Chapter 8

GROWTH, SURVIVAL AND PROSPECTS OF SUGAR PROCESSING SMEs

1. INTRODUCTION

The small and medium sized enterprises(SMEs) were centuries-old establishment since subsistence farming had been transformed into commercial agriculture. The large number of SMEs was largely the outgrowth of the agriculture sector which accounts for 38 % of GDP. Rice milling, edible oil mills, wheat flour mills, manufacture of jaggery (non-centrifugal sugar), mini sugar plants, etc. are all agriculture-based industries scattered all over the country.

Among different types of SMEs, resource-based industries with domestic market orientation form the bulk of SMEs. Nu Nu Yin (2001) subdivided into agro-based industries and agro-supportive industries. The former is represented by rice and oil milling, mini sugar plants, etc, while the latter category constitutes cottage industries producing farm tools, machinery, bullock carts, etc.

In this report, the problems and issues of domestic market-oriented and resource-based SMEs with particular reference to jaggery manufacturing cottage industry and mini sugar plants will be addressed.

2. THE CURRENT STATUS OF SMEs IN MYANMAR

In 1988, the economic system was changed from centrally planned economic system (1962-1988) to market-oriented system and accordingly the private sector had grown appreciably in all sectors of national economy. The establishment of industries in Myanmar is also predominantly made up of SMEs.

In terms of contribution toward Gross Domestic Product (GDP), nearly the state-owned industries contributed 28.7 % of GDP while the coop-

Table 1 : The Number of State-Owned, Cooperative and Private Establishments (1998-1999)

Commodity	State	Cooperative	Private	Total
Food and Beverages	197	145	28,177	28,519
Clothing/Wearing Apparel	33	220	4,084	4,337
Construction Materials	125	103	3,392	3,620
Personal Goods	14	26	1,684	1,724
Household Goods	10	12	481	503
Printing and Publishing	22	15	427	464
Industrial Raw Materials	818	15	1,825	2,658
Mineral and Petroleum Products	24	23	3,206	3,253
Agricultural Equipment	5	4	139	148
Machinery and Equipment	6	3	646	655
Transport Vehicles	4	7	277	288
Workshops and Dockyards	305	-	-	305
Miscellaneous	13	104	8,932	9,049
Total	**1,576**	**677**	**53,270**	**55,523**

Source: Ministry of National Planning and Economic Development.

Table 2 : Classification of Manufacturing Industries in Myanmar

Category	Capital Outlay (Million Kyats)	Annual Production Value (Million Kyats)	Employees (Number)	Electrical Power(H.P)
Small	<1	<2.5	10-50	3-25
Medium	<5 & >1	<10 & > 2.5	51-100	<50 & >25
Large	>5	>10	>100	>50

Source: Private Industrial Enterprise Law (1991).

erative and private sectors contributed 0.9 % and 70.4 % respectively in 1996-97 (Kyaw Htin, 1998). As of 1999, nearly 99% of SMEs are in the private sector and the remaining small extent in cooperative and state sectors (Table 1). The food and beverages establishments are predominantly operative followed by clothing, construction materials, mineral products, and industrial raw materials.

The definitive term of SMEs covers all economic sectors including agriculture, manufacturing and processing industries, mining, livestock and

fisheries, forestry, construction, transportation, etc. The Industries could be categorized in term of size as specified under the criteria by the Private Industrial Enterprise Law, 1991(PIEL) (Table 2).

Under the Promotion of Cottage Industries Law (1991), the cottage industries are defined as units employing not more than 9 workers and using less than 3 H.P. but for handicrafts, there is no limit to the number of workers. Anyhow, the number of employees appears to be the most common criteria to classify these industries.

According to the PIEL, any private enterprise unit, employing more than 10 workers and using electrical power more than 3 H.P. is subject to registration to the Directorate of Industrial Supervision and Inspection, Ministry of Industry No.(1). If the number of employees less than 10 and the energy unit less than 3 H.P. are utilized, the enterprise unit is to register at the Cottage Industry Department, Ministry of Cooperative. According to the size distribution of private industries registered with the Industrial Supervision and Inspection Department, it was reported that 84 % of total registered private industrial enterprises was small scale industries leaving 11 % for medium scale industries and 5 % for large scale industries (Kanaung Journal of Industry and Commerce, March 2000) (Table 3). In addition, to the registered industries in Table 3, the number of cottage industries registered at the Cottage Industries Department amounted to 4,685 under the Promotion of Cottage Industries Law. It includes 697 handicraft industries. Of all the industries as listed in "Review of Financial Economics and Social Conditions, 1998-99" (Anon, 1998-99), the SMEs constitute the larger number under the private ownership. The total number of private-owned SMEs in 1998-1999 reached 53,270.

Table 3 : List of Registered Private Industries (31 Dec. 1999)

Size	No. of Units	No. of Workers	Electrical (H.P.)	Investment (Kyat million)	Production (Kyat million)
Large	1,746	44,276	164,924	4,429.04	11,758.24
Medium	4,107	39,034	128,791	2,512.63	8,685.05
Small	30,056	108,698	362,647	4,303.63	12,022.94
Total	**35,909**	**192,008**	**656,362**	**11,245.30**	**32,466.23**

Source: *Kanaung Journal,* March 2000.

3. DESCRIPTION OF DIFFERENT FORMS OF JAGGERY PRODUCTS

Jaggery (commonly known as gur in India) is solidified and clarified cane juice: molasses do not appear as a by-product when it is made. It is hard, crystalline and has a colour ranging from golden yellow to brownish yellow. 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. The analysis of composition of jaggery is usually in the following range. Sucrose constituents range from 65 to 85%, invert sugar is 10 to 15%, ash percentage is 2 to 5% and moisture is 3 to 6%. Protein is 0.25% and insoluble matter is 5%.

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 business had long been well established in Upper Myanmar. Cane jaggery was produced in Yemathin district and Lower Myanmar down to Thaton district. Marketing and trade for both forms of jaggery had expanded simultaneously from different source regions during earlier period of colonial rule.

In Myanmar household, jaggery is important article of diet. The common Myanmar sweetmeats and cakes are almost prepared with jaggery in one form or another. With passage of time, household uses of jaggery was expanded into industrial uses which had led to the emergence of sugar processing SMEs. In fact, jaggery is the final product for multipurpose household uses but when it was led to industrial purposes, the production at the cottage industry level had switched from jaggery manufacture to processing of syrup which is a semi finished product which again serves as raw material for production of centrifugal sugar by SMEs.

The raw materials for sugar processing SMEs are locally called *Thakaryi* (literally, liquid sugar) or *Pwet-yi* or *Pwet-thar* in the markets. Techni-

cally, this semi finished product is 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 sugar processing and upon further boiling in the vacuum pan, the material has been concentrated to a point (over 82-83° brix) at which it will crystallize. Then mixture of crystals and molasses at this step is called massecuite. The trading of raw material for SMEs is in fact the intermediate product between the syrup (60° brix) and the massecuite (> 80° brix) but for practical purpose, this feed stock will be referred to as "syrup" in this paper (Appendix 1).

4. BEGINNING OF SUGAR PROCESSING INDUSTRY IN MYANMAR

The earliest written record indicate that sugarcane cultivation may begin in the lands of Pyu (Lower Myanmar) during AD 800 (Luce, 1960). The art of manufacturing jaggery (locally called Kyanthaga) was introduced in the later period of Inwa era (15th century) (Sangermano, 1819). White sugar was then introduced during the reign of King Bodawpayar (AD 1781 - 1819) and a crude sugar was manufactured from cane at Amarapura employing the native and Chinese laborurers (Anon, 1989). The first white modern sugar factory in Myanmar is recorded to be that established by Messrs. O'Riley and Bell at a Amherst (Kyaikami) in 1840 (McLean, 1934). The yearly output was 175 ton white sugar from 1843 to 1845. The commercial production was successfully established under the government policy of protection during Lord Auckland administration in the colonial period. Under the next administration, protection was discontinued and the factory could not compete the imported sugar of cheap and inferior quality. The factory was closed and sold out to Calcutta in 1846. The factory was short-lived. Brief account of early white sugar industry was given in the second volume (chapter 3) of Myanmar Industrial Development (Kudo ed., 2002).

During the unsuccessful attempts over 80 years to establish white sugar factory, sugarcane growing area was steadily expanded by increase in jaggery manufacture. From the *Revenue Administration Reports and Agricultural Statistics of Burma (1877-1901),* sugarcane growing area

Table 4 : Area under the Sugarcane Crop in Myanmar from 1878 to 1932

From the Revenue Administration Reports of Lower Myanmar and from Agricultural Statistics, Myanmar of 1877-78 to 1900-01		From the Season and Crop Reports of Myanmar	
Year	**Acre**	**Year**	**Acre**
1878-79	3,782	1905-06	12,701
1879-80	3,496	1906-07	13,795
1880-81	3,919	1907-08	13,452
1881-82	6,351	1908-09	12,167
1882-83	7,221	1909-10	12,267
1883-84	9,984	1910-11	13,275
1884-85	7,332	1911-12	13,902
1885-86	9,356	1912-13	14,241
1886-87	7,148	1913-14	15,040
1887-88	7,459	1914-15	15,362
1888-89	8,389	1915-16	15,791
1889-90	10,546	1916-17	18,356
1890-91	11,320	1917-18	20,509
1891-92	10,071	1918-19	20,378
1892-93	9,544	1919-20	20,669
1893-94	10,091	1920-21	24,690
1894-95	12,084	1921-22	32,045
1895-96	15,362	1922-23	28,542
1896-97	14,278	1923-24	25,483
1897-98	12,447	1924-25	20,462
1898-99	11,794	1925-26	20,276
1899-00	11,566	1926-27	21,007
1900-01	12,538	1927-28	19,408
1901-02	15,286	1928-29	18,153
1902-03	16,277	1929-30	18,251
1903-04	13,108	1930-31	17,227
1904-05	11,303	1931-32	17,624
		1932-33	18,073

Source: A. McLean. 1935. *Sugarcane in Burma. Agricultural Survey No.19 of 1934.*

was recorded to be 3,653 acres in 1877-78 and it increased two fold in the succeeding fifth year and three fold in the tenth year (Table 4). Thereafter the area fluctuated slightly from year to year and the area reached 15,362 acres in 1914. By 1921, the above figure was more than doubled, the area increasing to 32,045 acres presumably on account of the rising prices caused by the post World War I effects. The retail prices of kyanthaga (jaggery)in Yangon markets from 1919 to 1935 is given in Table 5 to help match the yearly trend of sugarcane growing area. The

Table 5 : Monthly Average of the Whole Sale Prices in Rupee of 100 Viss Jaggery, First Quality in Yangon

