OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

19171

Distr.
LIMITED

ID/WG.513/2(SPEC.)
30 April 1991

ENGLISH
ORIGINAL: FRENCH

United Nations Industrial Development Organization

Workshop on the Asian Sugar-Cane Industry with Emphasis on Sugar-Cane Diversification

Islamabad, Pakistan, 5-9 May 1991

EVOLUTION AND PRESENT STATUS OF THE SUGAR INDUSTRIES OF ASIA

Background Paper*

Prepared by
Patrick du Genestoux**

12

* Mention of firm names and commercial products does not imply the endorsement of the United Nations Industrial Development Organization (UNIDO). The views expressed in this document are those of the author and do not necessarily reflect the views of the Secretariat of UNIDO. This document has not been edited.

** Director-General, ERSUC (Etudes et Recherches Sucrières), Paris, France.

V.91 27280 0979E

CONTENTS

THE STATUS OF THE SUGAR-CANE INDUSTRIES IN ASIA AND THEIR DIVERSIFICATION

This report has been prepared at the request, and with the funding, of the United Nations Industrial Development Organization (UNIDO) in Vienna. It was used as a background paper at a working meeting between French industrialists and their Asian counterparts, which was held at Islamabad, Pakistan, from 5 to 9 May 1991.

This version contains the updates and corrections suggested by the Asian industrialists who participated in that meeting. A translation into English has been prepared by UNIDO.

The report reviews the growth and status of 14 sugar industries in Asia:

Bangladesh, China,* India,* Indonesia,* Malaysia, Myanmar, Nepal, Pakistan,* the Philippines,* Singapore, Sri Lanka, Taiwan, Thailand* and Viet Nam*.

In the case of the seven main producers, indicated by an asterisk (*) in the paragraph above, the information is presented in the following order:

I Historical background

II. The agricultural sector

- Sites
- Areas
- Agricultural population
- Growing methods
- Yields
- Relations between planters and mills

III. The sugar industry

- Size structure
- Duration of the season
- Technical performance
- Production per mill
- Quality of the sugar

IV. Refining

V. Financial structure of the industry

VI. Sugar consumption and outlook

VII. Foreign trade

VIII. Use of by-products

IX. Production costs

X. Fiscal treatment of sugar

XI. Technical and economic evaluation

Conclusion: Prospects for cooperation with European and, particularly, French industrialists

CONCLUSION

The sugar-cane industry in Asia accounts for half the total of the world's sugar facilities: about 1,000 sugar mills and 10,000 plants producing non-centrifugal sugar. To this should be added some 30 sugar refineries in Japan, Korea, Malaysia, Viet Nam and Singapore. About 60 mills are under construction in 1991 - in India, Pakistan, Indonesia and China.

The very recent growth in sugar production has primarily been in response to the increase in the demand for sugar. The consumption of sugar on the continent of Asia doubles every 15 years (17.5 million tons (raw value) in 1973 and 35 million tons in 1988). This growth is based (table 1) on a population growth rate, which at 2 per cent per annum is still high, and above all on increasing per capita consumption (3.5 per cent per annum). The potential for growth is still very considerable, an exceptional situation in the world, since average consumption in Asia is still low: 20-25 kg in the Philippines, India and Pakistan; 18 kg in Thailand, Korea and Sri Lanka; less than 10 kg in China; less than 5 kg in Bangladesh; and nearly zero in Myanmar and Viet Nam. In addition, economic growth is strong.

The zone comprising the Indian subcontinent and South-East Asia, which produces 28.5 million tons of cane and beet sugar and refines 1.5 million tons of Cuban and Australian raw sugar, is very nearly self-sufficient, but this overlooks the fact that a number of producers (in the Philippines and occasionally in India) have pursued and are still pursuing an export policy. An example is Thailand, the world's second- or third-largest exporter of sugar.

The areas under cane are impressive - more than 7 million hectares - and provide a livelihood for a large population. Except in the Philippines, cane is produced exclusively by small-scale and often very small-scale planters. It is fair to say that 50 million persons are directly involved in working with cane and sugar in this zone. The industrial sector employs more than two million persons.

Everywhere or nearly everywhere (with the exception of the Philippines in the case of plantations, and of Thailand and the Philippines in the case of mills), the production units are of small size and labour productivity is low: according to ERSUC, 300 to 400 times lower in India than in the sugar-beet sector in France or in the sugar-cane sector in Australia. Wages for labour are also low, but the poor productivity level constitutes an obstacle to the reduction of production costs.

Another obstacle is the inadequacy of the agricultural yields. Certain zones - Maharashtra and Tamil Nadu in India, the coastal regions of Guangdong and Fujian in China, along with certain Philippine and Indonesian provinces - are among the most productive in the world, but elsewhere the yields are average (Thailand), mediocre (Sindh) or simply bad (Punjab, Bihar and Bangladesh). The poor yields as measured in tons of cane are frequently aggravated by the low sugar content, due to cultivation practices (the short cycle of the cane in rotation and competition with other crops) or to delays in harvesting and transport (Pakistan, Northern India and Indonesia).

On an overall basis, more than 90 per cent of the growth in production is a result of an expansion of the areas under cultivation (table 2 and graphs No. 1 and No. 2). Field yields have declined in Indonesia and the Philippines, and industrial yields nearly everywhere.

Thus, while mills in Maharashtra and in certain areas in China obtain 9 to 10 tons of sugar per hectare per annum, the average for the zone is about 4.5 tons/hectare/year. The poor agricultural yields represent a major obstacle to the expansion of this sector, including the modernization of the industrial plant.

This industrial plant is rarely (except in Thailand and the Philippines) sophisticated, but it does operate without major problems.

The refining of the sugar at the cane mill has been developed to an outstanding degree by Thailand and the Philippines and, using imported raw sugar, by China. These countries' products are of excellent quality. French technology (ion-exchangers of the Applexion Company in Thailand) is present.

The average size of the mills (typically between 1,000 and 2,000 t.c./d; see graph 3) remains a handicap because of the poor labour productivity and, above all, the low steam efficiency.

The equipment is affordable and moderately priced, since most of these countries have developed equipment-manufacturing industries (mainly India, but also China, Pakistan, Thailand, the Philippines and even Indonesia) and produce good machinery. The industries have concluded licensing agreements with equipment manufacturers or process licensees in Europe - especially in France (FCB with KCP in India) - that allow them to extend their sales to other continents (Africa).

French equipment manufacturers have been active in Pakistan, the Philippines, Thailand and Indonesia in the construction of turnkey plants. Currently, their deliveries tend to be limited to equipment incorporating new technology (for example, mills, centrifuges and continuous boiling systems).

* * *

India and China are two of the world's leading countries in the development and use of cane by-products, particularly as regards the use of molasses.

Since milk and meat production cannot easily be rationalized, the approximately 12 million tons of molasses produced in the zone must find export outlets (the EEC market is largely open to these countries) or be fermented locally. Relatively little has been done to develop the use of molasses in the form of carbonated substrates. One may be reasonably certain, however, that this application will increase, since the large international groups with an interest in fermentation (Japanese and Korean but also European and French) should be attracted by the relatively low local prices for molasses.

One fermentation product, alcohol, is well developed, particularly in China and, above all, in India and Pakistan. India is the world's second-largest producer of cane-derived alcohol, after Brazil, and uses one half of its colossal alcohol production in alcochemistry, producing some 30 products of great value, and in alcopharmarcy. Considering the Indian experience, which is destined to spread, and the availability of extremely advanced technologies in Europe (the Applexion processes, for example), the use of molasses derivatives may represent a major new source of income for the sugar industry of these countries. Obstacles do exist: they include structural limitations on transfers of technology and, the limited size of the world or local markets. These obstacles deserve further study by UNIDO experts. Finally, the low distillation and, particularly fermentation, yields are a source of concern.

With respect to bagasse, the greatest obstacle is inefficiency in the management of heat at the mills. While Thailand succeeds in obtaining bagasse surpluses, many of the Indian, Pakistani and Chinese mills - partly because of their small size - still face shortages. The example of the large Indian paper manufacturers is encouraging, but much remains to be done, even in the area of economic rationalization (one example is China, where the selling price of energy has for a long time been subsidized). Thailand and India should, it would seem, find the generation of electricity from bagasse an altogether interesting proposition.

Once the Asian mills begin producing substantial bagasse surpluses, a large new market will open up to them, considering that, as indeed will be true everywhere in the world towards the year 2000, the zone suffers from a wood shortage.

* * *

Despite the sometimes excessively high costs of the cane, given its poor quality, and the occasionally extremely constraining regulations governing the market, which are designed to protect the consumer, these countries have succeeded in resisting the demagogic enticements that have ruined or "nationalized" so many industries in the Caribbean, Latin America and Africa.

The State sector is important in China, India, Pakistan, Bangladesh and Indonesia, not to mention Viet Nam. But the bulk of the sector is controlled by private groups that have rightly taken the position that the sugar industry is a profitable area for investment and are reinvesting in it profits that are sometimes substantial.

Foreign investors - Japanese, European and American - are still present in the zone, and Chinese family-based financial groups are rapidly developing production capacities in Indonesia, Malaysia and even the Philippines.

In India, the cooperative sector is powerful, which is always a sign of economic health.

Considering the financial strength of the national groups that are best placed in the area and the excellent relationships between planters and mills, it is undoubtedly towards the downstream industrial applications that foreign investment might usefully be directed, particularly if it is channelled and conceptually sustained through research and studies conducted by the international organizations.

OVERVIEW OF THE SUGAR INDUSTRIES OF ASIA
(Cane sugar only, Iran and Japan not included)
(1989-1990 crop year)

	Areas under cane (1,000 ha) (a)	Cane production (millions of tons)	No. of mills		Sugar production		Consumption (1,000 t raw value)	Exports (1,000 t raw value)	Imports (1,000 t raw value)
			Total	Operating	Centrifugal	Non-centrifugal			
India	3 400	223	401	377	11 950	7 150	11 050	10	275
China	1 000	55	460	450	5 150	(200)	7 000 (b)	550	1 250
Taiwan	60	6	23	23	575		600	10	25
Thailand	700	34	47	47	3 500		1 075	2 750	-
Pakistan	850	35	50	48	2 000	950	2 375	-	325
Indonesia	395	27	69	68	2 250	450	2 525	-	325
Philippines	360	20	39	38	1 750		1 600	250	
Viet Nam	145	6	10	? 10	60	300	75	-	25
Bangladesh	150	6	16	16	200	500	325	-	150
Myanmar	120	4	9	6	(35)		(35)		
Malaysia	20	1	2	2	110		710	230	790
Nepal	15	0.3	4	3	20		40	-	20
Sri Lanka	5	0.2	4	4	30		375	-	315
TOTAL	7 220	417.5	1 137	1 093	27 630	9 550	27 785	3 800	3 500
Percentage of world total	39 (c)	47 (c)	66 (c)	-	39 (c)	93 (c)	26 (d)	13 (d)	12.5 (d)

Notes

(a) Areas under cane (the harvested area may be substantially smaller).

(b) Includes about 1 million tons of Chinese beet sugar.

(c) Refers to the sugar-cane industry only.

(d) Refers to the world total (cane and beet).

( ) The figures in brackets or preceded by a question mark (?) are to be regarded with caution, for lack of information.

Table 1

Sugar consumption growth rates

1960-1990

	1 Population	2 Per capita consumption	(3) (Per capita income)	4 (1+2) Consumption
India	2.15	3.2	3.3	5.4
China	1.75	3.35	4.2	5.15
Thailand	2.5	4.8	4.8	7.4
Indonesia	2.2	2.1	2.0	4.4
Pakistan	3.1	5.8	3.6	9.0
Philippines	2.6	2.9	1.7	5.5
Average for the six countries	2.0	3.4	3.0	5.5

Table 2

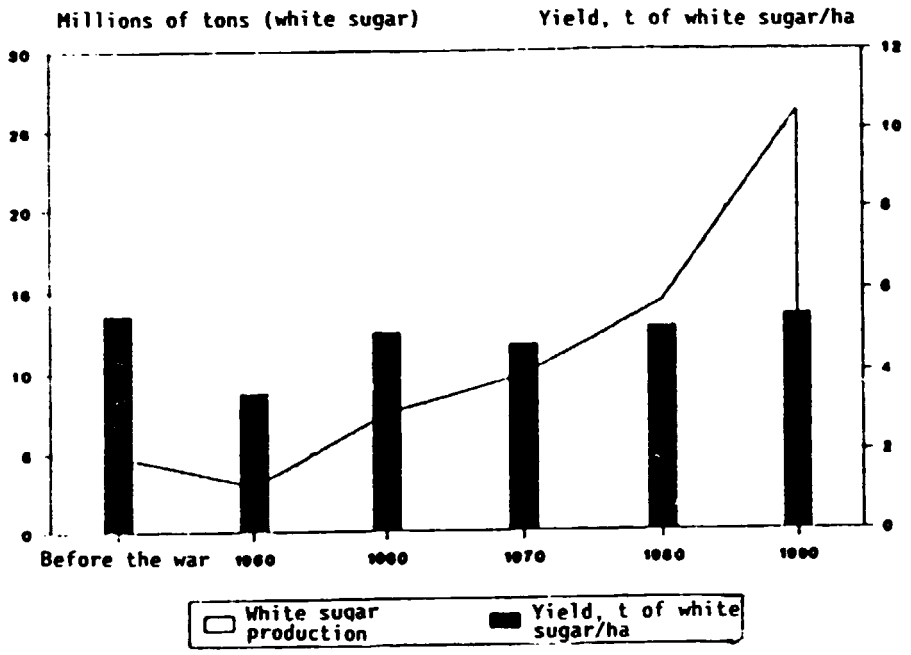
Sugar production growth rates
Percentage/year

1960-1990

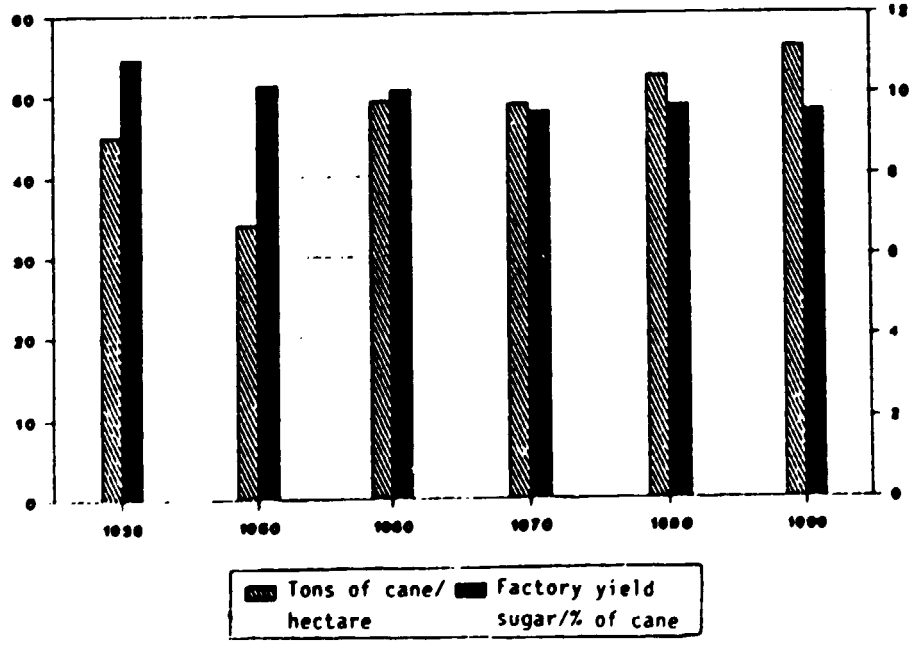
	1 Area	2 Field yields	3 Factory yields	4 (2+3) Overall yields	5 (1+4) Production
India	3	1.3	0.1	1.4	4.4
China	4.4	1.15	-0.2	1.0	5.4
Thailand	9.6	1.0	0.3	1.3	11.0
Indonesia	4.1	-0.3	-0.7	-1.1	3.0
Pakistan	10.2	0.15	0.2	0.4	10.6
Philippines	1.7	-0.5	-0.2	-0.7	1.0
Average for the six countries	4.2	0.5	-0.15	0.35	4.6

Graph No. 1

Sugar-cane production and yields in Asia

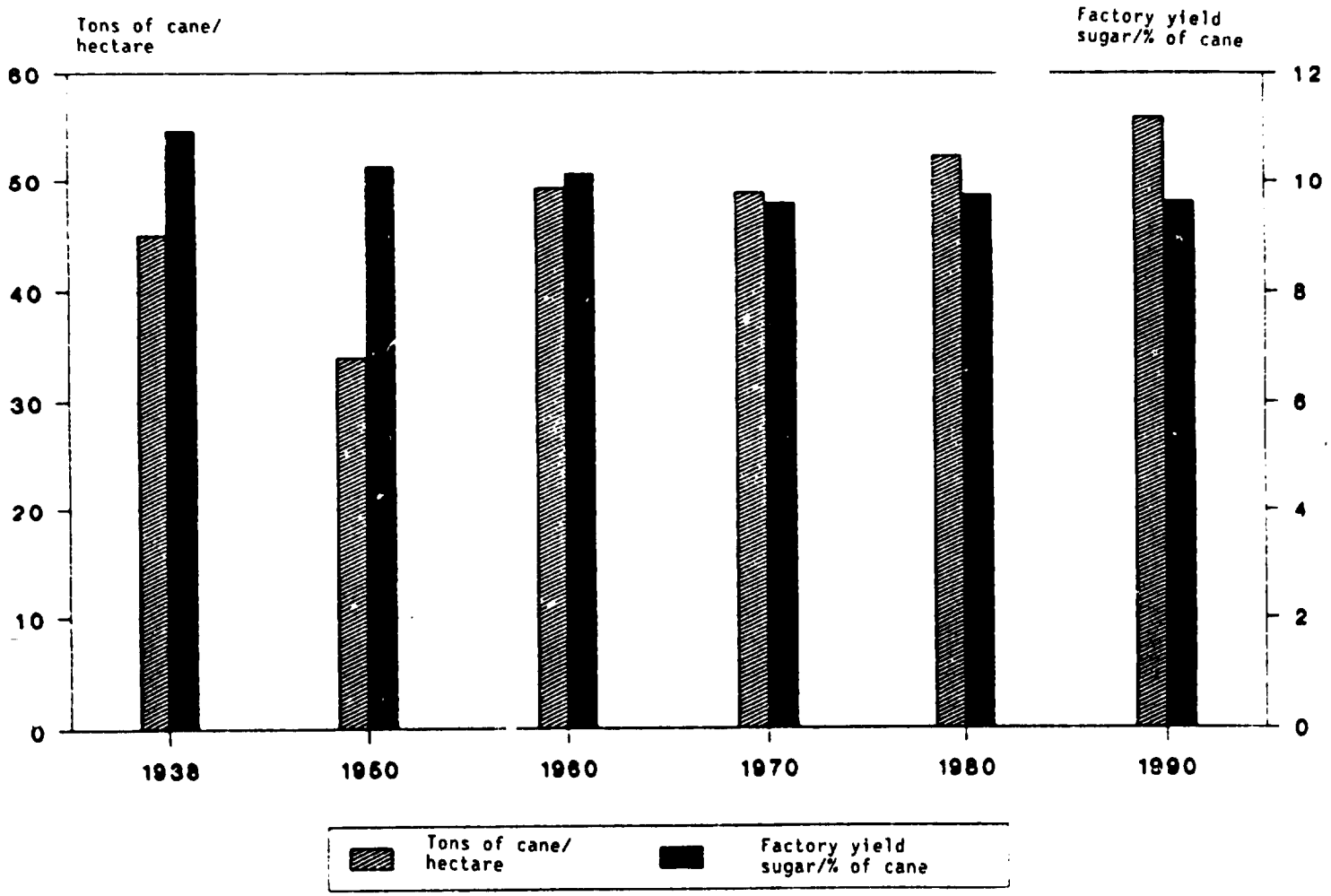


Field and factory yields of cane sugar in Asia



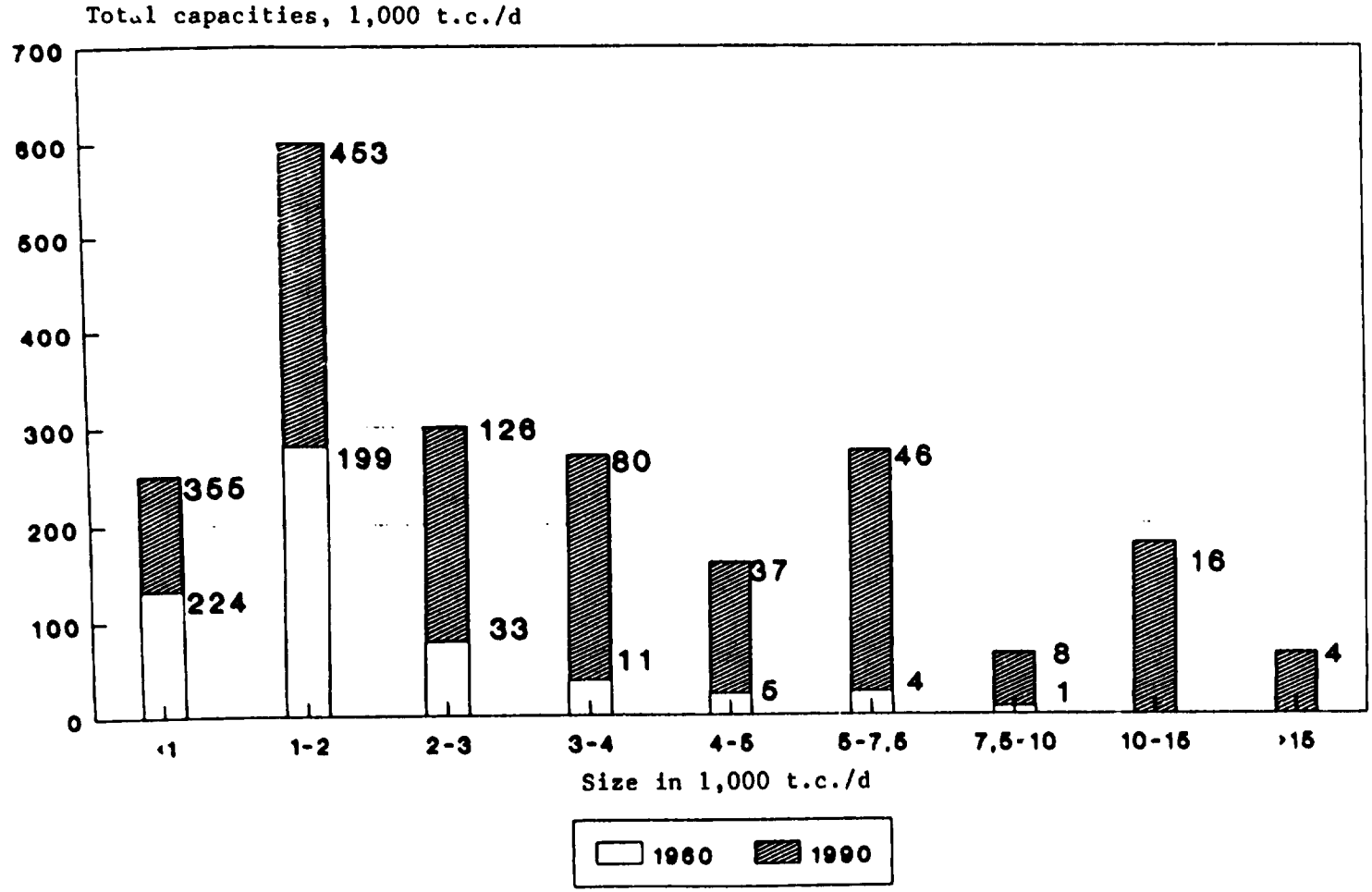
Graph No. 2

Field and factory yields of cane sugar in Asia



Graph No. 3

Evolution of sugar mill size in Asia
1960-1990



BANGLADESH

I. HISTORICAL BACKGROUND

In 1947, Bangladesh (then East Pakistan) inherited some 100,000 hectares of sugar-cane set aside for the production of non-centrifugal sugar (gur). A small amount of gur was also produced from palm (borassus) juice. Five small-scale sugar mills (600-800 tons/day) were built before 1950, but processed only 10 per cent of the total cane produced. The establishment of the Sugar-Cane Research Station at Ishurdi dates back to 1951. In 1960, there were eight sugar mills, but production did not exceed 60,000 tons.

Subsequently:

- The areas increased by 50 per cent;
- The five, later eight, original mills were enlarged;
- Eight new mills were built;
- A seventeenth mill (2,000 t.c./d) had been planned;
- Production has surpassed - if only during one year - the 200,000-ton mark.

II. THE AGRICULTURAL SECTOR

1. Sites

Cane cultivation is concentrated in the wettest districts of the North and North-East (see map). Even so, the climate is not conducive to the optimal maturation of the cane: the sugar content in the cane (9.5 to 10.5 per cent) is one of the lowest in the world. Flooding is frequent.

2. Areas

Cane is today grown on about 150,000 hectares, 60 per cent of which are located in the mill supply zones (mill zones). Even in these mill zones, a major portion of the cane grown is used to produce gur, as in India and Pakistan. Finally, a sizeable amount is consumed directly (by chewing) or is used for replanting, the proportion being abnormally high since the fresh growth accounts for only 15 to 18 per cent of the surface area.

All told, the area devoted to commercial sugar-cane and set aside for the sugar mills represents no more than approximately 50,000 hectares, one third of the area under cane.

3. Agricultural population

Although mill plantations of from 800 to 2,000 hectares exist, the bulk of the cane produced (95 per cent) comes from some 150,000 planters.

4. Growing methods

These are, in general, extremely primitive.

The rule is to cultivate only one plant cane, with the stool pulled out after cutting to make room for another crop (primarily jute). The lack of suitable cuttings is chronic and the Bangladesh Sugar and Food Industries Corporation (BSFIC) must distribute them.

Fertilizers are heavily used: urea (200 to 300 kg/hectare), triple superphosphate and potassium chloride.

The Sugar-Cane Research and Training Institute has, since its establishment (fusion with SRI in 1973), introduced four new varieties.

Eighty per cent of the surface is irrigated.

5. Yields

Due to the absence of ratoon cane, the area harvested is practically identical to the area under cane.

The yields vary from one year to another and from one region to another from 35 to 48 t.c./hectare or, considering the low extractable sugar content in the cane and the mill recovery rate, from less than three to about four tons of sugar per hectare, which is among the lowest yield figures in the world.

6. Relations between planters and mills

BSFIC, the country's only sugar company, is responsible for nearly all:

- The cash credit (412 million taka in 1987-1988);
- The distribution of the cuttings, fertilizer, pesticides and small-scale processing equipment.

It carries out these activities in the areas that are under its supervision (about 80,000 hectares).

The Government sets the cane prices, which have risen considerably in recent times following the disastrous season of 1985-1986. These prices fluctuate between $US 20 and 25 per ton of cane, depending on variations in the exchange rates. In 1989, the price was in the order of 775 taka ($US 24) per ton, while the gur producers were paying as much as 950 taka ($US 29.5) a ton.

III. THE SUGAR INDUSTRY

1. Size structure

The breakdown in terms of capacity (t.c./d) of the 16 sugar mills (see map) is as follows:

300	1
1,000	6
1,200 - 1,300	3
1,500	5
2,000	1

The total capacity, therefore, is 20,000 tons of cane per day. The average mill capacity (1,200 tons/day) is among the lowest in the world.

2. Duration of the season

The climatic conditions and the amounts of cane available limit the season to 120 days.

Delays in the delivery of the cane (five to seven days are not unusual) over bad roads may further reduce the number of actual days in a season.

