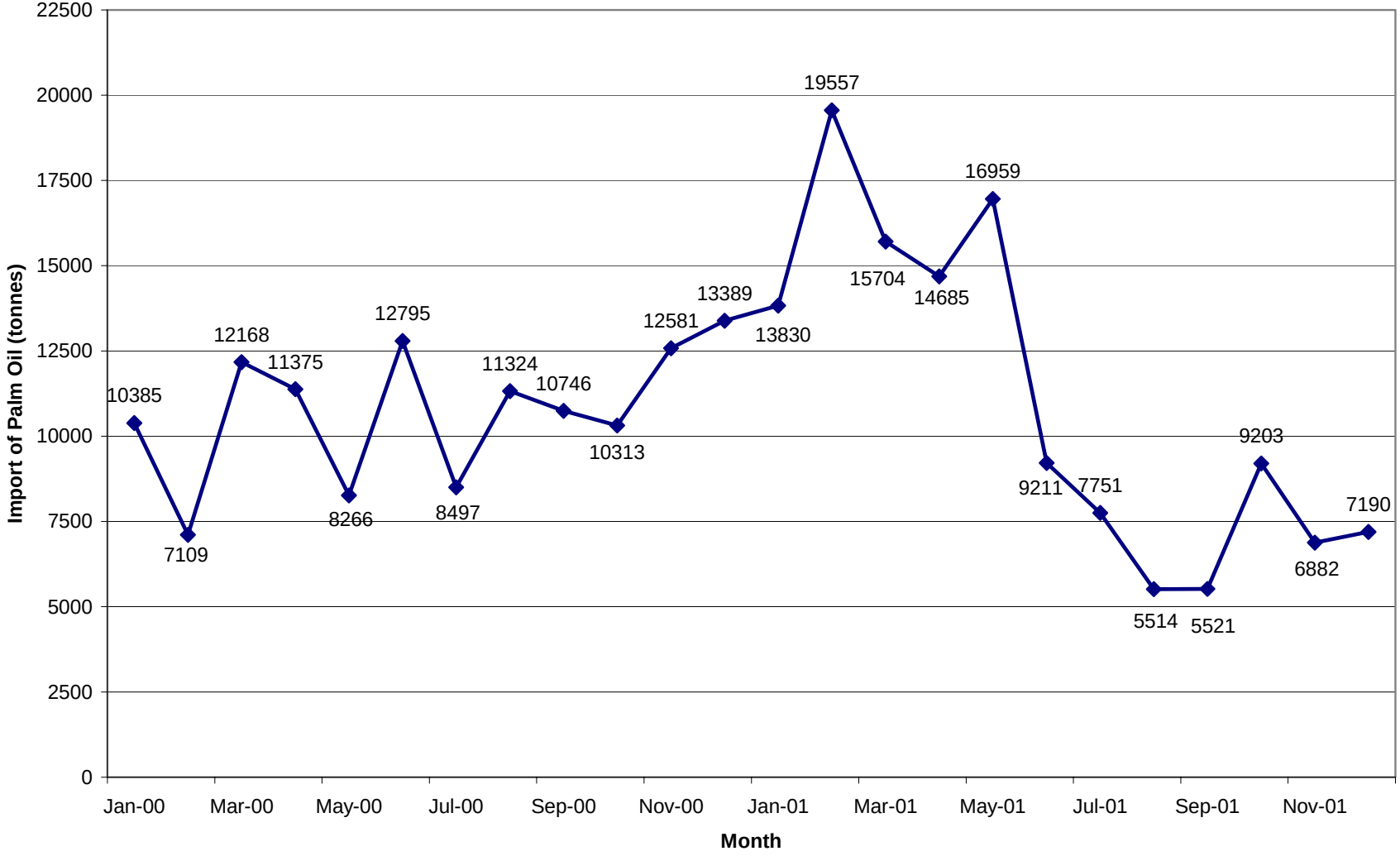


Figure 6 Rice Marketing Chain



Source: (Myanmar-Japan Cooperation Program 2002, pp. 119-120)