Year	Season month					Mean
	Nov	Dec	Jan	Feb	March	
1919	28.50	28.00	-	-	-	28.25
1920-21	33.00	32.50	27.50	27.00	26.00	29.20
1921-22	41.50	41.25	30.00	30.00	28.50	34.25
1922-23	48.50	48.00	40.00	38.00	38.00	42.50
1923-24	54.00	52.50	46.50	44.00	43.00	48.00
1924-25	60.00	52.00	50.00	49.00	47.50	51.70
1925-26	54.25	55.00	50.00	48.00	52.00	51.85
1926-27	42.00	42.00	55.00	55.00	44.25	47.65
1927-28	60.00	60.00	44.00	45.00	45.00	50.80
1928-29	37.75	39.19	60.00	74.75	70.00	56.34
1929-30	34.75	35.00	40.75	45.00	39.56	39.01
1930-31	34.00	34.00	33.50	34.25	34.75	34.10
1931-32	32.50	25.88	35.56	45.00	48.75	37.54
1932-33	30.38	31.00	26.50	32.50	27.38	29.55
1933-34	29.50	19.25	25.19	26.00	25.00	24.99
1934-35	-	-	16.06	14.00	-	15.03

Source: A. McLean. 1935. *Sugarcane in Burma. Agricultural Survey No.19 of 1934.*

retail prices of kyanthaga in Yangon was Rs.28.50 per 100viss in November 1919 and reached a peak at Rs.60 in November 1924. It is noteworthy of the seasonal price fluctuation within the same year. The opening price was usually high in the month of early cane season (i.e. November) and gradually dropped to the minimum towards the end of the cane season (i.e. March) and increased during the off-season. Despite the seasonal fluctuation, the yearly prices exhibited an increasing trend. Therefore it could be said that, except the area expansion particularly associated with the establishment of modern white sugar factories in 1926 and 1934 at Myitkyina District and Taungoo District respectively, the steady increase in cane area throughout the period from 1877 to 1938 could be primarily attributed to jaggery cottage industry which became expanded and widely dispersed over the country.

Introduction of suitable sugarcane varieties followed the area expansion. By the time Mr. O' Riley attempted to establish the first white sugar factory at Kyaikami, he introduced Otaheite cane to Tinninthari district of Lower Myanmar (Mc Lean, 1935). It is of Mauritius origin and it thrived best in Upper Myanmar as widely known as Taungoo Yel-

low Cane. It was esteemed for kyanthaga production although it did not yield heavily. With the organization of Department of Agriculture in 1906, measures were successively taken to improve sugarcane through varietal introduction. Pyinmana Central Farm was then opened in 1925 and several sugarcane varieties were introduced from Java, India, etc. and selected by repeated trials and released for commercial planting to the farmers.

In 1926, the Burma Sugar Company Limited established a white sugar factory with an estate at Sahmaw in Myitkyina District. The cane crushing capacity was 1,000-1,200 tons cane per day(TCD).The cane area was only 179 acres in the district in 1924 but the demand from the newly operated factory expanded the cane area to 2,936 acres in 1933 (McLean, 1935). Another large modern sugar factory with 1,000 TCD was built in 1934 at Zeyawaddy grant in Taungoo district. These two new sugar factories produced 38,252 long tons of white sugar in 1940-41 (Andrus, 1948).

The fluctuation in production was also associated with changes in paddy price. Since 1921, paddy price increased steadily and reached a peak at 1927. Sugarcane area started decline from 28,542 acres in 1921 down to 18,153 acres in 1928. Growers switched from sugarcane to rice. By 1932, paddy price dropped. Establishment of Zeyawaddy sugar factory coincided with the stagnant paddy trade. Sugarcane area again jumped to 37,632 acres in 1934 and continued expansion had registered an all time high record of 76,875 acres in 1940-41. Bumper cane harvest went to both sugar mills and jaggery cottage industries. Farmers throughout Taungoo, northern Bago, and southern Yemathein District grew considerable quantities of sugarcane for shipment by rail to Zeyawaddy. The farmer received Rs.8 per ton cane delivery at mill or railway. With a prewar normal crop yield of 20 to 30 long tons per acre, he makes his gross return Rs.160 to Rs.240 (about USD 50 to 70) per acre. The cash net return was about Rs.40 (USD 12) which was quite high as compared to gross values of other crops (USD 5.12 for rice, USD 4.58 for beans, USD 4.05 for groundnut, USD 2.18 for sesame) (Andrus, 1948). In the case of cane jaggery manufacture, assuming that the jaggery outturn was from 1250viss to 1750viss per acre, the gross returns were recorded in the years 1925-26 to be Rs.375 in Pyinmana, Rs.360 in Lewe, and the

corresponding net return were Rs.112 and Rs.105 per acre at the jaggery price Rs.30 per 100viss (Agriculture Department, Bulletin No.23, re-print, 1962). Jaggery prices were however declined to Rs. 12.07 in 1938. (Market Survey No.16. Director of Agriculture, 1951).

Under those conditions, had milling capacities of the factories been greater, it is likely that more white sugar and less jaggery would have been produced. But the great rewards of sugarcane caused a flooding of the market, and cane which could not be sold to the factories was ordinarily converted into jaggery as a last resort. Thus under the circumstances that whenever the cane production chronically outran the capacity of the mill the jaggery processing cottage industry served as an outlet in order to prevent waste.

By 1941, Myanmar had become self-sufficient in sugar production, the two working factories producing 38,252 long tons that year. Consumption in the previous decade had averaged 34,000 tons. According to Binns (1945), other non-centrifugal sugar production, mainly cane jaggery amounted to a normal 47,000 ton while plam jaggery amounted to about 50,000 tons. But Mr. Watson, the then Director of Agriculture, suggested that 20,000 tons was better estimate of cane jaggery production. In 1945-46, only Zeyawaddy mill was operating with an estimated output of white sugar at 2,049 tons due to the World War II. Cane jaggery fell to about 16,000 tons while palm jaggery dropped slightly to about 45,000 tons. Production was around one-third of the prewar level. The government planned to import about 30,000 tons. The actual import was 11,000 tons.

5. MYANMAR INDIGENOUS TECHNOLOGY OF PAN BOILING

The jaggery processing factory adjoins the homestead which is often semi-permanent and outside the village or amids the sugarcane fields. It is a large high-roof shed under which cane crusher was set up for extracting the juice. The earlier local-made crusher consisted of two heavy vertical rollers driven by wooden sprockets superimposed upon the rollers. Machine with a third roller was then introduced. In prewar period, wooden mills were replaced by iron three-rollers drawn by bullocks and

later by diesel engine with about 10 to 20 HP.

Adjoining the mill, a jaggery furnace is set up for the manufacturer of jaggery. The ordinary furnace consisted of a pit 2m long by 1m wide by 1m deep. At one end of this pit, a tunnel about 45-60cm in diameter was started for the fire box and continued for a distance of about 6 m, holes being cut in the roof for placing pans. No chimney is usually built but if so it is never more than 60cm or 1m high. As no fire-bars are provided in the fire box, the supply of air is not sufficient for complete combustion, and the fire box gets choked up with partly consumed fuel and requires frequent cleaning. In the furnace without chimney, draught is small with the result that the fire is not drawn through the flue properly.

Smith-Rollo (1926), agricultural engineer of Mandalay Agricultural College and Research Institute, improved the furnace design with a view to saving fuel and time. In the improved design, fire doors and fire bars were fitted and chimney of 2 to 5m was added. The furnace has more brick work to raise it, thus allowing for an ash pit.The flues and fire boxes were more carefully proportioned and fitted with buffle plates to direct the hot gases against pan bottoms. Smith-Rollo designed improved furnaces into two prototypes: straight type and return type. Both types required no fuel wood but the available bagasse could furnish sufficient amount of energy. Fuel wood was required in small quantity used to kindle the fire at the start of the daily operation. The straight prototype of the improved furnace was widely accepted and currently being employed in the permanent sites of the jaggery production areas.

The deep iron pans about 1.2 m in diameter are seated in the brick walls well plastered with clay and dung mortar. There are six or seven pans (3 pans for smaller size) placed contiguous but in ascending series towards the chimney. Since sugarcane juice is boiled into such open pans, the indigenous juice boiling technology is known as open pan technology (OP technology). In the contrary, the modern white sugar factory employs the vacuum pan technology (VP technology) by which cane juice is boiled into vacuum pan in order to save energy, improve quality and minimize the sugar loss due to inversion.

The cane juice is collected at the mill and it was fed to the coolest i.e., the outermost pan. As the boiling proceeds, the richest juice is concentrated in the two pans nearest to the furnace door where the heat is greatest. Scum is frequently removed from the boiling juice which as it froths up is kept within the pans by large thin zinc or bamboo cylinders. When the syrup has become sufficiently concentrated it is ladled from the innermost pan to a separate pan placed upon the ground. It is cooled for a few minutes and it is stirred by a wooden blade. Then the thick golden liquid is poured quickly upon a clean bamboo mat to solidify, is marked off into sections about the size of a cigarette packet. It is then, upon cooling, solidified and collected in a wooden box holding from 30 to 40viss (49 to 65 kg). The first class cakes of jaggery must be bright yellow in colour, crystalline in section, thin, hard and free from stickiness, giving a clear hard sound when struck with the knuckle.

6. JAGGERY TRADE AND BUSINESS

The incoming trade in Yangon was formerly in the hands of a smaller number of Chinese buyers.These firms had branches of agents or bought through dealers located where jaggery was manufactured. These dealers were mainly Chinese and few Myanmar and Indian merchants. From colonial period until planned economy era, the jaggery prices in the free market were fixed by the demand from Yangon and Mandalay. That rate was fairly well known and individual buyers were advised by trading companies or dealers in Yangon and Mandalay and bought accordingly, throughout the production districts. There was no assembly market, sales being arranged privately between the producers and buyers. A man of small mean might not be in a favourable position in securing those trade and business. Besides, sugarcane is an intensive crop which requires a considerable amount of capital. Manufacturing process is also expensive. Sale of cane was not the rule in these areas and growers turned it into value-added product i.e. jaggery for sale. Thus growers in this business were inseparably bound up with money lending. Chettiars lent money when there was cane land to mortgage at a rate of 2 percent per mensem. Myanmar moneylenders gave advance cash for which Myanmar dealers stand security for money lending. Growers had recourse to a third source for necessary fund i.e. dealers particularly Chinese. It is customary to

enter into an agreement with the financing dealer that the grower shall dispose of the whole of the factory's produce. The prevailing system had led some growers in indebtedness. Authorities addressed the question of supplying capital at reasonable rate of interest. It was also a question of character, stimulating independence, business ability, entrepreneurial spirit and habits of thrift on part of the growers. Upon examination of the pre-war jaggery trade, the Director of Agriculture noted that growers did not get the real value of the crop and were deeply in the hands of Chinese dealers (Agric. Dept. *Bulletin No 23*, 1963).