At times when the cane shortfalls are most severe, the duration of the season may drop below 90 days..

3. Technical performance

The poor quality of the cane and the sometimes inadequate equipment (general recovery below 80 per cent) have led, in some years, to yields of below 7.5 per cent.

An upward trend began towards the end of the 1980s (8.7-9 per cent).

4. Production per mill has varied greatly in recent years because of the competition of gur. In a normal recent year, however, the average production per mill was barely more than 10,000 tons, with the largest mill producing 15,000 tons.

Record production by Bangladesh's 16 sugar mills was achieved in 1981-1982 when 2.473 million tons of cane were crushed and 202,168 tons of sugar produced.

5. Quality of the sugar

A single type is produced: standard-type plantation white with a polarization (sugar content) factor of 99.7-99.8. Coloration in solution (ICUMSA) is high.

IV. REFINING

No activity.

V. FINANCIAL STRUCTURE OF THE INDUSTRY

The 16 sugar mills and their plantations belong to the Bangladesh Sugar and Food Industries Corporation (BSFIC), a State company that is also active in the crushing of vegetables and refining of vegetable oils, the production of confectionery products, equipment manufacturing and cold-storage warehouses. BSFIC also controls SRTI.

VI. SUGAR CONSUMPTION AND OUTLOOK

With 330,000 tons of sugar consumed a year, in 1989 Bangladesh ranked among the world's countries with the lowest per capita consumption of this product:

Bangladesh	3 kg/inhabitant/year
India	11 kg/inhabitant/year
Pakistan	17 kg/inhabitant/year
Singapore	60 kg/inhabitant/year
France	33 kg/inhabitant/year

It should not be lost sight of, however, that for every kg of sugar the Bangladeshis consume at least 2 kg of gur, which continues to be a very popular basic foodstuff in the countryside and even in the towns, where sugar is consumed in greater quantities.

Even so, gur, the price of which is unregulated, is often sold for more than the fixed price of sugar ($US 0.50/kg). Sugar retail prices on the free market have ranged from $US 0.70 to 0.95/kg, which is extremely expensive.

VII. FOREIGN TRADE

Bangladesh is an importer of sugar - as much as 300,000 tons (in 1984), a sizeable portion of which was traded in compensation deals involving jute and sacks with socialist countries (USSR, North Korea and Bulgaria).

In some years (1984) Bangladesh may provide a market for about 100,000 tons of sugar from the European Economic Community.

In principle, the importing of sugar is a monopoly function of the Trading Corporation of Bangladesh, but imports by private companies are sometimes permitted. Import duties are very high - above 100 per cent.

VIII. USE OF BY-PRODUCTS

Bagasse: normally burnt in boilers. There is, however, a demand for about 40,000 to 50,000 tons a year (wet bagasse) for paper manufacturing (North Bengal Paper Mills at Paksey).

Molasses: from 45,000 to 80,000 tons a year of production:

- 30,000 to 40,000 tons are fermented and distilled at three distilleries located at Darsana, Panchagarh and Skyampur and at a pharmaceuticals plant at Darsana (Carew & Co.);
- Use as animal feed is negligible;
- The remainder is exported.

IX. PRODUCTION COSTS

These costs are high:

- $US 17.5-18.5/t.c according to local sources, which, considering the poor quality, means a cost of $US 200-230 per ton of sugar in the cane.
- For the BSFIC, this cost, on the basis of the cane price paid to the grower, rises to about $US 300 per ton of sugar.

The cost of sugar ex-works is about $US 400-450/ton.

The price of sugar ex-works is fixed (1989) at 21,000 taka/ton ($US 650/ton).

X. FISCAL TREATMENT OF SUGAR

This treatment is currently (1990) designed to protect the industry and has severe consequences for the consumer.

	Taka/ton	$US/ton
World price cif	10,650	330
Surchage of 6 per cent	640	20
Tariff of 100 per cent	7,100	220
Internal tax of 20 per cent	3,680	114
	22,070	684
Wholesale margin	970	30
Retail margin	1,160	50
	24,650	764

The selling price of the less expensive locally produced sugar has recently fluctuated between 23 and 28 taka/kg ($US 0.70-0.87/kg).

XI. TECHNICAL AND ECONOMIC EVALUATION

With 20,000 t.c./d of capacity and a productivity figure of 45 tons/hectare on some 60,000 hectares, Bangladesh could produce 250,000 tons of sugar, which is equivalent to 70-75 per cent of its real current needs, instead of, as now, one half.

It could even become self-sufficient (350,000 tons) with:

- Four million tons of cane, or the 2.5 million tons from the area cultivated in 1981-1982 plus 1.5 million tons grown on land taken from cane used to produce gur, that is,
- 80,000 hectares (currently 50,000 for sugar);
- Three additional mills with a capacity of 2,500 t.c./d each, which is, moreover, in line with earlier plans;
- Cane of still modest quality (sugar content of 11.5 per cent), with a mill recovery rate of 78 per cent (mill yield of 9 per cent).

It is certain that, thanks to a very rewarding price structure, the sector would, to a considerable extent, be self-financing if the costs paid by the consumer could be diverted from the treasury to the industry.

In addition, a satisfactory solution must be found to the problem posed by the competition of gur (the same problem as in India) and the payment for cane according to its extractable sugar content.

This being the case, these rather modest figures are sufficient to indicate that the natural conditions are not ideal and that Bangladesh, if for no other reason than the ease with which its borders can be penetrated, is vulnerable to the competition of Indian sugar, which, because it will always be less expensive, is clearly more competitive.

CONCLUSION

Prospects for cooperation

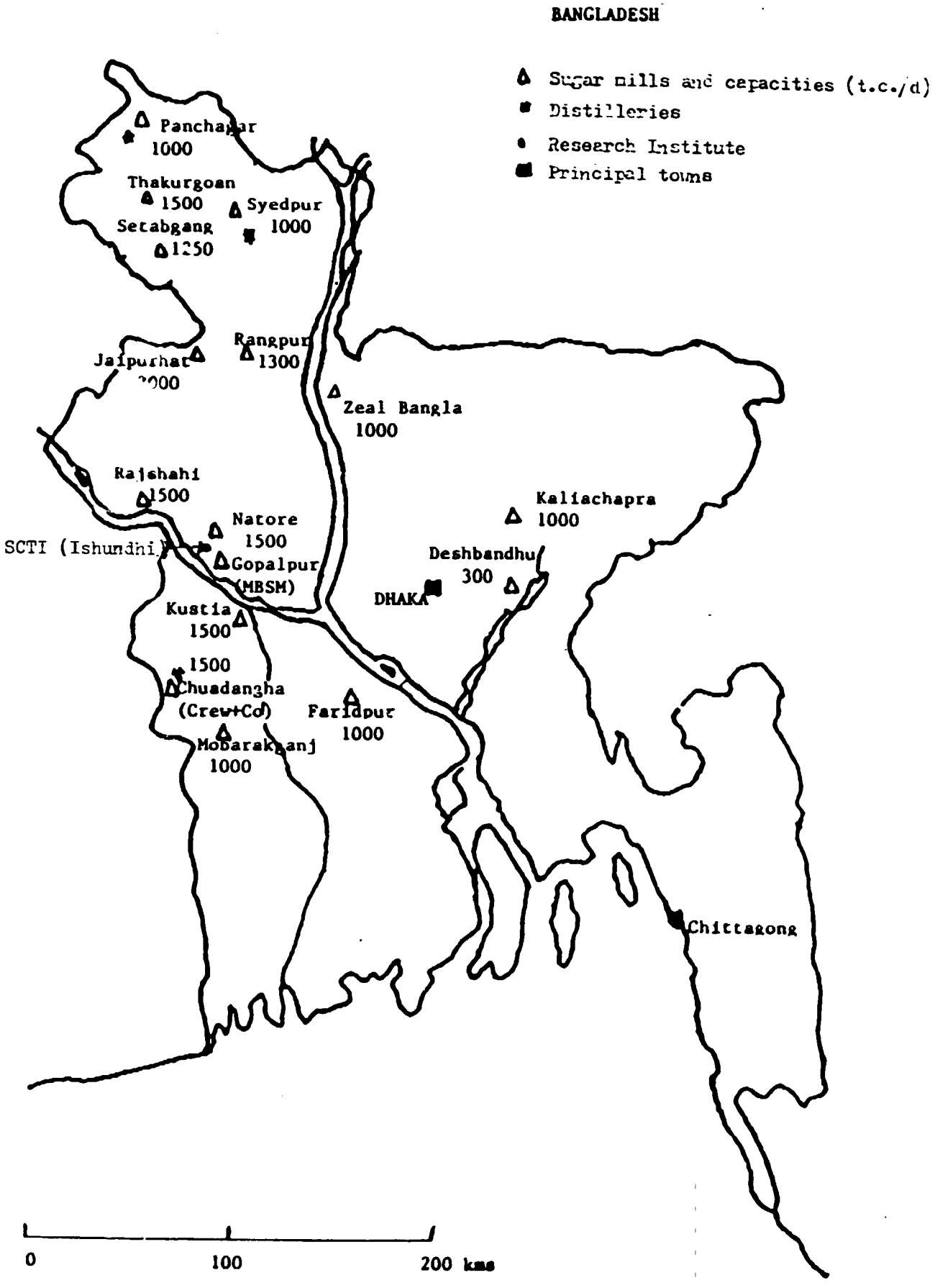
The last mill built (Natore) was put up by the Pakistani State company Heavy Mechanical Complex (HMC) of Taxila. Inexpensive equipment will always be available in the region (India, Pakistan and Thailand).

There are currently in the planning stage or in progress:

- The construction of a new sugar mill with Pakistani assistance;
- An eighteenth sugar mill being planned with Indian assistance;
- Three mill rehabilitation programmes, also with Indian assistance.

Cooperation projects with industrialized countries may be based on the use of molasses (fermentation), although the amounts available are modest and the world market for the alcohol that Bangladesh is already producing is currently very strong.

The production of liquid sugar by Northern Distilleries Ltd. (10,000 tons/year) has been initiated with the assistance of the Applexion Company of France.


BANGLADESH
Sugar mills and capacities (t.c./d)
Distilleries
Research Institute
Principal towns
Panchagar
1000
Thakurgoan
1500
Syedpur
1000
Setabgang
1250
Rangpur
1300
Jaipurhat
Zeal Bangla
1000
Rajshahi
1500
Kaliachapra
1000
Natore
1500
SCTI (Ishundhi)
Gopalpur
(MBSM)
Deshbandhu
300
DHAKA
Kustia
1500
1500
Chuadangha
(Crew+Cd)
Faridpur
1000
Mobarakganj
1000
Chittagong
0
100
200 kms

CHINA

I. HISTORICAL BACKGROUND

Sugar production is traditional, but in its modern form it was developed, largely thanks to foreign capital, at the beginning of the century:

- With regard to beet, in Manchuria, by Russian interests (with Polish technology);
- With regard to cane, in the province of Canton.

Before the World War, while beet-sugar production remained at a modest level (13,000 tons), cane sugar production reached 500,000 tons.

As to the production of non-centrifugal sugar (which had existed for several centuries), it was in the neighbourhood of 500,000 tons.

For cane sugar only, trends were as follows:

	1935	1950	1960	1970	1980	1990 (Est.)
Area in thousands of hectares	Nd	85	310	385	480	1,000
Cane production (millions of t)	Nd	3.25	11.8	13.45	22.8	55.0
Sugar production (thousands of t)						
Centrifugal	500	260	960	1,150	1,950	4,750
Non-centrifugal	500	?				200 ?

In 1949, there were only four modern cane sugar mills. During the period of the First Five-Year Plan, 21 "large" mills (more than 1,000 t.c./d) and 81 small mills (500 t.c./d) were built. In 1960, there were 135 mills in operation.

Production has seen ups and downs ("Great Leap Forward" - cane production fell to 3.4 million tons and cane sugar production to 300,000 tons in 1962 - the cultural revolution), but overall it has increased very fast, particularly in the last two years. From 1960 to 1987, 300 mills were built.

It should be noted that sugar beet production in the order of 1 million tons (North-East and Inner Mongolia), which is also developing rapidly in the Chinese Far West (Xinjiang Province), is proceeding in parallel with cane production and refining.

II. THE AGRICULTURAL SECTOR

(1) Sites and area

The cane is naturally concentrated in the southern provinces. In 1988, there were the following areas:

	Cane production Millions of tons	1988 Assumed area Thousands of hectares	1986 Actual area Thousands of hectares
Guangdong	16.15	290	385
Guangxi	13.55	300	234
Yunnan	5.85	100	88
Fujian	3.90	50	69
Hainan (new province)	2.55	40	(incl. in Guangdong)
Sichuan	2.35	50	52
Jiangxi	1.75	35	39
Hunan	1.10	20	29
Zhejiang	0.80	15	22
Other	1.05	25	31
TOTAL	49.05	925	950

Over two years, we find a decrease in area in the best coastal zones (Guangdong and Fujian), where the cane is being displaced by more profitable crops.

(2) Growing methods and yields

The cane is cultivated on the basis of a plant cane, which is pulled out after 14-16 months or sometimes less.

Sometimes one ratoon is grown, but this is rare. In the areas with cooperatives linked to sugar mills (Canton area), the cane is cultivated continually. Elsewhere it may be rotated.

Great care is used in the growing techniques; most of the activities are carried out manually, except for ploughing.

There is quite a lot of fertilization, as well as of irrigation, which is used most of the time. This often leads to high tonnages per hectare but, as cane is not paid for on the basis of its sugar content, to low sugar contents. Yields in sugar per hectare are tending to decrease (from 5 tons/hectare to around 4.75 tons/hectare).

The most productive areas are the Guangzhou and Pearl River region and the coastal province of Fujian, with yields per hectare sometimes exceeding 100 t.c./hectare and 9 t.s./hectare.

The province of Hainan, on the island of the same name, also seems promising, with 200,000 t.s. and 35,000 hectares. But sugar content is mediocre (10.5 per cent), with the result that the yield is only 5.7 t.s./hectare.

(3) Agricultural population

Up to 1985-1986, production took place in cooperatives, or sometimes State farms. Since then, cultivation of a certain area of under cane (normally six mao (or 0.40 hectares) is entrusted to one family. The plantation may sometimes exceed a hectare and make use of "associated" labour.

This means that several million planters, and for economically active persons a multiple of that figure, are involved in sugar cultivation.

Sixty different varieties of cane are cultivated. The Guangzhou Scientific Research Institute of Sugar Cane and Sugar conducts research for the sector.

(4) Relations with the mills: These are regulated at the level of groups of planters or distribution cooperatives. The tonnages delivered are carefully checked and weighed in the fields.

After having long been stable, the price of cane has experienced violent fluctuations in recent years.

In 1987, cane was still bought at about 70 yuan/ton (then equivalent to $US 20/t.c.).

With the liberalization of agricultural prices, this price removed all incentive for cane cultivation, particularly in the smallest areas and those nearest to towns: the sugar production of Guangdong province fell from 1.9 million tons in 1987 to 1,230,000 tons in 1988.

The price of cane was readjusted once in 1988 to 105 yuan/ton, then a second time in October 1990 to 170 yuan/t.c. Even with the devaluation of the yuan, this price (about $US 33/t.c.) is now attractive. However, before the subsequent reorganization of the economy, cane had to be paid for at up to $US 50 /t.c. in 1989 in the Canton area. The incentive prices of other crops make cane cultivation expensive.

III. THE SUGAR INDUSTRY

(1) Size structure (Only the information concerning capacities of 1,000 tons and more is confirmed).

	Less than 1,000 t.c./d.	1,000 tons	1,200 to 2,200 t	2,500 to 4,000 t	5,000 and more	Total (Est.)	Average size t.c./d
Guangdong	63	17	19	8	7	114	1 370
Guangxi	65	12	20	6	1	96	1 300
Yunnan	35	11	11	-	-	57	850
Fujian	5	1	5	3	2	16	2 000
Sichuan	25	6	2	-	-	33	600
Other provinces	± 105	11	20	-	-	136	500
	± 300	58	75	17	10	± 460	900

Total capacity is 450,000 t.c./day. The smallest mills are of less than 500 t.c./d capacity, but China can build units of 6,000 tons/day: the Meishan and Shunde mills in Guangdong and the Zhangzhou mill in Fujian. Guangdong (156,500 t c./d) and Guangxi (124,500 t.c./d) account for the largest capacities.

(2) Duration of the season

The season is short, rarely exceeding an average of 110 season days and 100 days of actual work. In 1987/88 and 1988/89, there was a drop to 60-70 days in the large Guangdong mills for lack of cane.

However, the cane season is often supplemented by a refining season (see below, refining).

The season begins in November in the interior (Hunan, Sichuan, Jiangxi), and generally in December on the coast (Guangdong, Fujian). It finishes in March (Fujian), or sometimes already in January (Jiangxi).

(3) Technical performance

Technical results are relatively good, at least as regards the mills in the large production areas.

Figures for a recent season for two large mills are:

	Meishan (Guangdong)	Putian (Fujian)
Capacity, t.c./d	6,000	4,000
Beginning of the season	29 Nov.	14 Dec.
End of the season	3 March	19 March
Season days	95	95
Actual season days	89.4	86.4
Cane crushed, tons	376,680	353,930
Time used	94%	91%
Cane polarization	13.61	12.87
Reduced extraction	95.9	96.2
Boiling house recovery	90.4	90.0
Yield	11.8	11.22
Losses	1.83	1.67
Total recovery	86.5%	87%
Sugar produced	44.450	39.725
Kg of coal (7,000 kgcal)/t.c.	60	62

At least 10 mills utilize cane diffusion.

The overall recovery level should be noted: it is good for the area.

(4) Quality of the sugar

The Chinese cane sugar mills produce a good-quality direct white sugar, in spite of the generalized use of sulfitation (90 per cent - the other 10 per cent use carbonatation). A small number of mills utilize carbonatations + ion exchanges or carbonatations + active carbon to obtain products of excellent quality.

(5) Energy

To be noted is a high coal consumption, explained by practically systematic use of part of the bagasse for other purposes.

The average energy consumption is estimated at 4,500 kgcal/kg of sugar, although some mills have reduced this consumption to less than 3,500 with higher boiler pressures (25-40 bars instead of 13), higher Brix readings for the syrup, drying of the bagasse by chimney gas, etc.).

(6) Small output per mill

In recent seasons only some 15 mills produced more than 30,000 tons. Zhoumgsan, Meishan, Zhinee, Shitow, Jiangnen in Guangdong, Guesian in Guangxi and Zhangshou and Sianyou in Fujian produced close to or more than 50,000 tons/year.

By far the largest proportion of the mills, even those with a capacity of 1,000 t.c./d, produce less than 10,000 tons.

In the 1989/90 season, average production per mill was 10,000 tons.

Many small plants (more than a thousand) produce non-centrifugal sugar - 200,000 tons.

During the 1990/91 season, cane sugar production approached 5 million tons (white value).

IV. REFINING

The refining of imported raw sugar is an important activity for the mills, there being no independent refinery in China.

Some mills have a refining season after the end of the cane season - beginning in May, after a maintenance period - sometimes as long as the cane juice season or longer (70-80 days).

This activity may involve up to a hundred mills, and during some years (1988) may lead to an additional production of 2-2.5 million tons, or more than half the cane sugar production.

Although the raw sugar is generally delivered to the mills near the unloading ports (particularly Whampoa) and the cost of conveyance by barge (as for cane) is moderate, rail transport to the interior is costly. However, transport, like the cost of energy (coal) charged to the mills, is subsidized.

The irregularity of supplies and their dispersed nature often leads to interruptions, costly in energy, in the refining campaign. There is a trend towards concentrating refining in the big mills.

However, this activity leads overall to an appreciable reduction in fixed costs per ton of sugar delivered to the Chinese market.

Moreover, in the periods when there is a high premium for white sugar in relation to the price of raw sugar on the world market, the import for further processing ("toll") and subsequent re-export of refined sugar leads to substantial foreign currency earnings ($US 30 million for 450,000 tons exported in 1990).

V. FINANCIAL STRUCTURE OF THE INDUSTRY

All the mills belong to the public sector, but the forms of control (provincial level, county level, sometimes cooperative arrangements) vary.

Some mills have developed diversified activities - or other industrial activities, from food products to textiles - and grouped them in a single enterprise.

Both from a technical and from a general supervisory point of view, the sugar industry comes within the purview of the Ministry of Light Industry at Beijing.

VI. SUGAR CONSUMPTION AND OUTLOOK

The Chinese population does not consume a high quantity of sugar or products using sugar. Consumption may reach 20 kg per inhabitant per annum in the southern urban centres. In the north of the country, and particularly in rural areas, virtually no sugar is consumed.

Sugar is subsidized for the consumer (sometimes being resold below the production cost), and the market has increased rapidly.

From one kg per inhabitant per annum in 1963, consumption rose to 2 kg in 1970, 4 kg in 1980 and 6.7 kg in 1987. Rationing and substantial price rises introduced since 1988 have kept consumption at this level, or have probably reduced it.

From 1,000 yuan/ton ($US 270/ton) in 1987, the price has risen to 1,700 yuan/ton in 1988/89, or $US 460/ton - for rationed sugar allocated on a priority basis. For this season, freely "negotiated" prices, resulting from the "negotiated" cane prices, have made their appearance: up to 2,800 yuan/ton ($US 750/ton) at the beginning of 1989 in Guangzhou. It is to be noted that these prices included a consumption tax of 15 per cent.

Since October 1990, the official price of sugar cane has increased to 2,600 yuan ($US 500/ton), before consumption tax. At $US 0.6-0.7/kg, sugar has become an expensive product in China, after a long period of subsidizing of the consumer.

High prices are necessary for the development of national production, as it is ultimately production that determines the consumption level. Even so, and even assuming the same per capita level, consumption should continue to rise, increasing from 6.3 million tons (white value) in 1990 and 1991 to about 7.3 million tons in the year 2000.

While the majority of the mills operate with capacities ranging from 500-1,000 t.c./d, only 10 have capacities of 5,000 t.c./d or more. The total capacity exceeds 400,000 t.c./d.

VII. FOREIGN TRADE

The fall in production and the spectacular rise in consumption resulted in imports by China of 3.7 million tons of sugar in 1988, in a context of over rapid liberalization. Afterwards, restrictions on imports brought this figure down to 1,580,000 in 1989 and hardly over one million in 1990.

Agreements with Cuba (in respect of about 800,000 tons) and Australia and Fiji (300,000 tons) for the purchase of raw sugar now meet Chinese needs.

China also buys 400,000-500,000 tons of Thai raw sugar in international markets to refine it and re-export the same quantity of white sugar.

Lastly, Hong Kong imports of 50,000-100,000 tons of white sugar pass in transit (1988 and 1989).

VIII. USE OF BY-PRODUCTS

Mainland China, alongside Taiwan, India and Cuba, is one of the world's leaders in the use of cane by-products.

Since the 1960s, plants substitute coal for bagasse to produce paper in shops with capacities of 40-60 tons per day.

(1) Molasses

Many mills have distilleries attached and the production of alcohol is very substantial, using about 1.5 million tons of molasses.

However, higher added values are sought: high-activity yeast (the Dong Guan mill - BTI process, Denmark - and the Meishan mill - MAURI process, Australia).

Projects for citric acid production by the Zhan Jiang and Huizhou mills (Vogelbusch, Austria). Lysine, for Fujian province (1,000 tons/year, German equipment). Monosodium glutamate (MSG) projects for the Bei Jiao and Zhan Jiang mills.

Production of glycerol (3 tons/day) by Shu-wen county. Production of guanosine and of inosinic acid extracted from ribonucleic acid at the Jiangmen mill, which produces some 20 different products from molasses and bagasse.

(2) Alcohol

Production of acetic acid, and then of acetyl anhydride, vinyl acetate and ethyl acetate, at the Zhong Shen mill.

(3) Vinasse

Used as fuel, pellets for animal feed, or a dehydration agent for cement.

(4) Bagacillo

Mixture with molasses or vinasse to make compound feeds. Production of furfurol (hydrolysis technology without pollution effects - to be reviewed).

(5) Bagasse

Since 1984, 15 units have been in service - Zhujiang mill in Guangdong, J/V Sucres et Denrées, France, Siempelkamp, Germany, and Shi-Tow China mill - and five are in course of construction (Shunde mill).

Average sizes remain low: 3,500-10,000 m^3/year. One cause is the small size of the sugar mills: a mill of 2,000 t.c./d will extract 40,000 tons of wet bagasse in a year. To supply a shop with a capacity of 5,000 m^3/year, it must part with a quarter of its bagasse - and invest $US 1 million.

IX. PRODUCTION COSTS

With a cane price which can hardly fall below $US 30/ton (raw material cost, $US 300/t.s.), Chinese production costs are hardly competitive, and even the increase in the size of the sugar mills, while complicating transport problems, could hardly reduce costs below $US 400/t.s.

It is precisely in the use of cane by-products that the Chinese industry has sought to reduce its raw material cost, which, in the case of advanced processing of molasses and bagasse, may fall to $US 20/t.c. or less. This being so, to be able to make a complete assessment one would have to take into account the cost of subsidized energy which was recently still 50 per cent cheaper than in the market-economy world.

X. FISCAL TREATMENT OF SUGAR

Under the supervision of the Ministry of Light Industry on one hand and of provincial food-processing offices or companies on the other, this production sector is regulated, and indeed compartmentalized, although the liberalization of agricultural production regulations for a time produced a certain dissaray in cane deliveries.

During the period of import liberalization (1988/89), the Chinese market was protected by a tariff of 15 per cent and by costs of refining and intermediate transport of around $US 100-110/t.s. High world prices at the time made imports unprofitable except for sale on the "negotiated price" market.

The resumption by Beijing of control over external trade in sugar now eliminates any danger.

XI. TECHNICAL AND ECONOMIC EVALUATION

The Chinese cane sugar industry obtains, without difficulty, results superior to the world average, although, as indeed almost everywhere, the supply of cane and its high relative cost in a country with limited agricultural land pose a problem.

The response has been - and will continue to be - diversification and the establishment of agroindustrial complexes around the mills, in order to make full use of the abundant labour. To allow this, however, energy consumption will have to decrease.