Figure 7 Import Volumes of Palm Oil, 2000-2001

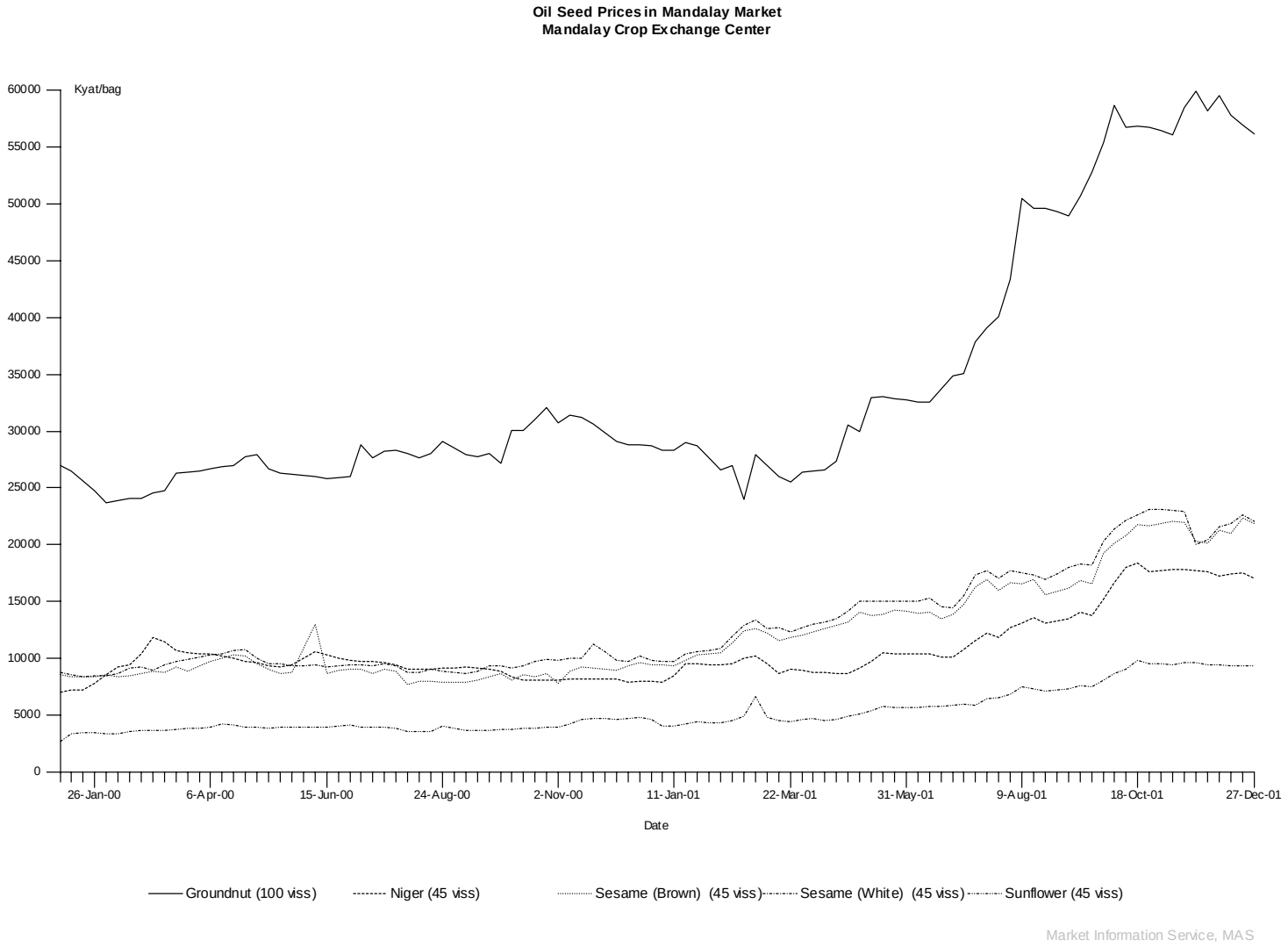


Figure 8 Oil Seed Prices in Mandalay Market

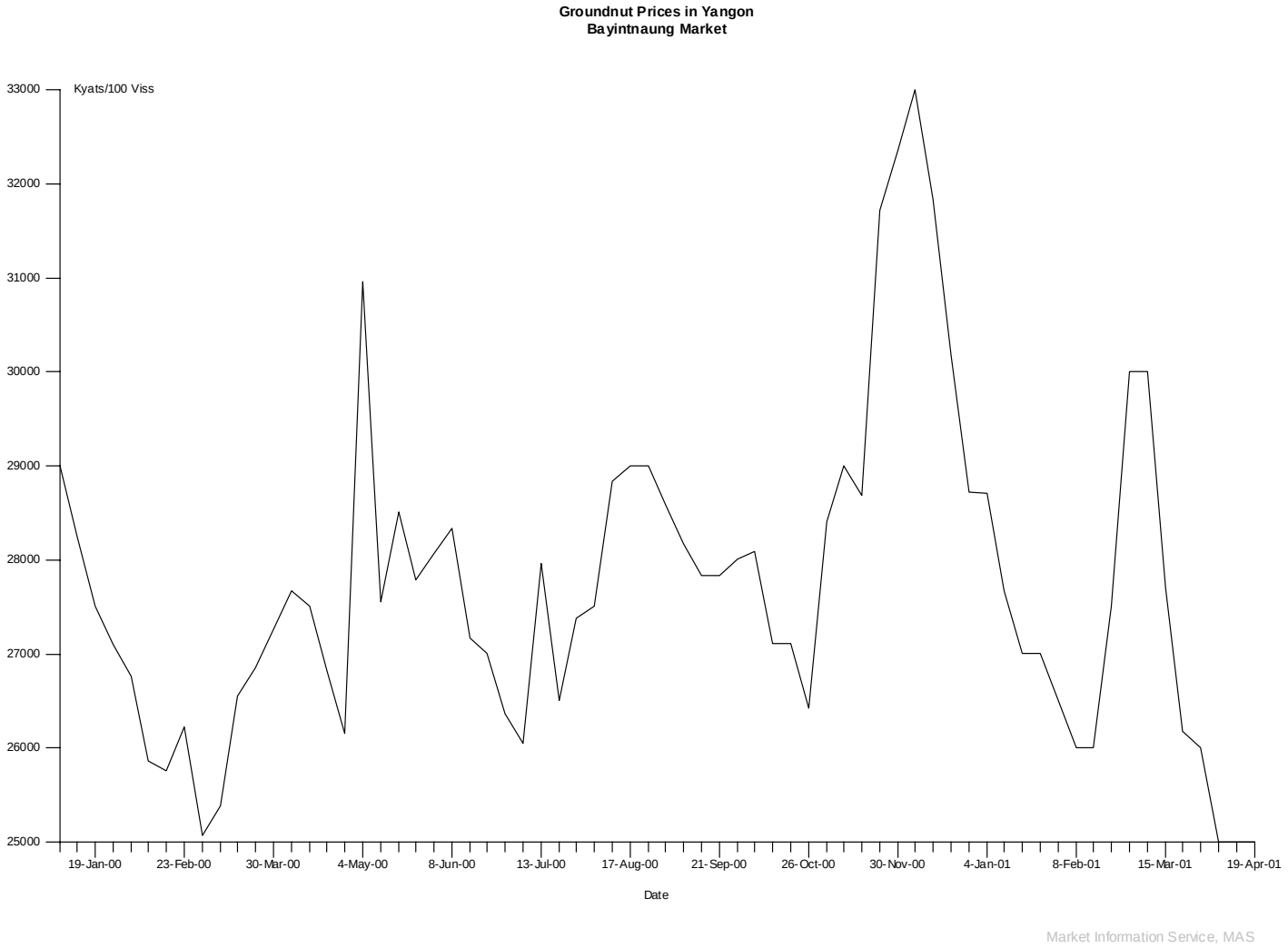


Figure 9 Groundnut Prices in Yangon Market

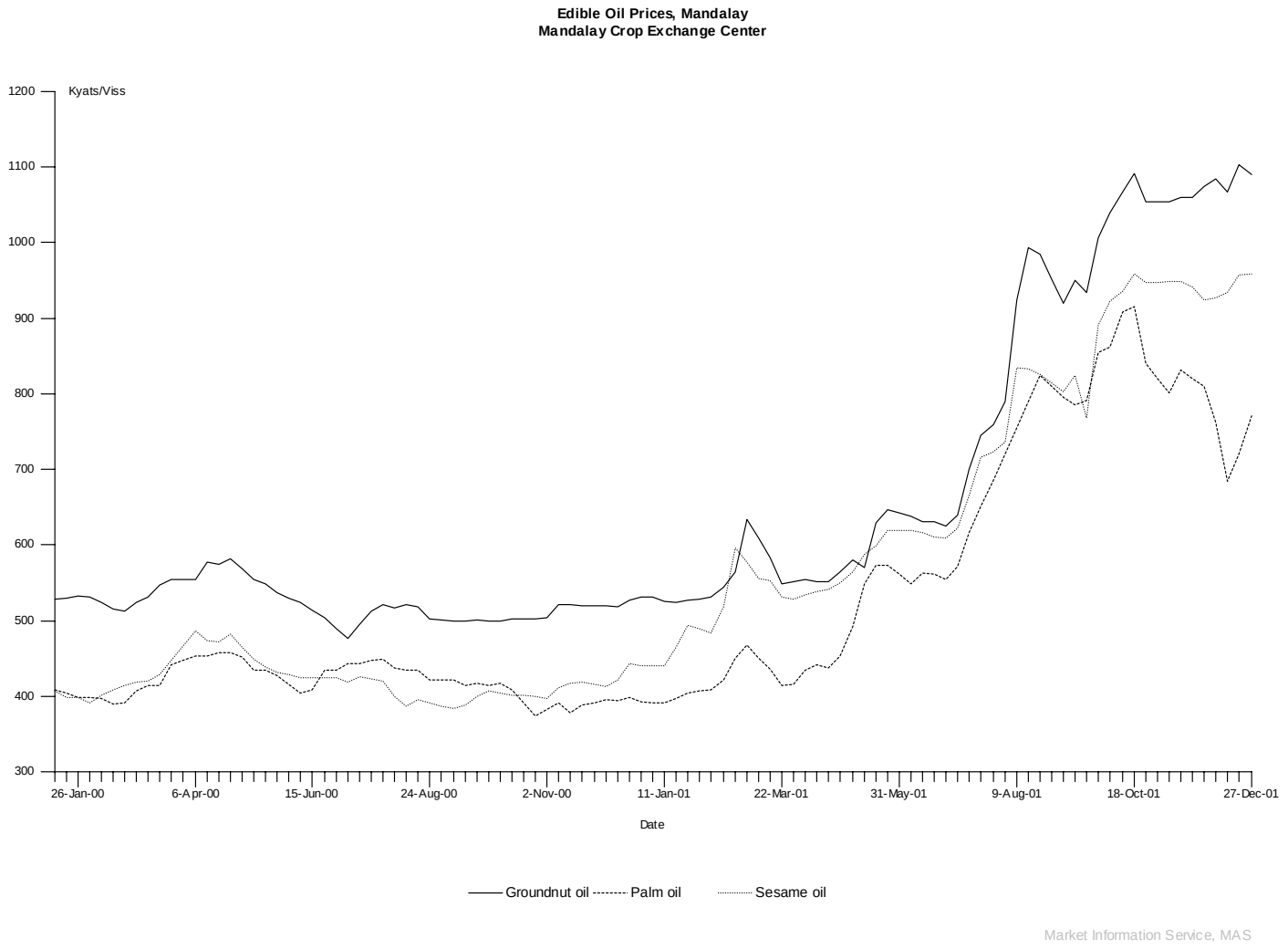


Figure 10 Edible Oil Prices in Mandalay Market

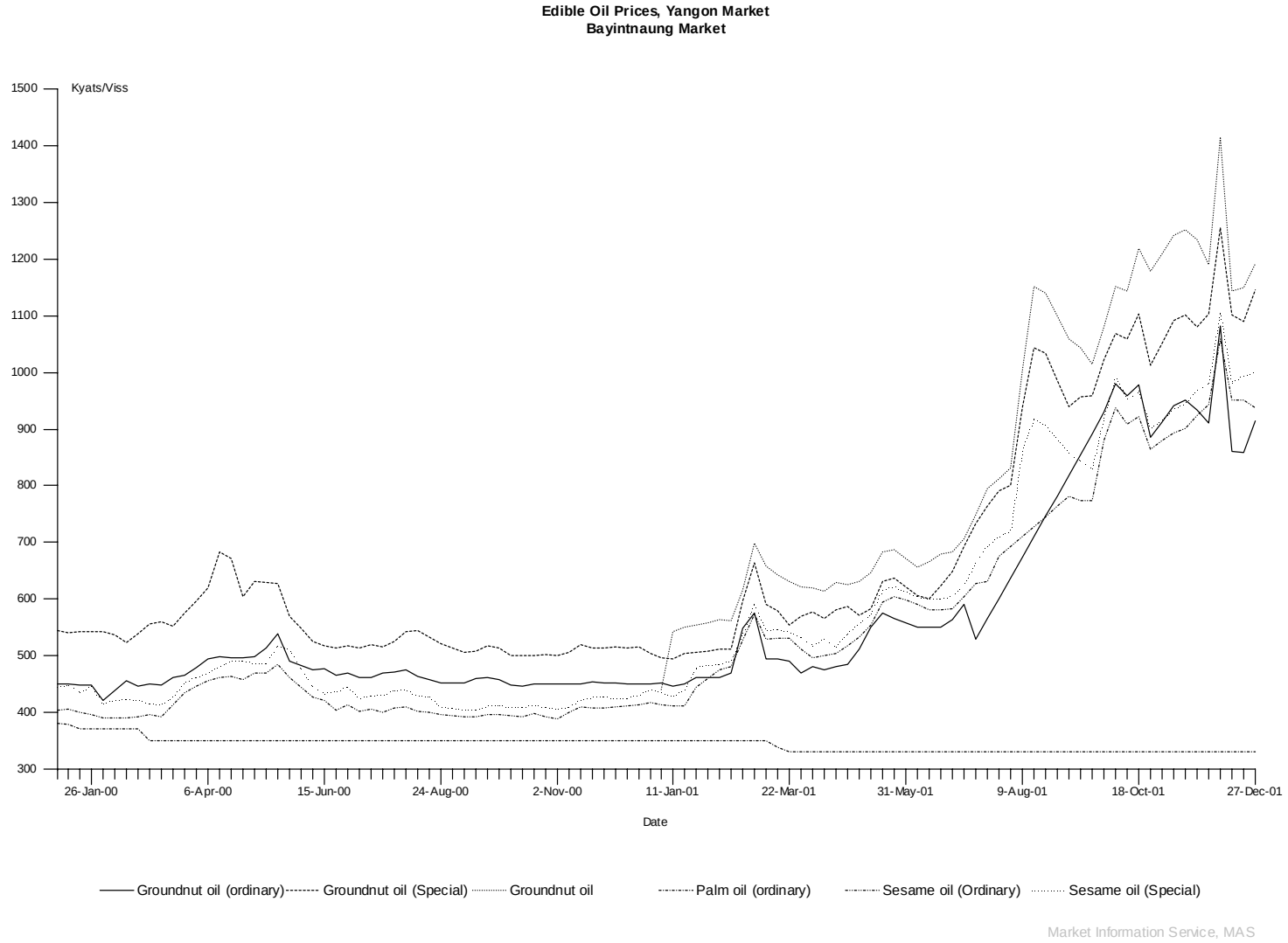
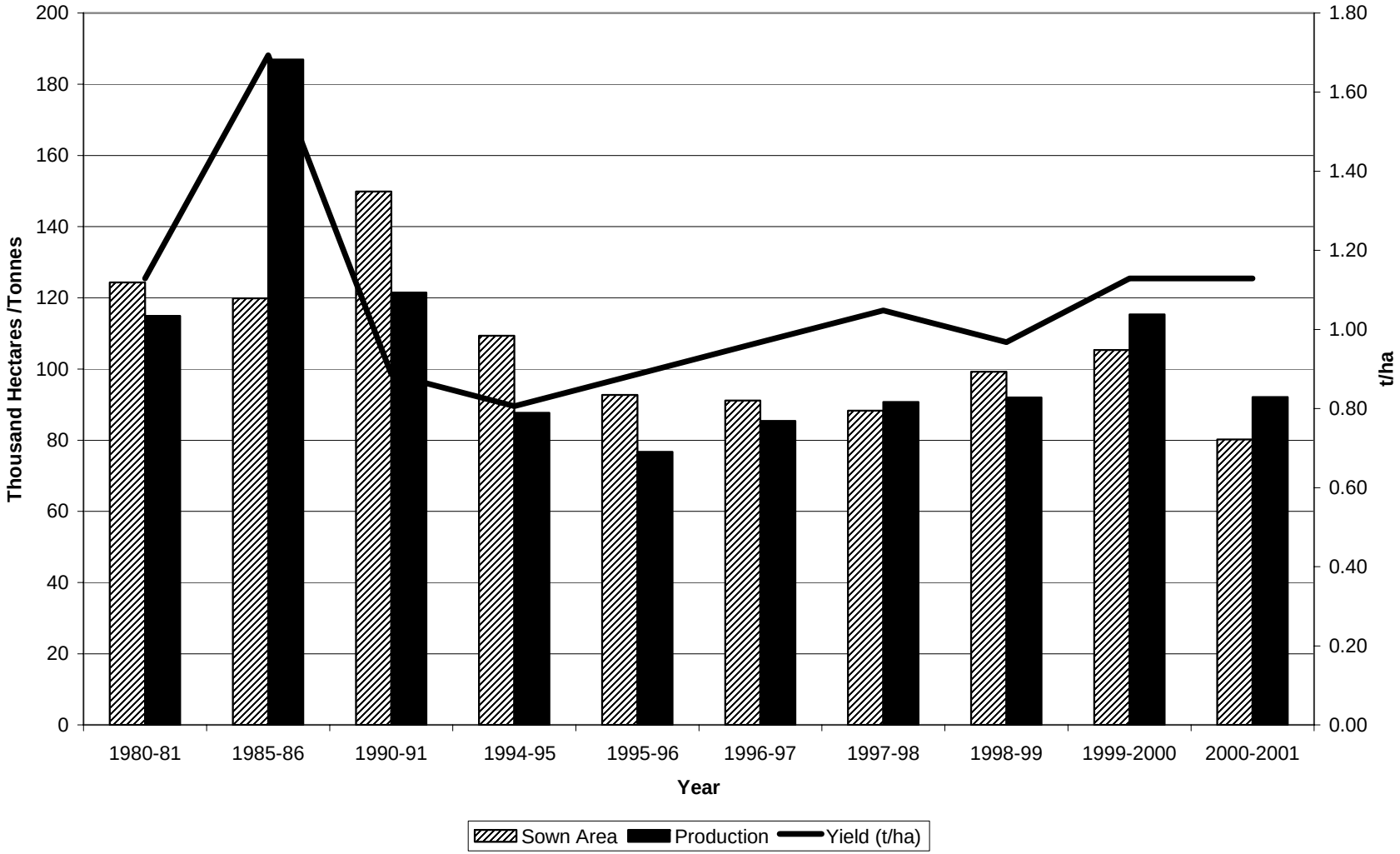
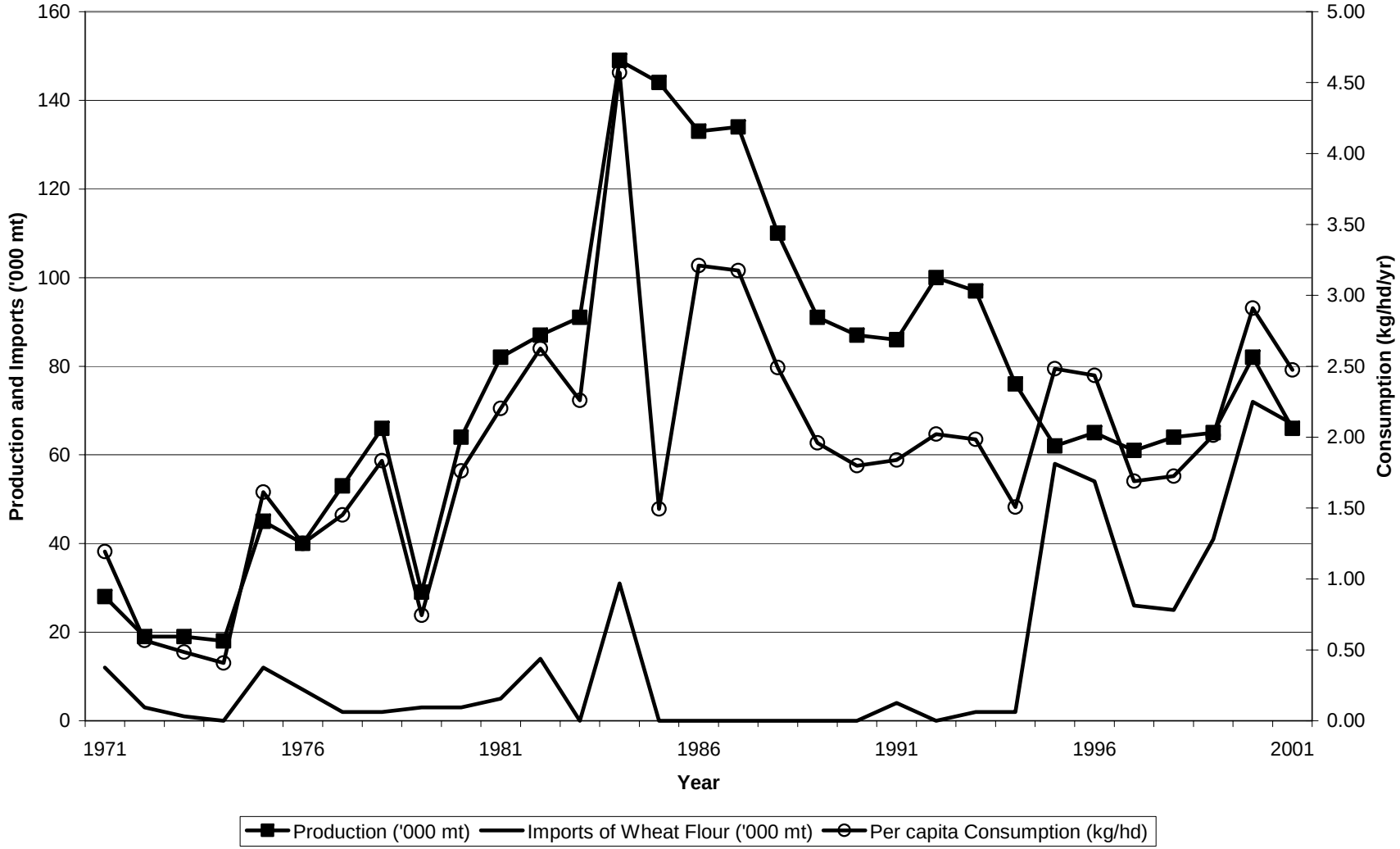