In the post war era, both industries suffered the proportionate drop in production. After independence, Myanmar pursued the raw material-oriented, import substitution industrialization policy (Kudo, 2001). In 1954, large white sugar factories were nationalized. Centrifugal sugar production became state-owned enterprise while jaggery cottage industry was left to operate in small scale by scattered individual owners in the free market. During the period from 1959 to 1964, about 51% of total cane harvested was processed by state-owned large scale VP mills and the remaining 49% was manufactured by jaggery OP technology. The yearly jaggery production was estimated to be 37,219 ton over the same period (Anon, 1964). The jaggery production in 1963-64 was 24,240 ton contributed from different source regions (Table 6). The 1964-65 production of jaggery as estimated by jaggery traders was 23,210 ton.

Table 6 : Production of Sugarcane and Jaggery in Different Districts, 1963-64

(ton)

District	Township	Sugarcane	Jaggery
Yemathin	Pyinmana , Lewe, Tatkone	182,000.00	14,625.00
Taungoo	Pyu,Taungoo,Oaktwin,Mone	35,400.00	2,845.00
Bago	Western Nyaunglaybin	3,850.00	309.40
Thaton & Kayin State	Bilin, Phaan, Hlaingbwe	50,000.00	4,018.00
Kyaukse	Kyaukse, Sintgaing, Belin	21,660.00	1,740.60
Taunggyi	Nyaungshwe	n.a	n.a
Total		**301,650.00**	**24,240.40**

Source: Anon, 1964: Socialist Economy Implementation Committee, Agriculture Symdicate, Sugarcane and Sugar related products. 1964.

The monthly jaggery prices from 1959 to 1963 is presented in Table 7. The prices being from source regions, would be relatively lower than Yangon retail market. The seasonal price movement was the same as the

Table 7 : Mean Monthly Jaggery Prices (ks/ 100 viss) Over the Period from 1959 to 1963 in Pyinmana Area .

(1 viss = 1.633 kg)

Month	1959	1960	1961	1962	1963	Mean
Jan	85.57	92.78	97.54	89.26	64.35	85.90
Feb	80.45	90.07	92.46	70.00	59.07	80.01
Mar	90.17	97.16	107.65	62.50	53.56	83.95
April	99.29	80.14	109.89	58.70	65.24	84.25
May	96.44	96.05	108.50	60.00	69.55	86.11
June	103.25	107.47	108.40	58.75	85.22	92.62
July	119.54	117.65	108.90	61.83	91.60	99.90
Aug	141.45	118.25	110.49	64.76	97.71	106.53
Sep	113.86	111.83	123.93	71.57	98.51	103.94
Oct	86.74	96.16	105.20	72.81	83.77	88.94
Nov	101.40	103.72	104.28	86.60	94.43	89.08
Dec	86.22	108.91	100.87	69.04	92.11	91.34
Mean	**101.62**	**102.40**	**106.51**	**68.82**	**79.59**	**91.79**

Source: Socialist Economy Implementation Committee, Agriculture Syndicate (Sugarcane & sugar related products), 1964.

prewar trend with opening prices high in November and low in the peak season from January to March and the highest usually during the storage period from June to September.

Jaggery trade was primarily occupied by Chinese dealers as in prewar period. Few cane growers did not seek loans or advance cash and produced jaggery with their own financial means and they sold their jaggery to the dealers on cash down basis. Handling expenses of local dealers who provided boxes and paid freight costs were 2Ks/100 viss. But majority of growers received loans or advance payment before the manufacture of jaggery. The interest rate was normally 5 percent per month. His jaggery produce was disposed at the prevailing price in order to meet his obligation to the dealer or moneylender. Dealers' profit was estimated to be 3% of the business transaction. Moreover, at peak production season, dealers purchased jaggery at low price and gained profit by selling their stored product at higher price in the off season. Low keeping quality of jaggery, however, limited the length of storage period, particularly in the mid rainy season.

In the trade channel of Taungoo and Phyu jaggery, about 30% of total produce was consumed locally and the rest was shipped to Yangon and

again sent to Delta areas. About 90% of Pyinmana produce shipped to Yangon, Mandalay, Taungdwingyi, and southern Shan State while the rest was locally consumed. The Yangon channel was diverted to Rakhine, Dawei, and Meik whereas the trade channel via Mandalay went to Shwebo, Monywa, Sagaing, Kachin and northern Shan State regions. Mawlamyine jaggery flowed into Yangon in small amount and primarily consumed locally. Sintgaing jaggery was sent through Mandalay dealer house to Shan State, Sagaing, Shwebo, Monywa and Katha. About 75 % of jaggery from Zeyawaddy, and northern parts of Nyaunglaybin were consumed by local Indian households and the surplus 25 % was marketed to Yangon suburb areas for dairy cattle feeds.

7. STATE ENTERPRISE VS PRIVATE ENTERPRISE

The state-owned large scale modern sugar factories are capital-intensive sugar boiling with vacuum pan whereas private-owned small scale and scattered jaggery cottage industry employed pan boiling and are labour-intensive. After independence, Myanmar attempted to achieve self-sufficiency in sugar by establishment of modern factories. There were eight factories over the period from 1953 to 1988 with a total crushing capacity of 8,600 TCD. Over the crushing season days, about 120,000 acres of sugarcane are required to meet the need of the factories. Under the planned economy, cane procurement was based on the quota system and cane was purchased at an officially controlled price. The cane quota assigned to individual grower was 13 tons cane per acre (TCA) for plant cane and 6 TCA for ratoon cane. After fulfilling the need for factory cane, growers could use the surplus cane for jaggery processing. The state-owned factories run under the centrally set target. The jaggery cottage industry was operated by purchasing the cane with market price. Since the amount and quality of jaggery produced depends to some extent on the quality and sugar content of cane, the farmer tended to keep his best cane for the jaggery. He tends to deliver lower quality cane to the factory where cane is paid for by weight.

Farmer's income from jaggery manufacture was double his income from quota cane as explained in the cost and return analysis (Table 8). Since typical farmer had usually about 5 TCA for processing jaggery, he could

fulfil his contracted cane supply according to the quota to the factory even though the factory price was relatively low. Thus in the last three decades, the state owned factories had retained the quota system to ensure the sufficient cane supply to the factories in spite of the competition with jaggery. When the cane supplying capacity in a region exceeded the factory needs, the quota system worked well though not smooth since it generated additional incentive for sugarcane growing. Besides, the cane procurement price was also favourably set in relation to paddy price. Paddy was also the state-controlled crop being a less attractive crop at that time.

Table 8 : Typical Farmer's Cost and Return from Jaggery in Pyinmana , 1977

(Kyat/ton cane)

Costs and return items	Amount
Additional costs for jaggery	
Additional harvesting labour and oxcart hire	22
Processing charge	60
Boxes	12
Transport to town	5
TOTAL ADDITIONAL COSTS	99
Revenue from jaggery	
1 ton cane produces 50 viss of jaggery at ks. 6/viss	300
Net return to farmer from jaggery	201
Payment by factory for quota cane	100
Net benefit to farmer from jaggery	101

Source: San Yu Consultants Inc., 1977.

Regarding paddy, prior to 1972, the price of sugarcane(35Ks/ton) was competitive in relation to rice. However, from 1973 to 1975, rice had greater price increases than cane and consequently, farmers had switched out of cane into rice. The increase of cane price to 100Ks/ton again brought into line with rice and in fact gave it a slight edge (San Yu Consultants Inc., 1977).

The delicate balance that the quota system for the state owned factories maintained between the cane and jaggery prices and paddy prices were deteriorated over time. It was only in 1972-73 that the state owned factories witnessed the highest sugar production up to 68,912 mt and thereaf-

ter production gradually decline due to the inadequate supply of sugarcane (Kudo ed., 2002). The factory procurement price for cane was 100Ks per ton in 1988 while the cost of cane production was 115 Ks. per ton (Cools, 1989). The price of jaggery in the beginning of the season, when it was forbidden to produce jaggery, stood at about 12 Ks. per viss, while later in the season, when the majority of farmers were producing jaggery, the price dropped till 9 to 8 Ks per viss. If the price of jaggery was 12 Ks per viss, farmers still obtained profit but at the price of 8 Ks per viss, farmers' profitability was low even if he could be completely free to make jaggery out of his total cane production. According to the calculation of Cools (1989), the market price of sugarcane equivalent to the prevailing jaggery price of 12 Ks per viss was found to be 330Ks per ton cane indicating that the government procurement price was three times lower than market price. Cools (1990) conducted survey in Yedashe township when the cane purchasing price went up to 150 Ks. per ton. The net return averaged from both plant cane and ratoon cane was only 2,674 Ks per acre. Even of this total income, jaggery contributed up to 77%. When compared with paddy cultivation, he reported that sugarcane could hardly compete with paddy plus a follow-on crop at the prevailing price ratios. Sugarcane would be much more attractive if the factory paid the market price of about 450 Ks per ton since the cost of cultivation was amounted to 355 Ks per ton plant cane. But if the paddy were decontrolled crop by abolishing the paddy quota system, it will become more attractive again, becoming less attractive for cane.

Around 1930s when the private-operated Zeyawaddy factory procured cane at market price, cane supply from farmers had fully met the factory requirement. Besides, whenever the cane supply outrun the factory capacity or mill stoppage or mechanical breakdown occurred, jaggery manufacture became an outlet for the surplus cane. But after all the factories became state economic enterprises (SEEs) and the factories procured fixed quota cane at low price, jaggery manufacture became instrumental for survival of sugarcane growing.

After 1997, however, the nine new sugar factories with a total crushing capacity of 17,500 TCD was built by the Myanmar Sugarcane Enterprise (MSE), the recently organized state enterprise under the Ministry of

Agriculture and Irrigation (MOAI). The expansion of sugar industry in the state sector pushed up the cane area to an upper limit and sugar factories were crowded in some regions upsetting the demand and supply situation of sugarcane. Thus, the small-scale, private-owned jaggary processing plants were driven outside the state-owned mill areas. The private-owned SMEs in sugar industry were shifting to the Upper Myanmar and now concentrated in Upper Myanmar. In fact, the jaggery processing and mini sugar plant had been established and grown to a large number during the period especially since 1990 in Upper Myanmar (Appendix 2).

8. STRUCTURAL ADJUSTMENT OF SMEs IN MYANMAR SUGAR INDUSTRY

Despite the competition with large scale modern factories, the private-owned sugar processing SMEs had managed to survive over years. These SMEs exhibit the quick response to changing situation. In the mid 1970s, the state sector sugar production declined sharply. The market price jumped from 2.10 Ks. per viss in 1970 to 6.70Ks in 1971 followed by series of price increases in subsequent years. Market price stood at 27.4 Ks. per viss in 1976. The government agencies distributed sugar at 5.32 Ks.per viss but in rather small amount (Table 17).