CONCLUSION

Prospects for cooperation

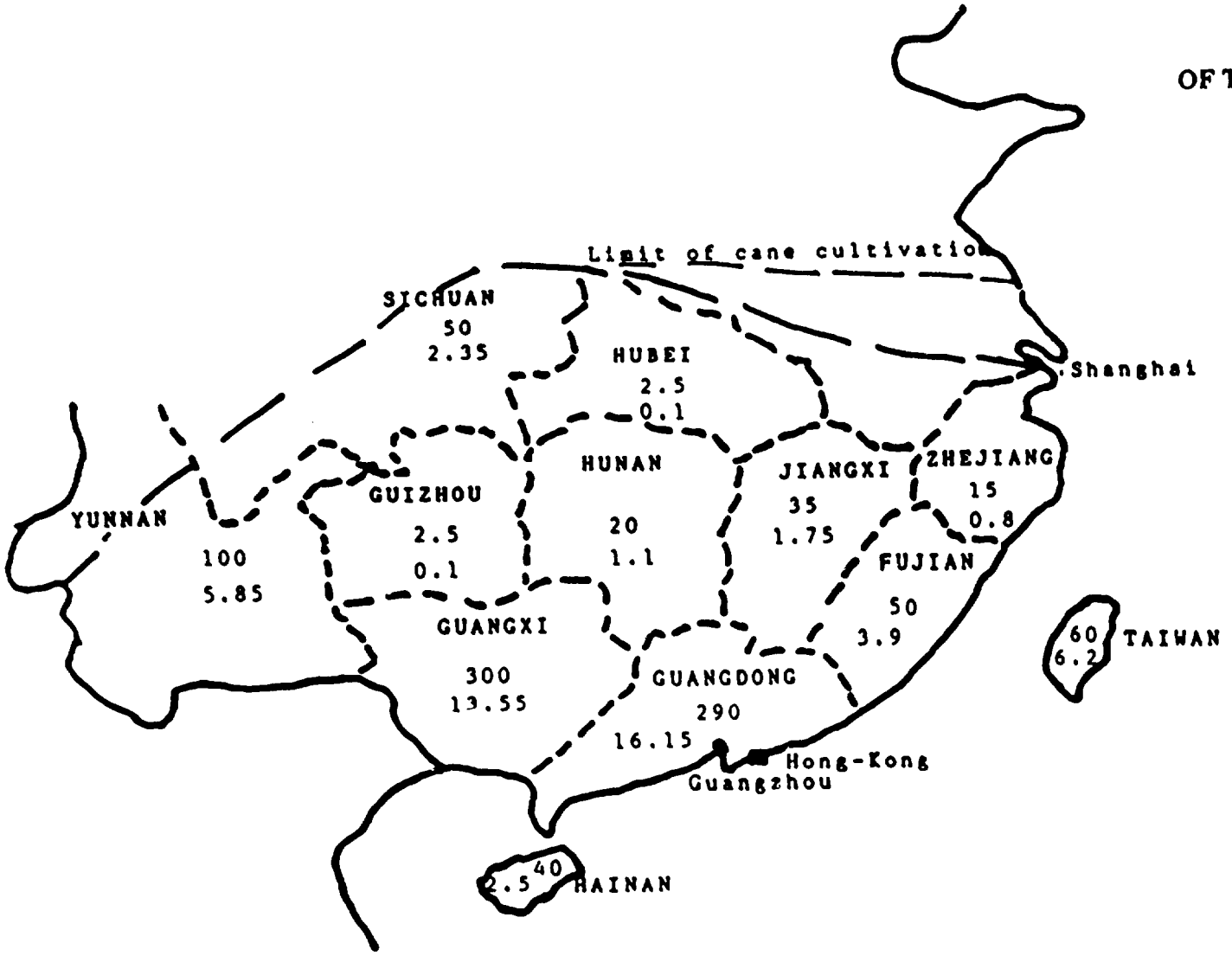
China must - and intends to - increase its sugar production by more than a million tons in the coming years, which will involve a larger cultivated area and a higher incentive price for cane.

Hence the importance of diversification, the favourite area for cooperation between European equipment suppliers, package-project contractors and patent owners (cooperation which already exists), whereas sugar industry equipment in the strict sense will come largely from China, which is manufacturing such equipment for its own needs and for export (Pakistan, Thailand, Africa).

In addition, energy-saving technologies will always be of interest to China.

GEOGRAPHIC SKETCH OF THE CHINESE CANE SUGAR INDUSTRY

I - 1988 Acreages



- Acreages (1000 has)
- Cane production (Mil. TC)

GEOGRAPHIC SKETCH OF THE CHINESE CANE SUGAR INDUSTRY

II - 1989 Capacities

- Number of mills
- (Number of mills 1000 TC/d and above)
- Overall capacities TC/d

INDIA

I. HISTORICAL BACKGROUND

The cultivation of sugar-cane is traditional in India, primarily in the form of cane for chewing or for the production of non-centrifugal sugar (**gur**, known as jaggery and produced in open pans, as well as **kandsari**, which is produced in installations of a somewhat more sophisticated nature). There are today some 8,000 gur and kandsari production shops in operation.

The first sugar mills were built at the beginning of the twentieth century, but it was only after 1932 that, thanks to the tariff protection then introduced, it was possible to initiate the production that by 1937 would see 140 mills (100 of them built between 1932 and 1937) producing a million tons. Cane was then grown on some 1.5 million hectares, of which 250,000 were allocated to the production of sugar and the rest to gur and kandsari (3.7 million tons).

During the war and following independence, sugar production rose sharply:

	Sugar			Other uses			
				Gur/kandsari			Seedlings, direct consumption, etc.
	Thousands of hectares	Millions of tons of cane	Thousands of tons	Thousands of hectares	Millions of tons of cane	Thousands of tons	Millions of tons of cane
1950	400	11.35	1 100	1 030	35.25	3 400	6.50
1960	700	31.1	3 000	1 300	56.35	5 550	12.00
1970	860	43.0	4 000	1 750	72.00	7 400	15.50
1980	900	51.5	5 150	1 750	81.00	8 300	18.00
1990	1 700	111.15	11 000	1 700	85.00	8 575	26.40

The number of mills increased from 150 during the post-war period to 180 in 1960. A powerful sugar equipment industry made its appearance in the 1950s and, especially, the 1960s. For the most part, the sugar industry first developed in the northern states (Uttar Pradesh and Bihar), followed well behind by tropical India (Maharashtra and Andra Pradesh). Subsequently, it was this latter region where the growth of the sector was to be most rapid.

Breakdown of capacity in tons of cane per day

	1960			1991		
	Mills	Capacity	%	Mills	Capacity	%
Uttar Pradesh	72	85 000	44	105	190 000	27
Bihar	28	29 000	15	30	40 000	5
Other northern states	17	16 000	8	46	60 000	9
Total for the North	117	130 000	67	181	290 000	41
Maharashtra	27	28 000	15	101	185 000	27
Andra Pradesh	14	14 000	7	34	60 000	9
Tamil Nadu	8	8 000	4	32	60 000	8
Karnataka	4	3 000	1	29	60 000	8
Others	7	10 000	4	23	45 000	7
Total for tropical India	63	63 000	33	219	410 000	59
TOTAL	180	193 000		400	700 000	

II. THE AGRICULTURAL SECTOR

1. Sites

Although cane is grown in all the Indian states, a distinction is generally made between:

- Northern India, subtropical, dry (500-1,000 mm of precipitation), requiring intensive irrigation from April to June before the monsoon, and cold (temperatures of less than 7°C) in winter, with occasional frost, which limits growth;

- Tropical India, where irrigation conditions are better and, most important, winter temperatures are more suitable.

2. Areas

The areas (in 1990-1991) exceed 3.6 million hectares. The figures for 1989-1990 were as follows:

Uttar Pradesh	1.75 million hectares
Other northern states	0.55
Total for the North	2.30
Maharashtra	0.40
Other states of tropical India	0.70
Total for Tropical India	1.10
TOTAL	3.40

3. Agricultural population

The number of planters is said to approach 10 million, which shows how widespread the growing of cane is and how little average area is allocated to it: the typical plot measures less than half a hectare of cane. Some 25 million persons are involved in the cane-gur-sugar process.

4. Growing methods

Particularly in tropical India, it is now unusual for the plant cane to be pulled out after the first cut. In most cases, cultivation involves one plant cane and one ratoon, more rarely two.

As in Pakistan and Bangladesh, cane is planted as part of a crop-rotation system.

In the northern regions, the existence of winter crops (for example, wheat) harvested in the spring delays the planting of the cane until April, so that it has only a very short vegetation cycle. Elsewhere, the cane is planted at the end of the year (annual "eksali" cycle) and cut after 11, 12 or 13 months. Only in the tropical zone is the cane, which is planted during the monsoon, a "long-term crop" ("adsali"); here it is cut at 14 to 19 months and produces higher yields.

Cultivation is for the most part by hand (animal traction), with tractors of from 40 to 60 horsepower occasionally used for the work. Irrigation is the rule over more than two thirds of the area cultivated (over more than 80 per cent in the North). It is frequently inadequate.

Fertilization, generally adequate, in some places relies too heavily on nitrogen (e.g., Uttar Pradesh). Cutting is always by hand; a very slow process, it coincides with the monsoons in the North in March and April, a factor that may limit the duration of the season.

Research has been conducted by the Indian Institute of Sugar-Cane Research at Lucknow (Uttar Pradesh). The Sugar-Cane Breeding Institute at Coimbatore (Tamil Nadu) was the birthplace of the famous CO varieties that are now found throughout the world.

5. Yields

Markedly higher on the whole than in the rest of the subcontinent, yields are:

- Still low in the subtropical zone of the North (45-50 t.c./hectare);

- High, on the average, in the tropical zone (85-90 t.c./hectare). Maharashtra (nearly 100 tons/hectare) and Tamil Nadu (more than 100 tons/hectare) achieve results that are among the best in the world.

Taking into account the sugar content, which is too low in the North (10.6 to 12.7) and better in Maharashtra, the yields in sugar/hectare are:

- Mediocre (4-4.5 t.s./hectare) in the North;

- Among the best in the world in Maharashtra (more than 9 t.s./hectare).

6. Relations between planters and mills

There are three types of credit and purchasing systems:

- Cooperative sugar mills (nearly half of the total number), an arrangement under which the mill belongs to the planters. This is the predominate pattern in Maharashtra (70 mills) and it also exists in Uttar Pradesh and in Tamil Nadu. There is complete integration;

- Cooperative groups of planters (widespread in Uttar Pradesh and Bihar). The cooperatives discuss the delivery arrangements with the plants and advance money on the season to the planters;

- Direct relations, generally with the larger-scale planters, in the tropical zone.

The price of cane is fixed by the Union at a minimum level for the entire country. This is the so-called statutory minimum price (SMP): 220 Rs/t.c. ($US 13.5/t.c.) in 1989-1990 for a mill yield of 8.5 per cent, with a bonus of Rs 2.26/t.c. for every tenth of a point of yield above 8.5 per cent.

Accordingly, for a yield of 10 per cent the price of cane delivered to the mill would be about Rt 265/t.c. (about $US 16/t.c.).

In practice, however:

- The states set so-called state-advised cane prices, which may be far higher, as much as Rs 390/t.c. ($US 24/t.c.) in Madya Pradesh;

- The competition by the gur producers, who in 1989-1990 were able to pay as much as Rs 450 ($US 28) per ton, may force local sugar mills to pay even higher prices.

Price (SMP) for 1990-1991 for cane with a sugar content of 8.5 per cent	Rs 230/t.c. ($US 13);
Price (SMP) for 1991-1992 for cane with a sugar content of 8.5 per cent	Rs 240/t.c.

III. THE SUGAR INDUSTRY

1. Size structure

By far the predominant mill capacity category is 1,250 t.c./d; this size class includes 155 mills out of a total of 400. This is, therefore, the typical size, although, because of the existence of ten large-capacity mills (above 5,000 t.c./d and up to 8,000 t.c./d), the national average is in the order of 1,750 t.c./d. It should be noted that some 30 mills crush less than 1,000 t.c./d.

The figures (in nominal capacity) for all the Indian mills may be seen in the following table:

	Number of mills	Total capacity
Up to 1 000 t.c./d	30	25 000
1 000 to 1 250	51	60 000
1 250	155	194 000
1 250 to 2 500	93	174 000
2 500	25	62 500
2 500 to 4 000	26	84 500
4 000 to 5 000	10	45 000
Above 5 000	10	55 000
	400	700,000

The differences in size are not significant from one zone to the next. The average capacity is 1,000 t.c./d in Bihar. It should be noted that 15 to 30 plants are permanently in the planning stage or under construction. As of 30 April 1991 there were 401 existing mills and there are building licences for 503 plants.

2. Duration of the season

The seasons are not nearly as long as those in Pakistan - from 115 to 165 days in recent years. The north-western states (Gujurat, along with Central and Western Uttar Pradesh) may have seasons of more than 200 days for climatic reasons, and Tamil Nadu for economic reasons (abundance of cane harvested and available to the mills). For opposite reasons, the season in Kerala is always less than 100 days.

The national average was 158 days in 1989-1990.

3. Technical performance

The cane is of better quality than in Pakistan. In a normal year, the extractable sugar content may vary from one mill to another from 10.5 to 13.5 per cent, the fibre content of the cane from 13 to 15 per cent, and the purity of the mixed juice from 77 to more than 80 per cent. The following figures refer to three large mills during a recent season:

	Mill 1	Mill 2	Mill 3
Capacity, t.c./d	3 500	5 500	4 000
Crushed cane (tons)	365 000	785 000	740 000
Duration of the season (days)	157	164	208
Time loss, percentage	32.5	13.6	9.8
Cane: extractable sugar content	12.76	10.63	13.09
fibre	13.3	14.7	14.0
Reduced extraction	93.0	90.9	93.3
Total recovery	79.2	77.0	81.1
Mill yield, %	10.1	8.2	10.6
Losses, % of cane			
Bagasse	0.9	0.97	0.88
Filter cake	0.1	0.09	0.07
Molasses	1.36	1.27	1.42
Indeterminate	0.29	0.11	0.11
TOTAL	2.65	2.44	2.48
Purity of the molasses	36.9	34.9	37.3
Charcoal consumption/ton of cane, kg	32	0	4

Beginning with the 1991-1992 crop year, the mills will be expected to achieve the performance figures that have been set by the Federal Government since 1988: minimum reduced extraction - 94 per cent (95 per cent for the new mills); maximum losses in sugar by percentage of cane - 2.2 per cent (2 per cent); steam consumption/t.c. - 550 kg (500 kg); time lost - 10 per cent.

The overall performance is unfortunately not as good as this sample, but with an average mill yield of 10.2 per cent during the last seasons, India occupies a respectable and better-than-average position in the world.

The seat of the Indian Sugar Institute is at Kanpur (Uttar Pradesh).

The Vasanti Dada Patil, at Puni (Maharashtra), is a cooperative research centre of great importance.

Research and the financing for the development of capacity are funded through a "sugar cess" of 140 Rs/t, which is paid into an Industry Development Fund.

Regional comparison (recent years)

	Bihar	Uttar Pradesh	Maharashtra	Andra Pradesh	Tamil Nadu
Time lost, %	>25	15-20	12-20	25-30	15-20
Mill yield, %	8.3-9.0	9.1-9.8	10.7-11.2	8.6-9.6	8.8-9.3

4. Production per mill

This may vary from less than 5,000 tons/year in extreme cases (the mills in Assam) to nearly 100,000 tons. The state averages (1989-1990) are revealing:

Gujarat	47 650 tons
Maharashtra	40 850 tons
Tamil Nadu	29 600 tons
Uttar Pradesh	28 900 tons
Bihar	12 000 tons
All-India average	29 150 tons

In 1989-1990, 10,988,000 tons of white sugar were produced; production in 1990-1991 is moving towards the 12-million-ton mark.

5. Quality of the sugar

A single type is produced: standard-type plantation white with a polarization (sugar content) factor of 99.7-99.8. Coloration in solution (ICUMSA) is high.

The ISS classifies the sugars produced according to five grain sizes (A to E) and two colour classes (the best being 30 and 29). This classification is of only national interest. The North prefers the larger and whiter grains while the South accepts smaller grains (D).

Sulfitation is by far the predominant method, but a number of plants in the North, to the exclusion of the other regions, use carbonatation.

IV. REFINING

No activity.

V. FINANCIAL STRUCTURE OF THE INDUSTRY

(a) Nearly half the Indian sugar mills, and two thirds of those in Maharashtra, are operated on a cooperative basis.

(b) From 50 to 60 mills are controlled by the states: Uttar Pradesh State Sugar Corporation (30 mills), Bihar State Sugar Corporation (15 mills), Nizam Sugar Factories Ltd. (Andra Pradesh - 8 mills), to name only the main ones.

(c) Eleven private groups control more than one mill (25 mills in all). Mention may be made of the following groups: Birla Group (six mills), DCM (three), Substhee Sugar (three plus one under construction), KCP (two), and Lanpur Sugar Mills (one plus two under construction).

(d) The rest, about 140 mills, belong to private or family groups that control a single mill.

It should be noted that most of the seven or eight major equipment assemblers or manufacturers operate sugar mills.

This is true of the KCP Group, which owns one of the largest Indian mills - Vuyyuru in Andra Pradesh.

VI. SUGAR CONSUMPTION AND OUTLOOK

1. Non-centrifugal sugar

As recently as 1989-1990, India consumed 8,573,000 tons of gur and kandsari, which is nearly the same as the amount of sugar consumed (10.5 million tons). The consumption of gur leads by a wide margin in the rural zones of the North, where it is produced (more than 5 million tons in Uttar Pradesh).

2. Sugar

Sugar consumption has increased remarkably in the last ten years, having in fact doubled (from 5.4 million tons in 1979-1980 to 10.5 million tons in 1990). Consumption stands at 13 kg per capita per annum. The consumption of cane-derived sweeteners amounts to 24 kg per capita per annum, very much the same as in Pakistan but with a larger proportion of sugar produced by small-scale operators.

Sugar provides a major source of tax revenue: an excise tax of 500 Rs/ton (about $US 28/ton) is imposed on the free sale sugar, and of 380 Rs/ton on the levy sugar, to which are added:

- A "cess" or supplementary federal tax of 140 Rs/ton to finance the Sugar Industry Development Fund;

- Provincial dues of 100 Rs/ton for the states.

Taxes total 740 Rs/ton ($US 40/ton) for the "free" sugar.

In addition, the State operates a double market:

- Mandatory deliveries by the mills of a percentage of their production that has been as high as 65 per cent and is still at 45 per cent (20 per cent during certain periods of the year) at a price theoretically corresponding to the SMP of the cane for sale to the public through the network of Fair Price Shops at a subsidized price of 5.25 Rs/kg (about $US 0.25/kg). This is the levy sugar.

- The balance (free sale sugar) is sold at an unregulated price, 25 per cent of it to the remaining direct consumers and 75 per cent to industry.

The following table shows the wholesale price scale for the different products (September 1990):

	Rs/kg	US cents/kg
Levy sugar	5.25	29
Free sale sugar	7.8-8.7	43-48
Kandsari	7.5	42
Gur	4.5-5.6	25-31

Except at times when there are shortages, gur tends to sell at the same level as levy sugar. Since it is not subject to the taxes imposed on cane earmarked for sugar production and on the sugar itself, it is almost always competitive.

It was the sharp increase in the prices for cane intended for sugar, coupled with an increase in the percentage of free sales, that gave rise to the recent and significant surge in the production of sugar, which in this way brought about - by displacing gur - an increase in the consumption of that product.

The projected production figure (requirement) for consumption and reserve stocks for the period 1994-1995 is 13.4 million tons.

VII. FOREIGN TRADE

The competitive interplay between sugar and gur introduces a highly erratic note to the production and consumption of sugar in India. Sugar production and consumption may be in phase, as at the present time (since 1988-1989). They may also be out of phase: India has found itself in a position of having to export as much as a million tons (1975) or of having to import as much as 1.6 million tons (1985). Since the quality of Indian sugar is not outstanding, the export of quantities of over 300,000-400,000 tons (as has happened in 1991) may pose a problem.

On the other hand, India is:

- A major exporter of molasses (250,000 tons sold in the EEC market), and
- A major exporter of alcohol (500,000 hectolitres sold in the Japanese market).

VIII. USE OF BY-PRODUCTS

A. Molasses

India is the world's largest producer of molasses (4.88 million tons of mill molasses in 1989-1990).

- It distills four million tons;
- It uses 470,000 tons for animal feed;
- It employs small amounts for other applications, namely, the production of citric acid (Citurgia Biochemical accounts for 5,000 tons/year, and a plant in the Punjab, which uses the Vogelbush process, consumes a similar amount). It should be noted that these plants are facing serious technical problems owing to the purity of the raw material;
- It exports the rest.

B. Alcohol

India has 200 distilleries, half of them connected with sugar mills and the other half autonomous.

In 1989-1990 production was in the order of 5.5 million hectolitres, including:

- 2.7 million hectolitres used in beverages;

- 2.8 million hectolitres used as a substrate in the chemical industry.

India is in fact the world leader in alco-chemistry products, with 40 plants producing an entire range of these products extending from acetic acid (9 plants - 65,000 tons) to rubber (one plant - 35,000 tons of styrene and butadiene), pentaerythritol (four plants - 4,000 tons), polyethylene (three plants - 15,000 tons), and polystyrene (two plants - 30,000 tons). Other products we might also mention include butanol, acetone, diethyl oxalate, the acetates, acetic anhydride, etc., as well as numerous pharmaceutical products such as ephydrine.

C. Bagasse

1. Pulp and paper

- Ten plants connected with sugar mills (capacity of 25 tons of paper/day).

- The major units:

  - Tamil Nadu Newsprint & Paper - 100,000 tons/year, using 400,000 tons of wet bagasse and 60,000 tons of wood;

  - Seshasagee Paper & Boards (Tamil Nadu). This paper plant has built an associated sugar mill (Ponni Sugars) as a source of its bagasse, the sugar being a by-product;

  - Mysore Paper Mills - same arrangement as above (associated sugar mill at Bhadravati) producing 100,000 tons/year.

- Several projects in progress.

2. Furfurol

Tamil Nadu Southern Agrifurane Ltd. (3,000 tons/year).

3. Electricity co-generation for two mills in Tamil Nadu.

IX. PRODUCTION COSTS

The average production cost per ton of cane - if in fact an average can be meaningful in a country of this kind - may be put at $US 15. It is known that this ton costs the mill $US 20-28. With a yield of 10 per cent, the cost of sugar in the cane is about $US 200-280, averaging $US 240.

With this kind of cane cost, the total production costs may be between $US 350 and 450/t.s., distinctly above the levy sugar price, which varies ex-works from Rs 4,600 ($US 255)/t.s. to Rs 4,900 ($US 272)/t.s.

X. FISCAL TREATMENT OF SUGAR

National production is protected by a high customs duty (80 per cent), to which are added the consumption taxes.

India has once again become a sugar-exporting country. Considering that the world price since the autumn of 1990 has been about $US 300/ton, but with a quality-linked discount of about $US 40, and taking into account the transport and freight costs, the operation makes a loss, even assuming the State Trading Corporation makes its purchases at the levy price; this poses the problem of who should bear the cost of subsidizing, as the State Trading Corporation no longer holds a monopoly of foreign trade in sugar. As part of the privatization movement in 1990 responsibility for foreign trade operations has now been entrusted to the Indian Sugar Industry Export and Import Corporation (ISIEC), an all-milling industry-controlled organization. The Federal Government is offering a 20 per cent subsidy on the FOB price, which, in the light of the 1991 prices, is inadequate.

XI. TECHNICAL AND ECONOMIC EVALUATION

India is, therefore, a competitive sugar-producing country, and occasionally a very competitive one (Maharashtra), but not to such a degree as to envisage the export of large tonnage amounts to the world market on a permanent basis.

Larger-scale production structures, on the part both of the planters and of the mills, could clearly lead to even lower costs, but progress in this direction will inevitably be slow.

Finally, India has a sugar industry that provides high-quality by-products and, even though it still has some way to go in this direction and recognizing that it enjoys very favourable conditions (market size) found in few other places, its experience in this area may well serve as a model.

Moreover, production growth is encouraged by the financing of new mills and the expansion of capacity. To this end, the Development Fund is offering financing covering 40 per cent of investments at 6 per cent per annum. So-called "soft loans" at low interest rates (14 per cent instead of 16-17 per cent per annum) may be obtained to cover one half of the investment, and the equity capital requirement may be as low as 10 per cent.

CONCLUSION

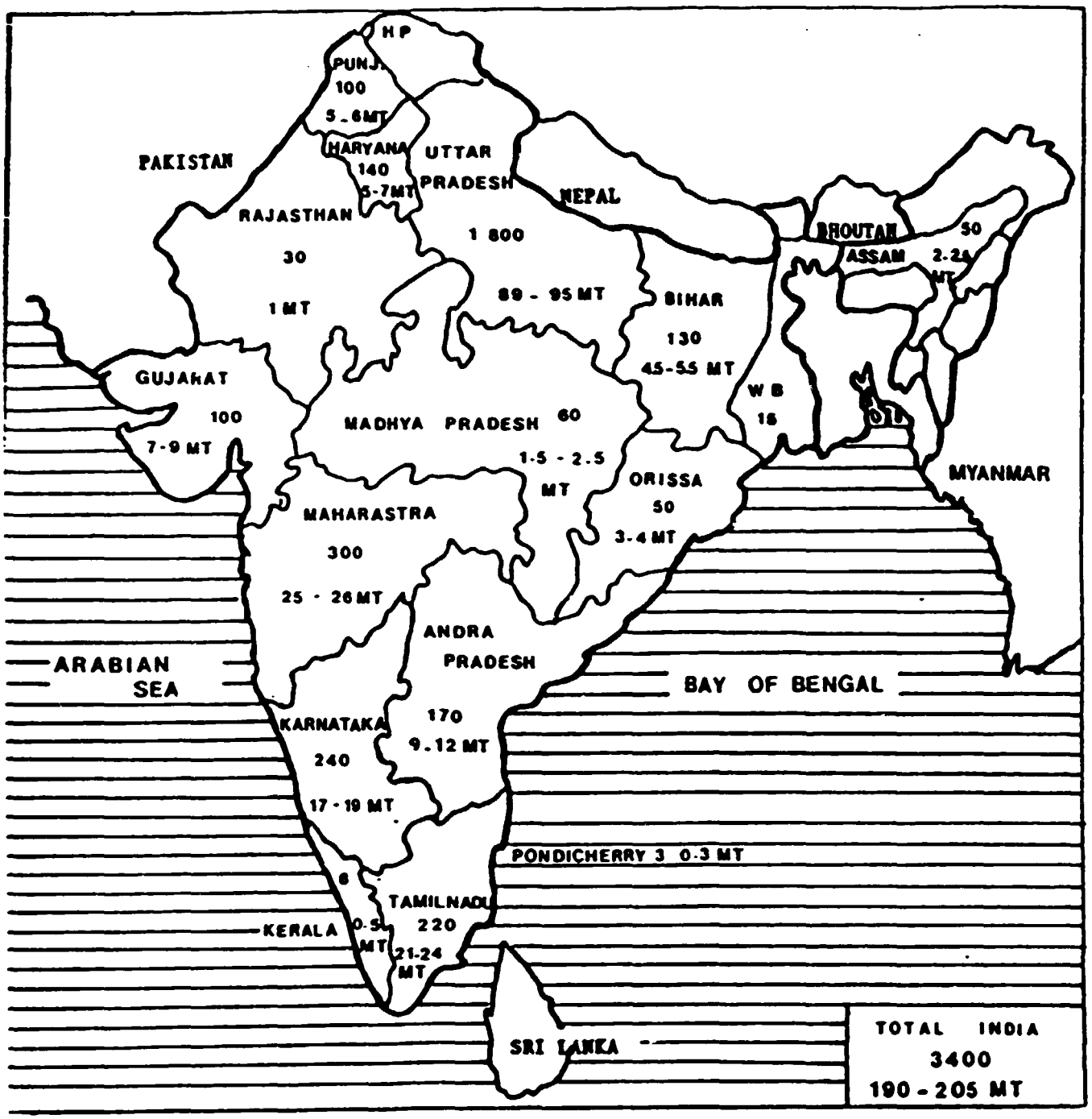
Prospects for cooperation

India, a major industrial country, has several score manufacturers of equipment for sugar mills, distilleries or paper plants. Six or eight of them have an international reputation and are exporting equipment of this kind (to Bangladesh, South-East Asia and East Africa).

These manufacturers find it easy to cooperate in India and elsewhere with European, especially French, companies.