Figure 11 Edible Oil Prices in Yangon Market



Source: (Central Statistical Organization 2001)

Figure 12 Wheat Sown Area, Yield and Production (1989-90 to 2001-2002)



Source: (Central Statistical Organization 2001)

Figure 13 Wheat Production, Imports and Consumption of Flour

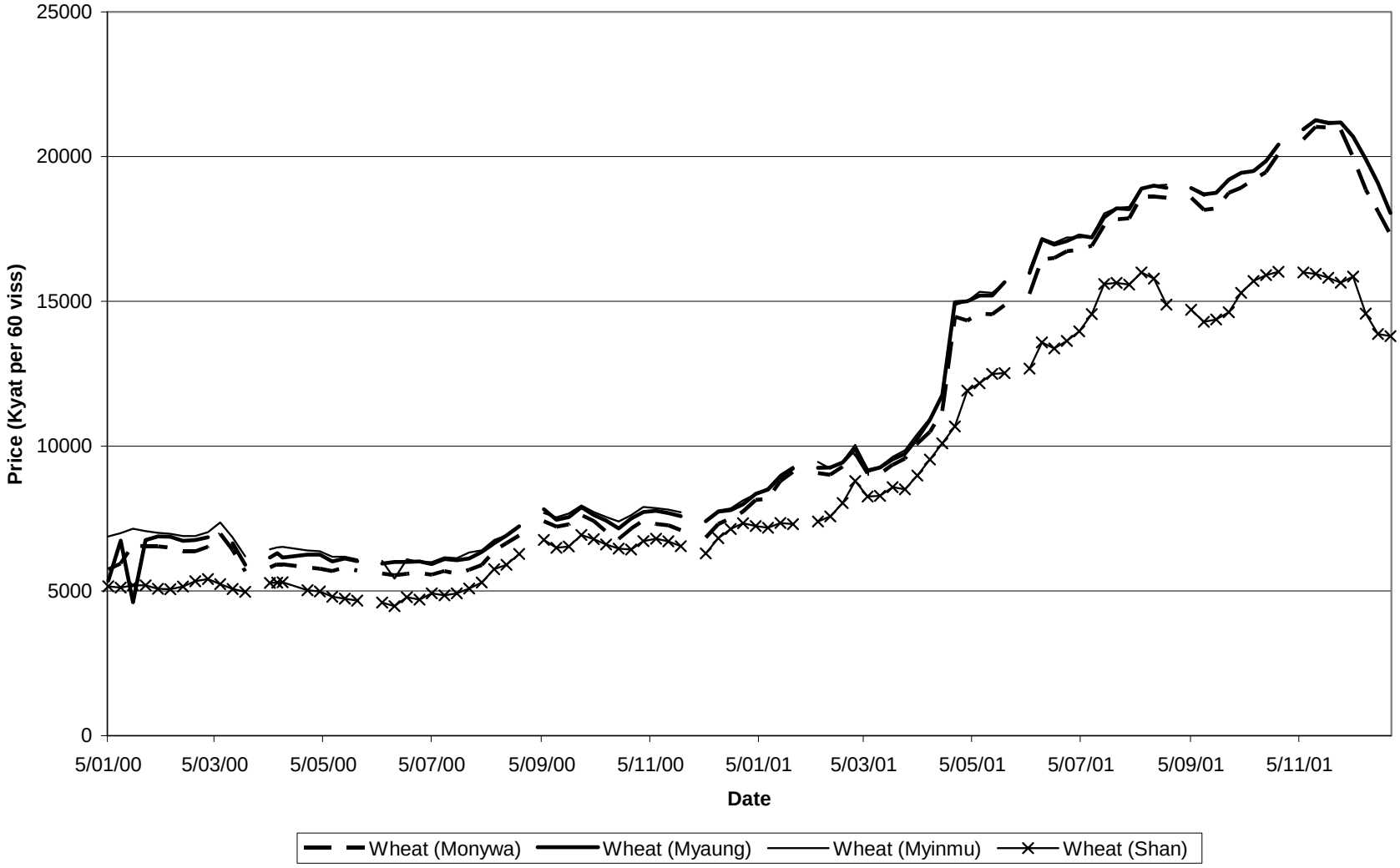


Figure 14 Price of Wheat in Mandalay Market