Driven by shortage of sugar, private entrepreneurs sought the near substitute for centrifugal sugar. U Khin Maung Nyo (now owner of Diamond Crown Vacuum Pan Sugar Plant) and his associates from Pywebwe town (Mandalay Div.) took pioneer attempts around 1972-73 to produce crystal sugar from jaggery and syrup. By means of static crystallization, the brownish powdery sugar was formed and separated by locally fabricated centrifugal with about 1400 rpm. The product gradually penetrated the market. The produce was similar to what Indian sugar technologist termed Khandsari sugar (UNIDO, 1980). It is locally called *khar* sugar in Myanmar. By colour, it is a brown sugar. By production method, it is the OP centrifugal sugar while crystallization took place in the earthen vessels where jaggery or syrup were stored for 3 to 4 weeks. The pioneer workmanship was the crystal formation and the increase in crystal size (personal communication, 2002). U Khin Maung Nyo attempted to fabricate the VP by locally available materials. It worked but with low efficiency.

By 1984, U Sai Kyaw Tin (now owner of Nan Chaw Vacuum Pan Sugar Plant) established the first successful VP mini sugar plant in Mandalay with the help of a Yunan Chinese blacksmith possessing working knowledge of sugar factory fabrication and design. The plant started operating in 1985 with the daily output of 1,500 viss (2.45 ton) white sugar. All materials were fabricated at Mandalay Seinban workshop. No crushing mill is attached. Clarification, pan boiling, crystallization and centrifugal separation process are employed. The old boilers of pre-war period were erected to produce steam. Once the standard design was first introduced, it was later adapted to varying capacities and copied by several follower owners in Mandalay, Pywebwe, Meiktila, Pyu, Pyi, Sagaing, etc.

The product of vacuum pan sugar plant is not directly processed from sugarcane. But it processes the syrup or jaggery which was manufactured by OP boiling method. The final product is then obtained by hybrid technology, i.e. OP cum VP-Centrifugal technology. At present day improvement, the vacuum pan centrifugal sugar (locally called Paung sugar) nearly assumes the standard quality of plantation white sugar. The conversion of jaggery into khandsari sugar (brown sugar) and then into white sugar (Paung sugar) was lucrative at the prevailing prices. The net return of processing 100 viss of jaggery into 46 viss of khandsari sugar was about 155 Ks. The profitability was not very high but if the jaggery price was dropped from 10 to 8 Ks. per viss, the net return of conversion increased to about 355 Ks per 100 viss of jaggery. Conversion of 100 viss of jaggery (8 Ks./viss) into 35 viss of Paung sugar (at the existing level of technology)gave a net return of about 736 Ks. The value-added profit was two times higher in Paung sugar than in khandsari sugar. The required capital investment is high for Paung sugar production.

Development of syrup trading had led to the formation of assembly syrup market, "Sugar and Syrup Traders' Religious Association" in 1985 in Mandalay. The daily function of the association was trading and business transaction under the religious title as it was organized during the socialist regime and the association collected the contribution from the members for annual offerings to the Buddhist monks.Through this trade channel, the SMEs in Mandalay and other areas obtained the raw material supply.

There are two processing types of syrup at this stage. The small-scale entrepreneurs employ centrifugal machine only to turn the syrup into centrifugal brown sugar (khandsari sugar). This type of business is locally designated as mini centrifugal sugar plant. The next type is medium-scale plant employing both vaccum pans, centrifugal, and boilers to undergo the process of remelting, filtration, clarification, vacuum pan boiling, crystallization and separation. The process is similar to large scale modern factory except the presence of cane milling and mixed juice boiling.

The plant size is categorized into small(100-215 KVA), medium(215 to 315 KVA),and large(315 to 500 KVA)enterprise with respect to the use of electrical power. During the period of centrally planed economy, the private sugar plants were suppressed. But after 1992, the private sugar industry grew rapidly. In 1997-98, there were 761 registered number of mini sugar VP plants and mini sugar centrifugal plants in different state and division (Table 9). Comparatively, there were about 250 mini plants in the whole country towards the end of centrally planned economic systems in 1988. From the information in Table 9, it is difficult to categorize the particular type of mini sugar plants in the respective area. It appeared that the majority were mini untrifugal (kandsari sugar) plants.

Table 9 : Number of Mini VP Sugar Plants and Mini Centrifugal Sugar Plants in Different Parts of Myanmar, 1997-1998

	No.of Plants	Investment Value (kyats)	Sugar Output (mt)	Employees (number)
Mandalay	389	596,417,600	22,763	2,174
Sagaing	31	26,892,500	200	137
Shan	316	80,499,500	637	3,832
Bago	17	47,441,011	110	140
Magway	2	2,400,000	13	15
Yangon	2	1,848,000	12	9
Ayerwaddy	2	2,213,000	12	15
Mon	1	886,000	6	5
Rakhine	1	62,000	4	3
Total	**761**	**811,557,600**	**23,757**	**6,330**

Source: Industrial Supervision and Inspection Department, Ministry of Industrial No. (1).

In the same year, census of the jaggery manufacturing indicates that there

were 900 jaggery plants in western part of Bago Division, 300 plants in Shan State, and nearly 1,800 plants in both Mandalay and Sagaing Division. As of 2002, the total jaggery manufacturing plants had been increased. The manufacturer had distributed 2,200 mills since 1976 to the present. The parallel manufacturer at Mandalay also rented out his mills yearly and in 1996-97, the total number of mills rented out was 1,500 and in 2002, the number of renting mills was 800. There were also a few number of local workshops in the cane growing areas where there had produced about 350 mills. Therefore total number of jaggery plants are estimated to be from 3,350 to 4,050 in the private sector.

Recently, San Thein and survey team from MSE and T.Kudo, Visiting Research Fellow of IDE in 2001 conducted survey on sugar processing SMEs in Mandalay city and they reported that there are 5 VP sugar plants of large scale, 58 VP plants of medium scale, and 15 VP plants of small scale and 720 mini centrifugal sugar plants operative in Mandalay area (Table 10) (San Thein et al., 2001).

Table 10 : Number of Sugar Plants (VP and Centrifugal) in Mandalay, 2001

Type and Size	Number	Sugar Output (tons/d)	Season days in year	Sugar Production (ton/year*)
VP & centrifugals plants				
Large	5	24.10	180	21,699
Medium	58	9.70	180	100,746
Small	15	3.90	180	10,422
Centrifugals only	720	1.30	150	67,500

Source: San Thein et al. and T. Kudo (2001) survey in Mandalay.
* Raw materials are cane syrup and palm jaggery assumed to be in equal ratio.

It should be noted that brown sugar(khar) obtained from mini centrifugal plants are reprocessed at the VP plants to produce white centrifugal sugar. It is estimated that about half of the brown sugar from mini centrifugal plants is converted at VP plants. The active number of season days was assumed to be180 days for over all SMEs although some plants could operate almost 10 to 11 months a year with sufficient supply of feedstock. The raw materials were assumed to be cane syrup and palm jaggery

in almost equal proportion for most of the sugar plants. Therefore, the estimated total sugar production was calculated to be about 100,183 mt in all SMEs sugar processing plants (Calculated from Table 10).

In the developed countries, sugarcane milling and processing are undertaken in large sugar factory close to the cane fields as a continuous process and the plantation white sugar is produced. In the case of refine sugar, however, refinery may be established in large cities, by virtue of very small weight loss ratio between white sugar and refine sugar. In Myanmar, the situation is different. The mini sugar plants with limited capital outlay and organization ability, could not readily overcome the existing constraints such as the poor infrastructure, scattered distribution of sugarcane in rural areas, the perishable nature of the cane crop, and the restrictive technical requirement of the modern sugar factory for continuous crushing in regular and steady cane supply in specified amount, etc.

The growth of the SMEs in private sugar industry is unique. The cottage industry with OP technology was located close to source region (sugarcane growing areas) while SMEs with VP and centrifugal separation technology was established at market centres (especially Mandalay in Upper Myanmar). When the sugar processing SMEs started establishment, the jaggery cottage plants did not process to produce jaggery but syrup as industrial feed stock. In the first stage with OP technology, sugarcane juice is extracted and boiled in the open pan to produce semi-solid "syrup" sugar which again is transported in half-cut iron drum over long distance from various source regions to centralized market in Mandalay. By turning perishable sugarcane into less perishable syrup, the mini sugar plants could run the full stream operation by using the stored syrup almost throughout the year. By setting up the jaggery processing cottage plants amids the cane fields, the SMEs could have overcome the infrastructural constraints. And it produces half-finished product(syrup) which becomes much less perishable and transported to large city for further process into finished products. Thus through an appropriate combination of OP and VP technologies, sugar processing SMEs in the private sector overcome the difficult tasks of sugarcane assembly and transport, and processing.

By 2001, U Tin Maung, the owner of the Mandalay 'Great Wall' VP sugar processing plant moved one step forward by establishing a sugar factory together with cane crushing unit with a capacity of 500 TCD. It locates in Madaya, Mandalay Division. It is the first sugar factory in private sector of Myanmar established to directly process sugarcane since 1954. Commercial operation commenced in 2002 cane season with daily output of sugar from 24.5 to 34ton. The old small factory was bought and moved from a small town of Yunan province in China to Madaya. The company established own plantation of 2,000 acre in addition to cane procurement from farmers.

9. EXPANSION OF THE INDUSTRY

Prior to early 1990s, jaggery cottage industry coexisted with SEEs in the mill areas. In 1994, Myanmar Sugarcane Enterprise (MSE) was organized, holding responsibility of sugarcane production, processing and distribution of the produces. The SEEs industry was expanded with a view to increasing fulfilling domestic needs and increasing export. In 1999-2000, nine new sugar factories were established. Formerly, jaggery cottage industry was thriving in western part of Bago Division in order to compensate the shrinking supply areas in the typical mill areas of Pyinmana and Taungoo Districts. At the same time the cottage industry was setting foot in Kanbalu and Shwebo first and then in Singu, Tagaung, Htigaint, and Katha gradually in that order. When the western part of Bago Division was occupied by five new large sugar factories of SEEs, the cottage industry had left there for new areas in Shwebo, Kanbalu, Htigaint, and Katha townships of Sagaing Division and Thabeikkyin and Singu townships of Mandalay Division. The cane area increase in those townships in 1998-99 coincided with increase in cane areas of SEEs mill areas.