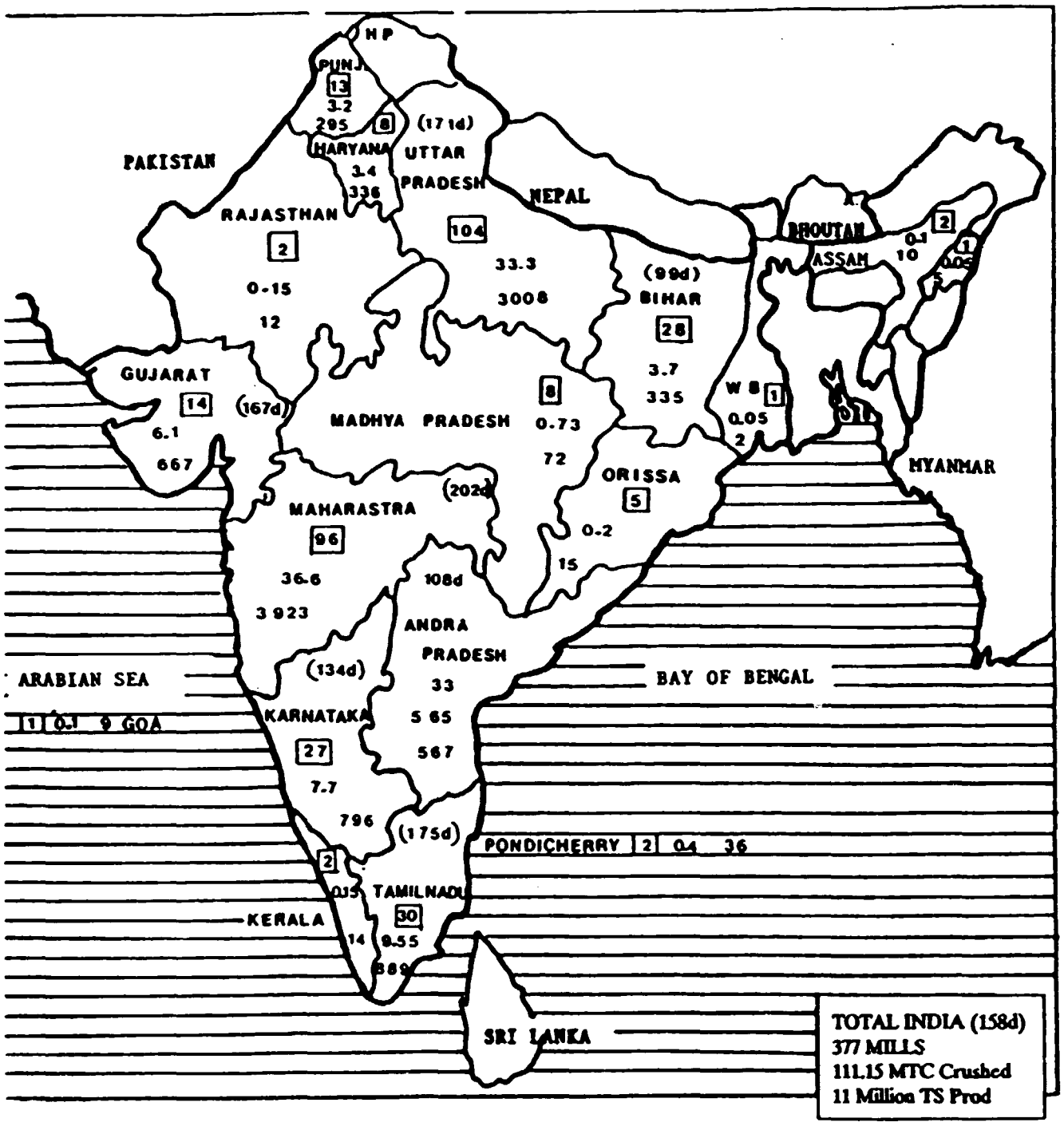
The Bio-Stil process is used in at least three distilleries. FCB has signed cooperation agreements with the KCP firm.

India is continuing to increase its sugar production capacity. The long 1989-1990 season led to a 120-per-cent utilization of its capacities (9.2 million tons of sugar) for the production of 11 million tons. By the end of the Eighth Five-Year Plan (1995) consumption should reach 13.3 million tons. In line with this expectation there are projects for 100 new mills and for the enlargement of 150 existing facilities. An expansion programme of this scale does, however, pose serious questions or problems for the sugar industry in zones where there is a high density of mills. In any case, there may be the potential here for cooperation opportunities with the more industrialized countries.



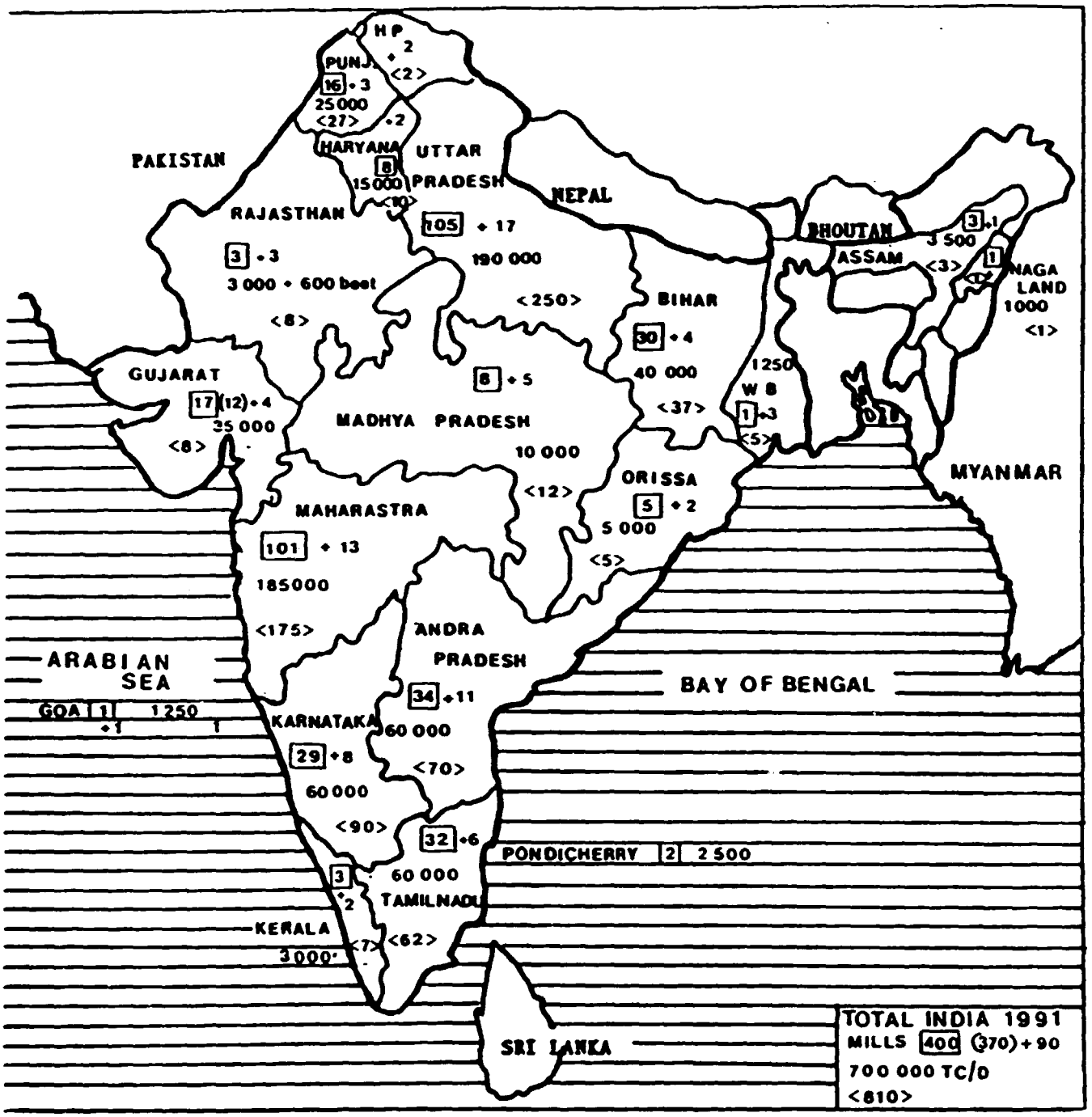
CANE ACREAGES (Thousand HAS) AND CANE PRODUCTION (Million tons)

Recent crops.



1989 / 90 CROP YEAR

[1] Number of mills in operation
2) Million tons of cane crushed
3) Sugar produced (000 T)
(4) Duration of crushing season (days)



[1] Number of Mills (+ number of independent distilleries)
2 Aggregate daily capacity (TC/D)
<3> Capacity of alcohol (1000 L/D)

INDONESIA

I. HISTORICAL BACKGROUND

Indonesia, which was probably the birthplace of sugar-cane and was the world's first sugar exporter in 1900, with an output of 1.4 million tons, saw its production decline almost without interruption after 1935 (2.8 million tons), with the world crisis, the World War and the independence struggle.

Output was down to 280,000 tons in 1950; the 50-odd mills - built before 1914 - still exist.

	Cultivated area, thousands of hectares	Cane production, millions of tons	Production of centrifugal sugar, thousands of tons	Non-centrifugal sugar, thousands of tons
1935	260	25.6	2 800	
1950	-	-	200	500
1960	115	8.9	850	450
1970	80	7.7	720	570
1980	200	14.6	1 290	512
1990	395	26.7	2 080	550

In 1966, exports stopped and imports started to increase rapidly. In East Java, the production area par excellence, it was no longer possible to add to the area under cultivation.

From 1978 onwards, the first surge in the price of petroleum having caused a huge increase in consumption, the Government endeavoured to develop cultivation outside Java, first in Sumatra and Kalimatan, and then in Sulawesi, as part of the "Transmigrasi" programme.

	1960		1978		1985		1990	
	Mills	Capac t.c./d	Mills	Capac t.c./d	Mills	Capac t.c./d	Mills	Capac t.c./d
East Java							34	83 000
Central Java							15	32 000
West Java							9	18 500
Total, Java	53	80 000	56	100 000	57	101 000	58	133 500
Sumatra					6	21 500	7	44 500
Sulawesi					3	8 000	3	8 000
Kalimatan					1	4 000	1	4 000
Total, Indonesia					67	134 500	69	190 000
Projected:								
Sulawesi (1992)							1	4 000
East Timor							1	3 000
Irian Java							1	3 000
Sumatra							5	15 000
							8	25 000

As a result of this expansion in acreage, sugar production has exceeded 2 million tons since 1986. It remains well below consumption, estimated at 2.5 million tons.

II. THE AGRICULTURAL SECTOR

(1) Sites and areas

East Java, the birthplace of the sugar industry, has the most suitable climate for cane cultivation: rainfall is abundant (1,800 mm), but there is a real dry season. However, the area under cultivation, after reaching a maximum figure of 270,000 hectares in 1983, has decreased (260,000 hectares in 1988). As already pointed out, other areas are currently the scene of increased growing activities: 115,000 hectares outside Java, despite very rainy climates that are unsuitable for the proper maturation of the cane, as for example in Sumatra.

Area under cane in 1988

Java	East	175 000 hectares
	Central	55 000
	West	30 000
		260 000
Sumatra	South (Lampang)	60 000
	North	20 000
		80 000
Sulawesi, South		15 000
Other (North Sulawesi, Kalimatan, etc.)		40 000
		395 000

The declared objective of the Indonesian Government is to achieve a substantial reduction of cane cultivation in Java.

(2) Agricultural population

Indonesia has moved from a system based exclusively on plantations before the war and up to independence to a system based on small planters (20 per cent of the area in 1975 and 80 per cent of the area in 1981).

The TRI (Tebu Rakyat Itensifikasi) programme launched in 1975 - with targets impossible to achieve, it may be added - encouraged small farmers to plant cane with an intensive use of inputs, thanks to loans. This programme has not been a success from a technical point of view. The planters' areas increased from 22,000 hectares in 1975 to 200,000 hectares in 1982, but yields were disappointing (for planters accustomed to two harvests a year a wait of 16 months for the first harvest was too long) and output had hardly increased by 1982. The State sugar mills, moreover, which had been left with the poorest land and had turned increasingly to crops that depend on rainfall, saw their yields go down from 10 t.s./hectare in 1975 (with 80,000 hectares) to about 6 t.s./hectare eight years later (with 50,000 hectares).

For this reason, new projects outside Java, whether public or private, are making a point of integrating plantations with the complexes. The proportion of plantation cane is increasing rapidly to about 50 per cent.

In the system adopted by the "intensification" programme, blocks of land under cane of between 10 and 15 hectares were held and worked by groups of 30-50 planters, making a total, in Java, of more than 600,000 planters. However, this figure has decreased substantially with the partial abandonment of cane.

The distribution of areas in 1990 was as follows:

Small planters	275 000 hectares
State plantations	75 000
Private plantations	45 000
	395 000

Counting the plantation workers, this branch involves more than a million economically active persons.

(3) Growing methods

Before the country gained its independence and up to 1975, cane was cultivated:

- Using irrigation (in the paddy fields) with a single harvest (plant cane, 16 months old);

- Without irrigation (relying on rainwater), with two harvests (plant cane plus one ratoon).

At the new sugar complexes, where there is no competition with food crops as in Java, an attempt is made to work with one plant cane plus two ratoons.

The trend is towards an annual cycle for all areas.

In Java, the Reynoso system (plots 50 m wide between canals used for irrigation and drainage), which requires much labour, is still practised. Work is exclusively manual.

Elsewhere, labour is less abundant, and the tilling and maintenance work is carried out mechanically on level ground.

The cutting is performed exclusively by hand, without prior burning, except at large plantations where mechanical cutters (1,000-1,500 t.c./d) are partially used (for example, in the Takalar complex in South Sulawesi and the Bunga Myang complex in South Sumatra).

The Indonesian Sugar Research Institute (P3GI), successor to the famous Proefstation voor Suikerriet in Java (POJ), continues to produce varieties (Ps30 and 56). Mauritian (M 442-51), Taiwanese (F154) and Indian varieties are also cultivated.

(4) Yields

Yields, formerly among the highest in the world (100 t.c./hectare, 11-12 tons of white sugar per hectare), have fallen to around 70 t.c/hectare and less than 7 t.s./hectare, which is still good, but suggests a certain deterioration in the care of the crops on the part of the small planters.

With very wet climates outside Java, yields in cane per hectare are still good (80 t.c./hectare), but the polarization of the cane is very low (sometimes below 10), which gives yields in sugar per hectare often below 6 t.s./hectare; this remains overall a good performance, with a rainfall of 2,600 mm.

(5) Cane production

	Millions of tons of cane		
	1975	1984	1988
Small-scale planters	1.4	15.0	17.5
State-owned plantations	8.9	4.0	5.0
Private plantations	-	1.0	4.0
	10.3	20.0	26.5

(6) Relations between planters and mills

In the areas with a large number of small-scale planters (Java), each 10-15-hectare parcel of land (30-50 planters) belongs to a cooperative that receives inputs and credit from the Bureau of Logistics (BULOG) and the banks, and that is the mill's counterpart.

Payment for the cane is theoretically according to the sugar yield obtained at the mill under a variable sharing system. For example:

Mill yield	Planter share
Less than 8 per cent	62 per cent
8-10 per cent	65 per cent
More than 10 per cent	70 per cent

On the basis of a sugar price ex-mill of $US 350/ton and an average yield of 9 per cent, the result for the planter would be 350 x 0.09 x 0.65 = $US 20/t.c. To this should be added a molasses component of 18.6 kg of molasses/t.c., that is, $US 1.15/t.c. in 1989-1990.

In fact, the recent increases in the price of sugar and cane have been accompanied by the establishment of a guaranteed price for sugar. Prices doubled from 21,000 rupiahs/t.c. in 1985 to nearly 40,000 in 1990, but owing to the devaluation of the rupiah the price of a ton of cane is barely above 20 dollars, making it hardly competitive with rice.

III. THE SUGAR INDUSTRY

(1) Size distribution (t.c./d)

	Java E	Java C	Java W	Sumatra	Sulawesi	Kalim.	Total
1,000 or less	2	-	-				2
1,000-1,500	8	2	4				14
1,500-2,500	13	10	1	1	1		26
2,500-5,000	6	3	4	2	2	1	18
5,000 or more	5	-		4			9
	34	15	9	7	3	1	69

The typical size of a mill in Java continues to be 1,700-2,000 t.c./d. A mill crushes less than 900 t.c./d.

The large-capacity mills are concentrated in Sumatra. Gunung Madu in Sumatra has a capacity of 10,000 t.c./d.

(2) Duration of the season

The duration of the season varies between 150 and 180 days in Java, depending on the tonnage of cane to be crushed. (Season from May to October.)

In Sumatra (Gunung Madu) the season has been shortened, thanks to the higher volume of daily crushings, from more than 200 days (1978) to 160 days (1988).

(3) Quality of the cane

Highly variable: polarization in Java has fallen to about 11.5, with low rates of purity (77 for mixed juice).

In Sumatra, due to the effect of diseases, parasites and the climate, polarization has fallen to barely 10 per cent, with juice purity rates of 75.

Fibre is high in Java (15-17 per cent) and lower in Sumatra (13-15 per cent).

(4) Technical performance

Good, typical mills	Java	Sumatra
Crushed cane	290 000 t	1 400 000
Season days	180	180
Time efficiency, %	90	95
Days of actual crushing	162	171
Crushings/day	1 790	8 200
Polarization, %	11.62	9.60
Purity of mixed juice		77
Fibre, %	15.4	15.0
Losses:		
Bagasse	0.94	
Scums	0.14	
Molasses	1.20	
Undetermined	0.12	
	2.40	2.47
Yield, mill, %	9.2	7.13
Recovery	79.2	74

In Java, performance is not very good, mainly because of the quality of the cane and inadequate operation of the mills (reduced extraction below 93).

In Sumatra, climatic factors complicate an assessment. Good results cannot be achieved becausae of the poor purity of the juice.

The steam balance, except in the large sugar mills, is not as good as the high rates of fibre would allow one to expect. The power plants of the mills are often old and operate under low pressures.

(5) Quality of the sugar

Direct white sugar is obtained, in most cases, by sulfitation (46 mills) followed by carbonatation (11 mills). Standard sugar polarizes 99.8, with a colour in solution above 70.

Non-standard sugar may go as low as 99.2. Coloration is then not measured.

(6) Output per mill

Some mills do not produce more than 10,000 t.s./year.

The largest mill in Indonesia (Gunung Madu in Sumatra) produces 100,000 t.s./year.

In 1990, average production per mill was 30,000 tons, with a total production of 2,080,000 tons.

IV. REFINING

No activity.

V. FINANCIAL STRUCTURE

Almost all the mills still belong to the public sector. Six State corporations (PTPs) operate 57 mills between them:

- PTP XXI - XXII: 12 mills (East Java);
- PTP XXXI: 2 mills in Sumatra (detached from PTP XXI - XXII);
- PTP XXIV - XXV: 14 mills (12 in East Java, one in Kalimatan and one in Sulawesi);
- PTP XV - XVI: the 13 mills in Central Java;
- PTP XIV: the eight mills in West Java;
- PTP XX: five mills in East Java and two in Sulawesi;
- PTP IX: three mills in Sumatra.

The PTPs established in Java have been encouraged to set up capacities in new sugar regions, under the Transmigrasi Programme.

The non-PTP (private) sector includes:

- The Rajawali Group (with public capital, however): three mills in East Java (8,000 t.c./d capacity);
- The Tri Gunabina Group: two mills in Java (6,000 t.c./d capacity);
- Four groups possessing a single mill;
- The Gunung Madu Group, which includes among its shareholders the Chinese-Malay group Kwok, has invested in Sumatra establishing a plantation of 20,000 hectares and the largest mill in the country (10,000 t.c./d).

Other private groups, sometimes with foreign participation, are investing:

- In North Sulawesi, at Gorontalo: a plantation of 10,500 hectares; a mill of 4,000 t/d, which should begin operations in 1992 (Naga Manis Plantations);
- In Sumatra: five mills of 3,000 t/d (Salim and Bimantana Groups).

VI. SUGAR CONSUMPTION AND OUTLOOK

Consumption is now 2.4 million tons of white sugar, or more than 13 kg/inhabitant/year. It is limited only by:

- The existence of a small-scale non-industrialized sector (non-centrifugal cane sugar and coconut sugar) accounting for 350,000 tons;
- Domestic production of isoglucose from cassava (60,000 tons);
- High consumption of saccharine (300 tons) and cyclamate (5,000 tons).

In all, consumption per inhabitant per year exceeds 16.5 kg of sugar equivalent.

Sugar consumption could go above 3 million tons by 1995.

The sugar prices (fixed in 1990) for the standard type SHS 1 were:

650,000 rupiahs/ton ($US 370/ton) ex-mill in bags, delivered to BULOG; (Bureau of Logistics);

800 rupiahs/kg ($US 0.42/kg) to distributors, by BULOG.

On 1 May 1991, the prices increased to 750,000 rupiahs/ton ex-mill and to 900 rupiahs/kg to the distributors.

Retail prices exceed $US 0.50/kg.

VII. FOREIGN TRADE

Indonesia has thus become a "structural" importer of sugar, importing amounts that could rise above 400,000 tons. At a rough estimate, to take into account the population increase, it would be necessary to build a medium-sized mill (30,000-50,000 t.s.) every year.

External trade is basically regulated by BULOG, which places orders with foreign suppliers. Direct purchases are possible but must be recommended by BULOG.

Indonesia exports about 200,000 tons of molasses (Japan, European Economic Community) and 30 million litres of alcohol (Japan).

VIII. USE OF BY-PRODUCTS

The context is not very favourable for the utilization of by-products. There is virtually no bagasse surplus and the production of molasses (about 1 million tons) is highly dispersed.

Sizeable distilleries nevertheless exist, some of them attached to sugar mills (the two Jatiroto distilleries, Comal and Makudismo, and one distillery near the Bone mill at Sulawesi). The largest distillery, at Surabaya, in East Java, has a capacity of 100,000 hectolitres/year. Total capacity (and production) is in the neighbourhood of 500,000 hectolitres/year, using 200,000 tons of molasses.

A very large production capacity for monosodium glutamate (MSG) is currently being developed with a view to exports to other Asian markets.

IX. PRODUCTION COSTS

In Java, the production cost of cane is high: $US 20/t.c., which gives raw material costs - cost of sugar in the cane - of $US 220-250/t.s.

On the large plantations, the cost is well below this, but the low sucrose content of the cane drives up the mill's raw material costs with the need for particularly high capital investment.

Industrial costs in Java, where the production units are generally small, simply do not permit a total cost below $US 350-400/t.s.

The original sugar sector, again in Java, thus provides a certain degree of protection for the new producers (outside Java), but the need for very substantial new investment means that the prospects for a decent return on investment must be good.

X. FISCAL TREATMENT OF SUGAR

The remuneration of the sector is still largely fixed by the State, by far the largest producer. The State sector is subsidized, basically through the mechanism of low-cost loans.

Government agencies (DGI - the National Sugar Council - and BKPM) manage production rights and, in particular, grant licences for increases in capacity.

Lastly, BULOG controls the distribution of domestic and imported sugar.

XI. TECHNICAL AND ECONOMIC EVALUATION

In spite of technical conditions (climate) and economic conditions (small planters for whom rice cultivation is highly remunerative) which are not always easy, Indonesia obtains higher yields than the average for the area (5.5-6 t.s./hectare).

Industry, taking advantage of low wage costs, continues to invest in the agricultural sector.

The production of sugar, like that of palm oil and cacao, contributes to the development of the Indonesian agricultural potential, which is enormous.

It is in the new areas which are rapidly developing that the growth potential is to be found, a potential unequalled in the world.

CONCLUSION

Prospects for cooperation

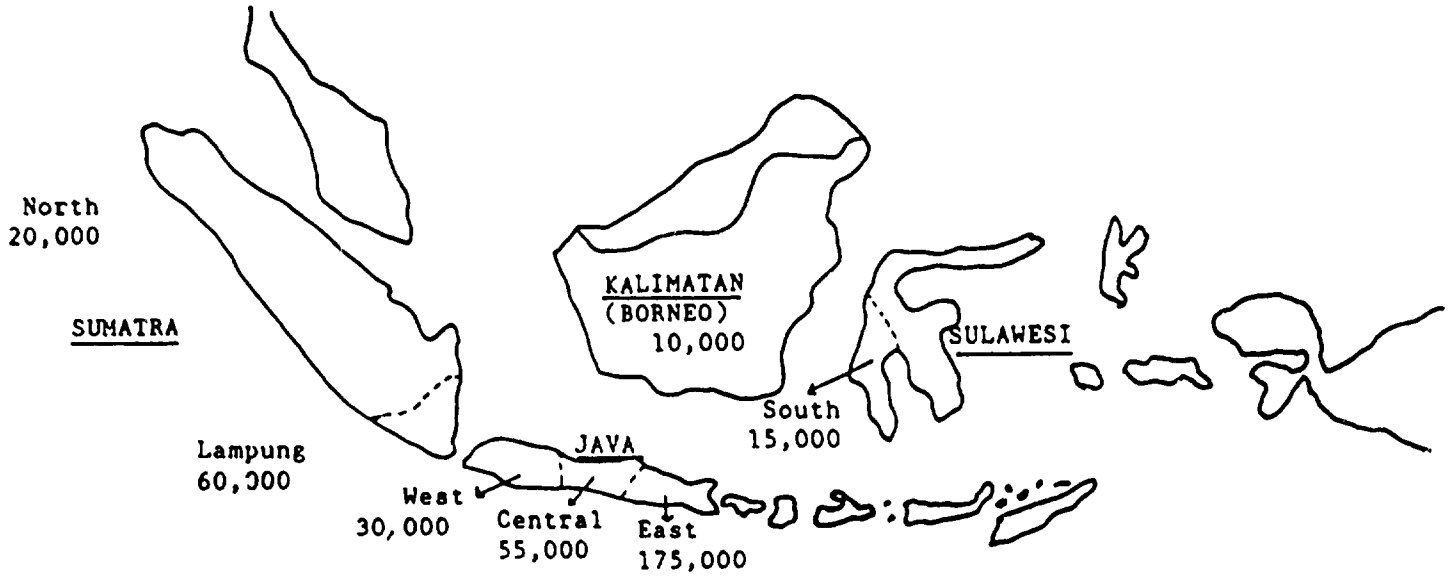
Indonesia represents an almost unique case in the area in that foreign investment in sugar production, including plantations, is sought and actively encouraged.

Cooperation has developed with package-project contractors in the area (Thailand) in the construction of new sugar mills.

There is undoubtedly room for European investors and perhaps equipment suppliers in the context of a prospective installation of new capacities to produce several hundred million t.s./year during the coming years.