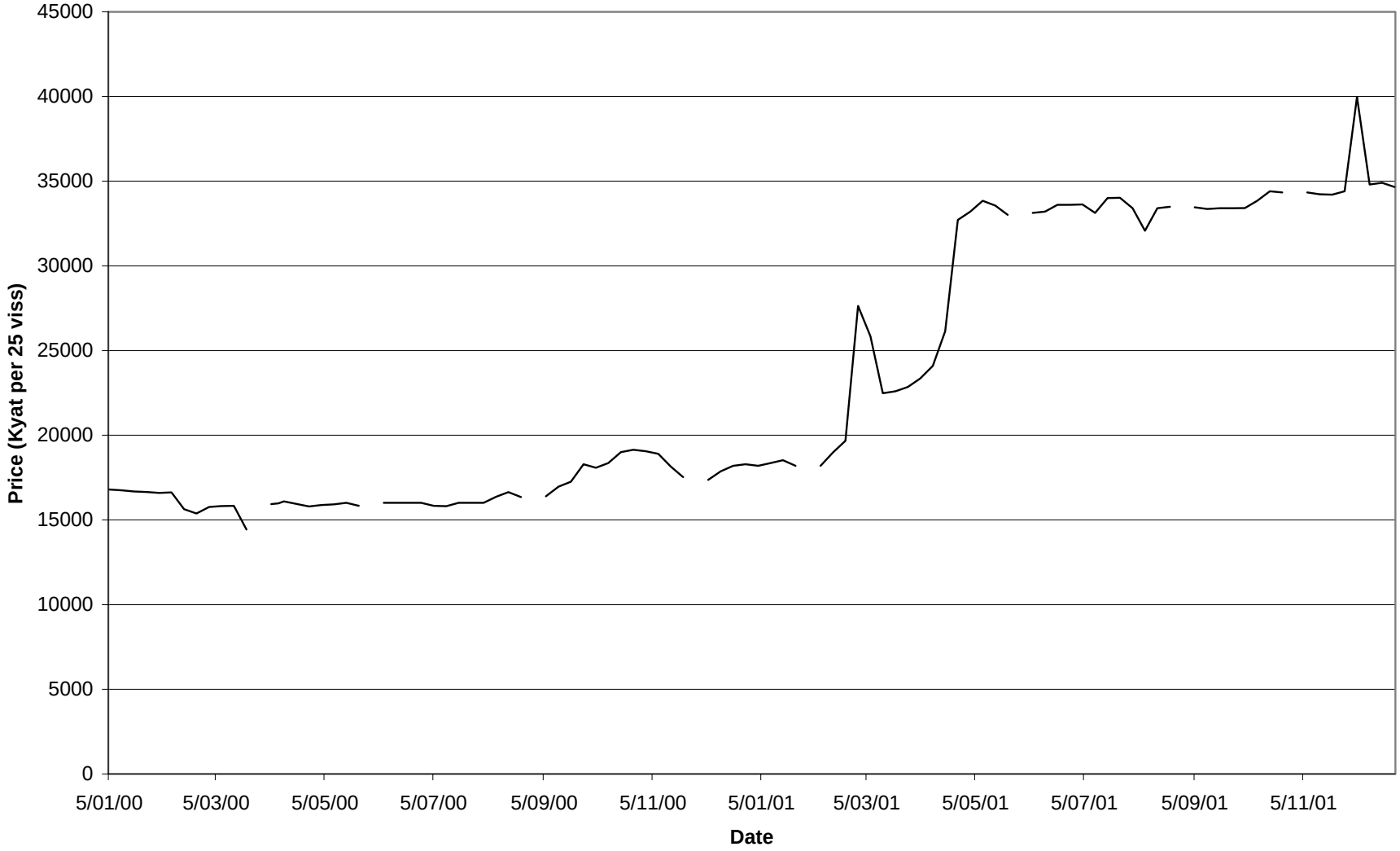


Figure 15 Price of Wheat in Yangon Market

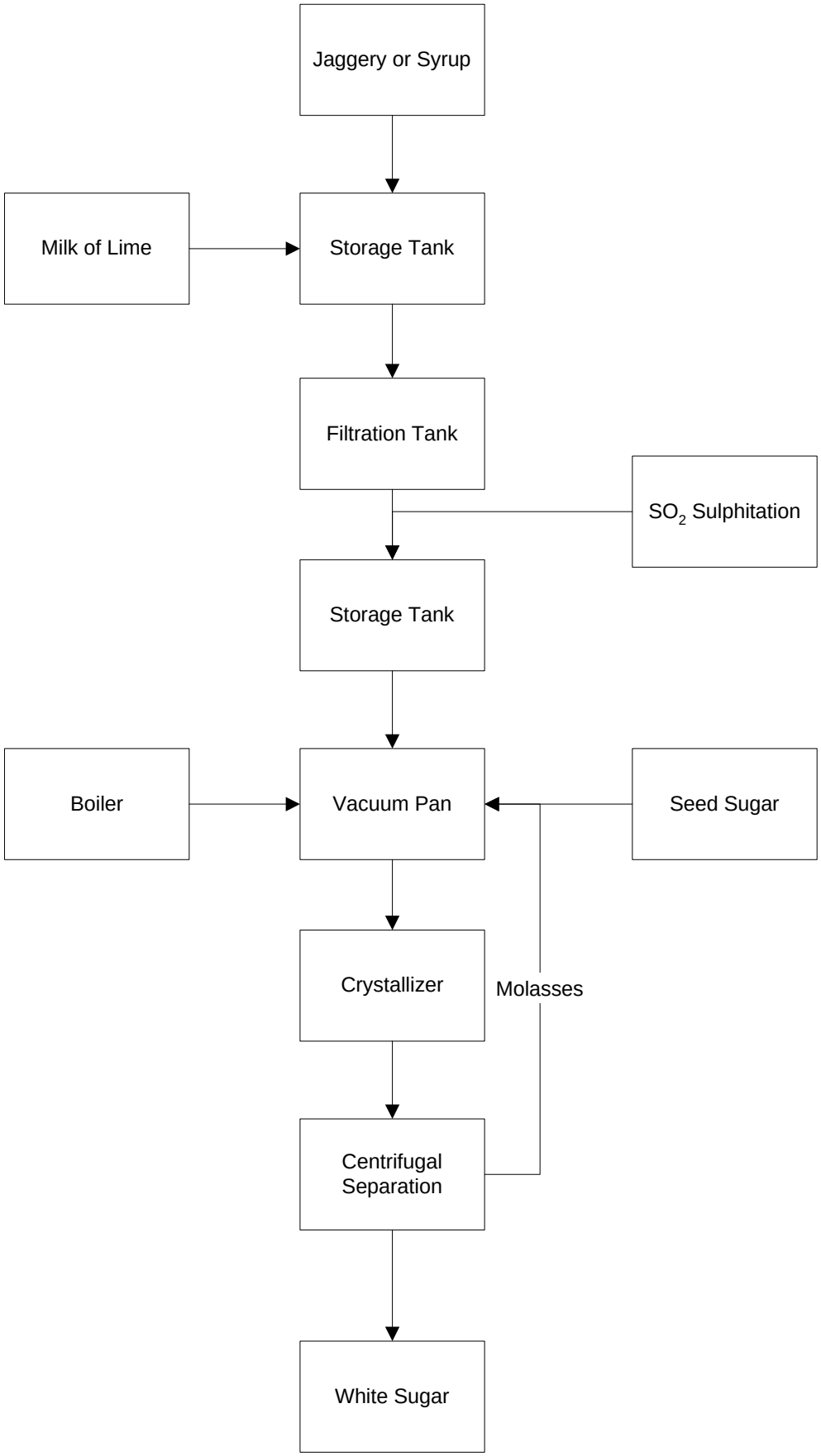
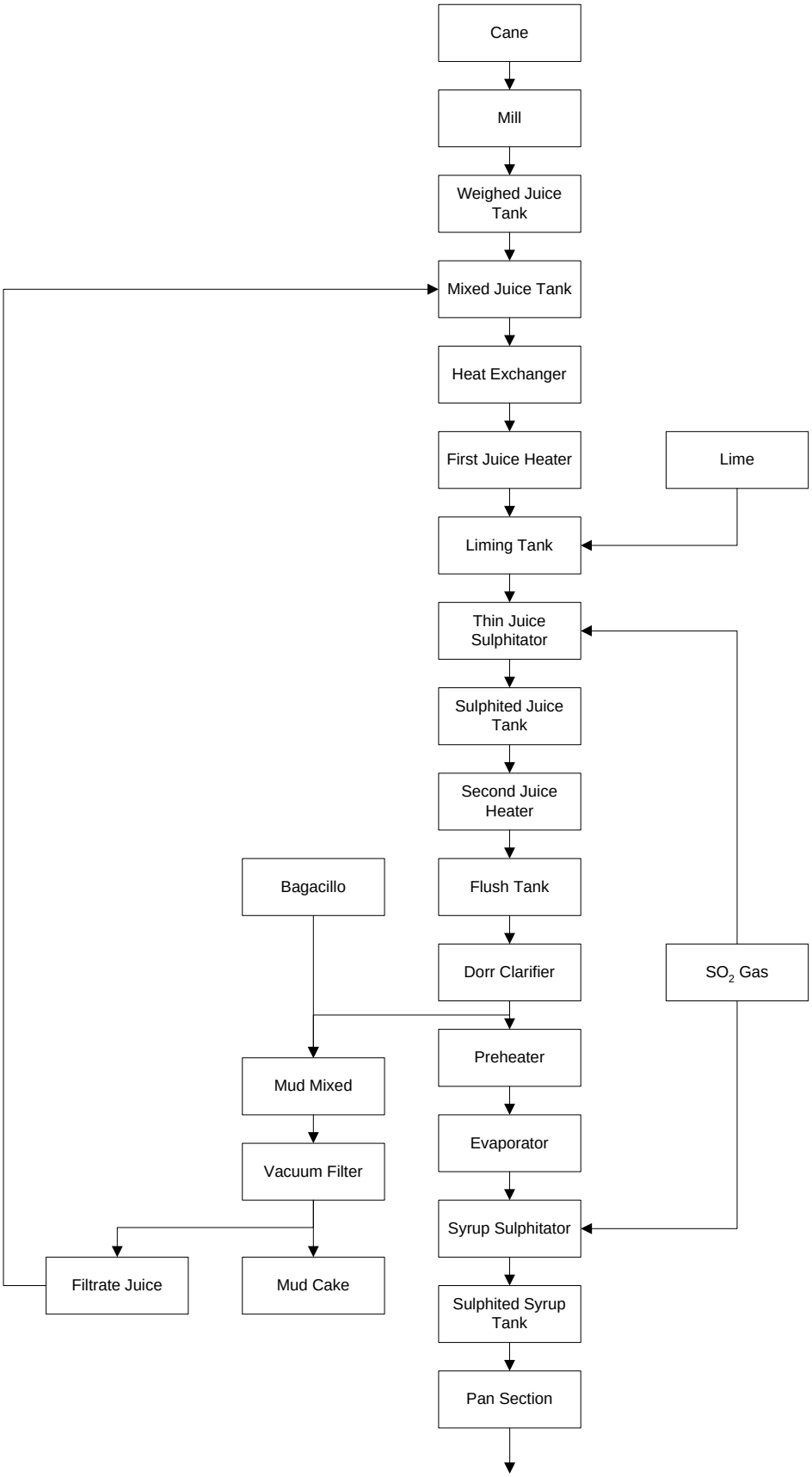
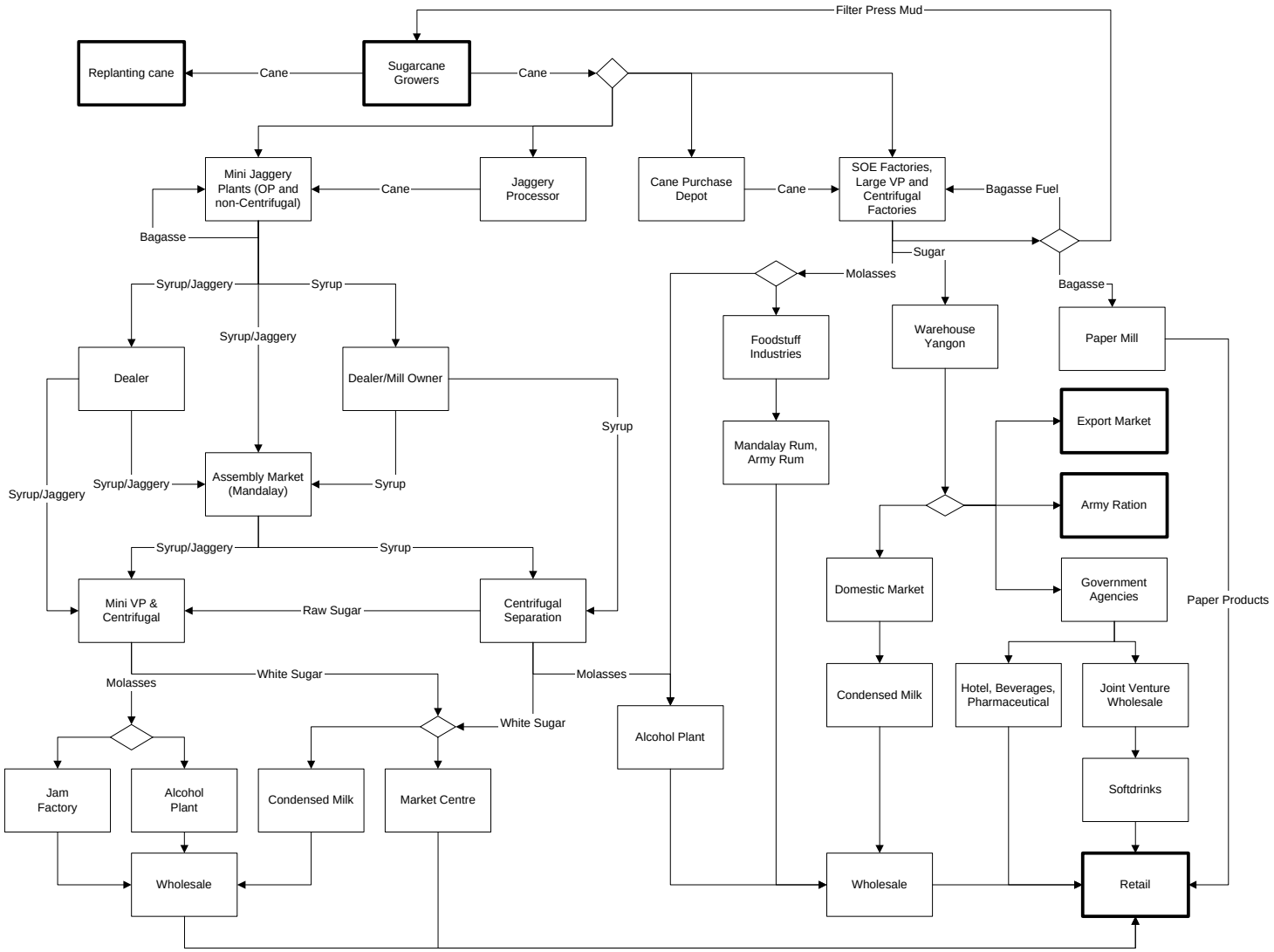


Figure 16 Vacuum Pan Process Flow Chart for Sugar Processing



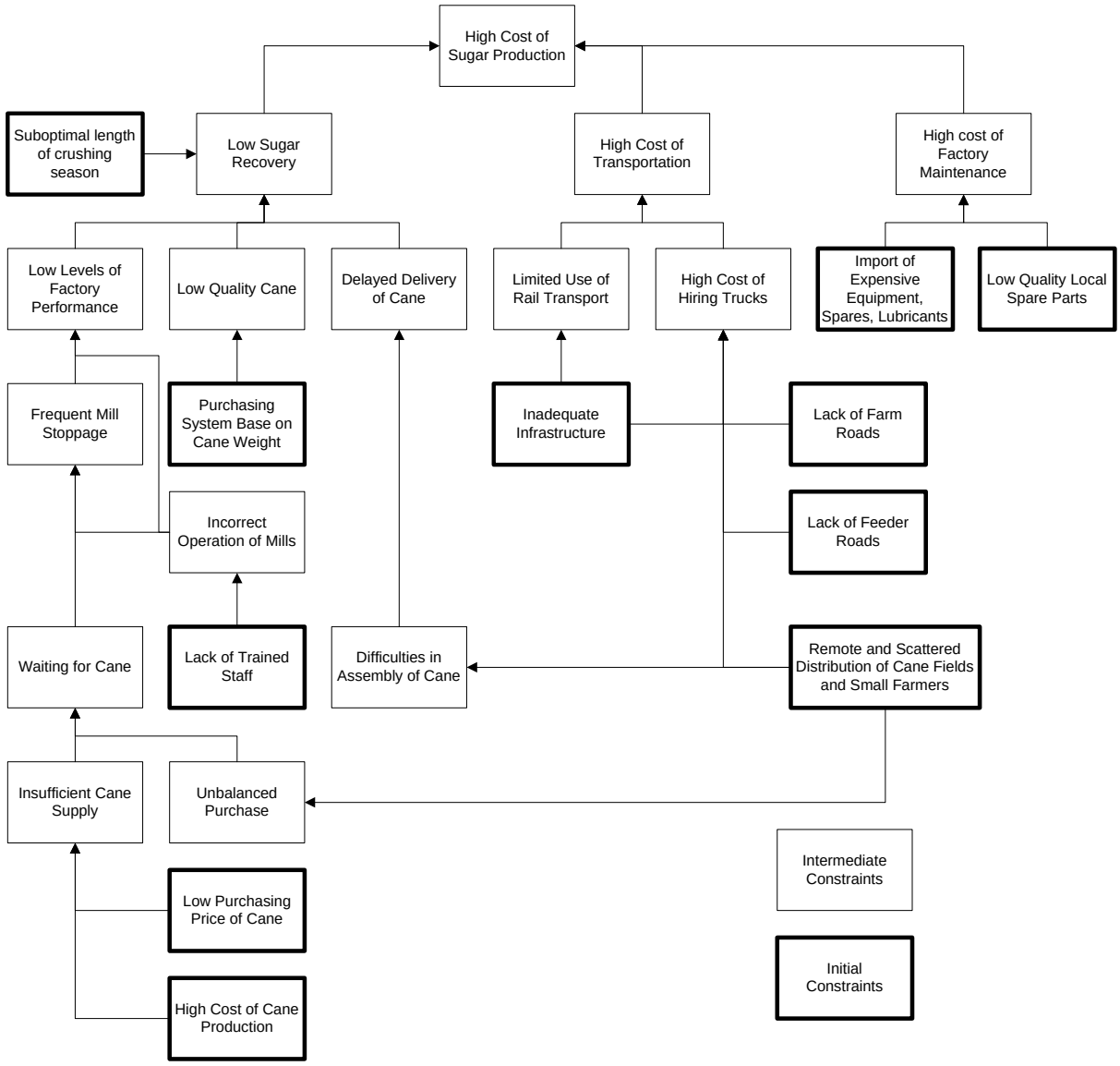
Source: ASR Field Team Interview, 18 September 2003