The private industry was expanded in Upper Myanmar to the extent that it gave away to the areas to SEEs factories. Again when another factory with 2,800 TCD was built in Kanbalu by Myanmar Economic Corporation Company Ltd., jaggery plants were removed from the area. However, the huge demand for raw materials from private-owned SMEs sugar plants in Mandalay had pushed the jaggery cottage plants far into the

Table 11 : Sugarcane Area under State and Private Sector from 1989 to 2002

Year	State-owned cane acreage	Sagaing Division			Mandalay Division	Northern Shan State	
		Kanbalu, Shwebo, Wetlet, KhinU	Kathar, Htigaint	Other Townships	Thabeik-kyin Singu Madaya	Kyaukmee District (Kyaukmee, Thibaw, Naungcho)	Koekant, Laukai
1989-90	51,164	8,874	6,858	1,315	4,770	3,984	
1990-91	68,958	15,424	7,963	1,454	5,471	1,750	
1991-92	81,186	21,772	9,785	2,029	6,355	3,429	
1992-93	96,750	27,109	9,651	2,157	8,352	3,730	
1993-94	83,428	12,389	10,067	2,424	10,169	5,511	
1994-95	74,225	20,037	9,418	2,389	13,606	4,262	
1995-96	77,841	20,507	10,121	2,603	15,485	4,584	20
1996-97	98,474	19,063	12,371	3,386	19,395	7,093	1,446
1997-98	155,804	17,186	26,312	4,239	22,644	8,413	4,146
1998-99	118,623	23,591	25,476	5,848	23,175	10,477	6,605
1999-00	128,685	22,675	26,457	7,370	21,375	19,769	9,685
2000-01	140,305	21,650	42,882	6,609	21,444	21,861	9,531
2001-02	171,909	32,318	69,638	6,750	25,147	21,346	9,232
2002-03	171,363	30,583	73,095	5,794	25,895	21,094	7,828

Source: Settlement and Land Record Dept, MOAI.

interior areas of Thabeikkyin, Htingyaint, and Kathar townships. By 2002, the cane area was expanded over ten times during 15 years of growth. The area expansion in both state and private sectors is shown in Table 11.

10. PRODUCTION ESTIMATES

There was no reporting system nor assigned working team on production and trade in the private sector sugar production. During the second trip of survey of San Thein and T. Kudo from May to June in 2002, four basis of sugar production were established as follows.

i. volume of trading of syrup
ii. transported amount via truck roads and waterways
iii. number of syrup processing cottage plants in specified areas
iv. combination of production norms established by survey findings and

official reports of Settlement & Land Record Dept. on sugarcane acreage.

In the first method, marketing and trade of syrup in production areas of the respective township could be estimated from the local traders. Not only the volume of turn over in trading but also the volume of syrup stored should be taken into account. This could be figured out from long term associate with the local traders or through the township association of syrup dealers and traders. The bigger the dealer, the greater the stored capacity of syrup expecting higher prices in the off season. The storage capacity of a dealer or trader could be limited by three factors:

(i) financing power
(ii) amount of storage barrels or earthen vessels possessed by each trader and
(iii) storage space for syrup vessels

Generally one third portion of total syrup purchased is estimated to be under conditional storage for each trader while two-thirds are in the market channels or are being processed at SMEs plants.

Production estimate of the second method is based upon the volume of transport. In Upper Division of Mandalay, the strategic road had been built from Moegoke-Thabeikkyin junction through Tagaung to Shweli (Katha) since 2000. This all-season road serves as major transport route for syrup from production areas along the road to Mandalay SMEs plants. Previously all the produces were carried via waterways. In the road net work, inquiry could be made for number of trucks, the loading capacity and number of trips per month. The transport data could be easily compiled by an assigned recorder during the sugar season at the truck weighing bridge at the entrance gate of Mandalay. For the volume of waterway transport, some record keeping for the transported amount of syrup from riversides along the route from Bamho to Mandalay could be available at porter supervisory deport under Mandalay City Development Committee at Gawwein jetty, Mandalay.

The third basis for production estimate mainly comes from the number of jaggery or syrup processing plants in each production regions. Based upon the processing capacity of each plant, the production estimate could

be made in a season. One syrup processing plant could crush 5 to 6 tons cane a day from which about 516 to 619 kg of syrup could be processed. Assuming 120 net crushing season days and 3350 mills operating, total syrup production would be 207 to 248 thousand metric tons. With about 50% recovery from syrup to centrifugal sugar, total private sector sugar production could be around 100,000 tons. It should be kept in mind that cane area and number of syrup processing plants are in equilibrium.

The last basis combines the production norms and the official reports of sugarcane acreage. One ton cane produces 103.2 kg syrup (10 % recovery). Plant cane and ratoon cane could be assumed 60:40. About 3.5 tons cane and 2 tons could be deducted as seed purpose for new planting and as wastage or loss respectively. If not available, data for cane yield could be estimated on the national basis as 24 tons and 14 tons per acre yield of plant cane and ratoon cane respectively. These norms could be integrated into sugarcane acreage data to better estimate sugar production. The sugar production based on the fourth method is estimated and compared with state sector production from 1994 to 2002 (Table 12). It points out that the market share of private sector production constitutes over 50% of total almost all the time. The sharp rise in state sector production in 2000-01 could be explained by the emergence of nine new sugar factories of SEEs. The private sector production has been steadily increasing from year to year.

Table 12 : Yearly Sugar Production in State and Private Sectors

Year	SMEs Private sector (mt)	State sector (mt)*
1994-95	45,623	37,117
1995-96	48,052	41,240
1996-97	63,254	49,115
1997-98	96,803	53,797
1998-99	74,870	48,201
1999-00	77,396	54,759
2000-01	93,902	94,429
2001-02	127,774	115,655

*Source: Myanmar Sugarcane Enterprise.

11. SALIENT INDUSTRIAL FEATURES OF PRIVATE SECTOR SUGAR PRODUCTION

Before the emergence of SMEs sugar processing plants, sugarcane cultivation and jaggery manufacture were undertaken at the cottage scale. But after 1985, sugarcane growing and processing assumed the industrial character. The salient industrial features had been observed as follows.

i. Sugarcane farmers grow sugarcane, convert it into syrup and sell it out. The business is relatively labour and capital intensive and grower's market share is 100 percent of total production.

ii. When a farmer grows sugarcane and processes syrup, he usually gets net return in the promising market of syrup. He may supplement his investment with loans. After repayment, he is still left with surplus by which he extends sugarcane area in the virgin soil and increases his asset and productivity. Thus the commercial agriculture generates the surplus by which production is expanded.

iii. Farmers needs additional capital to meet the current expenses, or to clear the land in the open forest or degenerated forest. Since there exists a market for their produce, farmers want to produce syrup as much as they could and there was a great demand for capital to extend their lands, buy additional draught cattle or tractor or establish a syrup processing plant in their farms. He could not wait for one year until he could earn 500,000 Ks from growing five acres of sugarcane for one year. If he waits, the opportunity will pass on to other farmers who will take up the available land near his holdings. These situation has led the farmer to borrow money. The owners of sugar processing SMEs, on the other hand, want to secure the raw material supply and give loans to farmers who in turn dispose of their produces to the money lenders. Thus, with the increasing demand for syrup in the market a great deal of capital flows into the sugarcane production areas. In consequence, all virgin soils, waste land, open forest and degenerated forests were suddenly turn into sugarcane fields. In Kathar alone, there are about 20 syrup dealers and their revolving loan is estimated to be 200 million Kyats. If taken into account the loan from rural brokers and SMEs owners in Mandalay, the total cash flow into one township (Kathar) with over 100,000 acres of sugarcane is estimated to be 500 million Kyats.

iv. The high prices of syrup raises the commercial value of both sugarcane and the land.

v. Sugarcane cultivation itself gives little reward but upon extraction of syrup, it gives high reward. It is value-added giving handsome profit to farmers. Once the farmer could generate surplus or could borrow money, the first step he usually takes is to integrate cane farming with syrup processing by setting up the syrup processing plant in his field. Due to this vertical integration at farm level, farmers could earn reasonable profit. In other words, this step could be considered as "agricultural ladder" for the farmer by which he looks forward to being a syrup processing owner and then a dealer and finally an owner of sugar processing SMEs plant owner. The attainment of his goal will certainly depend upon his organizational ability, entrepreneurial spirit, industriousness and thriftiness.

vi. The cane season usually coincides the operations of planting, harvesting and syrup processing. Besides cane growing, one syrup processing plant requires at least 15 labourers. Assuming that it could process up to 50 acres of cane in one season, Kathar township alone with 100,000 acres under sugarcane need 2,000 labourers. Due to this peak seasonal labour demand, migrated labour particularly from Dry Zone areas is moving into the sugarcane areas of private sector. The number is estimated to be 5,000.

12. COMPARISON AND CONSTRAST BETWEEN PREWAR MYANMAR RICE INDUSTRY AND PRESENT PRIVATE SECTOR SUGAR INDUSTRY

The opening of Suez canal in 1869 and easy access to European market gave Myanmar farmers a secured market for any surplus they could produce from their land. This suddenly changes subsistence agriculture into commercial agriculture particularly in lower Myanmar. Impressed by such tremendous changes, Furnivall (1957) described how Myanmar traditional rice culture had transformed into Rice Industry. The private sector sugarcane growing and processing is now following the same path. The following is an analogy between the prewar rice industry and present day private sugar industry.

i. *Expansion in acreage*: In 1830, Myanmar rice land was not more

than 66,000 acres. Once Myanmar was drawn into world market under Btitish rule, rice area drastically went up to 9.93 million acres in 1940. Similarly, private sector sugarcane growing was initiated in 1980s in Upper parts of Sagaing and Mandalay Division. The recorded cane area was 43,051 in 1988-89 and it went up to 132,805 acres in 2001-02. The adoption of market economy had accelerated cane area expansion.

ii. *Market boom*: In 1840, paddy price was 8Rs. per 100 basket. It increased to 50-60Rs. in 1865 and 85Rs. in 1880, 95Rs. in 1890 and 165Rs. in 1928 (Cheng Siok-Hwa, 1968). In sugarcane business, there usually is no rule to sell the cane but it is the syrup processed and traded as the value-added product. The syrup assembly market was organized in 1985 in Mandalay. Its daily market price became a signal for the business. Syrup price was moving from 9.50 to 12.25 Ks. in 1990. It slowly increased until 1994 and markedly went up to 52.70 Ks. in 1995. Although inflation could be partly attributed to such swift price movement, great demand for syrup was in fact a reality. The price information was collected over about 10 years at Mandalay and parallel trend in prices of syrup, khandsari sugar and paung sugar is shown in Table 13 to 16.