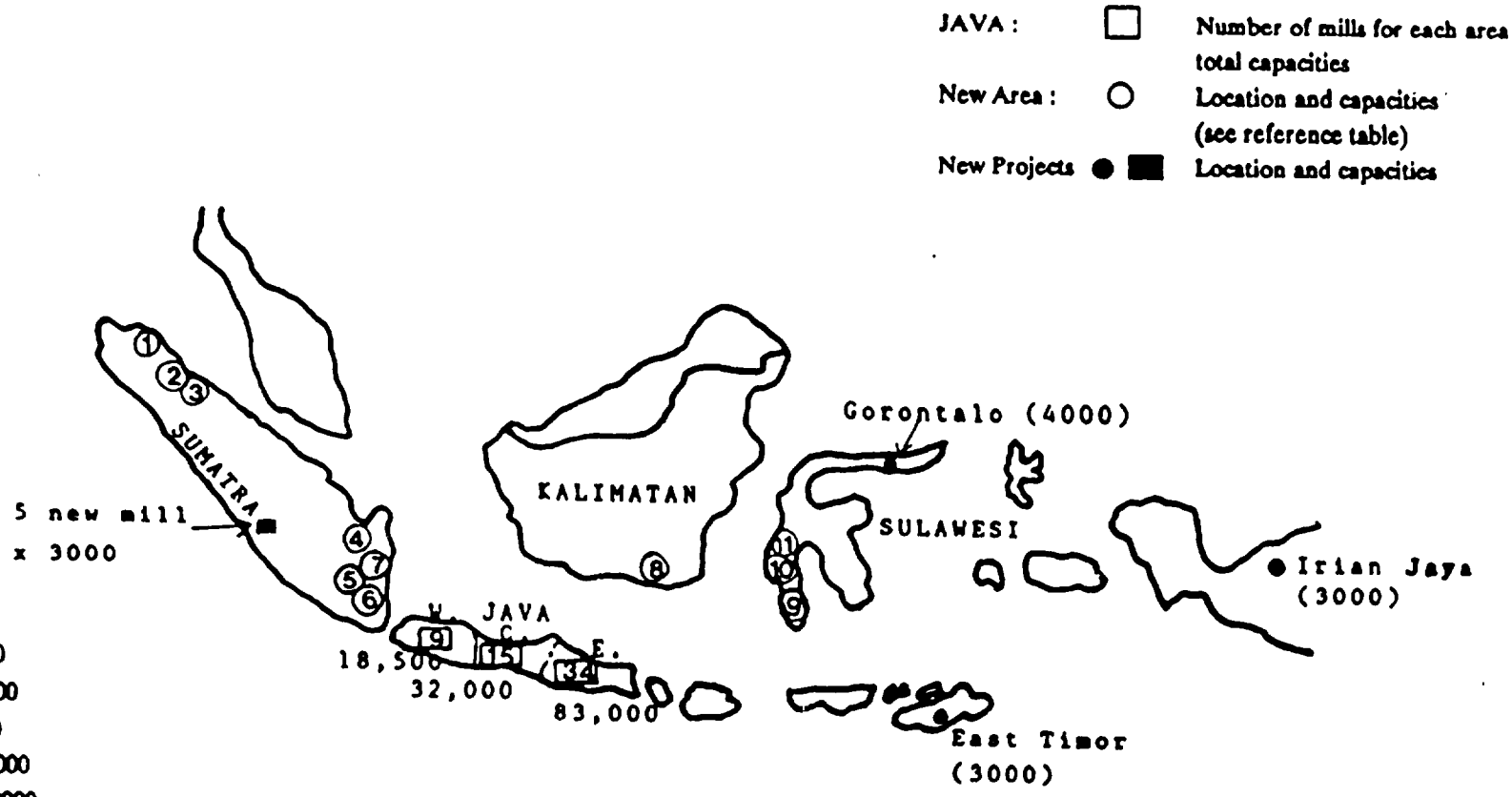
GEOGRAPHIC SKETCH OF THE INDONESIAN SUGAR INDUSTRY

1 - Cane Area 1988 - hectares



GEOGRAPHIC SKETCH OF THE INDONESIAN SUGAR INDUSTRY

II - Capacities (1990)



1 - Cot Girek 2000
2 - Kuala Madu 4000
3 - Sei Semayang 4000
4 - Cinta Manis 7600
5 - Bunga Mayang 9000
6 - Gunung Madu 10000
7 - Gula Putih Mataram 8000
8 - Pelai Hari 4000
9 - Takalar 3000
10 - Camming 3000
11 - Bone 2000

MALAYSIA

An exception in the zone, Malaysia has no sugar-producing tradition and, until as late as 1962, had to import 200,000 tons of white sugar under a preferential tariff for the Commonwealth countries.

1. Refining

In 1962 a Japanese-Malaysian consortium built the MSRC (Malayan Sugar Refining Company) refinery at Prai near Penang, with a capacity of 120,000 t.s./year.

This refinery, which now belongs to the Malaysian Kwok Group - Malaysian Sugar Manufacturing Company (MSM) - is one of the largest in the Far East, having a daily capacity of 1,450 tons of sugar and the capability of producing 500,000 tons of refined sugar a year.

Another refinery was later built at Klang, the port of Kuala Lumpur, with a capacity of 600 t.s./d (200,000 tons/year). This facility is operated by the Central Sugars Refinery Company (CSRB - Tradewinds Group).

These two mills, which are currently operating at full capacity, could easily supply the Malaysian market, which has risen to 600,000 tons, but are engaged in a very heavy volume of further upgrading (toll) for the re-export of refined sugar, in amounts that in 1989 and 1990 exceeded 200,000 tons a year.

2. Sugar production

The remaining requirement (100,000 tons) is met through small-scale national sugar-cane production.

This production began in 1973-1974 (16,000 tons produced) and has spread to three locations:

- **Perlis**, in the extreme North, near the border with Thailand;
- **Kedah**, at Kuala Nerang, also in the North;
- **Perak**.

The Perak mill (1,500 t.c./d) is now shut down. There remain, therefore:

- **Perlis Plantation Berhad**, a mill of 4,000 t.c./d since its construction, owned in the amount of 50 per cent by the Kwok refining group and 50 per cent by FELDA (a federal agricultural development agency). It produces some 60,000 tons a year on 8,700 hectares.
- **Gula Padang Terap**, at Kuala Nerang, a mill with a capacity of 3,500 t.c./d and with an annexed refinery producing 400 t.s./d, which can also refine imported raw sugar if necessary. The mixed financial structure involving FELDA and a private investor is the same as in the previous case. Production is about 40,000 tons on 8,600 hectares.

The cane is grown, for the most part at the mill plantations, on some 17,500 hectares. Although the humid climate limits the yields, primarily because of the low sugar content (5.7 t.s./hectare), plantations and mills are well managed, with the Perlis Plantation even achieving yields of 7 t.s./hectare.

For the two mills, the yield is 11 per cent for cane, which is not bad fcr this zone.

The price of the sugar in the domestic market varies according to the world price and thus within wide limits: from $M 1.74/kg in 1981 (the high) to $M 1.10/kg in 1986 (the low) - $US 0.76 and 0.42, respectively.

The small Malaysian industry is, therefore, competitive and could grow, but under a price arrangement directly linked to the world price for raw sugar as processed by the two efficient refining mills.

There is a reason to believe, however, that the sugar industry will undergo some interesting developments.

MYANMAR

Cane cultivation, which is traditional in Myanmar for the production of non-centrifugal sugar, permitted the establishment of the first sugar mill at Zeyawaddy (Lower Burma). The first season was 1933/34.

Capacities developed as follows:

Mill	First year of production	Location District or state	Capacity t.c./d
Zeyawaddy 1	1934	Toungoo	2 000
Pyinmana 1	1956	Yamethin	1 500
Namti	1956	Myitkyina	1 000
Bilin	1966	Toungoo	1 000
Shwenyaung	1983	E. Shan	300
Kyanktaw	1983	E. Arakan	300
Pyinmana 2	1983	Yamethin	1 500
Zeyawaddy 2	1986	Toungoo	1 500
Yedashe	1988	Toungoo	1 500
			10 600

Sugar production was initially a success: the cane cultivated particularly in the districts of Toungoo and Pegu (12,600 hectares), Yamethin (14,000 hectares) and Myitkyina (4,000 hectares) allowed the production of 620,000 tons which went to produce non-centrifugal sugar (145,000 tons) and centrifugal sugar (50,000 tons) in 1960. At this time, consumption was 65,000 tons.

In 1970, production bordered on 70,000 tons of sugar.

However, a disastrous cane price policy, leading to its resale to small factories using craft-type methods, brought production down to 20,000 tons in 1975.

Since then, production has gone through ups (65,000 tons in 1986/87) and downs. As the authorities do not permit the import of sugar, consumption has fallen to a low level, and the level of consumption per head per year, according to ISO, is the lowest in the world (0.6 kg).

It may be added that Myanmar even regularly exports 5,000-8,000 tons/year of direct white sugar (to Sri Lanka).

The population can feed itself with non-centrifugal cane sugar (production of which is estimated at 200,000 tons) and with palm sugar.

CONCLUSION AND PROSPECTS

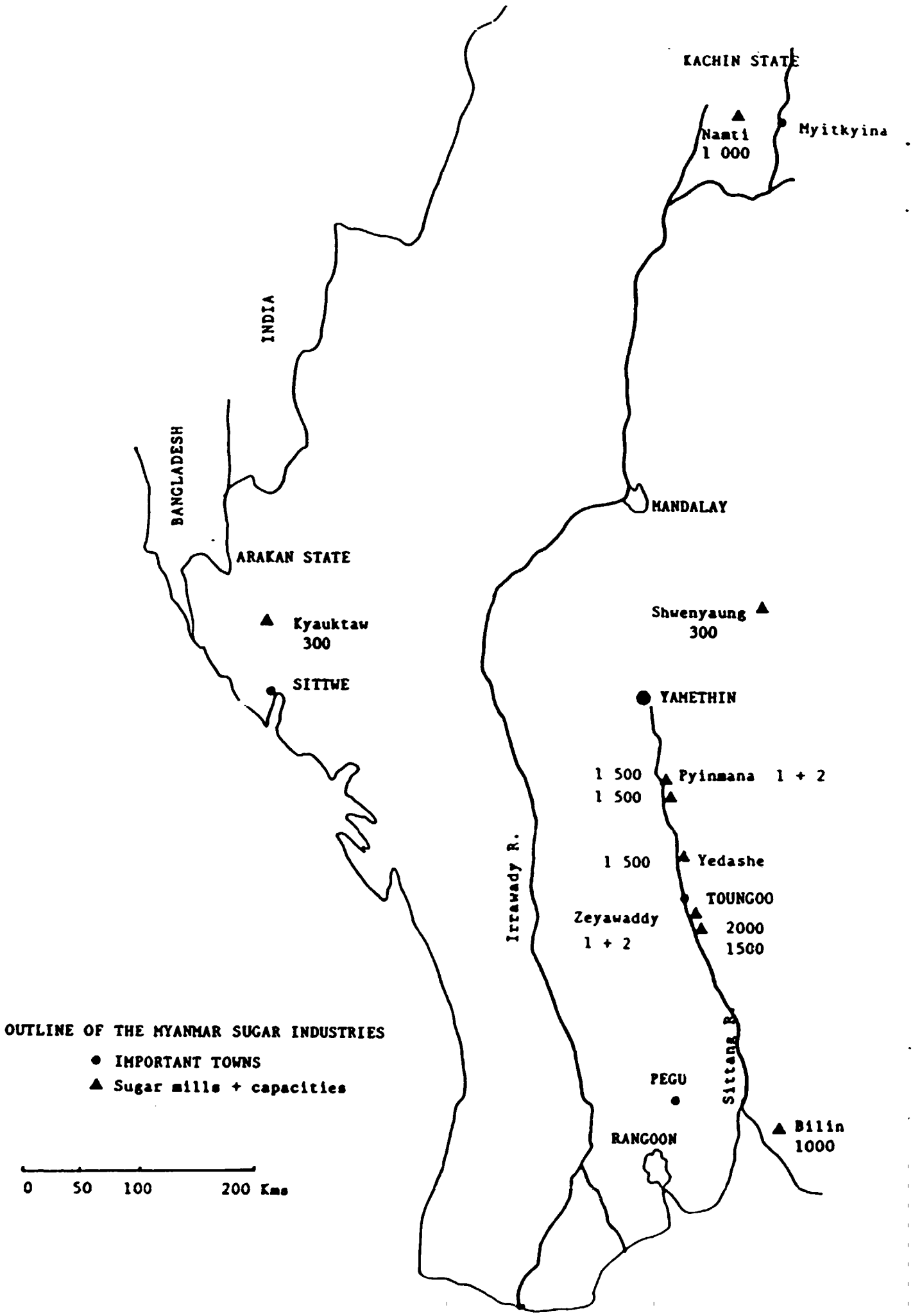
On paper, daily capacity, exceeding 10,000 t.c./d, would allow production of 110,000-120,000 tons of sugar. However, are all the mills in operation? The old Zeyawaddy mill has been closed or is about to close.

The area under cane, which amounts to 120,000 hectares, would a priori guarantee adequate supplies for the mills.

Do the authorities and the Foodstuff Industries Corporation (FIC) wish to relaunch sugar production?

This seems to be indicated by the recent inauguration of the Yedashe mill (1,500 t.c./d). This mill was built, with Japanese public financing (3.2 billion yen, $US 25 million) by the Japanese engineering firm TSK, which had built the old Pyinmana mill 35 years ago.

FIC, renamed MFI (Myanmar Foodstuff Industries), a State corporation, is owner of the nine mills. It is also active in the production of alcohol, beer and monosodium glutamate, produced partly with sugar or its by-products.


KACHIN STATE
Namti
1 000
Myitkyina
INDIA
BANGLADESH
MANDALAY
ARAKAN STATE
Kyauktaw
300
Shwenyaung
300
SITTWE
YAMETHIN
1 500
1 500
Pyinmana 1 + 2
1 500
Yedashe
TOUNGOO
Zeyawaddy
1 + 2
2000
1500
Irrawady R.
Sittang R.
PEGU
RANGOON
Bilin
1000
OUTLINE OF THE MYANMAR SUGAR INDUSTRIES
IMPORTANT TOWNS
Sugar mills + capacities
0 50 100 200 Kms

NEPAL

Although cane occupies less than 1 per cent of this country's cultivated land, in terms of its value as an agricultural product it ranks third (behind jute and tobacco). It is grown in 60 of the country's 75 districts, particularly in the Plane of Terai, covering, at the height of the sugar production season, 18,000 hectares.

The first sugar mill (private) was built in 1946 at Morang. With its capacity of 300 t.c./d, it never produced more than 5,000 tons of sugar a year.

In 1964, this mill was joined by:

- The Birganj mill in the District of Parsa (1,500 t.c./d), built by the Government (10,000 to 12,000 t.s./year);

- The Bhairahwa mill in the District of Rupandehi (Mahendra Sugar and General Industries P.O. Ltd. - private sector). With its capacity of 600 t.c./d, it produces from 6,000 to 10,000 tons.

In 1977-1978, production rose to a record 26,500 tons. In recent years, it has declined to less than 20,000 t.s./year, despite the appearance of the Indu mill at Janakpur Anchal and the Lumbini mill at Nawal Parasi.

The natural conditions - precipitation in the order of 800-900 mm/year concentrated in June-August and the low winter temperatures - are simply not favourable.

The following, by way of example, are the results of the 1977-1978 season, which was the best so far:

Area harvested by the mills	15,000 hectares
Tons of cane produced	296,000 tons
Yield in t.c./hectare	19.7 t.c./hectare
Sugar produced	26,500 tons
Mill yield	8.9 per cent
Tons of sugar per hectare	1.77.

The yields here, therefore, are among the lowest in the world.

Nepal, which was once self-sufficient, is forced to import Indian sugar to make up the supply of its domestic market of 35,000-40,000 tons.

PAKISTAN

I. HISTORICAL BACKGROUND

At the time the country gained its independence, in 1947, the area under sugar-cane was about 200,000 hectares, primarily allocated to the production of non-centrifugal sugar ("desi"). Two sugar mills had been built in 1936-1938, each producing 300 to 400 tons of cane a day (t.c./d), namely, one at Rahwali in the Punjab and the other near the frontier at Mardan (North-West Frontier Province) operating with British and Czechoslovak equipment.

In 1949, the Premier mill was built at Mardan (with a capacity of 2,750 t.c./d, the largest mill in Asia at that time) along with two other mills producing 1,000 tons/day in the Punjab (with British equipment). In 1951, production had reached 30,000 tons of sugar.

A major development plan (1955-1968) led to the construction of 13 mills with a capacity of 1,500 t.c./d (two in the NWFP, three in Sindh and eight in the Punjab) with equipment acquired from various sources (Federal Republic of Germany, the Netherlands, England, Czechoslovakia, Poland, Italy and Japan). In 1968-1969, production had risen to 300,000 tons.

The growing of the sugar-beet was established in the NWFP on an industrial scale in 1960 when a sugar-beet extension service was set up at the Charsadda mill.

Subsequently, expansion continued uninterruptedly:

- Fourteen mills from 1968 to 1980 (French - FCB (Kot Diji, Dadu and Thatta mills)), Netherlands, Belgian, English, Chinese, Japanese and Polish equipment), seven of them in Sindh, the province where sugar sector growth has been the most intensive since 1970.

  In 1978-1979, the first two mills built with Pakistani equipment began operation.

  In 1980-1981, production reached 80,000 tons.

- Fifteen mills from 1980 to 1990 (eight in Sindh and seven in the Punjab).

  In 1988-1989, production exceeded 1.8 million tons and has remained at that level ever since.

The increase in consumption, which has been steady and very rapid and which, during the period 1986-1987, made necessary the import of 750,000 tons/year, resulted, in 1990, in the granting of licences for 13 new mills to be built in Sindh.

Over the period in question, the area under cane has increased by a factor of five (nearly one million hectares in 1990) in the Punjab, but particularly in Sindh.

The Pakistani sugar industry holds, together with the Thai sugar industry, the record for the fastest growth rate in the world (more than 10 per cent/year over the last 30 years).

II. THE AGRICULTURAL SECTOR

1. Location and surface areas

Accounting for a little more than 850,000 hectares, sugar-cane occupies about 4 per cent of the cultivable land (20 million hectares), the area of which has ceased to increase.

Cane production, traditional in certain valleys of the North-West Frontier Province, in the regions of Peshawar and Mardan, where it covers 100,000 hectares, has developed primarily in the two major agricultural provinces:

- For the last 30 years, in the **Punjab**, where there are 500,000 hectares, for the most part in the districts of Faisalabad, Multan and Bahawalpur;

- More recently and, over the last few years, exclusively in **Sindh**, where there are 250,000 hectares.

The climate is always very dry and all of the cane is grown under irrigation. It is occasionally quite cold in the winter (NWFP and Punjab) for sugar-cane cultivation.

2. Agricultural population

There are more than one million sugar-cane growers (less than one hectare per grower). However, the number of planters supplying the sugar mills is put at about 800,000.

3. Growing methods

As in most of India and in Bangladesh, the single-plant-cane method of cultivation is common (one third of the plantations), but the rule is one plant cane plus two ratoons.

The cane is grown in a rotation system with food crops (rice, wheat and maize), legumes (berseem) or cotton, another typical cash crop. During the mid-1980s, a number of humid periods, more favourable to cotton, encouraged the more extensive cultivation of cane.

The growing methods are generally primitive and the labour requirement is extremely high - more than 600 days of work per hectare. Not enough fertilizer is used and hardly anything is done to combat the various diseases and, above all, the pests to which sugar-cane is vulnerable.

Although new strains have recently been introduced, the use of old varieties (type N-CO-310, B-L-4, CO-L-54) has for too long remained the rule.

Finally, the interruption of vegetation caused by the winter (in the NWFP and Punjab), which may even bring frost, works to the detriment of high yields.

4. Yields

The yields are invariably low, having ranged during the last 20 years from 31.5 to 42.5 t.c./hectare.

Since the quality of the cane is, technically speaking, also poor (with a mill yield of 8.5 per cent), the per-hectare sugar yield is generally below 3.5 tons, one of the lowest in the world.

For 1989/1990, a good crop year, we had:

	t.c./hectare	Factory yield %	t.s./hectare
NWFP	43.4	9.0	3.9
Punjab	37.3	8.35	3.1
Sindh	49.3	9.4	4.65
Total Pakistan	41.5	8.9	3.7

5. Sugar-cane production

(a) By region (millions of tons)

	1982-1983			1989-1990		
	Thousands of hectares	Millions of tons	Including for sugar	Thousands of hectares	Millions of tons	Including for sugar
NWFP	100	4.0	1.0	102	4.4	0.9
Punjab	630	20.8	5.2	501	18.7	9.15
Sindh	180	7.5	6.3	251	12.4	10.45
Total	910	32.3	12.5	854	35.5	20.5

(b) By destination

	1982-1983	1989-1990
Gur and kandsari	16.3	11.7
Sugar	12.5	20.5
Other products	3.5	3.3
	32.3	35.5

It will be seen that there has been a decrease in the area under sugar-cane since the beginning of the 1980s.

The growth in the proportion of cane sold to the mills has been achieved at the expense of non-centrifugal sugar, unlike the situation in India and Bangladesh, where the small-scale sector remains a major factor.

6. Relations between planters and mills

The help made available to the planters by the mills is considerable: experimental farms, distribution of fertilizers and other inputs, credit, and the haulage of the cane from the permanent collection centres, thereby enabling the planter to use his own means of transport (ox-cart) as far as the centres.

In addition to setting a minimum price, the authorities have endeavoured to regulate the collection of the sugar-cane by establishing mill zones and setting up Cane Control Boards that are responsible for controlling the supply of cane to the mills, even to the point of exclusively reserving an entire zone for a single mill.

In the face of the competition of the small-scale producers, this regulatory approach has not always produced the expected results, utilization of the mills' crushing capacity having ranged from 60 to 135 per cent (the latter figure in 1981-1982, when 14.6 million tons of cane were crushed, the capacity at that time being 11 million tons).

The abolition of the mandatory delivery zones in 1987 and the availability to the mill operators of the possibility of acquiring the cane from as far away as they wish have been among the factors that have contributed to the increase in production observed since 1988.

Another factor has certainly been the rising price of the cane.

Fixed for a long time at 5.6 Pakistani rupees (PRs) per maund of 37.3 kg (Punjab and NWFP) and at 6 PRs/maund (Sindh) ($US 15 and 16.25/t.c.), respectively, the current price (figures for 1990) is, for mill-delivered cane:

	PRs/40 kg	$US/t.c
NWFP	15.25	17.8
Punjab	15.50	18.1
Sindh	15.75	18.4
Sugar-beet (NWFP)	18.50	21.6

In comparison with the official support price (15.25 PRs/40 kg), the actual prices paid by the mills are frequently 4 to 6 PRs/maund higher, representing a bonus of $US 5 to 7.5 per ton of cane. These prices are to be understood as referring to cane delivered to the mills.

The competitive cost of the cane is therefore about $US 23/ton ($US 900/hectare), which is quite high for a raw material of such poor quality.

Further, a quality bonus of 19 paisas/maund ($US 0.24/t.c.) is paid for every tenth of a point of mill yield above:

8.3 per cent in the NWFP,

8.5 per cent in the Punjab,

8.7 per cent in Sindh.

This measure, which is hardly to the advantage either of the best planters, who supply fresh and mature cane, or of the best mills, which have nothing to gain by announcing better yields, does not appear to be producing very good results.

It should be noted that three research stations or institutes (Mardan, Lyallpur and Tando Jam) are introducing new varieties and techniques.

III. THE SUGAR INDUSTRY

1. Size structure

The breakdown in terms of capacity (t.c./d) of the 48 mills in operation during the 1989-1990 period (see map) was as follows:

	NWFP	Punjab	Sindh	Pakistan
2,000 or less	1	1	2	4
2,000-3,000	3	9	6	18
3,000-4,000	-	9	9	18
4,000-5,000	1	3	3	7
Over 5,000	-	1	-	1
Total	5	23	20	48
Typical size	2 400	3 200	3 300	3 200

The total capacity is around 143,000 t.c./d, 3,000 tons/day being the average.

In 1990-1991, 50 mills participated in the harvest, as compared with 48 in 1989-1990.

2. Duration of the season

Apart from exceptional seasons (214 days in 1981-1982), the average duration of the season in recent years has been about 180 days, with a recent trend towards 190 days.

The season usually begins:

- In September in Sindh,
- In mid- to late-October in the Punjab,
- In early November in the NWFP.

The season ends:

- In March in the NWFP and the Punjab,
- Between April and June in Sindh.

Seasons of 200 days and more are, therefore, not unusual in the very dry climate of Sindh (as much as 260 days for the mills at Khoski and Mirpurkhas). In the North-West Frontier Province, the lack of cane limits the season, even with the small additional quantities of sugar-beet (occasionally to no more than 150 days).

3. Quality of the cane

The quality is poor, the delay in transporting the cane being a major factor. The following figures were typical for 1988-1989:

	NWFP	Punjab	Sindh	Average
Polarization (% content of extractable sugar)	11.75	10.62	11.47	11.14
Fibre	13.0	14.5	14.3	14.40
Mixed juice				
Brix	15.0	15.2	16.2	15.7
Purity	78	74	76	76

Technical results

	1982-1983			1988-1989		
	Highest	Lowest	Average	Highest	Lowest	Average
Polarization, % of cane	12.8	10.1	11.5	12.3	9.5	11.14
Purity of the mixed juice	79	71	76	79	68	76
Reduced extraction	94.7	90.2	92.35	95.2	90.0	92.5
Losses, % of cane						
Bagasse	1.31	0.71	0.98	1.21	0.75	0.96
Filter cake	0.20	0.05	0.11	0.16	0.02	0.08
Molasses	1.66	1.12	1.44	2.80	1.06	1.65
Indeterminate	0.31	0.19	0.09	0.31	0.01	0.07
Total losses	3.08	2.05	2.63	3.21*	2.32*	2.76*
General recovery	82	72	77.3	79.2	70.8	75.2
Mill yield	10.14	7.25	8.87	9.89	7.43	8.38**
Purity of the molasses	40	32		38.9	31.7	
Time lost, %	48.5	9.25	17.5	30.0	3.6	15.0

* The best or the worst of the overall loss performances do not necessarily correspond to the sum of the best/worst for each item.

** Lowest yield of the decade. Yield was 8.92 per cent in 1989-1990.

4. Production per mill

The average production per mill, for 1988-1989 and 1989-1990, on the basis of cane-sugar output and figures of 1,818,000 and 1,829,000 tons, respectively, was 40,000 tons. Production ranged from a few thousand tons at a mill in the North-West Frontier Province to 89,000 tons at a mill in Sindh.

5. Quality of the sugar

All the mills are engaged in the direct production of white sugar, whose quality rarely achieves the minimum international standard (Paris Exchange), particularly with regard to the colour (70-80 ICUMSA at best, the standard being 45 ICUMSA) and, occasionally, the ash.

The procedure used most often by the 17 plants built before 1970 is that of double carbonatation and double sulfitation.

A number of mills (Crescent, Thatta) remelt the A and B sugars for a second carbonatation, passing them through a second series of boilings, in a procedure similar to the refining of sugar. The majority of plants operate with simple defecation.

6. Thermal efficiency

With an average of 310 kg of wet bagasse per ton of cane, nearly all the bagasse must be burnt in a boiler, and shortages sometimes occur.

Consumption may be high, as much as 800 kg of steam per ton of cane. Some mills (Thatta) obtain surpluses of bagasse, in the order of 100 tons/day.

7. Workforce: about 50,000 employees (1,000 per mill). The minimum wage is 1,100 PRs/month ($US 50/month).

IV. REFINING

No activity.

V. FINANCIAL STRUCTURE OF THE INDUSTRY

In the majority of cases, the mills belong to private groups or to families (34 out of 45 plants).

The most important is the Ittefaq Group (Noorpur Sugar Mill, with a capacity of 5,200 t.c./d, and two other mills, all of them in the Punjab). This group also manufactures sugar equipment.

The following are also important:

- The Hyesons Group (two mills);
- The Fecto Group (two mills);
- The Crescent Group (two mills).

Three mills belong to the Fauji Foundation (military retirees): Khoski, one of the most productive, Sangla Hill and Tandoo Mohammed Khan. A fourth (Badin) belongs to the Army Welfare Sugar Mills.

A number of mills are owned by provincial public companies (Sindh, Punjab).

VI. SUGAR CONSUMPTION AND OUTLOOK

There have been great changes in the pattern of consumption over the last 10 to 15 years. The consumption of gur has plummeted, dropping from more than 15 kg per capita per annum at the end of the 1970s to less than 8 kg in 1990.

Sugar consumption rose from 10 kg per capita per annum to about 20 kg, which is nearly twice as much as in India. In other words, in some 12 years a million tons of sugar has taken the place of a million tons of gur.

In 1990, consumption exceeded 2.1 million tons (the forecast is for 2.3 million tons for 1991). It is true that a part of the direct consumption is subsized, sold at low prices by State stores.

On the free market, retail prices rose from some 9 PRs/kg ($US 0.4/kg) at the beginning of 1988 to more than 15 PRs/kg ($US 0.7/kg) by mid-1989.