Figure 17 Double Sulphitation Process Pyinmana Sugar Mill No.2



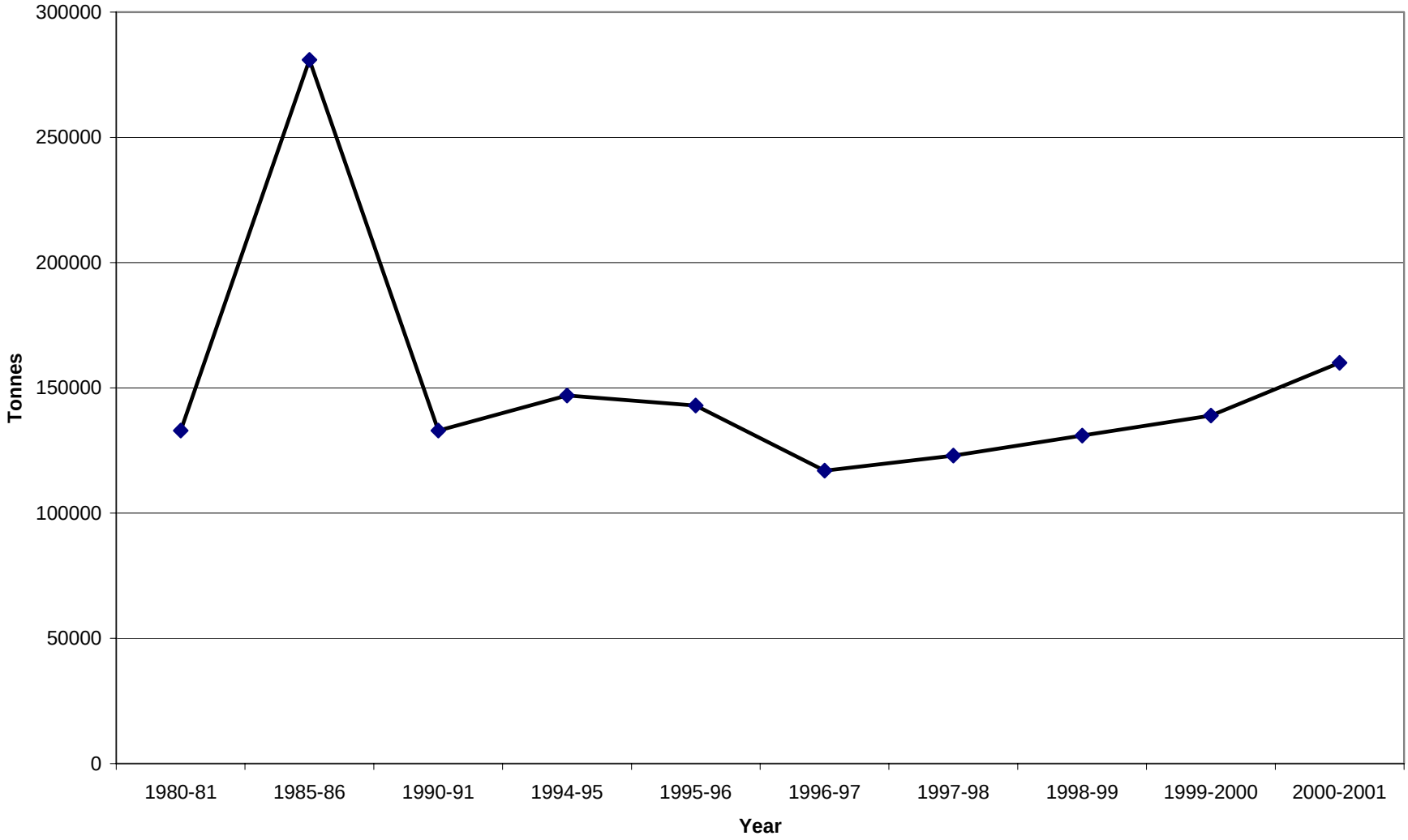
Source: (U Tin Htut Oo and Kudo 2003, pg. 278)

Figure 18 Marketing Chain for Sugar in Myanmar



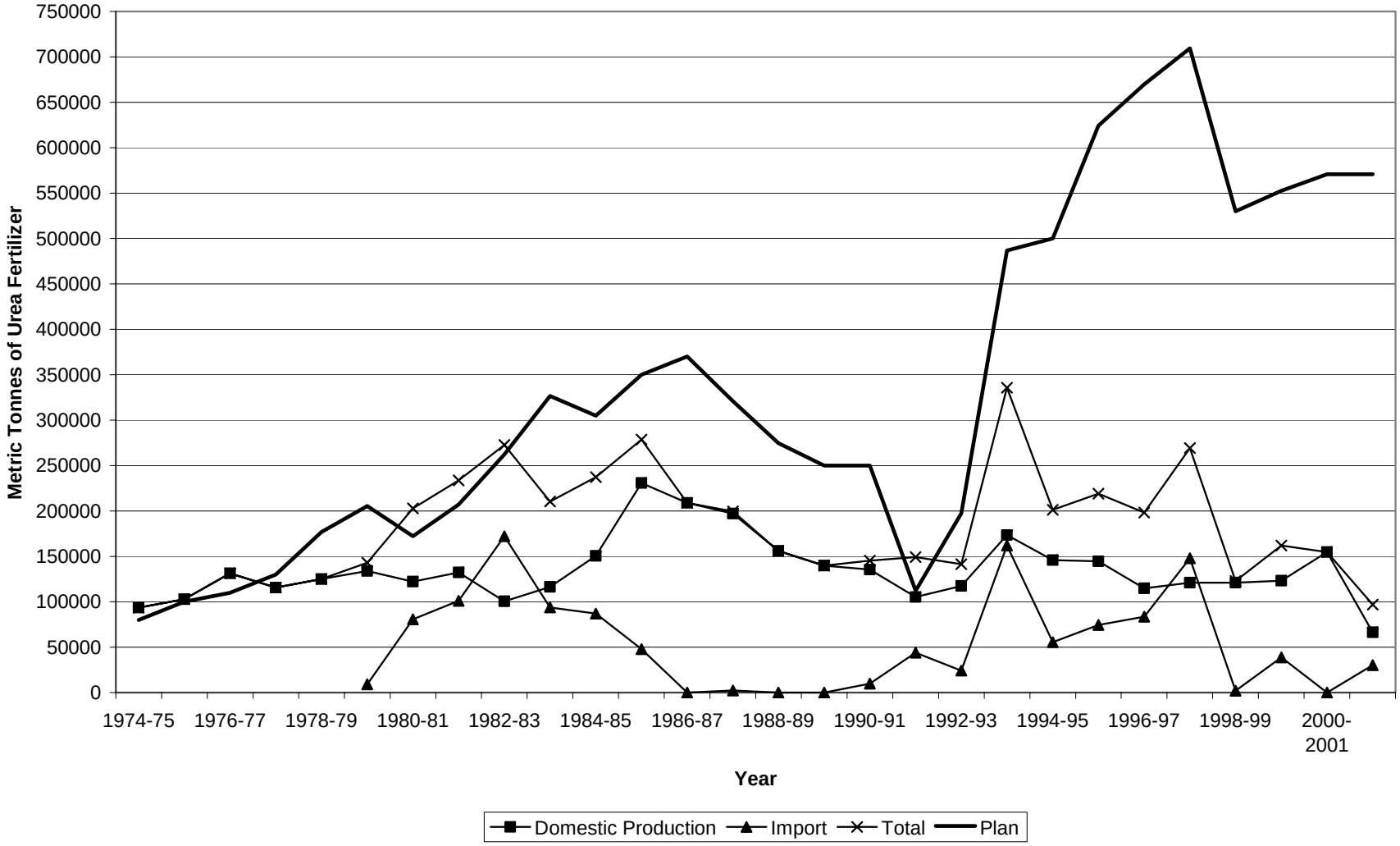
Source: (Kudo 2003, pg. 140)

Figure 19 Constraints in Sugar Procurement and Production for the State Sector in Myanmar



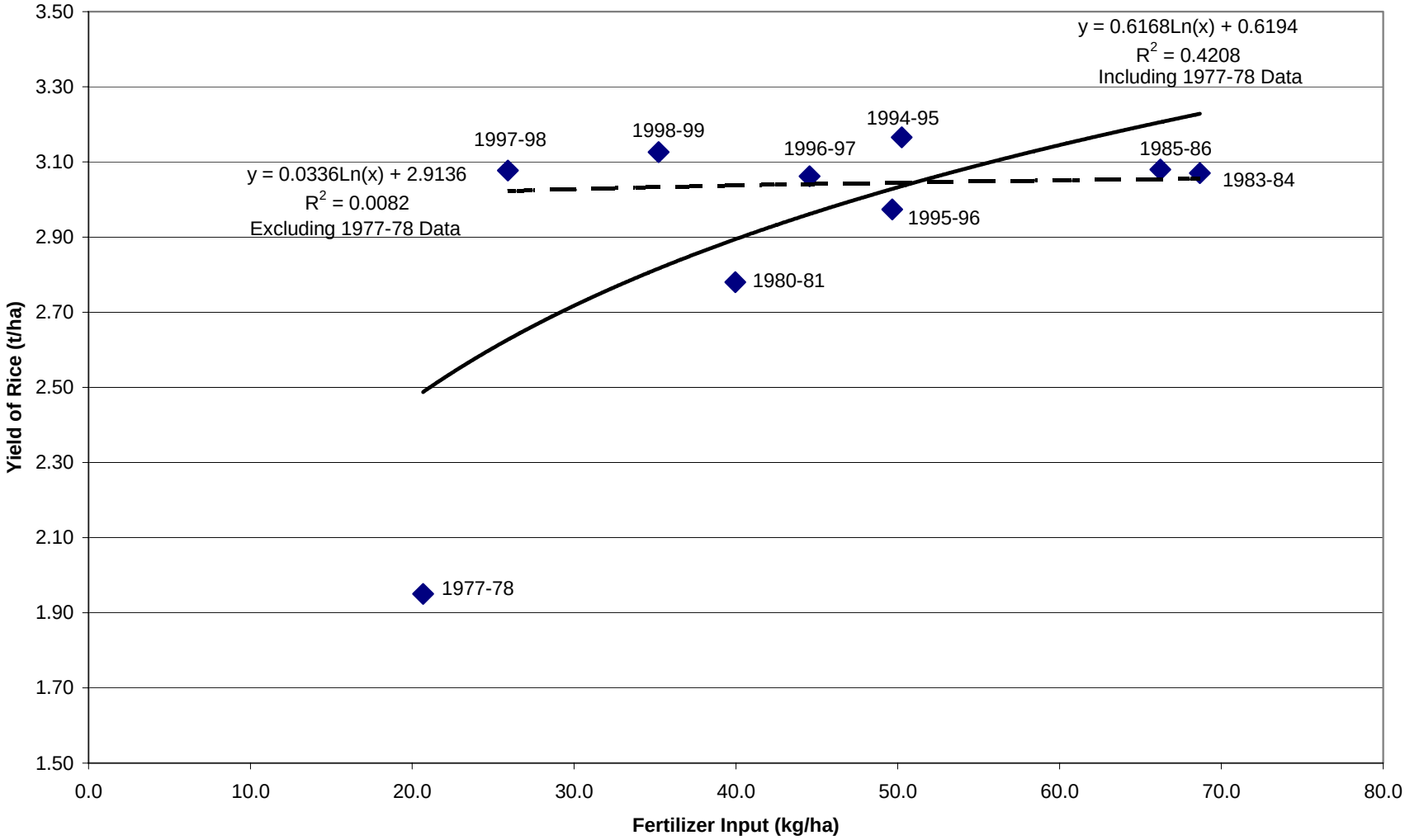
Source: (Central Statistical Organization 2001)