iii. *Cash flow*: During the colonial rule, chettyars, money lenders from Madras came into the country immediately after the occurrence of events such as increase value in paddy land and farmers' need for credit. Besides their own capital, chettyars with access to their own headquarter in Madras and European Banks, lent out money which they borrow from the banks at 10 or 12 % a year and their agents in the villages made loans to farmers at 15 or 20 % or more with mortgage of land. The Bank Inquiry Committee of 1929-30 estimated that the total amount lent out by Chettyars over the whole country amounts to Rs.750 million, of which two-third is applied to financing agriculture (Furnivall, 1957). In the sugar industry, on the other hand, cash flow from SMEs owners, local dealers and moneylenders - all Myanmar nationality, into cane fields stretching from Madaya to Bahmo is estimated to be 6,000 million Kyats today. The monthly interest rate is 5 to 6%.

iv. *Labour migration pattern*: The expansion of paddy lands might not have been speeded up without the flow of labourers from Upper

Table 13 : Yearly and Monthly Prices of Syrup

(Kyat/viss)

Yr / mon	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	14.0-15.0	20.0-21.5	8.5-18.5	19.5-22.5	36.0-48.0	52-63	36-44	44-55	57-68	80-110	64-68	133-156
2	13.5-15.5	20.5-25.0	14.5-17.0	18.5-21.0	55.0-62.0	53-54	36-40	37-44	60-70	83-95	69-85	135-170
3	14.5-16.5	24.0-26.0	14.5-45.5	21.0-26.0	-	52-53	35-37	38-45	71-77	90-95	75-80	130-148
4	15.5-20.0	24.0-26.0	14.0-15.0	23.0-33.0	58-59.25	53-56	34-35	40-45	73-75	94-104	80-100	140-150
5	16.5-20.0	22.0-25.0	16.0-17.0	27.0-30.0	54.0-57.0	51-53	31-35	44-50	77-78	95-103	98-103	-
6	18.0-19.0	23.0-25.5	17.5-19.5	27.0-35.0	-	52-53	35-37	50-63	72-83	90-93	100-104	-
7	19.0-22.0	-	21.0-24.0	38.0	-	53-67	37-50	63-80	83-85	93-106	118-120	-
8	20.0-28.0	26.0	23.0-27.0	42.0-43.0	-	67-75	52-55	73-80	88-97	106-124	125-142	-
9	26.0-31.0	22.5-26.0	24.0-29.0	-	-	69-75	53-60	80-86	100-120	107-110	140-143	-
10	30.0-31.0	5.0-25.0	25.0-29.0	50.0	-	67-70	60	83-85	140-150	75-90	145-150	-
11	25.0-30.0	17.0-24.0	23.0-25.0	-	-	65-68	58-67	58-55	80-83	140-150	75-83	-
12	21.0-27.0	-	23.0-24.5	45.0- 51.5	68.5-71.0	40-58	53-58	67-70	110-138	80-90	150-157	-
Mean	**21.17**	**22.53**	**21.44**	**35.81**	**56.88**	**59.13**	**45.13**	**59.79**	**88.96**	**100.13**	**107.25**	**145.25**

Source: U Kyaw Linn (Pyittaingtaung) Sugar House, Mandalay, Zaygyo Market.
1 viss = 1.633 kg

Table14 : Yearly and Monthly Prices of Khandsari (Khar) Sugar, Mandalay

(Kyat/viss)

Yr/Mon	1989	1990	1991	1992	1993	1994	1995
1	-	20.0-25.0	20.5-43.0	33.0-38.0	31.0-40.0	32.0-41.0	-
2	-	20.5-24.0	26.5-28.0	33.0-40.0	29.0-32.0	34.0-40.0	
3	18.0-21.0	23.0-24.0	29.0-31.0	39.8-42.0	30.0-32.0	39.0-48.0	-
4	18.0-26.0	22.0-24.0	31.0-40.0	39.0-47.0	29.0-32.0	45.0-50.0	
5	23.0-26.5	22.0-24.0	39.0-41.0	39.0-41.0	31.0-37.0	50.0-59.0	-
6	25.0-27.0	26.0-28.5	37.0-40.0	39.0-50.0	36.0-39.0	55.5-59.0	83.0-84.0
7	24.0-25.5	27.5-32.0	37.5-38.5	41.0-52.0	37.0-42.0	56.0-65.0	83.0-86.0
8	25.0-27.0	31.0-32.0	38.0-43.0	38.0-51.0	42.0-47.0	61.0-68.0	88.0-91.0
9	26.0-35.0	30.0-31.5	42.0-66.0	36.0-50.0	45.0-47.0	67.0-75.0	91.0-98.0
10	26.0-35.0	29.5-32.0	45.0-48.0	34.0-42.0	15.0-48.0	75.0-81.0	95.0-98.0
11	34.0-44.5	27.0-33.5	45.0-47.0	37.0-43.5	43.0-46.0	84.0-98.0	95.0-98.0
12	18.0-40.0	26.0-40.0	35.0-53.5	34.0-44.0	40.0-45.0	75.0-85.0	98.0-102.0
Mean	**27.4**	**23.6**	**34.4**	**35.0**	**31.8**	**54.0**	**90.4**

Source: Aung Maung Maung Dealer's House, Mandalay.

1 viss = 1.633 kg

Myanmar as well as from India. The volume of Indian immigration increased 20 times from 1871 to 1931. Census in 1931 indicated that about 140,000 Indian labourers were engaged in farming representing as seasonal labour about 5 % of total labour force. Indigenous labour force amounted to 3.1 million representing nearly 95% of the whole (Cheng Siok-Hwa, 1968). Another 40,000 Indian labourers were employed in rice mills. The labour migration in the sugarcane areas, on the other hand, is found to be seasonal and during the cane season, about 5,000 labourers came to work at syrup processing plants and the majority left at the end of the season.The SMEs plants also become important avenue of employment for labourers. There is no immigration labour force in sugar industry.

vi *Trade and Marketing*: Rapid expansion of paddy land, market access to paddy fields, and low population in the country during British rule are one of the major attributes for Myanmar to export rice. Cheng Siok-Hwa (1968) quoted the estimation of the market survey that the exportable surplus constituted about 78 % of the total marketable surplus or 63% of total produce. The overseas markets were Europe, India, Cyleon, China and Japan. For sugar commodity, on

Table 15 : Yearly and Monthly Prices of VP White Sugar (Paung)

(Kyat/viss)

Yr/mon	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	-	36	42	43	47	80	95	106	135	150	180	175
2	-	36	46	41	47	92	98	106	115	160	172	195
3	-	40	49	42	48	95	98	104	110	165	170	210
4	-	41	48	45	60	100	99	110	110	158	196	210
5	30	48	45	40	68	94	98	112	130	153	185	265
6	32	45	44	48	89	94	100	94	135	154	175	265
7	34	46	45	52	70	102	102	120	136	154	180	275
8	36	51	44	56	76	112	112	130	156	115	215	295
9	37	50	45	55	84	114	112	124	158	178	210	295
10	37	49	45	55	89	118	116	140	-	210	195	-
11	37	50	50	52	-	122	119	145	154	210	180	207
12	39-40	48	50	49	-	118	105	150	138	202	190	207
Mean	**35.8**	**45**	**46.1**	**48.2**	**67.8**	**103.4**	**104.5**	**120.1**	**134.3**	**167.4**	**187.3**	**236.3**

Source: U Kyaw Linn (Pyittaingtaung) Sugar House, Mandalay, Zaygyo Market.

1 viss = 1.633 kg

the other hand,export is subject to state control. Sugar quality of SMEs is also low and it fulfills the domestic market. There is irregular trade channel from Mandalay to China border for syrup or khandsari sugar as raw material. Another trade channel is occasionally from Mandalay through Monywa to Indian border for white sugar, paung sugar of SMEs as end user's need. The volume of border trade, however, usually is governed by the differences in exchange rate on either side.

vii. *Profit share*: In Myanmar rice trade of colonial era, the lion's share in the profitable exploitation was reaped by British capitalists and Indian business men. The party which benefited least was the indigenous people of the country (Desai, 1954). In private sugar industry, the stakeholders are growers, syrup processors, dealers, SMEs owners, traders, labourers, truck and steam line owners, etc. It is customary to purchase not the cane but the syrup that the farmer processes his cane. The syrup product share is usually 60:40 between farmer and processor. The processor gets 40 % of produce for value-added costs. The remaining portion is at the disposal of farmer. It is believed that majority of farmers have to dispose of almost the whole of produce at the cheapest time of the year. And they are bound to deliver their due amount to the dealers or SMEs

Table 16 : Comparative Prices of Syrup, Khandsari Sugar (Khar), VP White Sugar (Payng), Plantation White Sugar From 1990 to 2002

Year	SMEs' Syrup (ks/viss)	SMEs' Khar Sugar (ks/viss)	SMEs' Paung Sugar (ks/viss)	SEEs' Plantation White Sugar (ks/viss)
1990	9.0-12.3	23.6	30.0-37.0	52.0
1991	14.0-24.0	34.4	36.0-49.0	58.0
1992	21.0-25.0	35.0	44.0-54.0	60.0
1993	15.0-24.0	31.8	43.0-55.0	63.0
1994	25.0-48.0	54.0	47.0-84.0	95.0
1995	47.0-61.0	90.4	80.0-110.0	118.0
1996	52.0-70.0	-	95.0-116.0	119.5
1997	35.0-60.0	-	106.0-140.0	133.0
1998	40.0-80.0	-	110.0-150.0	175.0
1999	60.0-130.0	-	150.0-210.0	180.0
2000	80.0-124.0	-	172.0-195.0	210.0
2001	70.0-140.0	-	175.0-265.0	305.0
2002	130.0-185.0	-	310.-365.0	355.0

Source: SMEs' information collected from Mandalay Owners. 1 viss = 1.633 kg

owners at the prevailing price for repayment of the loan. The dealers or SMEs owners purchased as much syrup as possible in addition to their collection as repayment of loan and stored the produce anticipating the subsequent rise in the price in later season. The amount of produce that a dealer could store is dependent upon his financing power, the number of storage vessels and the available space he has. It is estimated that two third of the trading is currently processed at SMEs plants during the season and the remaining produce released after storage during the off season. The syrup price is usually the highest one month before the cane season. The value-added benefits for the conversion of syrup to brown sugar (khandsari) and from brown sugar to white sugar (paung) is going to the respective processors and owners with cumulative rate. The equity ratio among all stake holders needs to be investigated. A farmer is quoted as saying that he grows one stalk of sugarcane to produce five stalks at least expecting that one stalk is for him, one for processor, one for financier, one for truck owner, and the last subject to damage

Table 17 : Yearly Govt. Prices and Market Prices for Sugarcane, Jaggery and Plantation White Sugar