The rate of increase in the consumption of sugar in recent years (extremely high at 10 per cent per annum) should return to a more reasonable level.

Products that compete with sugar are produced (three plants):

- 18,000-20,000 tons of glucose,

- 10,000-12,000 tons of dextrose.

Annual production of isoglucose is estimated at 40,000 tons a year. The capacity is at least twice that figure.

VII. FOREIGN TRADE

The period 1986-1987, before the recent increase in national production, was one of record imports: 700,000 tons, including 200,000 tons of European Economic Community (EEC) sugar (65,000 tons from France).

Since then, imports have varied annually from 100,000 to 250,000 tons of white sugar.

On the other hand, Pakistan is one of the largest exporters of molasses in the world: between 650,000 and 800,000 tons a year in recent years. The figure for 1989-1990 is 1,165,000 tons, worth in the order of $US 50 million. A 25 per cent export tax on molasses is levied. Pakistan also exports alcohol: 82,500 hectare litres, worth $US 2.8 million, in 1989-1990.

VIII. USE OF BY-PRODUCTS

1. Molasses

Out of the 900,000-950,000 tons of molasses produced, 85 per cent is exported.

There are domestic markets for:

- Fermentation and distillation by 12 distilleries, of which nine are annexed to sugar mills and three are autonomous. In this way, from 50,000-100,000 tons of molasses a year are used to produce about 15 to 25 million litres, a small part of the total capacity, which exceeds 35 million litres;

- Use as animal feed, which is estimated (United States Department of Agriculture) at 35,000 tons a year, a small amount, considering the per capita consumption of milk (100 litres/year) and meat (16 kg) in the country.

- A sales tax of 12.5 per cent on molasses represents an obstacle to its greater utilization.

2. Bagasse

The bagasse production of the sugar mills alone may be put at some 6 million tons/year (wet bagasse), more than 99 per cent of which is used as fuel.

The particleboard production capacity is estimated at 60,000 tons/year. The particleboard is produced, except at two units attached to sugar mills (one of them being at Shakarganj, producing 25 tons/day), from waste wood, a rare product in this country. The units operate at only reduced capacity.

A third sugar company is setting up a medium-density fibre (MDF) plant designed to produce 70 tons/day from bagasse.

A paper production unit using bagasse (100 tons/day) is in existence.

In 1988, the transfer price of wet bagasse between sugar companies was 160 PRs/ton ($US 9/ton).

IX. PRODUCTION COSTS

The cane price is $US 23/t.c., which, considering the poor quality of the cane, represents a cost of $US 270/t.s. for the raw cane delivered to the plant. The cost of the sugar ex-works is about $US 450-500/ton.

X. FISCAL TREATMENT OF SUGAR

An import levy of 4,000 PRs/ton (about $US 200/ton), which normally had a disincentive effect, has been replaced by ad valorem duties, totalling 15 per cent. Import operations, which are in private hands, are subject to general authorization, which is occasionally suspended.

The producers pay a Central Excise Duty (CED). An exemption was accorded in 1985, but the Government reinstated it. The excise duty was 1,750 PRs/ton ($US 82/ton) in 1989-1990.

XI. TECHNICAL AND ECONOMIC EVALUATION

Although not a sugar-exporting country, Pakistan should be able, with its 10 to 15 new sugar mills, to achieve self-sufficiency by using 5 per cent of its cultivated areas, a limiting factor in its agricultural production. Regarding the industrial sector, which is showing great dynamism (recent investments are the proof), there can be no question. Moreover, the sugar equipment industry (HMC Taxila) is sizeable and is cooperating with European (Rolimpex of Poland), Australian (Walkers) and Chinese equipment manufacturers.

Despite the unfavourable climatic factors, it should be possible to arrive at quite acceptable yields, e.g., 45 tons/hectare x 12 per cent x 0.8 = 4.3 t.s./hectare, instead of the somewhat more than 3 tons at the present time.

The problem, therefore, is essentially an agricultural one. The Pakistani cane producers could easily supply the national market with sugar (and gur) by using only 4 per cent of the cultivated area (800,000 hectares), and the same areas, thanks to higher agricultural productivity, could provide the basis for an increase in consumption.

CONCLUSION

Prospects for cooperation

An early PICIC study (1983) identifies the barriers to the development of industries based on sugar-cane and cane by-products:

- Inadequate national demand for the chemical products based on carbonated substrates;
- The impact of considerable price fluctuations on the international molasses and alcohol markets;
- Lack of capital;
- Technological barriers: the advanced technology developed by the industrialized countries is not available.

A French mission in which ERSUC participated at the end of 1984 identified the principal products for which there was a potential market:

Bagasse: paper, particleboard and furfurol, but on the condition that bagasse surpluses are generated (heat management at the sugar mills, etc.);

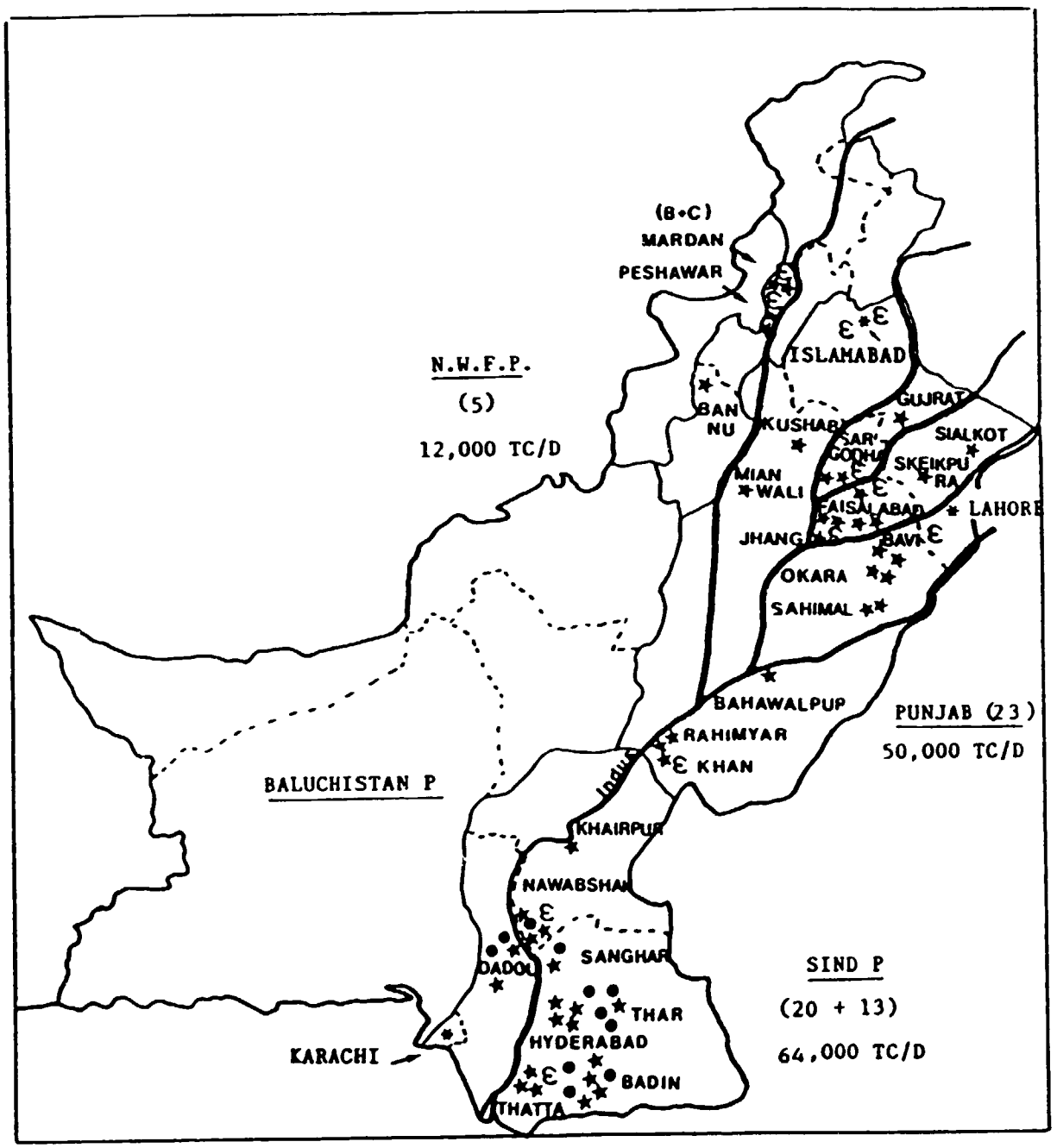
Molasses: animal feed, but the initial results have been disappointing;

Citric acid: national consumption is below 2,500 tons/year, the absolute threshold of profitability;

Lysine: a market study should be prepared. The value of the product justifies it;

Liquid sugar production: because capacities and production facilities for liquid products competing with sugar (glucose syrup and isoglucose) already exist.

GEOGRAPHIC SKETCH OF THE PAKISTAN SUGAR INDUSTRY



★ Mills operatingin 1989 (48)

● New mills with licenses (13)

Ɛ Distilleries (10)

Names are main cane PROVINCE'S and main cane DISTRICT'S

PHILIPPINES

I. HISTORICAL BACKGROUND

Although it is said that Magellan found growers of cane when he landed in this country in 1521, the first sugar mill was built only in 1913/14 at Mindoro (9,000 t.s.). Production flourished quickly thanks to exports to the United States of America, the special relationship between the United States and the Philippines permitting the establishment of preferential tariff treatment for Philippine sugar. Production amounted to 100,000 tons in 1921 and a million tons in 1932. The Philippines overtook Indonesia and became the first producer in Asia. The record achieved in 1933/34 (1,450,000 tons) was not broken until 1961.

During the World War, the industry was completely destroyed (less than 100,000 tons after the War). It was rebuilt (FCB at Tolong and Hilongos) at its pre-war level in 15 years: 85,000 t.c./d in 1960. Maximum for planted area (550,000 hectares), cane production (29.3 million t.c.) and sugar production (2.9 million t.s.) were achieved in 1975/76.

	Hectares Thousands	Prod. cane (Millions of tons)	Number of Mills	Mill capacity Thousands of t/d	Prod. sugar Thousands of tons Centrifugal	Non-centrifugal
Pre-war (1934)	270	9.0	45	75	1 450	50
1950	170	8.0	10	10	150	50
1960	230	14.0	25	85	1 400	50
1970	450	23.0	33	130	2 050	?
1980	400	22.0	42	190	2 350	?
1990	360	19.5	39*	190	1 750	

* Not all operate; for example, 38 were in operation in 1988.

From 1980 onwards, the slump in world prices, the dramatic reduction in the United States quota for the Philippines, the disappearance of special "protective" treatment for the sugar industry, and insecurity, particularly at Negros, brought the sector to the edge of complete collapse (in 1987, the area under cane had fallen to 270,000 hectares). A recovery is now taking place.

II. THE AGRICULTURAL SECTOR

(1) Sites and areas

Cane is grown on the largest islands - Luzon and Mindanao - but the sugar island par excellence is Negros. There is some cultivation on Panay, Leyte and Cebu.

	Thousands of hectares		
	1960	1976	1989**
Negros	117	255	165
Luzon	70	145	78
Panay	12	65	11
Leyte	5		12
Cebu	4	95	9
Mindanao	*		25
	211	560	300

* Cane for sugar mills only. Production was stopped from 1957 to 1961 at the sugar mill on Mindanao.

** Harvested areas.

Rainfall in Negros and Panay (2,200-2,800 mm) fully covers the needs for water, and there are only two (somewhat) dry months: March and April. Luzon has less rain and a real dry season (November-May). Mindanao and the Visayas are affected by cyclones.

(2) Agricultural population

In 1980, before production collapsed, there were 34,100 planters distributed as follows:

	Less than 10 hectares	10-25 hectares	25-100 hectares	More than 100 hectares	Total
Planters	24 650	5 400	3 250	800	34 100
Area	97 850	77 550	165 200	106 100	446 700
Hectares/planter	4	14	50	135	12

In 1988-1989, 29,610 planters made deliveries to the sugar mills.

The typical planter had seven hectares. We have no data on subsequent trends or the impact of the Agrarian Reform Programme (CARP). Agriculture then employed about 400,000 persons. It is to be noted that plantations are twice as large on Negros (an average of 26 hectares) as on Luzon (13 hectares). The mill plantations included in the total for planters are few (a handful) and of small size (2,000-3,000 hectares each, there being one with 6,000 hectares).

(3) Growing methods

As everywhere in Asia, the harvest cycle is 12 months. But the crop cycle here is three years: one plant cane plus two ratoons. Cane is rarely rotated.

The varieties are nearly all (85 per cent of the area) Philippine varieties, developed by the La Granja station (LGES) on Negros. The variety PHIL 56-226 has been predominant for a very long time.

Ploughing, planting and weeding are generally carried out mechanically.

Ten per cent of the area is irrigated on a make-up basis (Luzon).

The cane is cut and loaded manually, and rarely burnt (22 per cent for all of the Philippines), except on Luzon (50 per cent).

(4) Yields: With 60 tons/hectare and with the cane polarizing at 10 and 11, and average yields in t.s./hectare are rather modest: about 5.3 tons of raw sugar per hectare. This reflects:

- Very good results on Panay: 90 t.c./hectare and close to 7 t.s./hectare;
- Good results on Negros: 70 t.c./hectare and about 6 t.s./hectare;
- Mediocre results on Luzon, the Eastern Visayas and on Mindanao: 50-55 t.c./hectares and 4.5 t.s./hectare.

(5) Relations between planters and mills

Seasonal loans are extended to planters by commercial or rural banks, in the form of "harvest loans" (ASIL), guaranteed by "quedans" (see below).

The only factor taken into account when the cane is received at the mill is its weight.

Cane is paid for through "sharing" of the liquidation value of the sugar (normally 60 per cent for the planter); the figure may vary from one island to another or one mill to another (up to 70 per cent).

If the planter transports his cane to the mill himself, he is compensated.

There is a very complete individual contract between the two partners (planter and mill). It provides for the sharing basis, allowances for transport, the timetable for delivery, the mill's general recovery guarantees, representation of the planters in the laboratory and, lastly, issue of "quedans".

A "quedan" is a warehouse certificate: it describes the quantity of sugar belonging to the planter which is stocked for him by the mill. It is a commercial document of great value, negotiable with banks or in trading, or usable as security.

In 1988-1989, the composite price of the sugar (see fiscal treatment of the sugar) was fixed at 537 pesos/picul of 63.28 kg, or 8,500 pesos/t.s. On the basis of a yield of 8 per cent and a share of 60 per cent, the planter then received 412 pesos/t.c., or $US 19.5/t.c., loaded on lorries. To this must be added $US 1.5-2/t.c. of molasses income.

III. THE SUGAR INDUSTRY

(1) Size structure (t.c./d)

	Negros	Luzon	Panay	Cebu	Leyte	Mind.	Total
2,500 or less	2	3	2	1	1	-	9
2,500-5,000	8	4	3	1	1	2	19
5,000-10,000	4	4	-	-	-	-	8
10,000 or more	3	=	=	=	=	=	3
	17	11	5	2	2	2	39

The typical size is 4,000 t.c./d.

The three large mills are La Carlota, Victorias Milling Co. and Binalbagan, all in western Negros.

(2) Duration of the season

The average duration of the season, in 1988-1989, was 190-195 days, covering three types of situation:

- Eight mills operating for 8 months or more: 265 days;
- Fifteen mills operating for 6-8 months: 205 days;
- Fifteen mills operating for less than 8 months: 140 days.

(3) Technical performance

The generally rainy climate is not compatible with high cane polarization figuress: 12 per cent and sometimes less (down to 10.3 per cent in 1988-1989).

For the 1988-1989 season, we have the following results for the entire Philippines:

	Highest	Lowest	Average
- Crushed cane (tons)	2,264,000	26,000	483,000
- Number of season days	353	77	191
- Days actually worked	240	19	122
- Time lost (per cent)	77	6.5	36.3
- Cane sucrose	12.61	8.51	10.31
- Fibre	14.65	10.57	12.52
- Purity of mixed juice	81.4	72.5	78

	Highest	Lowest	Average
Losses (percentage of cane)			
- Bagasse	1.43	0.54	0.83
- Filter cane	0.17	0.03	0.09
- Molasses	1.74	0.91	1.25
- Undetermined	0.51	(0.10)	0.06
Total losses	3.30	1.63	2.23
Reduced extraction	92.7	86.0	91.9
General recovery	84.3	72.9	78.4

The overall result is very average and reveals weaknesses, particularly in extraction (iow imbibition).

The industrial workforce totalled 23,000 persons in 1988-1989.

(4) Production per mill

The largest mill (Victorias Milling Co. on Negros) produced 182,200 tons of raw sugar in 1988-1989.

La Carlota (Negros) produces more than 100,000 tons; Don Pedro and Tarlac (Luzon) and Bukidnon (Mindanao) are approaching that figure.

The Philippines produced 2.9 million tons of raw sugar in 1975, and still has a capacity to produce 2,450,000 tons. Actual production was 1,748,700 tons in 1989-1990.

Three mills produce less than 10,000 tons. The average in 1988-1989 was 42,000 tons.

(5) Quality of the sugar

Mainly raw sugar for export or refining.

Four mills produce "washed sugar", semi-white.

Two mills produce direct plantation whites.

IV. REFINING

The Filipinos consume raw sugar, but are demanding as regards the quality of the white sugar. Refining is therefore necessary, and the Philippines have also embarked on a programme for the export of white sugar, justifying the construction of new refineries attached to the mills. Eight annexed refineries were in operation in 1983.

At the present time, the following are the leading facilities:

- The Victorias Milling Co. Refinery: with a capacity of 1,250 tons/day, producing a product of excellent quality;

- The Batangas Refinery: 500 tons/day;

- The Tarlac Refinery: 350 tons/day.

CASUCO, Bukidnon, First Farmers, Calinog and La Carlota (250 tons/day) also have refining capacities.

A ninth annexed sugar mill is under construction at San Carlos.

The Philippines, turning to raw sugar in the off season if necessary, can thus produce more than a million tons of refined sugar.

Finally, the small, autonomous refinery near Manila still exists.

V. FINANCIAL STRUCTURE OF THE INDUSTRY

Foreign capital (Hawaian Philippines, Jardine Davies) has been decisive in the establishment of the sugar industry.

It is still present.

Moreover, new investors are arriving, for example from Hong Kong (recent establishment of the Don Pedro Group, La Carlota, Bukidnon).

The public and cooperative (First Farmers) sectors are also present. However, most of the production is in the hands of private concerns of the family type.

VI. SUGAR CONSUMPTION AND OUTLOOK

In 1989-1990, the Philippines consumed 1,507,000 tons of raw sugar equivalent, which occasionally made it necessary in these last years to resort to imports.

The Philippines is one of the few countries in the world to consume raw sugar in the natural state, even for industrial uses. Raw sugar accounted for 40 per cent of sales ten years ago. This proportion has since fallen to 20 per cent.

Most of the sugar consumed is in the form of refined sugar, but direct whites have appeared on the market.

For 1988, we have the following price figures:

	Raw sugar		Refined sugar	
	Pesos	dollars per kg	Pesos	dollars per kg
Wholesale (5-kg bag)	480.6	0.45	617.1	0.58
Retail - (1-kg bag)	10.5	0.50	13.17	0.625

In 1991, the ex-mill price for raw sugar is 650-700 P/picul (63.25 kg; ($US 370-395/ton). The retail price is 17.6 P/kg ($US 0.63/kg) for the refined quality.

VII. FOREIGN TRADE

The Philippines were for a long time among the very top world exporters of sugar. A United States quota exceeding one million tons at a highly preferential price (up to 20 cents/lb) permitted some of the production to be sold on the world market at a low price.

The reduction in sugar imports by the United States and the lowering of the Philippine quota (320,000 tons in 1990/91) was one of the major causes for the collapse in production between 1984 and 1988.

This collapse took on such proportions that, in order to ensure delivery of the quota, it was necessary to import nearly 300,000 tons of raw sugar in 1985, and smaller quantities in 1987 and 1990.

VIII. USE OF BY-PRODUCTS

All of the bagasse is used to fire boilers. The low fibre content (sometimes 12 per cent) makes it necessary at times to burn fuel oil.

The molasses (720,000 tons produced in 1989-1990) is allocated as follows:

- A small part (15,000-20,000 tons) for animal feed;
- Forty thousand tons for various fermentation industries;
- About 200,000 tons for distilling;
- The balance is exported.

The Central Fermentation Company produces monosodium glutamate from molasses at Bulacan.

The Philippines has a substantial alcohol production capacity.

There are:

- Ten distilleries annexed to sugar mills for a total capacity of 2,165 hectolitres/day. The largest is the one at the Tarlac mill-refinery on Luzon (400 hectolitres/day);
- Ten autonomous distilleries processing purchased molasses, with a total capacity of 3,500 hectolitres/day. The largest is that of the Asian Alcohol Corp. at Pulupandan (western Negros), which has a capacity of 2,100 hectolitres/day and operates with yeast recycling.

Actual utilized capacity is only 2,000 hectolitres/day on an average, and production is in the order of 300,000-400,000 hectolitres/year.

The national market is very substantial. Small quantities are exported.

IX. PRODUCTION COSTS

An ERSUC study estimates the average for costs of agricultural production at $US 15/t.c.

The income-sharing formula gives the plant, as we have seen, a cane cost of about $US 23/t.c. (or $US 240/t.s. in the cane). Fortunately, industrial costs are modest, varying from $US 100 to $US 180/ton of raw sugar for mills operating at capacity.

The premium of $US 130/ton for refined sugar is remunerative.

The profit investment margin provided by the domestic market and the United States quota seems reasonable, if production can be brought closer to capacity.

X. FISCAL TREATMENT OF SUGAR

This underwent substantial modifications after the fall of President Marcos, whose entourage had constructed a highly interventionist system, placing financing (Republic Planters Bank) and remuneration under supervision, and monopolizing exports de facto (PHILSUCOM), carrying the exercise to the point of sugar trafficking (NASUTRA) and even the unhappy purchase of a refinery in the United States.

The requirements of the World Bank (financing of the Sugar Rehabilitation and Diversification Program launched in 1987) led to the simplification and unification of State activities within the Sugar Regulatory Administration, which administers a system of quotas inherited from the former regime:

- "A" for the United States quota;
- "B" for the market;
- "C" for reserve stocks;
- "D" (non-existent until 1986) for the world market.

To take the example of the 1988/89 season, mills had to produce:

- One hundred per cent in quota B from 1 September to 6 November;
- Ten per cent in A, 70 per cent in B and 20 per cent in C from 7 November to 9 January;
- Twelve per cent in A, 70 per cent in B and 18 per cent in C from 10 January to 27 February;
- Twelve per cent in A, 60 per cent in B and 28 per cent in C from 28 February to 10 April;
- Sixty per cent in B and 40 per cent in C for the remainder.

The "C" of one season is converted into "A" or "B" for the following season.

The mills issue four categories of negotiable "quedans" (A, B, C and D) as their production proceeds.

Domestic and foreign trade in sugar was liberalized in 1984.

Distribution and export taxes on sugar were abolished on 1 January 1988.

Domestic prices are free. The sellers of sugar are often the banks (financing the campaigns of the mills and obtaining "quedans" endorsed in their favour.

XI. TECHNICAL AND ECONOMIC EVALUATION

The Philippines occupies an intermediate position among the countries producing cane sugar - 5 tons/hectare in white equivalent - and could undoubtedly do better in view of its sugar-producing tradition.

It may be added that it is difficult to evaluate an industry which is operating far below its capacity.

CONCLUSION

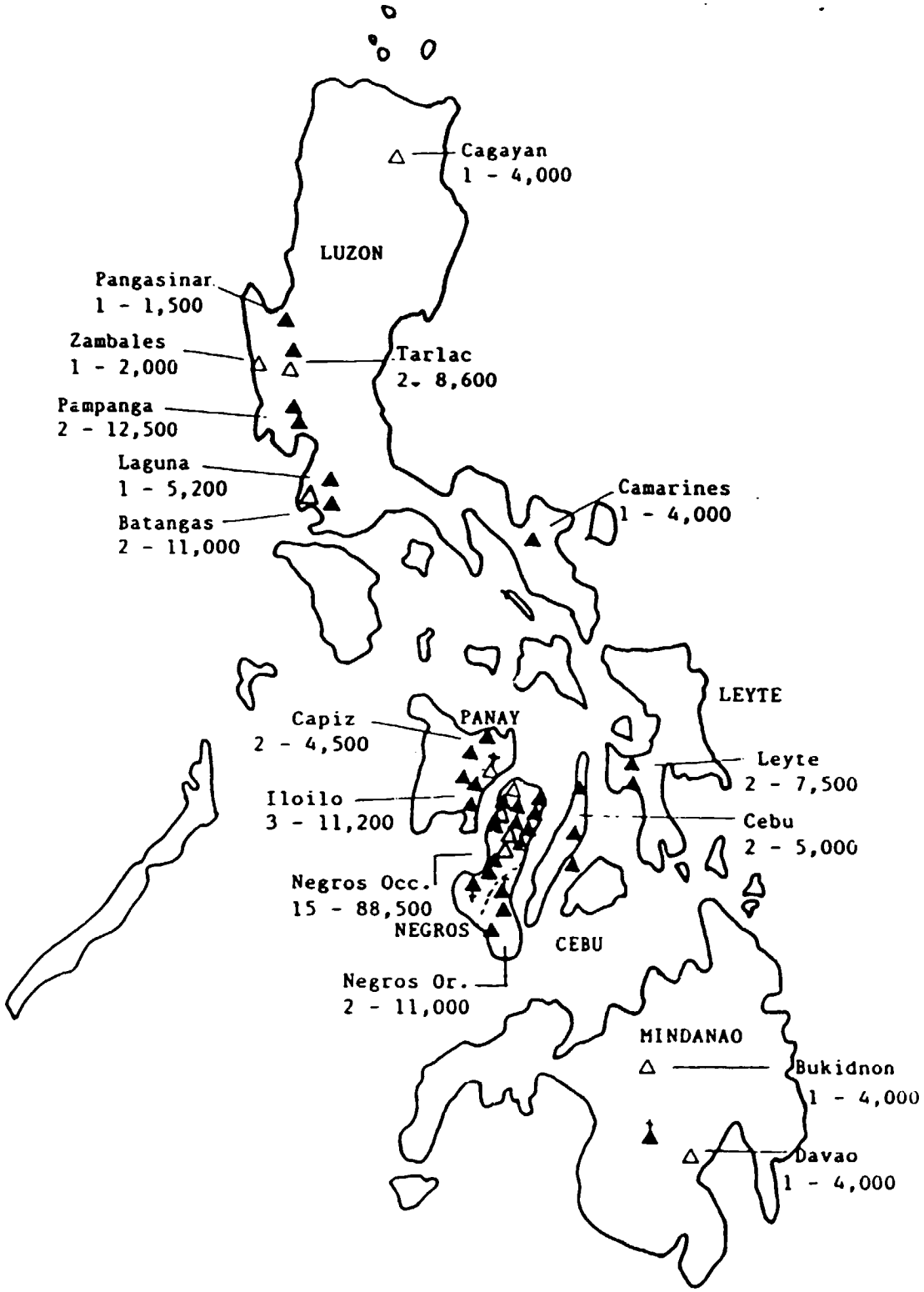
Prospects for cooperation

Philippine production has recovered well and should rise above 2 million tons again in the very near future.

Foreign investors are taking an interest in the rehabilitation and restructuring of the industry.

Agricultural and industrial costs are reasonable and the industrial infrastructure is substantial.

All these assets justify increasing attention on the part of industrial partners in other regions of the world.