Figure 20 Domestic Production of Urea Fertilizer



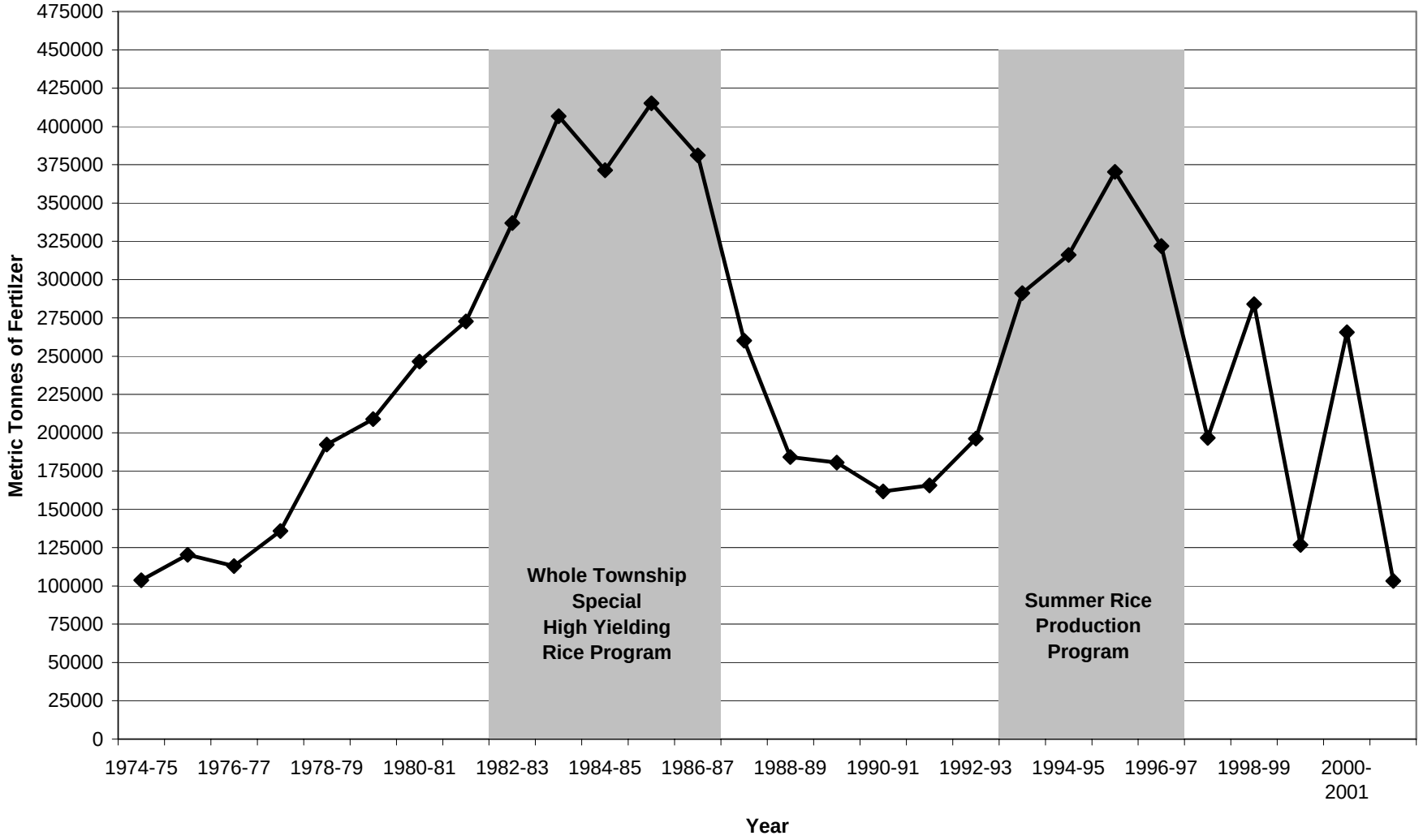
Source: (U Nyi Nyi 2002)

Figure 21 Supply of Urea Fertilizer in Myanmar



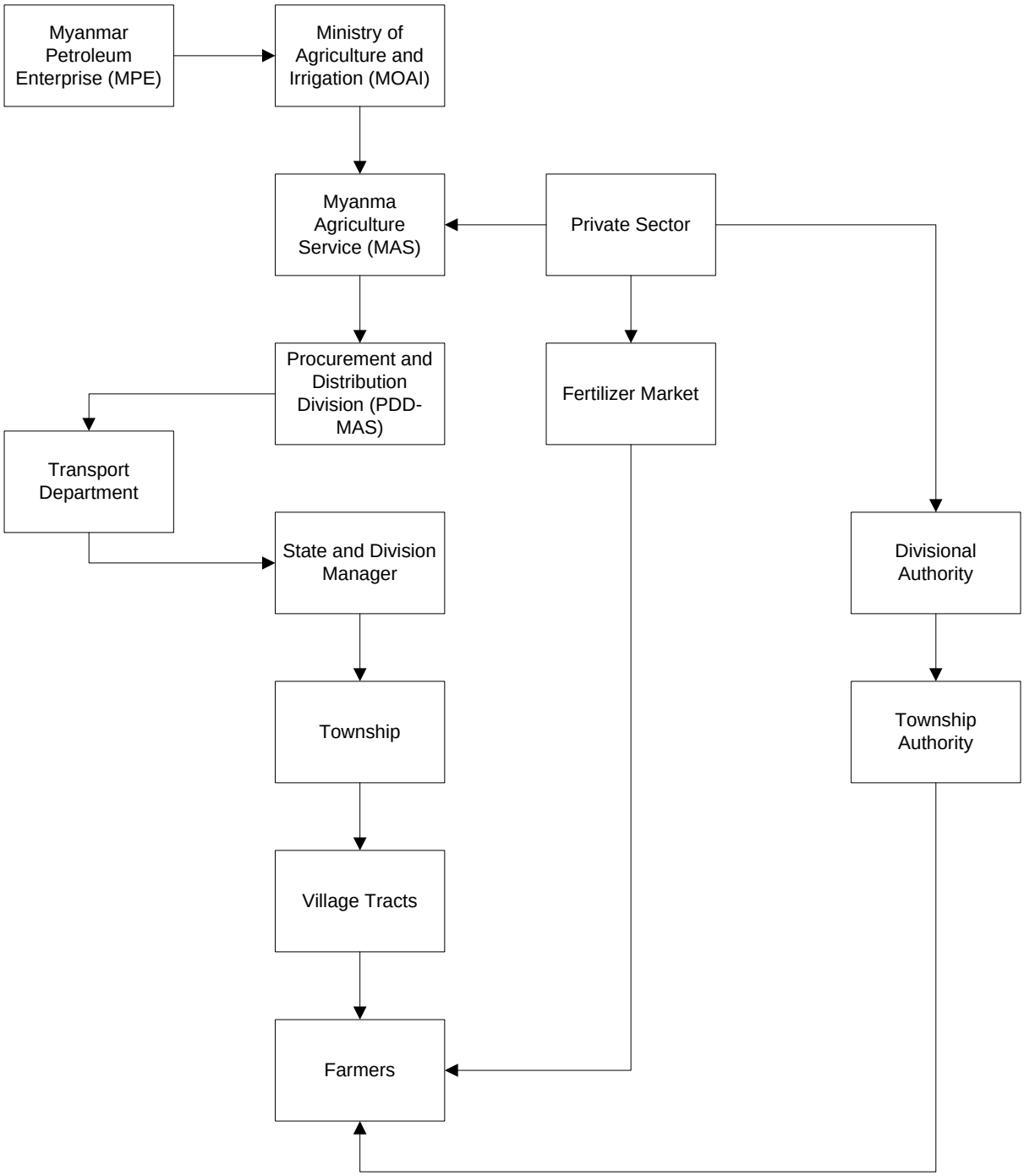
Source: MAS Planning Division 1999, cited in (U Nyi Nyi 2002)

Figure 22 Fertilizer Input and Rice Yield, 1977-1999



Source: (U Nyi Nyi 2002)

Figure 23 Fertilizer Use on Rice under MAS Programs



Source: (U Nyi Nyi 2002)