Year	Govt. fixed cane prices (Ks/ton)	Govt. fixed sugar prices (Ks/Viss)	Free Market Sugar price (Ks/Viss)	Retail Sugar prices (Ks/Viss)	Jaggery prices (Ks/Viss)
1952-53	51.00	1.50			
1953-54	45.00	1.37			
1955	40.00	1.49		2.19	
1956	40.00	1.60		2.57	
1957	42.00	1.60		2.57	
1958	42.00	1.56		2.48	
1959	40.00	1.56		2.03	1.02*
1960	30.00	1.56		2.00	1.02*
1961	35.00	1.56		2.00	1.07*
1962	35.00	1.60		2.00	1.60*
1963	35.00	1.64	2.00	1.94	1.60
1964	35.00	1.64	1.94	1.91	1.70
1965	35.00	1.64	1.91	1.90	1.70
1966	35.00	1.64	1.90	1.90	1.66
1967	35.00	1.64	1.90	1.95	1.40
1968	35.00	1.89	1.95	2.10	3.00
1969	35.00	1.89	2.10	2.10	3.10
1970	35.00	1.89	2.10	2.10	3.30
1971	35-40	1.89	5.32	6.70	3.41
1972	40.00	1.93	6.70	6.54	3.47
1973	40.00	1.96	6.54	8.15	3.29
1974	60.00	1.96	8.15	13.33	4.08
1975	60.00	3.25	13.33	29.74	5.70
1976	60.00	3.25	29.74	27.44	5.60
1977	100.00	4.25	27.44	24.88	6.00
1978	100.00	5.32	24.88	16.16	6.50
1979	100.00	5.32	16.16	18.00	7.00
1980	100.00	5.32	18.00	20.93	7.78
1981	100.00	5.32	20.93	21.94	10.74
1982	100.00	5.32	21.94	23.22	9.61
1983	100.00	5.56	23.22	23.58	9.20
1984	100.00	5.56	23.58	24.69	9.74
1985	100.00	6.60	24.69	17.67	12.54
1986	100.00	6.60	17.67	24.69	9.91
1987	100.00	6.60	24.69	37.03	10.12
1988	100.00	6.60	37.03	43.68	17.16
1989	150.00	18.00	43.68	40.43	20.55
1990	150.00	18.00	40.43	42.10	19.74
1991	270.00	20.00	42.10	56.93	24.97
1992	Nawali(Paid in kind)	21.00	56.93	57.78	35.58
1993	Nawali(Paid in kind)	21.00	57.78	58.85	45.12
1994	Nawali(Paid in kind)	23.00	58.85	81.64	48.27
1995	1,000.00	36.00	81.64	115.70	65.73
1996	1000/1400	36.00	115.72	125.93	92.22
1997	1,500.00	90.00	125.93	148.89	111.47
1998	1,850.00	90.00	130.00	174.01	130.00
1999	2,500.00	100.00	178.00	199.02	162.84
2000	2,500.00	100.00	196.00	219.74	176.73
2001	2,500.00	120.00	275.00	323.58	237.75
2002		120.00	369.00		

Source: Free Market Prices Quoted from CSO. *Retail price at Pyinmana

In 2002-03, cane is procured at 3500 Ks/ton plus 3 viss of sugar paid in kind by MSE.

presumably due to pests or theft for chewing.

viii. *Assembly pattern of produce*: In prewar rice industry, farmers prepared threshing floor near the river bank or the creek to facilitate the transport from the threshing floor to rice mill usually located by the side of the river. The first stage of the assembling process is the disposal of rice by farmers. The great bulk of the marketable surplus was sold or otherwise disposed of by farmers immediately after harvest.The rapid disposal of the crop was due mainly to the financial circumstances of the farmers. Another reason was lack of storage facilities among the farmers. In sugar industry, the syrup produced from the processing plants was sent by steamers or motor boat to Mandalay. After 2001, the long road had been constructed and the road transport became major mean of the route for the commodity except for the cane field locating near the river bank. In 2002, the whole year total of boat transport was only 408.6 ton of syrup according to the record of loading and unloading service depot at Mandalay jetty. Monthly transport volume was only 40 ton of syrup from January to July and the amount was reduced to half in the remaining month. In January, 2003, 41 ton of syrup was carried by 79 steamers and 250 motor boats to Mandalay. The amount could be a very small amount as compared to road transport but no data was recorded for inland transport amount.

ix. *Level of technology applied*: The dramatic increase in rice production during the colonial period was not due to yield increase (vertical expansion) but due to area expansion (horizontal expansion). Farmer's technology adoption and rice yield per acre remained at low level throughout the period. The private sector sugar production is following the similar route. There is no extension service in private sector sugar production area. Myanmar Sugarcane Enterprise is holding responsible for agricultural extension service in the mill areas. The extension agents are too much occupied with their primary responsibility for area extension, provision of inputs, cane procurement, etc. Sugarcane research and technology generation programme have been strengthened since the inception of MSE. There remains the accumulated reserves of technology generated over more than half a century of sugarcane research and development efforts. The high yielding and adaptable cane varieties were

and continues to be released successively. The organizational set up of MSE had been strengthened and on the job and overseas training programme were actively launched along with the expansion of the state-owned industry. Short and medium term human resource development programme are carried out for both field and factory staffs of MSE. Financial resources and international assistance opportunities are however limited for HRD programme at the professional level. For the private sector sugar industry, on the other hand, HRD opportunities or links are practically nil and adoption of technology is minimum in both farm and factory. Farmers are still growing the old varieties which had been released over 30 years ago. One energetic farmer from Kathar took great effort in massive transport of high yielding cane varieties from the Pyinmana Sugarcane Research Station to his plantation sites by overcoming several delivery and transaction points. In the SMEs processing plants, the majority of pan men do not receive formal technical education. The retired technicians from SEEs factories were employed in the pioneer processing plants and the sugar boiling art was passing down from father to son or to their trustworthy factory workers. Practical experience is also their best teacher. They are not trained in the school. They are bred in the factory. One processing plant owner in Manadalay has two sons: one is a graduated engineer and another is holding bachelor of arts degree. It is irony that the engineer is doing trading business at syrup assembly market while another with liberal arts degree is running the factory.

13. STRENGTH AND WEAKNESS OF SMEs IN PRIVATE SUGAR INDUSTRY

Over years, the mini sugar plants with limited capital and labour-intensive technology are still surviving although located side by side with large factories of huge capital and modern technology and their survival mechanism could be attributed to the following strengths.

13.1. Compatibility

a. The OP technology is compatible with available domestic investment, managerial and technological capabilities.

b. It is compatible with the prevailing farming systems (i.e. self-sufficient food-cum-cash crop economy operated by small scale farmers).
c. More than 20 to 30 percent of production cost of sugar in large sale modern factory could be accounted for by transport with vehicles using fossil fuel. There is much less cost in fossil fuel for transport since jaggery plant is close to cane fields from which cane is transported by bullock carts.
d. It harmonizes with the need to diversify agriculture without displacing the agriculture population through plantation of cane cropping.

13.2. Relevancy

a. The OP technology is particularly relevant to situation of dispersed and small fields, modest cane supplies, inadequate infrastructure, limited capital, and high level of rural unemployment.
b. The OP technology offers its flexibility and adaptability to a wide spectrum of local conditions. The scale of operation could be easily adjusted to cane supplies and sugar demand.

13.3.Appropriateness

a. Much of the essential equipments could be made locally by small workshop anywhere.
b. The level of skill required to maintain the small scale plants is not very high and could be made available.
c. The OP technology requires low capital cost.
The OP technology is batch-type process which does not require regular, continuous and sufficient cane supplies.

13.4. Weakness

a. The disadvantages of OP plants are relatively low sugar yield and high fuel consumption. Again when the semi-finished product (syrup) is converted into centrifugal white sugar at mini VP sugar plants, high amount of fuel wood is required to feed into boiler.
b. The conversion ratio of the OP technology is 63 viss (102.8 Kg) of syrup per ton cane. The rate may vary from 86 Kg to 103 Kg. If the

syrup is processed into white sugar by mini VP plants, the recovery is 50 percent. The overall sugar recovery is about only 4.5 percent by cane weight. There is a substantial loss in milling, boiling and centrifugal processes.

c. The OP technology produces inferior sugar quality.

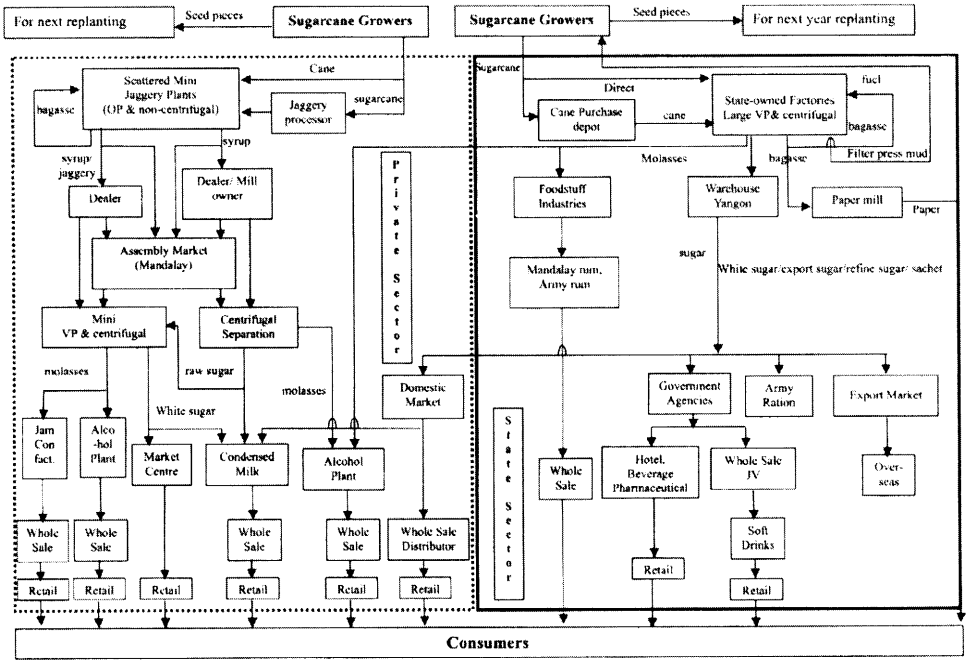
14. MARKET CHANNELS OF SMEs IN PRIVATE SUGAR INDUSTRY

Besides its largest number of mini VP sugar plants, Mandalay traders and SMEs owners organized a large trade center with over 800 members for traders, entrepreneurs and those involved in downstream industries of the private sugar sector. The market share of private sector production constitutes over 50 percent of total as indicated by the yearly sugar production in private and state sector.

The market channel of sugar and sugar by-products and commodity flow in private and state sectors are illustrated in Figure 1. In the state sector, there is direct processing of cane into white sugar. The recycling of bagasse as boiler fuel and pulp for paper indicate the degree of efficiency of the factory.The state sugar is not only distributed to the government agencies and downstream industries but also sold to domestic and oversea market. In the private sector, the syrup processed may be delivered directly to the SMEs owner through dealer whoever are financing the production. It may be traded at Assembly Market or directly delivered to the processing plants. The major downstream industries are alcohol plants, confectionery and bakery and dairy plants.