SKETCH OF THE PHILIPPINES SUGAR INDUSTRY

District names - Number of mills - Total daily capacity

▲ Raw + Direct white factories

△ Factories with annex refineries

Closed factories

SINGAPORE

This city-State, which produces cane only in its botanical gardens, nevertheless has a large sugar industry in the form of the Jurong Refinery (500 t.s./d), which can process 150,000 tons/year of raw sugar. Since 1988, the refinery (Sugar Industry of Singapore 88 Ltd.) has belonged to a British commercial enterprise.

Singapore is a veritable sugar trading centre for the zone:

- 150,000 tons of raw sugar for the re-export after refining (toll) of 15,000 to 30,000 tons of high-quality or specially packaged sugars to nearly all the Asian countries (from Kuwait to Australia);
- 50,000 to 80,000 tons of white sugar, making up the supply:
  - Of the actual local market (100,000 to 110,000 tons);
  - Of the industries that use sugar for exported food products (in a volume of about 80,000 tons of sugar equivalent).

Sugar balance 1989

Availability (imports)	Requirements
150,000 tons of raw sugar	Local consumption 100,000 tons
50,000 tons of white sugar	Export of white sugar 15,000 tons
	Export of sugar products 80,000 tons

SRI LANKA

Sugar-cane was introduced by the Dutch at the beginning of the nineteenth century, but never had much success in Sri Lanka. The climate is very rainy: even the so-called "dry" area in the east of the country receives 1,200-1,700 mm of rain and has a real dry season of only four months: June-September. Dry-season temperatures are high (minimum 23-24°). In 1960, when the first sugar mills were built, Sri Lanka produced only a few million tons of gur ("jaggery"), whereas it already consumed more than 200,000 tons of sugar.

The Sugar Corporation, a State enterprise, began producing in 1960 in two mills: Hingurana (Gal Oya, 2,000 t.c./d) and Kantalai near Trincomalee (1,200 t.c./d). Their capacities have not changed since. The pattern of production consisted of the cultivation of cane in plantations (5,000 and 4,000 tons respectively) attached to the mill.

Thirty years later, Hingurana's production has never exceeded 15,000 tons and Kantalai's 10,000 tons. Yields in tonnage of cane per hectare were sometimes about normal (up to 60 tons/hectare) and sometimes disastrous, the sugar content was low (mill yield 8-9 per cent), and above all the total area on which cane was harvested in the two plantations never exceeded 5,300 hectares, for lack of labour.

The cutting of the cane, work which is in any case considered "too hard", is in competition with a strong seasonal demand for the harvesting of rice.

In addition, the area began in 1983 to be affected by guerrilla operations.

Apparently not easily discouraged, the directors of the Sri Lanka Sugar Corporation borrowed $US 34 million from the Asian Development Bank to open a third mill at Sevanagala (South District). The new mill (1,250 t.c./d) did not aim to produce more than 7,000 tons/year, and this figure has never been achieved.

Private investment projects have also appeared on the scene, beginning with the construction of the Pelwatte Sugar Co. mill at Buttala, also in 1986. Its daily capacity of 2,200 should permit it to produce 47,000 tons per annum. Its output (1987) is about 18,000 tons.

Projects for two other private mills exist.

The large Danish sugar production and equipment supply firm DDS, already in 1987, proposed to the Sri Lankan Government the construction of a large mill with a capacity of 4,000 t.c./d in the area of the Mahaweli System C, drawing on 9,000 hectares of cane.

Recapitulation:

Name of the mill	Control	Location (District or area)	Year of the first season	Capacity t.c./d	Production maximum	Production recent
Hingurana	SLSC	Eastern	1960	2 000	15 000	10 000
Kantalai	SLSC	Eastern	1960	1 200	9 000	3 000 to 7 200
Sevanagala	SLSC	Southern	1986	1 250	?	?
Pelwatte Sugar (management, Bookers Tate)	Private	Uva	1986	2 200	25 000	18 000
				6 650	49 000	31 000
						-35 000
	Mahaweli		?	4 000	(planned)	
				10 650		

Cultivated area: 10,000 hectares

Cane production: about 400,000 tons/year

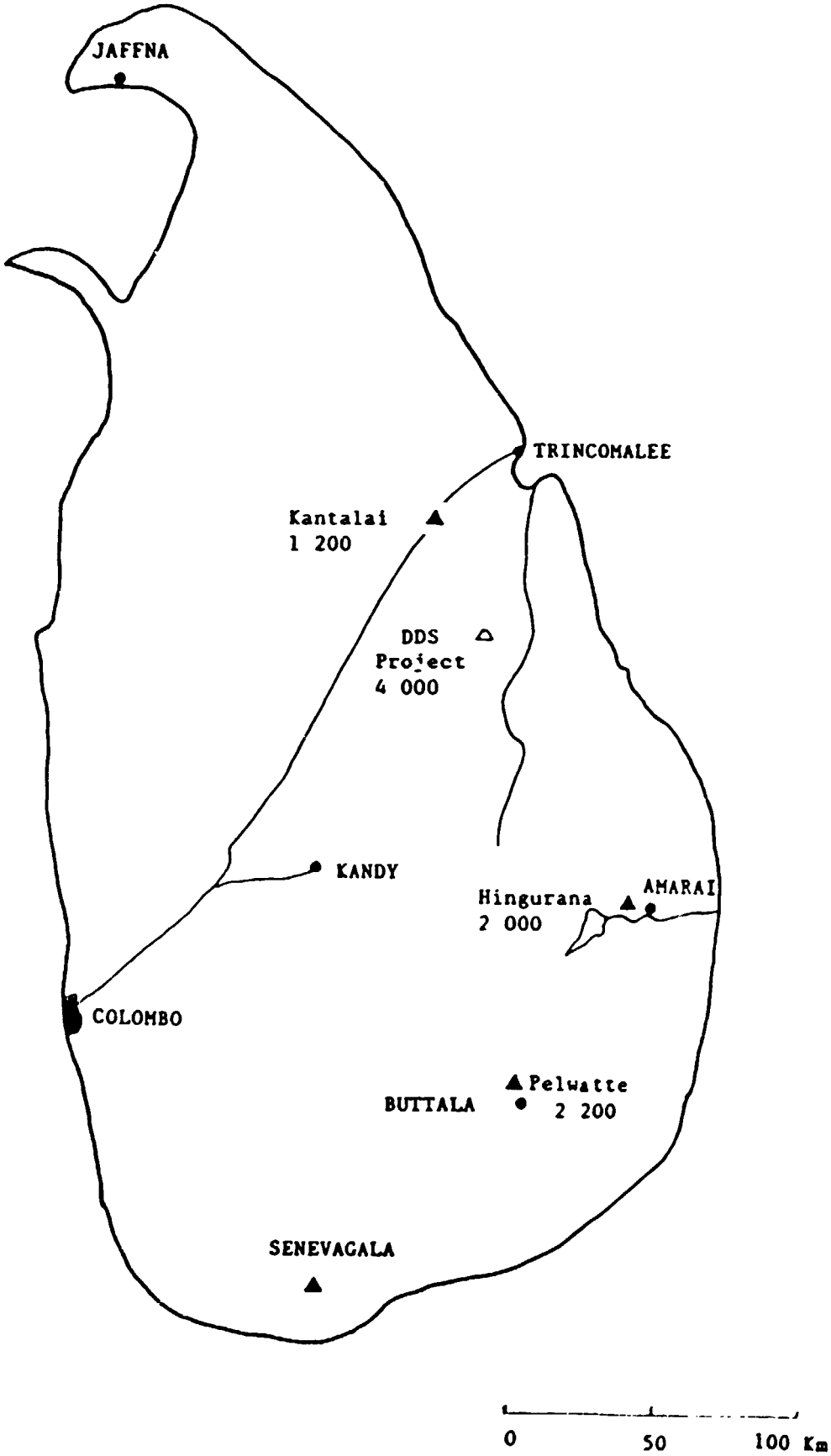
A distillery exists for producing alcohol from molasses (15,000 litres/day). It is operated by SLSC.

For lack of cane, Sri Lanka uses its mills during part of the year for refining imported raw sugar (from Thailand). The quantity refined is estimated at 30,000 tons/year.

The rest of the sugar imported (more than 300,000 tons/year in 1985 and 1986) is white sugar imported from India, the European Economic Community, Brazil, Thailand and other countries of the area (Myanmar, Viet Nam). The recent increase in world prices has severely limited Sri Lanka's sugar purchases. Consumption per head has fallen from 20 kg per inhabitant per annum in 1985 to 13 in 1988. It has almost always been rationed.

The future outlook for the sugar industry is dependent on prospects for cane production.

SKETCH FOR THE SRI LANKA
SUGAR INDUSTRY



TAIWAN

Taiwan is a traditional producer - and exporter - of sugar cane and became, between the two wars and under Japanese occupation, a major exporter of sugar, serving the requirements of the Japanese and more distant markets. In 1939, production reached a record of 1.4 million tons of sugar produced at 49 mills on some 125,000 hectares. Yields were very high.

The competition of food crops, particularly rice, was to reduce substantially the acreage under cane, which came to rely on lands of marginal quality.

It currently appears that the total area under cane cannot exceed 60,000 hectares, this being the acreage necessary to meet the consumption requirement.

Acreage, production and yields have periodically declined and later recovered.

	1939	1950	1960	1970	1980	1990
Total area, thousands of hectares	165	58	90	80	885	60
Cane production, millions of tons	120	28	69	64	83	62
Sugar production, thousands of tons:						
- Centrifugal	1,400	370	870	700	84	600*
- Non-centrifugal	25	4	20	?		

* Actual production lower because of a typhoon.

For a long time, Taiwan remained a major exporter, with sugar exports (900,000 tons in 1953) accounting for half of all exports between 1950 and 1963. Since 1983, exports have consistently been below 200,000 tons. They are currently reduced to supplying the United States quota (10,000-15,000 tons).

Cane-growing, found in all the agricultural zones, involves some 180 "farms" of 100 to 150 hectares each, belonging to the Taiwan Sugar Corporation (total: 25,000 hectares), and some 80,000 small-scale planters (0.4-0.5 hectares per planter).

The yields (100 t.c./hectare) bear testimony to a high degree of technical sophistication; in fact, in certain aspects - planting, fertilizing, treatment - the methods are among the best in the world. In the case of cane grown

by planters there may be one ratoon, which is mainly alternated with one planting of rice, but at the mill farms there may be several ratoons from the same plant. The vegetation period lasts from 12 months (winter planting) to 14-18 months (autumn planting).

Taiwan has developed the famous F varieites, which predominate on the island. The Taiwan Sugar Research Institute enjoys an international reputation.

In order to ensure some degree of income stability, the sugar company (TSC) guarantees planters a minimum price for their cane.

If, following the determination of the income to the planter (55-60 per cent), this income is found to be below the minimum price, a supplementary payment is made by the Government.

Cane prices are very high: $TW 1,400 or $US 58/t.c. in 1989-1990, reflecting cultivation methods still heavily reliant on manual labour and high wage levels.

The 23 remaining mills are owned by the Taiwan Sugar Corporation as a result of the nationalization of the eight Japanese companies after the war. Their capacities are small, ranging between 1,300 and 4,000 t.c./d (at Chihu). The total capacity is 61,000 t.c./d, which means an average capacity of 2,650 t.c./d.

Taiwan could, therefore, produce 900,000 tons of sugar a year without difficulty; because of costs and the reduction in cane production the industry is operating below capacity. Some mills will, therefore, have to be shut down.

Taiwan has always produced a high-quality direct white sugar (Superior White Crystal) at its mills. Since 1989, two refineries have been added to the mills at Peikang (500 t.s./d) and at Hualien (300 t.s./d).

The price of sugar ex-works amounts to $TW 22,500/ton or about $US 850/t.s.

Consumption has fortunately remained at a relatively even level thanks to the emergence of a strong industry producing starch from cassava (locally grown and imported from Thailand) and isoglucose derived from starch. Isoglucose production is in the vicinity of 70,000 tons, 80 per cent of which is earmarked for the beverage industry. There are 10 producers of starch and six of isoglucose, the most important being the Fong Leng Industrial Company, with a capacity of 50,000 tons/year.

Even so, the balance between production and consumption remains precarious and it is expected that Taiwan will have to import sugar in 1991.

Like the continent, Taiwan has been one of the world leaders in the use of cane by-products: paper and particleboard from baggase, intensive animal husbandry (specially pork) using molasses, alchohol and yeast production, and a highly diversified fermentation chemistry sector, to the point that Taiwan, which produces 200,000 tons of molasses, must now import this product.

Despite this spectacular diversification, Taiwan currently produces at too high a cost (approximately $US 700 per ton of sugar) to be able to envisage further growth in its production of sugar or even of sugar by-products, which are now fully utilized.

THAILAND

I. HISTORICAL BACKGROUND

Thailand, a traditional cane-growing land, was exporting sugar to Europe during the first half of the nineteenth century. Production declined until the introduction of tariff barriers around 1935, and Thailand remained an importer of sugar until 1959.

The first modern mill (800 tons/day) was built by the Government at Koh-Khar in the province of Lampang (in the North) in 1937, followed by a second mill (800 tons/day) at Uttaradit (in the North) in 1941. In 1960, 40 mills were in operation.

Production has evolved as indicated in the following table:

	Area thousands of hectares	Cane production thousands of tons	Production of centrifugal sugar thousands of tons	Non-centrifugal sugar - thousands of tons
Pre-war	10	260	20	15
1950	53	840	30	20
1960	152	5,200	145	95
1970	150	6,800	585	?
1980	470	19,850	1,600	
1990	700	33,560	3,505	

Evolution of capacity

	1960		1990	
	Sugar mills	t.c./d	Sugar mills	t.c./d
Central region	11	6,100	23	242,300
Eastern region	13	8,800	9	49,700
North-eastern region	9	2,000	6	35,300
Northern region	7	2,900	9	44,700

It should be noted that, in addition to one mill that has already been relocated from the central region to the northern region and is already reflected in the table above, three others are in the process of being relocated from the central region to the northern region, whose capacity will exceed 50,000 t.c./d in 1992 and towards the north-eastern region (55,000 t.c./d in 1992). As a result, the capacity of the central region should drop to 220,000 t.c./d in 1992.

The sugar industry has experienced the strongest growth rate on record in the world - 10 per cent per annum over 30 years. In fact, the actual figure is 15 per cent over 20 years, since it was in the 1970s that the industry really took off.

II. THE AGRICULTURAL SECTOR

1. Sites and areas

Although the sugar industry first sprang up in the North and spread to the South-East ("Eastern" Region), it has experienced its greatest expansion in the central provinces.

(a) The Central Zone

This zone includes the agro-economic zones (as defined by the Ministry of Agriculture) Nos. 7, 11 and 12 - essentially the provinces of Kanchanaburi (150,000 hectares), Suphanburi (100,000 hectares), Ratchaburi (50,000 hectares), Nakhon Pathom (25,000 hectares), Prachuap Kirikhan (20,000 hectares) and Lopburi (15,000 hectares), for a total of nearly 400,000 hectares.

The terrain is flat and the cane is grown on land that is used to plant rice and that is waterlogged well below the surface.

(b) The Eastern Zone

This zone represents the south-eastern extension of the Central Zone, with which it is now statistically linked. It comprises agro-economic zones 13, 15 and 16 and the provinces of Chonburi (65,000 hectares) and Rayon (15,000 hectares), for a total of nearly 100,000 hectares.

The terrain is rolling and the soil, which has a low moisture-retention capacity, is subject to the effects of drought. This is the preferred growing area for cassava, another major export crop.

(c) The North-Eastern Zone

This zone includes agro-economic zones 1, 2, 3, 4 and 5, which border on Laos and Cambodia. It comprises the provinces of Udon Thanit (40,000 hectares) and Khon Kaen (20,000 hectares), making a total of a little more than 100,000 hectares. It is the zone where cane-growing is currently expanding at the fastest rate.

The terrain is more broken than in the other regions, the soils are generally poor, and there is a strong potential exposure to drought.

(d) The Northern Zone

This zone includes agro-economic zones 6, 8, 9 and 10, of which zones 9 (Sukothai) and 10 (Chiang Mai) are hilly or actually mountainous. The provinces involved are those of Kamphaeng Phet (65,000 hectares), Nakhon Sawan (20,000 hectares), Uttaradit (15,000 hectares) and Sukhothai (10,000 hectares), for a total of 135,000 hectares.

Precipitation is heavier here than elsewhere. This is another zone that is currently undergoing redevelopment.

Recapitulation:

	1980	1990		
		Production		
	Thousands of hectares	Thousands of hectares	Millions of t.c./hectare	
Centre	370	370	16.4	42
East	75	90	4.5	50
North-East	60	105	5.9	56
North	70	135	6.8	50
	575	700	33.6	

2. Agricultural population

There are some 107,000 planters (i.e., somewhat less than seven hectares per planter), who employ their families (300,000 persons) and more than one million day labourers or temporary workers.

Agricultural employment may be estimated at about 1.5 million persons.

3. Growing methods

The general practice involves one plant cane plus one ratoon in the North and North-East; in the Centre there are frequently as many as two ratoons.

The absence of irrigation (Centre) makes it necessary to plant from April to July and results in plants of poor maturity (plant cane of 9-10 months).

In the North and North-East irrigation occasionally makes it possible to plant at the beginning of the dry season (October-January), with a cut at 12 months. In all cases, the cycle is annual.

Cane must compete with Thailand's major export crops (rice, maize and cassava). The fluctuations in the world prices for these commodities cause abrupt changes in the acreage under cane; for example, there was an increase from 540,000 hectares in 1986-1987 to nearly 635,000 hectares in 1988-1989.

Apart from the preparation of the soil (for which tractors of 60-70 horsepower are used), planting, crop management and harvesting are carried out entirely by hand.

Depending on the prices, there may or may not be heavy nitrogen-based fertilization (65-90 kg/hectare). This appears to be the only kind of fertilization in use.

Some 300 varieties are cultivated, the main ones being Taiwanese (F 134, 137, 140 and 172), Australian (Q 83, 96), Philippine, Hawaian and Indian (CO419, 1010). Two Thai varieties were introduced by Katetsat University (Suphan 1) in 1980 and by the Ministry of Agriculture (Uthong 1) in 1986.

There are four Cane Agricultural Centres, one for each region, but research is lagging.

4. Yields

Although there has been a noteworthy increase, the yields remain poor. They have varied in recent years from 41 (1982-1983) to 58 (1988-1989) t.c./hectare. Taking into account the low content (12 to 13 per cent), the sugar yield per hectare (which has risen from 4 t.s./hectare at the beginning of the 1980s) is now around 5 t.s./hectare.

The 1988-1989 performance - yields of 55.6 t.c./hectare and 6.15 t.s./hectare - seems unlikely to be repeated in the near future.

Recent cane production:

	Millions of Tons	t.c./hectare	t.s./hectare
1987-1988	27.2	46.4	4.75
1988-1989	36.7	55.6	6.15
1989-1990	33.6	48.0	5.00
1990-1991 (estimate)	40.0	53.0	5.00

5. Relations between planters and mills

The mills buy their cane either directly from the planter or through the intermediary of merchants or other planters (quota holders), who also function as distributors of inputs or of credits financed by the industrial operators.

The cane price is fixed under a profit-sharing scheme. A "preliminary price", which takes account of the price paid during the preceding season and of the movement in world prices, is announced in November. A "final price" is announced at the end of the season year (30 September). The result is:

- Income from sugar sales in the domestic market (Quota A);
- Income from the sales of the Thai Cane and Sugar Corporation (TCSC) (600,000 tons of raw sugar exported - Quota B) in the world market;
- The remainder of the sugar produced (actually the largest portion), sold by private organizations, in the form of raw or refined sugar, in the world market - tonnage multiplied by the TCSC's average unit sales price.

From this are deducted:

- The sales tax in the internal market and the export tax;
- Marketing costs.

The income is divided as follows:

- 70 per cent for the planters;
- 30 per cent for the sugar producers.

The cane price is, therefore, determined by the formula $P_c = \frac{0.7(R_1 = R_2)}{Q_c}$

- where R_1 = domestic income;
- R_2 = export income;
- Q_c = tonnage of cane crushed by the industry.

The final price of the cane delivered to the mills has developed as follows over recent years:

	Baht/ton	$US/ton
1984-1985	380	16.1
1985-1986	388	14.3
1986-1987	408	15.5
1987-1988	462	18.0
1988-1989	527	20.8
1989-1990 Preliminary	460	17.9
Final	596	22.8

This system, introduced in 1984, has produced satisfactory results, (relative) stability in the acreage planted and better cane and sugar yields.

Certain mills pay a quality premium of 20 B (nearly/$US 1) per ton to planters who supply cane with an estimated yield (CCS) of more than 10 per cent, and apply a penalty of the same amount to CCS cane of below 10 per cent. The cane is paid for according to the following system:

- 50 per cent of the preliminary price on delivery;
- 50 per cent of the preliminary price by cheque postdated 30 or 60 days.

Final payment, depending on the final price, is made in October.

It is not unusual to find certain mills overpaying for cane in heavy-density zones. However, the introduction of profit-sharing has greatly limited this practice.

II. THE SUGAR INDUSTRY

1. Size structure

The following is the breakdown of the 47 sugar mills according to capacity (t.c./d).

	Centre	East	North-East	North	All Thailand
Less than 2,000	-	-	1	4	5
2,000-5,000	5	6	2	1	14
5,000-10,000	5 (3)	2	2 (3)	3 (4)	12
10,000-15,000	10 (9)	-	-	1	11 (10)
15,000-20,000	3	1	1 (2)	-	5 (6)
	23 (20)	9	6 (8)	9 (10)	47

The figures in brackets indicate the likely situation in 1992 (following the relocation of some mills from the Central to the North-Eastern and Northern regions).

The total capacity is 365,000 t.c./d.

The average capacity is 8,000 t.c./d.

The smallest plant (Saharuang, North-East) has a capacity of 1,200 tons/days.

The largest plant Chaimong Kol (Centre) has a capacity of 17,000 tons/day.

The Thai sugar industry could crush 62 million tons of cane and produce 6.5 million tons of sugar. To date, the records have been:

- For cane, 1990-1991: 40.6 million tons (a still unprecedented sugar production figure);
- For sugar, 1988-1989: 4,055,000 tons of sugar, raw value.

2. Duration of the season

The season should normally start at the beginning of November and end at the end of April or beginning of May. It frequently extends into May, a month already characterized by abundant rainfall.

If the season is shorter in the Centre, it is because of the excess crushing capacity in comparison with the cane available. In 1990, a number of mills in this region operated at 75-80 per cent of capacity.

By way of example: there are 12 mills over the 16 km separating Banpong and Kanchanaburi along the Maeklong river.

3. Technical performance

The following figures are typical for recent seasons:

- Capacity: 8,000 tons/day
- Cane crushed: 1,200,000 tons

- Time lost: 12.5 per cent

- Cane fibre: 13 per cent

- Cane polorization: 13 per cent

- Purity of mixed juice: 78

- General recovery: 77.5 per cent

Losses:	Bagasse:	0.87
	Scum:	0.07
	Molasses:	1.67
	Indeterminate:	0.30

Raw sugar produced: 123,300 tons

To an increasing extent, the equipment, until recently imported (FCB equipment at Supanburi), is being manufactured in Thailand and is occasionally second-hand equipment.

4. Production per mill

The average production per mill has been:

- For 1988-1989: 88,000 tons of raw value;

- For 1989-1990: 76,000 tons.

Certain mills may produce less than 20,000 tons, while the largest may turn out as much as 150.000 tons.

5. Quality of the sugar

Three types are produced:

- Raw sugar, with a polorization factor of less than 97.3 to 98.75 and with frequently very high coloration;

- Direct plantation white sugar (polarization of 99.3 to 99.85), with frequently high coloration in solution (55 to 500 ICUMSA);

- Refined sugar (99.75 to 99.95 and ICUMSA 13 to 70, averaging 32) - a product of excellent quality.

The production processes for white sugar are:

- Sulfitation (17 mills);

- Carbonation (18 mills, 14 of which have their own refineries);

- Phosphatation (2 mills);

- Talofloc (4 mills).

Ion-exchangers are found at at least seven mills and active charcoal is used in two cases.

The tonnage distribution, in raw sugar equivalent, is approximately as follows (1989-1990):

- Raws (for export) 1,900,000 tons
- Direct white (for the internal market) 900,000 tons
- Refined (for the internal market) 100,000 tons
- Refined (for export) 700,000 tons

IV. REFINING

At least 18 mills operate their own refineries at which raws or occasionally plantation white sugar is remelted.

The refining capacity for the entire country may be estimated at 5,000 tons/day, which provides a basis for annual production in the order of 800,000 to 1,000,000 tons.

See Section III.5 for the processes.

V. FINANCIAL STRUCTURE OF THE INDUSTRY

The Government owns three small sugar mills (Lampang, Uttaradit in the North, and Suphanburi in the Centre).

The other 43 mills are distributed among some 25 private groups.

The most important of these groups is the Thai Roong Ruang Group, which owns seven mills (60,000 t.c./d and 600,000 tons of production).

There follow:

- Wang Kanai: four mills (55,000 t.c./d) 600,000 tons;
- Tamaka: four mills (37,000 t.c./d) 400,000 tons.

The Tamaka Group also owns a plant producing medium-density fibreboard from bagasse and another producing monosodium glutamate.

- Thai Identity: three mills 30,000 t.c./d) 450,000 tons.
- Mitr Siam/Mitr Phol: two mills (24,000 t.c./d) 250,000 tons.

Foreign investors (Tate & Lyle of the U.K. and Mitsui of Japan) are present.

VI. SUGAR CONSUMPTION AND OUTLOOK

Thailand currently consumes about one million tons of white sugar (17 kg/inhabitant/year). The "A" quota for 1990-1991 is 1,800,000 tons.

All of the sugar produced for domestic consumption is bought up by the Sugar Distribution Centre.

Prices in the domestic market are high: 13 B or about $US 0.5/kg for plantation white sugar. This price includes a tax set at a theoretical level of 9.9 per cent but currently fixed at 1.65 per cent.

Manufacturers of sugar products for export may obtain sugar at about 7,000 B ($US 300) per ton.

There is small-scale production (Friendship Cornstarch, Bangkok) of isoglucose derived from cassava or from maize (100 tons/day).

Sugar consumption should reach 1.4 million tons by the year 2,000.

VII. FOREIGN TRADE

Marketing for export is in the hands of:

- The Thai Cane and Sugar Corporation for the 600,000 tons of Quota B raw sugar;
- Four private export groups: TSTC, TSC, SSEC and SITCO.

The export revenue obtained is high (about $US 285/ton fob for the raw sugar and more than $US 350/ton fob for white sugar in 1990).

An export tax of 9.9 per cent exists but is not collected.

In addition, Thailand exports:

- About 650,000 tons of molasses (EEC, Japan);
- About 250,000-300,000 hectolitres of alcohol (Japan).

VIII. USE OF BY-PRODUCTS

Bagasse: Burnt in boilers. There is a market for the bagasse surplus at about 150 B ($US 6) per ton. A mill with a capacity of 10,000 tons/day normally burns 2,000 tons of bagasse daily and produces a surplus of 600 tons/day. Some 60,000 tons of bagasse per annum are used by a plant producing medium-density fibres.

Molasses: Out of an annual volume produced in the order of 1.5 million tons:

- 650,000 tons are exported;
- 50,000-60,000 tons are used for animal feed or other applications;
- The requirements of the monosodium glutamate plant;
- The balance (700,000 tons) is distilled.

Not much has been done to diversify the utilization of by-products:

- The possibility of renewed questioning of the revenue sharing agreement if the by-product revenue becomes very substantial;
- The financial resources have been mobilized to increase capacity.