Figure 24 Distribution of Fertilizer by MAS and Private Enterprises, Myanmar

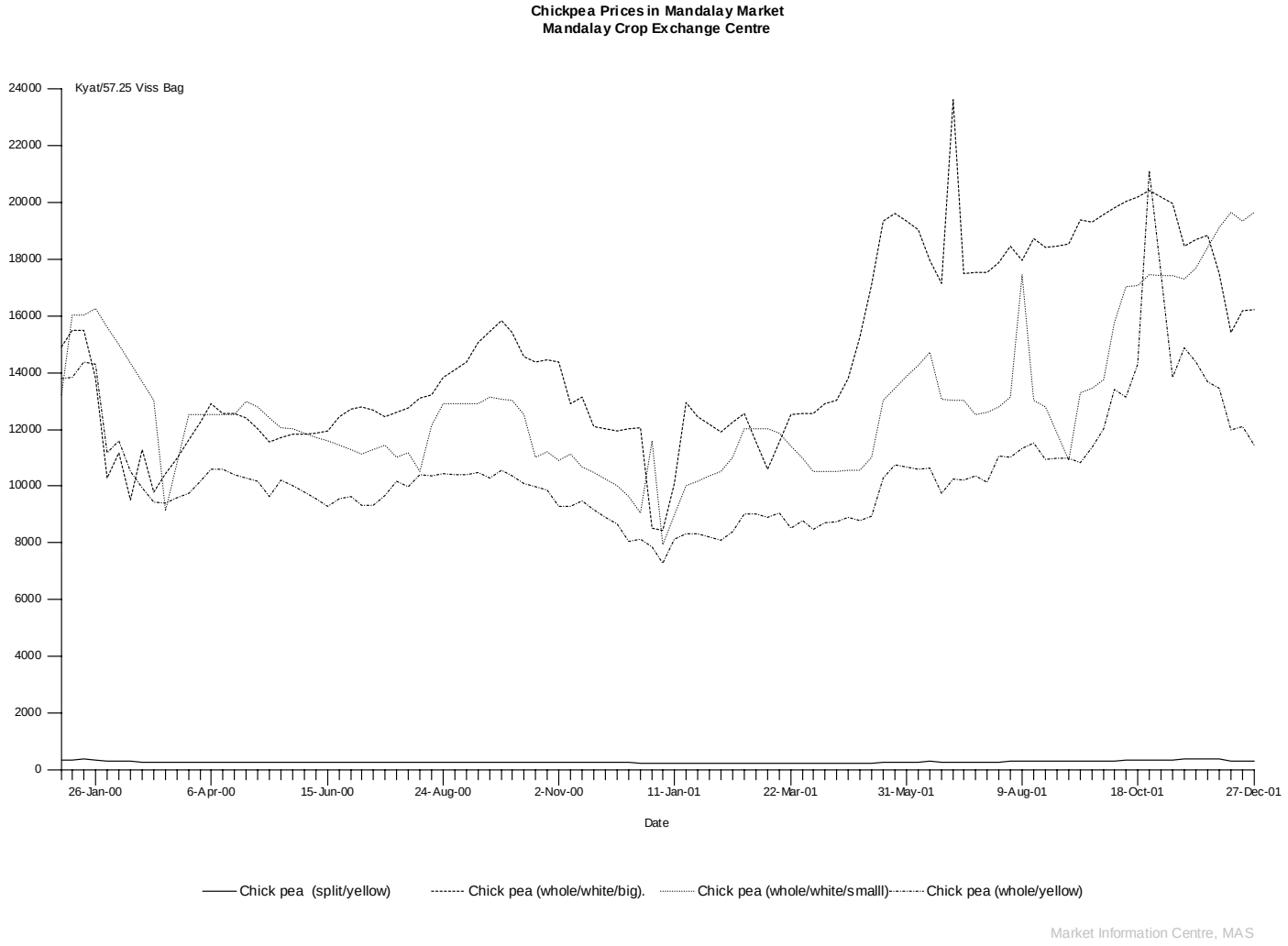


Figure 25 Chickpea Prices in Mandalay

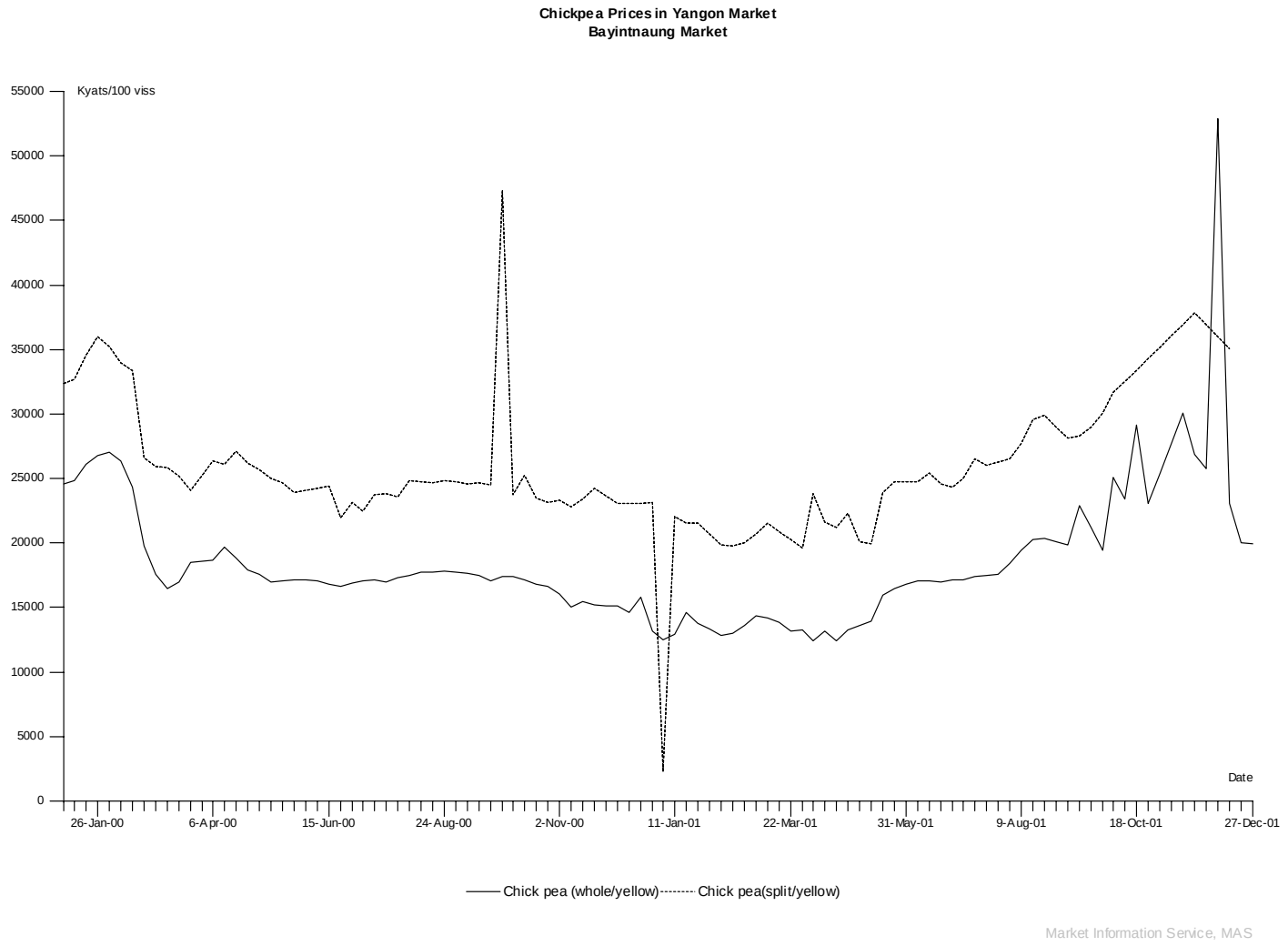


Figure 26 Chickpea Prices in Yangon Market

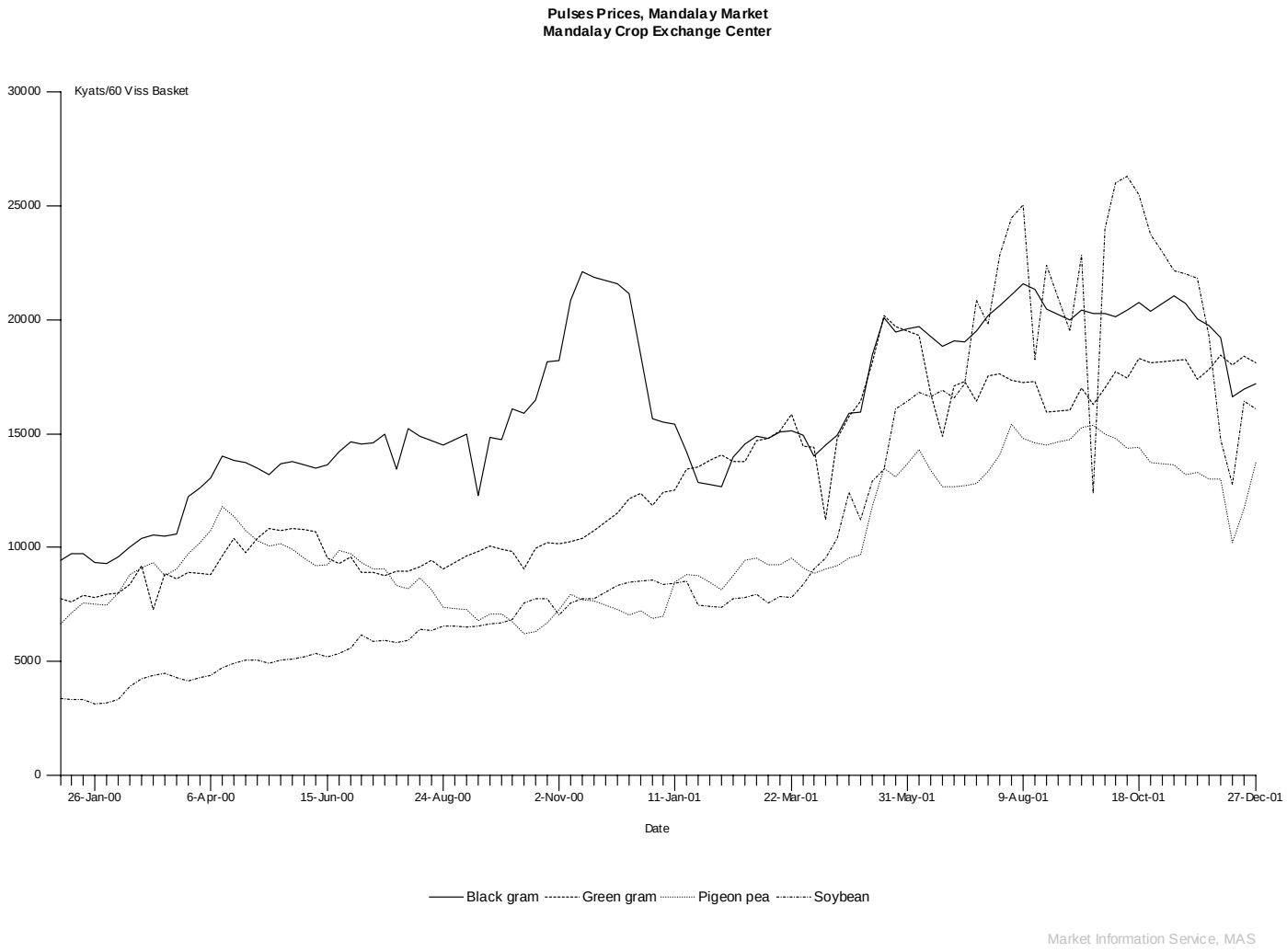


Figure 27 Pulses Prices in Mandalay Market

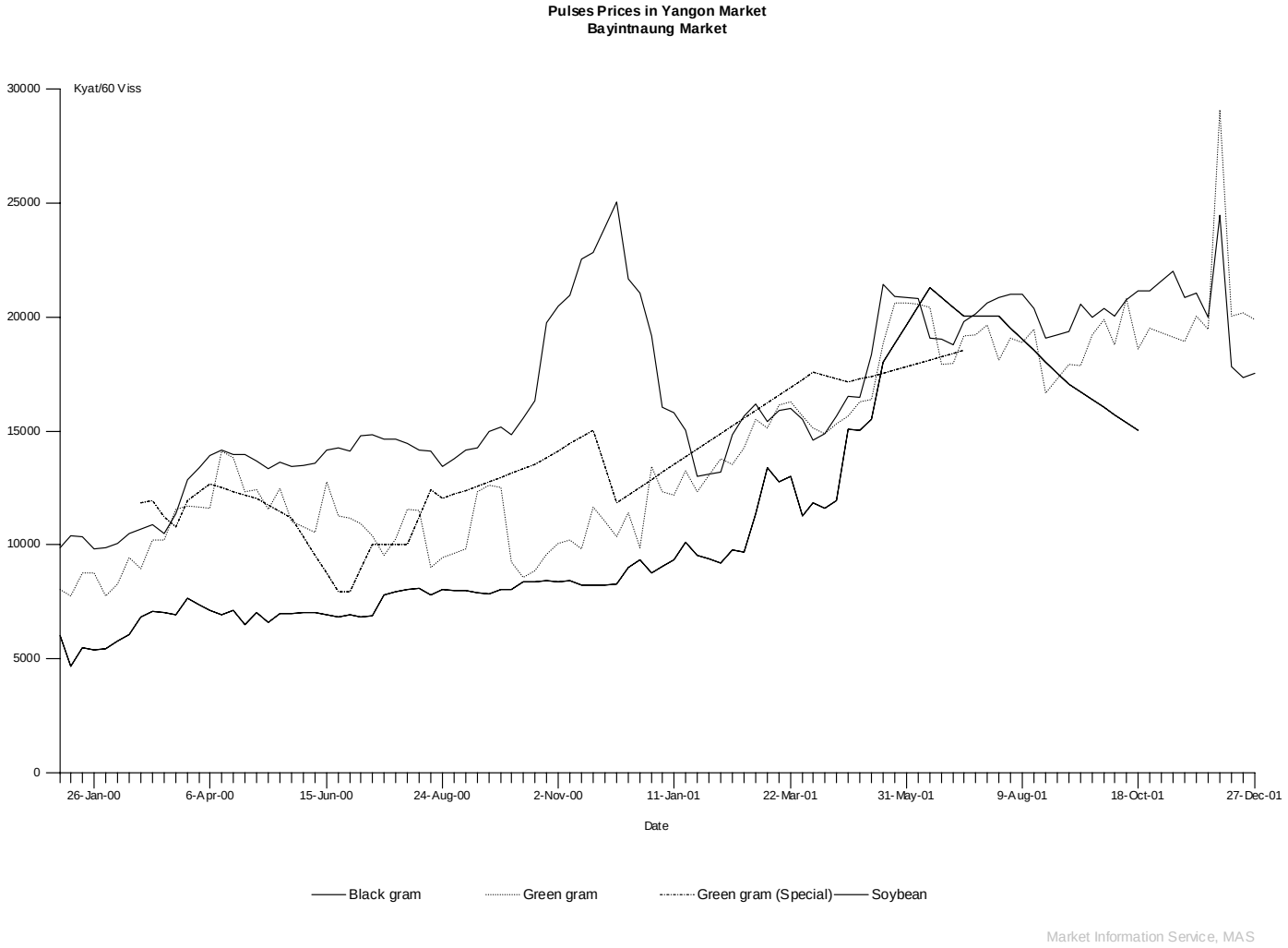


Figure 28 Pulses Prices in Yangon Market

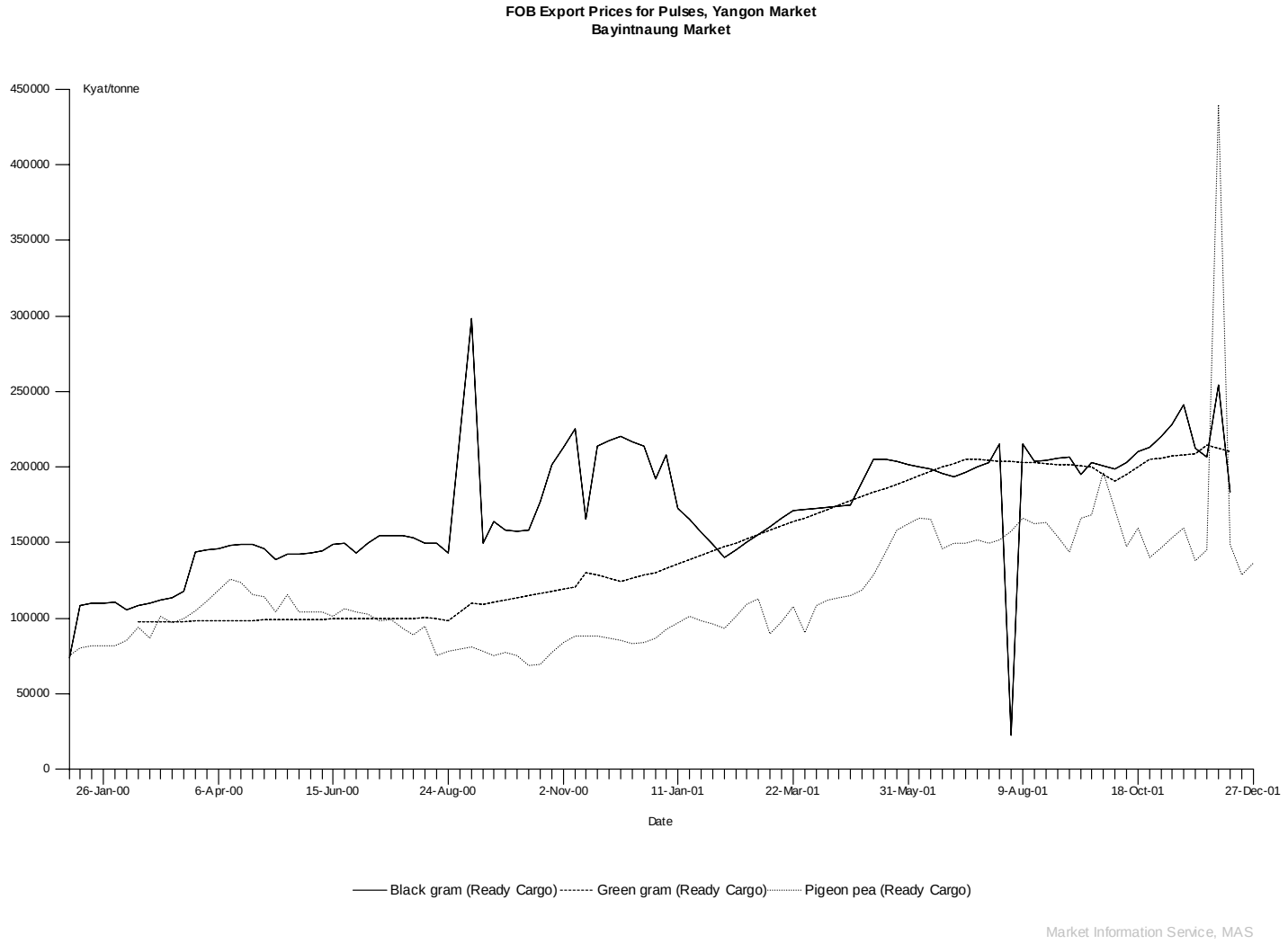


Figure 29 FOB Export Prices for Pulses, Yangon Market

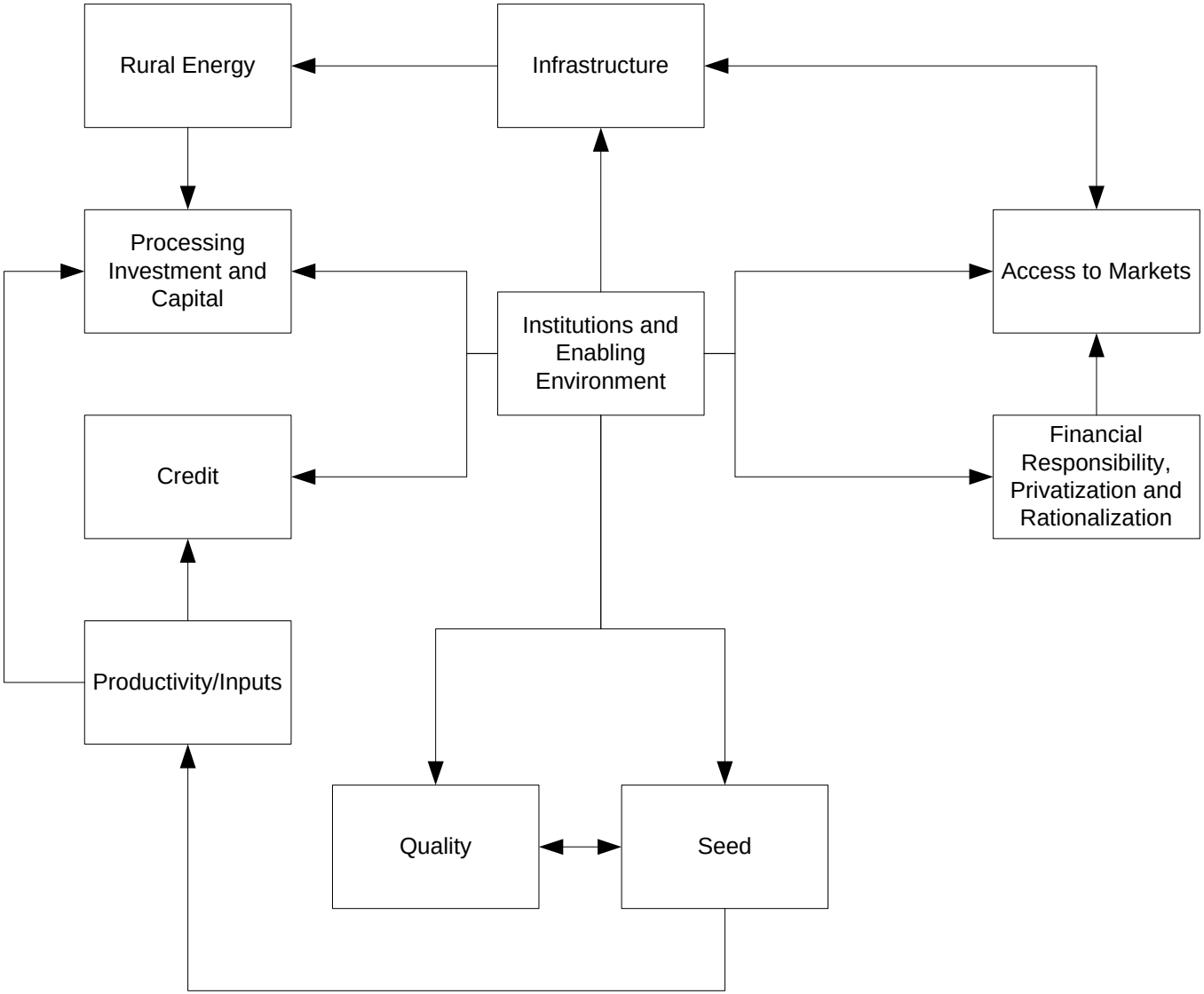


Figure 30 Framework for Agroindustry Policy

12. Boxes

Box 1 Policies, Objectives and Guidelines for the Myanmar Agriculture Sector

Policies conducive to the improvement of the agriculture sector leading to the development of the national economy include:

1. Production of food crops and industrial crops with no restrictions
2. Permit the production of industrial and plantation crops on commercial scale
3. Allow private investors and farmers to expand agricultural production in cultivable waste land
4. Encourage the participation of the private sector in the distribution of farm machineries and other farm inputs
5. Utilize agriculturally productive land for other production programs

In pursuance to the implementation of agricultural development policies, the following three main objectives are prioritized without jeopardizing the production of other crops of the country:

1. To achieve surplus in paddy production
2. To be self sufficient in edible oil production
3. To increase the production and export of pulses and industrial crops

To meet the above mentioned three objectives, the following five strategic measures have been laid down and integrated for implementation:

1. The development of new agricultural land
2. Provision of sufficient irrigation water
3. Provision and support for development in utilization of agricultural machineries
4. Adoption of proven agro-techniques
5. Development and utilization of modern varieties.

Source: (Myanma Agriculture Service 2002, pp 3-4)

Box 2 Terms of Reference for the Agroindustry Review

1. Review the current institutional framework of agroindustries and the roles, responsibilities and performances of various agricultural agencies, enterprises and cooperatives.
2. Analyze strengths, weaknesses and opportunities of agroindustry institutions and identify issues and capacity building needs of these institutions at the central and local levels; estimate requirements for effectively implementing capacity building and management support programs;
3. Identification of areas where the prospects for agroindustry development exist based on the assessment of the domestic and external market chains of agricultural inputs and outputs, and agro-based products;
4. Identification of key bottlenecks and constraints to increased commercialization and diversification of agriculture by (i) tracing the supply and marketing channels, (ii) examining the existing marketing information system, and (iii) assessing the institutional framework for ensuring internationally acceptable product quality and safety standards.
5. Make policy recommendations for the promotion of agribusiness in Myanmar including identification of ways to integrate smallholders into the supply chain.

Source: (United Nations Development Programme and The Government of the Union of Myanmar 2001)

Box 3 National Economic Objectives of Myanmar

- Development of Agriculture as the base and all-round development of other sectors of the economy as well;
- Proper evolution of the market-orientated economy;
- Development of the economy inviting participation in terms of technical know-how and investments from sources inside the country and abroad; and
- The initiative to shape the national economy must be kept in the hands of the State and the national peoples.

Source:(Kudo 2003, pg 56)

Box 4 Functions and Duties of the Myanmar Rice Trading Leading Committee

To provide policy guidance, supervision, and coordination for the smooth implementation of the new rice policy.

1. To grant permission for formation of rice trading bodies
2. To formulate rules and regulations for rice trade, transport, milling and storage
3. To decide the rice requirement for export and for specified forces
4. To coordinate the rice price if disparities arise in fixing prices
5. To make proposals and submissions for issuance of laws and principles with respect to the rice trade

Source: (Thein 2003, pg. 2)

Box 5 Noodle Processing in Myanmar

Well-cleaned pulses are first soaked in water for 24 hours and stirred occasionally. After draining, pulses are ground with a sour starter solution obtained from a previous batch. Then it is settled in a small tank and the liquid is removed. The residual meal is transferred into a wooden tub for 8 hours, then it is transferred into a cloth bag, which is hung up to drain for about 15 hours. The material is then put into tanks in an airtight room for sulfur fumigation, after which the product is allowed to dry for two days. A second sulfur fumigation then takes place.

After the second fumigation, the product is mixed with a sago (starch) solution and extruded into boiling water. The noodles are taken out of the hot water after 5 minutes when they are soft and put into cold water. After that, the noodles are then dried on poles or drying racks for 1-2 days. A typical pea noodles mill uses about 70-100 baskets of pulses daily as raw material and operates 200-300 days per year. All of the processes are manual, with the exception of grinding which uses electric motors. Generally one basket (31 kg) of pulses yields 7.35 to 8.17kg of noodles.