In SMEs, syrup purchase is based on market price while in state owned factories cane purchase is based on officially controlled price. In private sector, farmers also have the choice either selling their cane to jaggery plant owner or processing the cane by paying processing charge to the owner or with agreed equity ratio. Farmer with modest financial mean could keep his product until at the time of high price of syrup. As of 2000, the sugarcane market price was equivalent to 4,000 Ks. per ton cane while the procurement price of state-owned factories was Ks.2,500. In July 2002, the equivalent sugarcane price of the private sector was calculated to be

Fig 1 : Flow Chart of Sugar and Jaggery from Sugarcane to End Users



6,800 Ks. when the state sector procurement price did not change.

The sugar selling price also differed. The government selling price is 110 Ks. per viss of white sugar (1viss = 1.63 kg). But when it is entered into market the actual selling price may reach Ks 320 per viss (June 2002). In the private industry, the market price of 'paung' sugar ranged from 280 Ks to 300 Ks per viss in January 2002. There was a difference in 10 to 20 Ks from the price of state sugar. The sugar of SMEs is inferior and if the market is swamped with relatively cheap sugar of state-owned factories, there will be a bleak future for SMEs.

15. DEVELOPMENT ISSUES OF SUGAR PROCESSING SMEs

1. *Legal Framework*: In attempts to promote industries, the Government of Myanmar issued the Private Industrial Enterprises Law in 1990 and Promotion of Cottage Industries Law in 1991. The Private Industrial Enterprises Law is meant to assist in channeling new

investment into more value-added productions and to find ways and means to assist them in better production and management techniques, research and development and quality control. Similarly the Cottage Industries Promotion Law aims to assist the micro and cottage scale industries in technology transfer and consultations for process and management improvement. It is evident that the industry grew within this frame work. But advisory and implementing bodies or agencies should be specifically assigned for further development of SMEs. It is frequently quoted as saying that private sugar industry is operating with very low efficiency in outturn or sugar recovery and high in sugar losses and inferior in quality. Technological improvement is indeed in need. But what the industry basically needs is to ensure and guarantee the long term investment of the entrepreneur for sustainability, stability and development. Without this policy back up support, entrepreneurs will not take risk in investment for improving, reorganizing or expanding the industry and rather tends to stick to the old style survival strategy.

2. *Formulation of Sugar Policy*: With the expansion of Myanmar sugar industry in both state and private sectors, there should be economic structural adjustment in response to changing market economy. A sound sugar policy formulation should be seriously considered to enable to form the Sugar Council consisting of representatives from state sector, private sector and joint-venture entrepreneurs. Sugar policy would be instrumental for pricing policy and strengthening the industry including SMEs. It is now encouraging to learn that Myanmar Sugarcane and Sugar Related Merchants & Manufacturers Association has been recently formed in 2002 at the national level to help promote the trade, technology and production. Future possibility now exists to establish a sound market information service and price regulation network between state and private sector. At present, the production relation among all stakeholders shows no sign of exploitation. But under the circumstances that market may collapse or the prices may suddenly drop, deterioration may occur in their relation. It is important to assure that the present production relation should not be directed to the horrible situation of prewar land tenure system. A comprehensive study should be therefore undertaken to set up financial institution or to implement an appropriate rural credit

scheme while taking into account the associated land tenure system.

3. *Industry-Academia Collaboration*: For new technology development and commercialization, the Ministry of Science and Technology (MoST) is empowered. Under MoST, there are two important directorates which are responsible for industry-academia collaboration for new technology development and commercialization. i.e. Myanmar Science and Technological Research Department and Department of Technology Promotion and Cooperation. Ministry of Agriculture and Irrigation (MOAI) is responsible for the agro-technological development and research, technical assistance and consultancy to the SMEs involved in agro-based sugar industry. Myanmar Sugarcane Enterprise under MOAI initiated studies in sugar processing SMEs with respect to technologies and socio-economic research to assist the policy guideline and decision making processes. The new sugarcane varieties are now released in the state owned mill areas from which multiplication of promising varieties and dissemination of improved technology could be extended to the private sector sugar industry. A regular and devoted extension service should be set up in the areas of private sector sugarcane production. Dispatch of mission or study tour of sugar processing entrepreneurs and advanced farmers to foreign countries such as India, Thailand, China and other CAP countries should be arranged for strengthening technological advancement, enhancing their managerial ability and promotion of trade.
4. *Human Resource Development*: With expansion of the industry, there will be a great need for human resource development. The specific areas of training needs are
   (i) creation of teacher-training program
   (ii) seek for external co-operation
   (iii) collaboration between school and industry
   (iv) establishment of ties between SMEs and technical vocational centers
   (v) international and regional cooperation for capacity building of SMEs etc.
5. *Regulatory Environment*: Disposal of industrial waste reaches an alarming stage in the expansion of industrial zone including alcohol distillery plants. Water quality analysis at the site of the plants in

Mandalay revealed 8,250 mg/l BOD and 6,000 mg/l COD in the nearby water bodies. Environmental regulation should be enforced to minimize environmental pollution. The VP sugar SMEs in large cities consume huge amount of fuel wood for energy supply which could lead to rapid deforestation. Urgent attention should be drawn to seek better alternative energy sources for expansion of SMEs in sugar industry.

6. *Electrical Power Supply*: One of the main problem of sugar processing SMEs is serious shortage and irregular supply of electricity. Moreover the price of electricity increased about ten times in two years ago. The survey on private sugar sector by San Thein et al. in 2001 revealed that majority of entrepreneurs complained of the raw material shortage as the most important and electrical power shortage as the second most important problem.
7. *Raw material*: The sugar industry is resource-based and raw material-oriented industry. The state-owned large sugar mills are concentrated in Central and Lower Myanmar and the SMEs in private sector had been largely shifted to Upper Myanmar. Under the circumstances that a new large sugar factory is established, there will be competition of raw material.The alternative raw material for SMEs is palm jaggery (sugar) obtained from toddy palm in Dry Zone of Myanmar. The mini VP sugar plants are now capable of producing centrifugal sugar from palm jaggery. Systematic survey should be conducted to determine the resource potential, manufacture and trade in this alternative raw material source.

16. CONCLUSION

The SMEs in private sugar sector yearly contribute more than 50 percent of total sugar production of Myanmar while they fulfill more than half of the domestic consumption. Thus the important role of the SMEs needs not be overemphasized. But the SMEs have not yet received the duly consideration to be strengthened and promoted. The main challenges of SMEs as mentioned above, are

(i) policy back up support and creating a better investment climate for expansion, improvement and innovation for sugar industrial development,

(ii) sustainable development of resources in both cane and palm sugar,
(iii) development of renewable power supply or efficient harnessing of energy,
(iv) sound pricing policy of sugar and sugarcane through formulation of sugar policy and regulatory bodies,
(v) establishing the market information services and agricultural extension service with transfer of technology,
(vi) setting up a sound financing system,
(vii) regulatory measures in manufacture and waste disposal by SMEs to prevent health hazard and environmental pollution and
(viii) the institutional supports in R & D and human resource development and capacity building for SMEs.

Appendix - 1

Syrup Outturn From Sugarcane

A. Syrup recovery: From the field survey at Mya Taung village tract, Htigaing township in 2003 January.

1. Twelve ox-carts load of sugarcane produces 4.5 to 5 half-barrel containers of syrup a day.
2. Three ox-carts load of sugarcane approximately weigh 2 metric tons net.
3. Syrup in one half-barrel containers usually weighs 85 viss or 138.55 kg.
4. Thus 8 tons of sugarcane (12 ox-carts load) produces 692.75 kg of syrup (in 5 half-barrel containers) with the recovery rate of 8.65 percent.

B. Pre-war norms for farm production of sugarcane syrup in the United States. (C.F Walton et al. 1941. Farm production of sugarcane syrup USDA)

1. Theoretical syrup yield
   Assuming an extraction of 60 percent, i-e.60 kg of juice per 100 kg of sugarcane, and an average brix reading of 18° for the juice, the juice from 100 kg of sugarcane, if evaporated to a syrup of 74° Brix without losing any of the dissolved solids, should yield 18 / 74 x 60 kg, or 14.59 kg of syrup. The recovery rate is 14.59%.
2. Actual yield of syrup per ton cane with 60% extraction and with juice having 15° Brix, is only 17.5 to 19.5 full U.S. gallon of syrup. One U.S. gallon of syrup at 74° Brix weighs 5.193 kg, Thus syrup yield being 90.87 to 101.26 kg or recovery rate being 9.08 % to 10.13 %

C. Daily Syrup Production Norm.

A. From the field survey at Katha and Htigaing townships in January 2003.

1. Sugarcane is crushed at 4 a.m early in the morning. The juice collected then boiled to produce syrup. Syrup processing is then continued until 6 pm.
2. Daily crushing produces cane juice of about 30 half-barrel container (750 gallons).
3. Boiling the cane juice of 750 gallons yields syrup in 4.28 half-barrel container (about 580 kg syrup). Daily syrup production rate usually ranges from 580 kg to 678 kg syrup. (One gallon of syrup is assumed to be 5.421 kg in weight)

B. Pre-war norms for from production of sugarcane syrup in the United States. (C.F Walton et al.1941)

1. Crushing 10 tons of cane per 10-hour day and boiling the cane juice could yield 150 to 200 gallons of syrup daily.
2. A U.S gallons of syrup (74° Brix) weighs 5.193 kg. Daily syrup output is measured to be 778.9 kg to 1,038.6 kg.

Appendix - 2

Profile of Myanmar Sugar Industry

No	Criteria	State	Private
1	Ownership	SEEs	Private-owned
2	Market share (sugar, mt) (as of 2001 - 02)	115655	127774
3	Driving Force	Target driven	Profit motive
4	Production Technology	Vacuum Pan (VP) + Centrifugal	Open Pan (OP) technology
5	Mode of Cane Assembly	process directly form cane to sugar: Cane puchase at cane collection centres and cane transport to factory	process cane to syrup and then to sugar: Transform the perishable cane to semi-perishable syrup
6	Efficiency (sugar recovery)	8%	4%
7	Cane Procurement	Compulsory Delivery system with fixed price	Market price
8	Terms of Trade	Command Economy	Market Economy
9	Unit production cost	Ks 104/viss	Ks 250/viss
10	Raw materials	Sugar cane	Sugar cane + Palm toddy sugar
11	Marketing	Dual Pricing System	Market system
12	Market position	Upper	Lower
13	Export	Exportable	Now allowed
14	Response to price singal	Slow	Quick

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