Source: (U Tin Htut Oo and Kudo 2003, pg 164)

Box 6 Price Setting Procedures for Border Trade

The Price Evaluation and Setting Committee in the Ministry of Commerce, Yangon, is responsible for determining and updating the reference standard prices for all exportable commodities, taking into account international prices. These are used for the purpose of calculating the 10 percent export duties on all commodities, for the Overseas Trade and as a starting point for the same calculation for Border Trade.

The committee also has the authority to impose and lift bans on export and import commodities. However, it is understood that the Commanders of Border States have some freedom to exercise discretionary powers. For example, if the local price of basic foodstuffs such as rice is rising to unacceptable levels, the Commander might allow limited imports of rice from China or Thailand, strictly for local use.

In each Border Post there is also a Price Evaluation Committee, which consists of local representatives for the Department of Border Trade, Customs Department, Internal Revenue Department, Government Banks, Local Authority, and Township Traders' Association and meets every one or two weeks. It is responsible for updating the reference standard prices for all exportable commodities for relevant commodities and taking into account transport costs etc., subject to approval by the Department of Border Trade. The reference price has application only for calculation of export tax, as the real export prices are set by negotiations between Myanmar and the relevant foreign traders, based on the prevailing free market conditions.

Source: (Food and Agriculture Organization and Ministry of Agriculture and Irrigation 2000, pg. 27)

Box 7 Edible Oil Commodity Center, Nyaung Bin Lay Market, Yangon

The Commodity Center of Myanmar Edible Oil Traders; and Industrialists' Association in Nyaung Bin Lay Market is located on the second floor of Nyaung Bin Lay Market. The Chairman (in 2000) is U Than Oo. This is the place for price negotiations concerning imported palm oil and other edible oils, both domestic and imported. Licensed importers distribute palm oil to dealers who redistribute to the wholesalers of other States and Divisions.

In August 1999 only two companies had obtained an import license; the Asia World Company and Ngar Hna Kaung Company (Golden Flower Company). The price was fixed at K380 per viss. Imported palm oil is stored in big tanks in Kyee Myin Daing, which is near Yangon River and Thilawa Port. There are also 4 storage tanks owned by Myanmar Economic Holding. Oil dealers take delivery of their quota volume from these tanks.

Although the Center opens at 9am in the morning, activities usually start from 11am and end at 1pm. When the Center closes, the palm oil negotiations in the Mandalay Commodity Center start based on the Yangon prices.

(Food and Agriculture Organization and Ministry of Agriculture and Irrigation 2000, pg. 107)

Box 8 Sugarcane Procurement System for MSE Sugar Mills

The sugar factories normally prepare their cane procurement program in early July by conducting surveys and forecasting the cane acreage and production. This is a well-planned activity for all factories. The sugar factories have a quota system to ensure the smooth and regular flow of cane to the factory. The factory determines its cane requirements and develops the cane supply plan with the factory zone procurement committee. The sugarcane quota is set but the Township and Village Tract Procurement Committee in response to the factory requirement projected by the factory. Once the overall quota is set, it is then calculated on a farmer-by-farmer basis at the village tract level. The quota is based on land holdings of individual farmers, its suitability for cane and past performance level of cane production. Individual contracts based on the farmer total cane quota is signed between the factory and farmers. The factories prepare detailed procurement schedules for each 16-day cycle based on a 14 crushing days and 2 day scheduled shutdown for cleaning and maintenance. The farmer is given a cash advance of K1000 by the factory based on the quantity of cane he contracted to deliver. As of January 2000, 15 SOE factories contracted with about 37,600 farmers for the expected cane supply of about 1.35 million tonnes. Advanced cash payment was K1000/tonne. The farmers are responsible for harvesting and transporting his cane to the nearest buying centers.

In SOEs, cane collection and purchase are undertaken either through buying centers with rail or truck lines, direct loading or direct transport by oxcart to the factory. The factories organize the buying centers through which cane is procured from several farmers in surrounding areas. The maximum cart-hauling distance of 2 miles has been taken into account when establishing the buying centers. The buying centers are linked to the factory by either rail or road transportation systems. For the factories operated by MSE, there are normally 630 buying centers with truck transportation facilities, 39 centers with rail facilities, 30 centers with boat facilities, and 33 centers with ox-cart transportation. There are over 330 direct transportation lines. The daily cane requirements for 15 factories is over 22500 tonnes, which normally require 1800 trucks per season for cane delivery.

Source: Adapted from (Kudo 2003, pp. 122-123)