Still, there is a potential for the following products:

- Liquid sugar;
- Sorbitol;
- Mono-sodium glutamate;
- Yeasts;
- Citric acid;
- Molasses;
- And for bagasse and cane residue: an electricity generation project, financed by USAID, using 200,000 tons of surplus bagasse over a seven-month period (1,000 tons/day). The purchase price by the grid would be 1 baht ($US 0.04) per kw/h (?).

IX. PRODUCTION COSTS

These are among the lowest in the world, but cane is produced at an alternative-use (opportunity) cost (competing crops) in the order of 425 B/ton, i.e., a cost of sugar in the cane of about $US 160/ton. The industrial costs, on the basis of profit-sharing, would thus be about $US 70/ton for the raw sugar, which are extremely competitive. The international market for white sugar has recently greatly added to the value of refined Thai sugar, with premiums sometimes as high as $US 100/ton.

X. FISCAL TREATMENT OF SUGAR

The industry is regulated by the Office of the Cane and Sugar Board, under the Ministry of Industry, with responsibility in particular for annually setting the production quotas. The OCSB has not recently granted any new building licenses, but the holder of a production authorization, for example in the Central Region, can relocate his capacity to other regions and expand it.

An Office of the Cane and Sugar Fund may intervene to supplement the planters' income but has not recently been called upon. If necessary, the fund is maintained through taxes on income before distribution.

Finally, the OCSB enjoys parity representation (1/3) with the planters and sugar producers on the Board of Directors of the Thai Cane and Sugar Corporation, which is responsible for Quota B sales.

XI. TECHNICAL AND ECONOMIC EVALUATION

The Thai sugar industry, which is highly competitive despite the fact that it operates with raw material of very average quality, can be proud of its investments, with mills of a size rarely equalled in the world of cane, with production tools for quality white and refined sugar, and with investments made at costs per ton of capacity that are very low (frequently involving second-hand equipment).

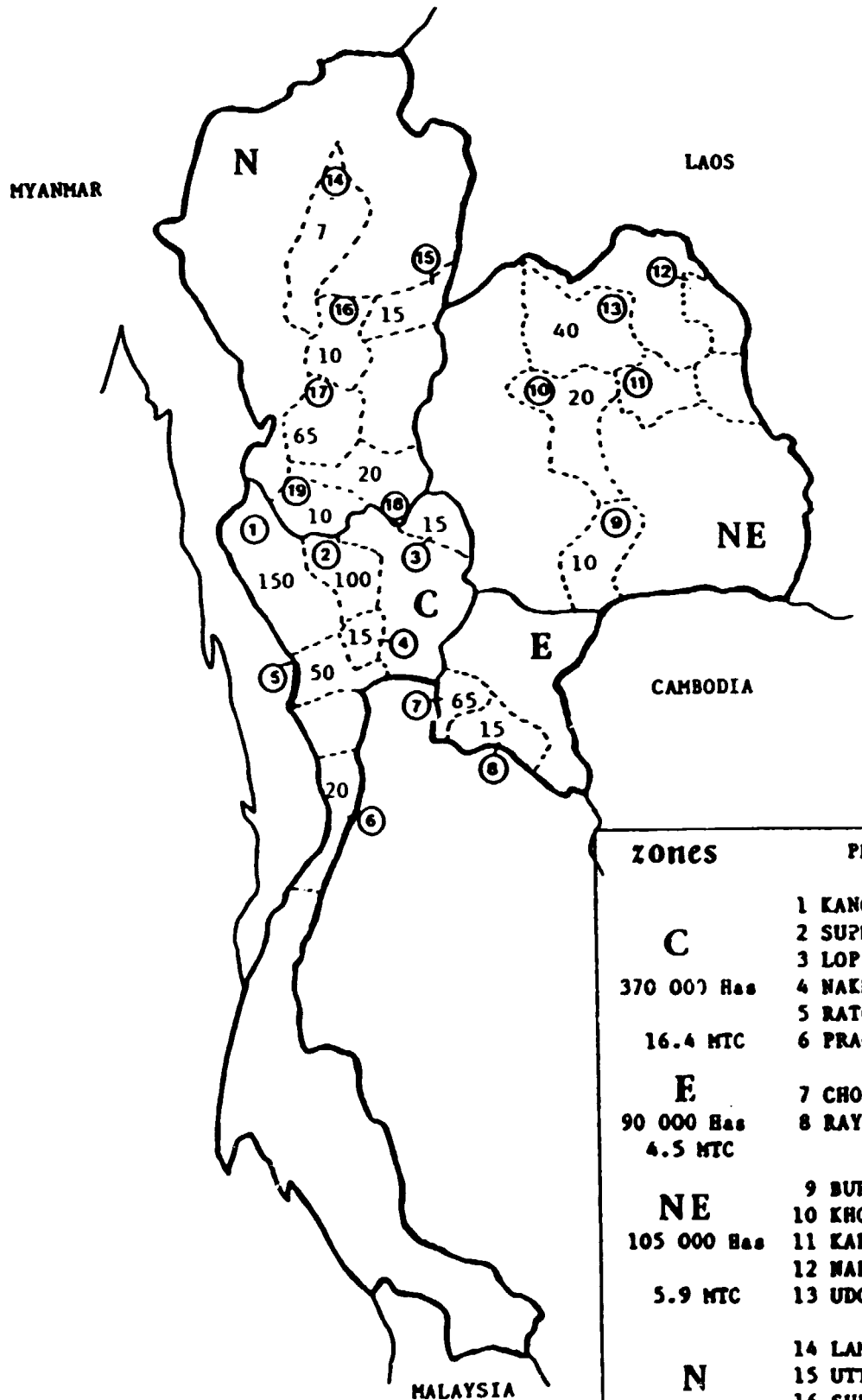
Not very much has been done to add to the value of the by-products, although there is potential in this area.

The problem has to do with the cane supply. In the Centre-East the industry is operating below capacity: it could crush between 40 and 45 million tons of cane but it is supplied with only 25 million tons while the cane, in this region, occupies nearly 20 per cent of the cultivable area. As a consequence, capacity is declining in the Central region as industry relocates towards the North and North-East.

Progress in the case of the Thai sugar industry lies in a yield increase that would have the effect of lowering the cane production costs and making it more competitive with competing crops.

THAILAND 1989/90

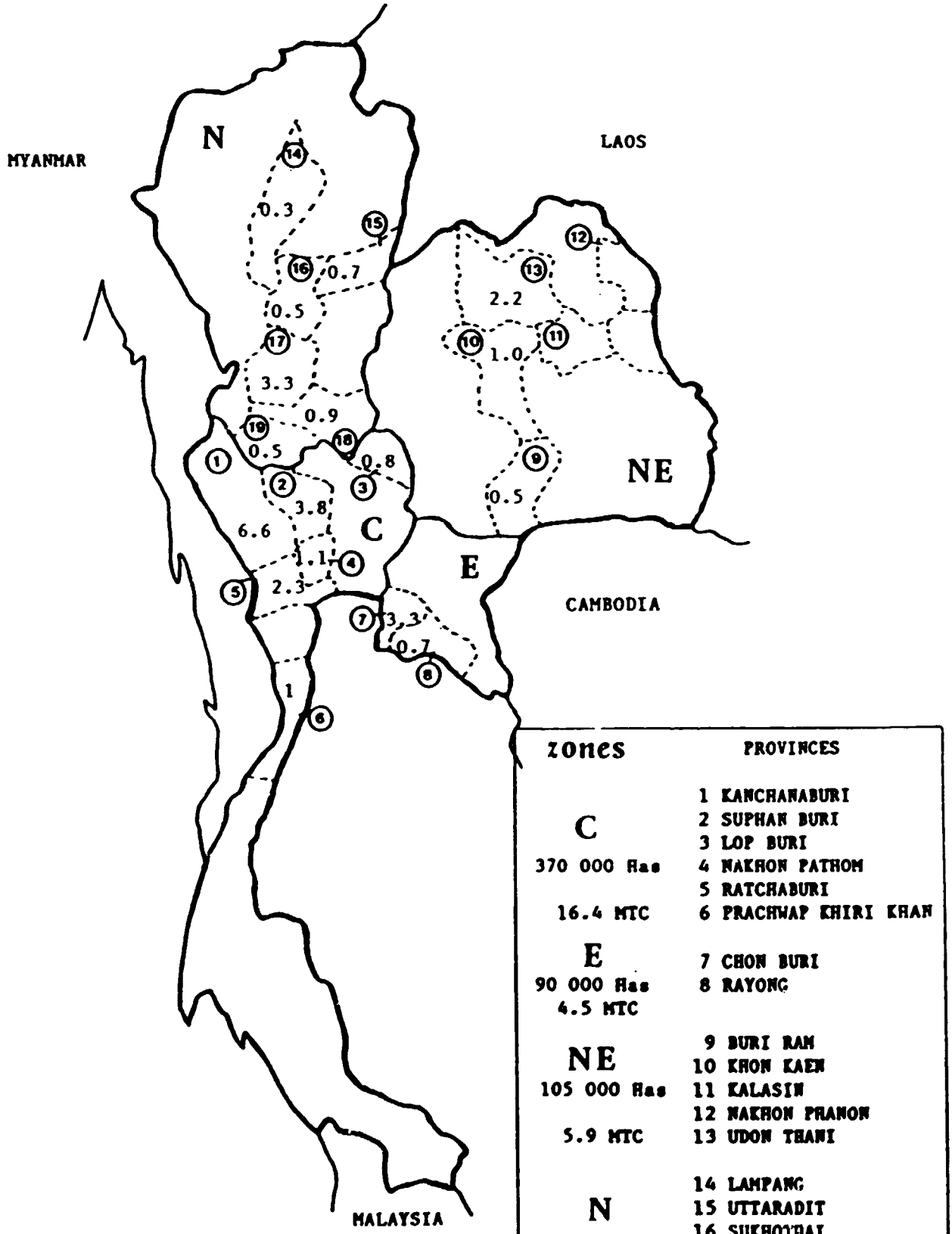
MAIN CANE GROWING PROVINCES
. Cane areas (1000 has)



zones	PROVINCES
C	1 KANCHANABURI
	2 SUPHAN BURI
	3 LOP BURI
370 000 Has	4 NAKHON PATHOM
	5 RATCHABURI
16.4 MTC	6 PRACHUAP KHIRI KHAN
E	7 CHON BURI
90 000 Has	8 RAYONG
4.5 MTC	
NE	9 BURI RAM
	10 KHON KAEN
105 000 Has	11 KALASIN
	12 NAKHON PHANOM
5.9 MTC	13 UDON THANI
N	14 LAMPANG
	15 UTTARADIT
	16 SUKHOTHAI
135 000 Has	17 KAMPHAENG PHET
	18 NAKHON SAWAN
6.8 MTC	19 UTHAI THANI

THAILAND 1989/90

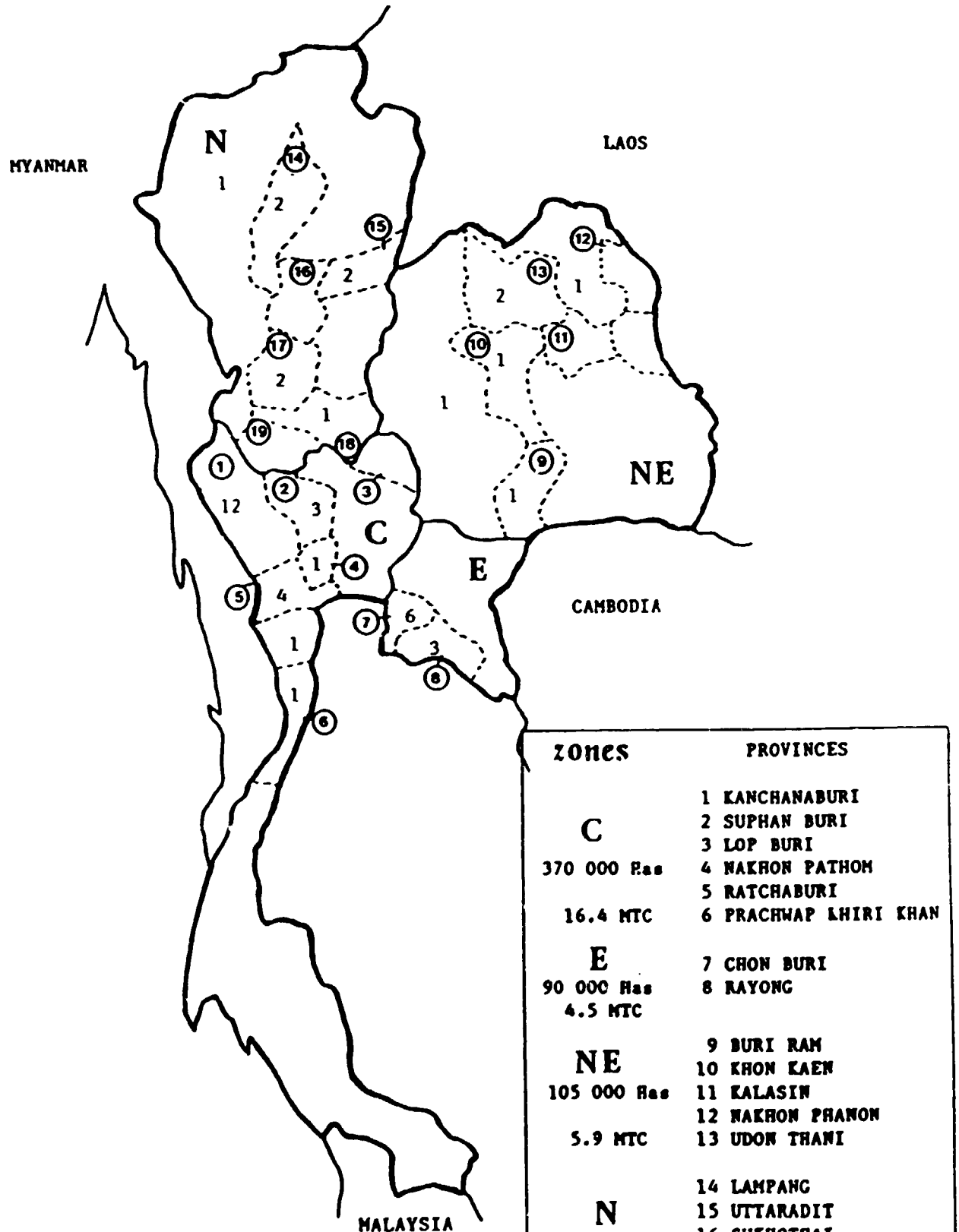
MAIN CANE GROWING PROVINCES
. Production of cane (million tons)



zones	PROVINCES
	1 KANCHANABURI
C	2 SUPHAN BURI
	3 LOP BURI
370 000 Has	4 NAKHON PATHOM
	5 RATCHABURI
16.4 MTC	6 PRACHUAP KHIRI KHAN
E	7 CHON BURI
90 000 Has	8 RAYONG
4.5 MTC	
	9 BURI RAM
NE	10 KHON KAEN
105 000 Has	11 KALASIN
	12 NAKHON PHANOM
5.9 MTC	13 UDON THANI
	14 LAMPANG
N	15 UTTARADIT
	16 SUKHOTHAI
135 000 Has	17 KAMPHAENG PHET
	18 NAKHON SAWAN
6.8 MTC	19 UTHAI THANI

THAILAND 1989/90

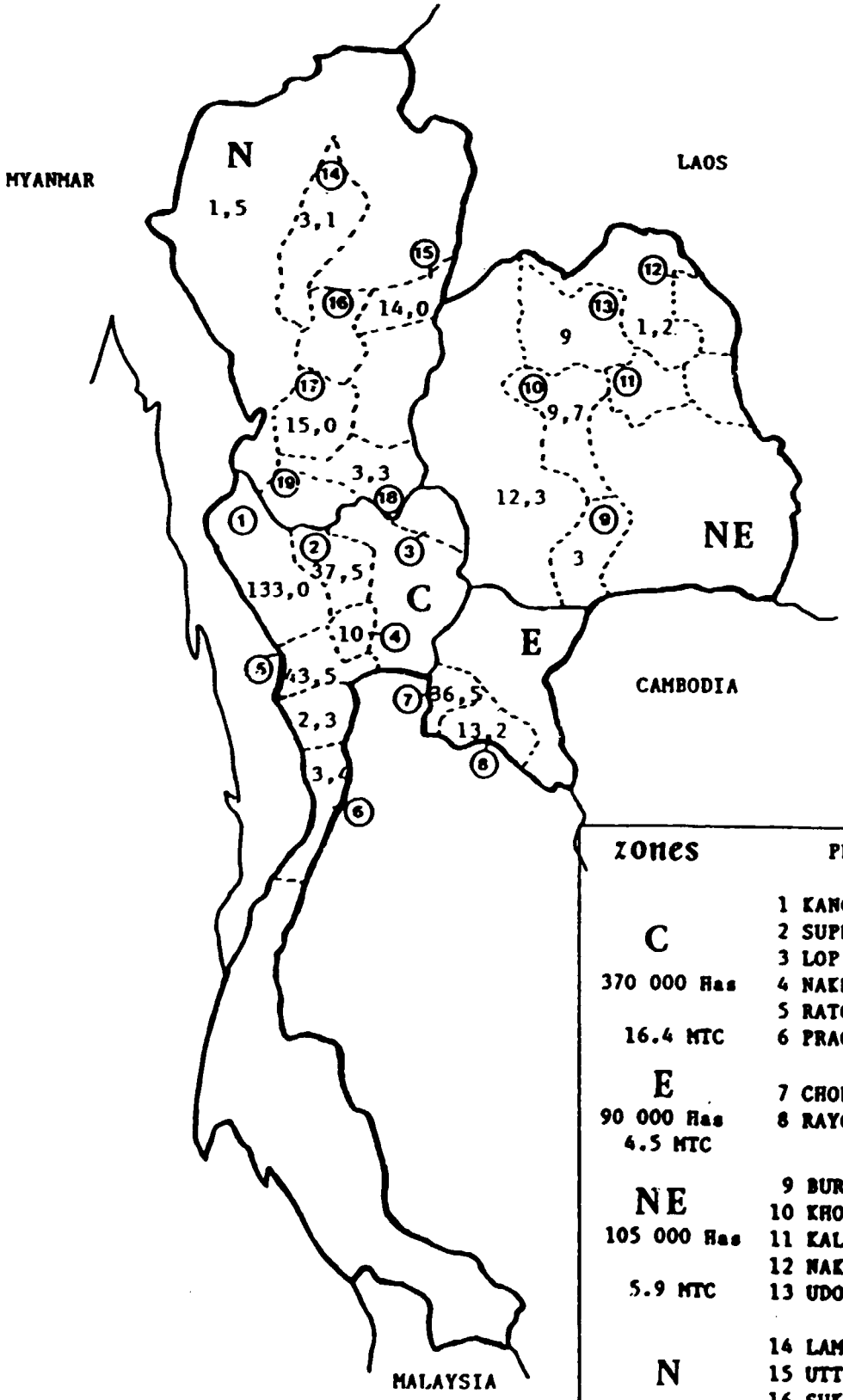
NUMBER OF OPERATING MILLS



zones		PROVINCES
C		1 KANCHANABURI
		2 SUPHAN BURI
		3 LOP BURI
370 000 Has		4 NAKHON PATHOM
		5 RATCHABURI
16.4 MTC		6 PRACHUAP KHIRI KHAN
E		7 CHON BURI
90 000 Has		8 RAYONG
4.5 MTC		
NE		9 BURI RAM
		10 KHON KAEN
105 000 Has		11 KALASIN
		12 NAKHON PHANOM
5.9 MTC		13 UDON THANI
N		14 LAMPANG
		15 UTTARADIT
		16 SUKHOTHAI
135 000 Has		17 KAMPHAENG PHET
		18 NAKHON SAWAN
6.8 MTC		19 UTHAI THANI

THAILAND 1989/90

MILLING (TC/d) CAPACITIES



zones	PROVINCES
	1 KANCHANABURI
C	2 SUPHAN BURI
	3 LOP BURI
370 000 Has	4 NAKHON PATHOM
	5 RATCHABURI
16.4 MTC	6 PRACHWAP KHIRI KHAN
E	7 CHON BURI
90 000 Has	8 RAYONG
4.5 MTC	
	9 BURI RAM
NE	10 KHON KAEN
105 000 Has	11 KALASIN
	12 NAKHON PHANON
5.9 MTC	13 UDON THANI
	14 LAMPANG
N	15 UTTARADIT
	16 SUKHOTHAI
135 000 Has	17 KAMPHAENG PHET
	18 NAKHON SAWAN
6.8 MTC	19 UTHAI THANI

VIET NAM

I. HISTORICAL BACKGROUND

Cane is traditionally grown in Viet Nam for the production of sugar using small-scale non-industrialized methods.

The production of non-centrifugal sugar began in the South in 1950 at Hiep Hoa near Tai Ninh (using FCB equipment). Despite the erection of two additional mills - Binh Duong and Quang Ngai (Japanese equipment) between 1960 and 1985 - production did not exceed 20,000 tons of sugar.

The small-scale non-industrial sugar sector continued in operation, using about 1 million tons of cane.

In 1968 cane-growing was prohibited.

In 1975, the production capacities were as follows:

Heip Hoa Sugar Mill	1,800 t.c./d
Binh Duong Sugar Mill	1,500 t.c./d
Quang Ngai Sugar Mill	1,500 t.c./d
Kanh Hoi Refinery (near Ho Chi Minh City)	150 t.s./d
Bien Hoa Refinery	200 t.s./d

The mills could have produced 70,000 t.s./year, but were used only to refine imported raw sugar. At that time, Viet Nam was refining about 300,000 tons of raw sugar a year at these five facilities.

It was only after the end of the war that sugar-cane production was able to expand to the point of reaching the current figure of 6 million tons of cane, yielding 400,000 tons of sugar, 350,000 tons of this in the form of non-centrifugal sugar.

II. THE AGRICULTURAL SECTOR

1. Sites and areas

Cane is grown everywhere in Viet Nam, both in the North and in the South.

The natural conditions are favourable: rainfall of 1,800 to 2,200 mm, average temperatures of 22-26°C, humidity readings of 85 per cent, sunshine in the amount of 1,700 to 2,000 hours a year, and a dry season of reasonable duration.

The total area under cane in 1991 is 145,000 hectares.

A sizeable portion of the growing area is located in regions of broken terrain, a factor that limits the possibilities of irrigation.

2. Agricultural population

The agricultural population consists of more than 500,000 persons. With the exception of the land belonging to the State farms and the cooperatives, most of the area under cultivation is worked by small-scale planters.

3. Growing methods

Again, except at the State farms and cooperatives, the growing methods are rudimentary (animal-drawn implements, and cultivation and cutting by hand).

The varieties in use are Taiwanese (F 134, F 154 and F 156) or Cuban (My 5514 and Ja 60-5). The Indian variety NCo 310 is still grown. All these varieties are old.

Irrigation is difficult in the hilly areas, where it is necessary to drill wells.

Harvesting, which is by hand, lasts five months, from November to March.

4. Yields

The field yields are relatively poor: 6 million tons of cane produced on 145,000 hectares, or 41 t.c./hectare, the range being from 40 to 43 t.c./hectare, with a sucrose content that, although not known, is thought to be low. The per-hectare yield for centrifugal sugar is about 3.4 t.s./hectare, while for non-centrifugal sugar it has fallen to 2.6-2.7 t.s./hectare.

5. Relations between planters and mills

No information is available on the cane price paid to the planter, but it may be estimated at between 100,000 to 125,000 dongs ($US 20-25/t.c.).

III. THE SUGAR INDUSTRY

This industry breaks down into three sectors:

1. The ten sugar mills as such

Site	Start-up date	Capacity	Equipment	Product
North				
- Lam Son	After 1975	1 500	FCB France	Raw
- Van Diem	"	1 000	Poland	Superior quality white
- Viet Tri	"	500	China	Plantation white
- Song Lam	"	500	China	"
- Vinh Tri	"	500	Viet Nam	"
		4 000		

Site	Start-up date	Capacity	Equipment	Product
South				
- Hiep Hoa	1950	1 800	FCB France	Plantation white
- Binh Duong	1961	1 500	Hitachi Japan	"
- Quang Ngai	1962	1 500	"	"
- Lan-Nga	After 1975	2 000	DDS Denmark	Raw
- Tay Ninh	"	500	Cuba	Plantation white
		7 300		
Total Viet Nam		11 300		

Duration of the season

The season lasts five months (November-March), i.e., 130-150 days. Consequently, these mills could crush from 150,000 to 170,000 tons of cane a year.

Techniques and quality

The Lan-Nga Mill uses a DDS cane diffusion technique.

In general, the equipment is very old and there are no spare parts. Only the more recently built mills, particularly the one at Lam Son, operate with acceptable results.

The mills producing plantation white sugar use the double sulphitation method (it is used in conjunction with double carbonation at Viet Tri). The average production per mill is about 5,000 t.s./year, with the largest mill producing 10,000 tons.

2. The semi-mechanized units

Twenty or 30 small sugar plants use mills powered by electricity or diesel motors, producing 30 to 100 t.c./day for 2 to 7.5 t.s./day. The sugar is boiled in the open air. A number of the facilities have their own centrifuges.

3. The non-mechanized units

There are several thousand of these. Their capacity does not exceed 1 ton of cane per day, yielding 50 to 70 kg of sugar over the same period. The energy used at these facilities is supplied exclusively by draught animals.

All told, production approaches 400,000 tons, more than 80 per cent of which is produced by units of type 2 or 3.

IV. REFINING

There are two units:

- The Kanh Hoi Refinery (located in a suburb of Ho Chi Minh City), which was built in the 1950s, operates with French equipment and produces up to 150 tons of raw sugar a day. It has refined as much as 35,000 tons of Vietnamese or imported raw sugar per annum.

- The Bien Hoa Refinery (also located in the vicinity of Ho Chi Minh City) was built in 1972 with equipment supplied by the Japanese Toyomenka firm and has a daily capacity of 200 tons of raw sugar. Because of the lack of spare parts and proper maintenance, this refinery is no longer in operation. It could refine as much as 55,000 t.s./year.

V. FINANCIAL STRUCTURE OF THE INDUSTRY

The industry comes under two State organizations:

- The Sugar-Cane and Sugar Union No. 1 (Vinasugar No. 1) for the North;

- Vinasugar No. 2 for the South (Vinasugar No. 2 also controls the two refineries).

VI. SUGAR CONSUMPTION AND OUTLOOK

Sugar consumption is distributed as follows:

- 70,000-75,000 tons of Vietnamese and imported centrifugal sugar;

- About 300,000-350,000 tons of non-centrifugal sugar.

Consumption per inhabitant per annum is:

- A little more than 1 kg for centrifugal sugar;

- Five kg for non-centrifugal sugar.

The retail price for centrifugal sugar is high: 3,200 dong ($US 0.64) per kilogram in 1990.

VII. FOREIGN TRADE

Viet Nam imports Thai raw sugar. Its imports from Cuba have decreased substantially, since the sugar that was formerly delivered by Cuba in exchange for Vietnamese products is now resold by Cuba for the account of Viet Nam. The country also occasionally exports sugar to Sri Lanka (from 6,000 to 10,000 tons).

VIII. USE OF BY-PRODUCTS

Bagasse. Three mills burn coal and send their bagasse to plants that produce paper, pulp and cardboard.

Molasses. Alcohol production (for human consumption). Exports in the amount of 5,000 tons (Japan).

Use of manpower. The labour force is used between seasons to manufacture bags for sugar (polypropylene or polyethylene).

IX. PRODUCTION COSTS

There are no data, but production costs are estimated at $US 500/t.s. for the centrifugal variety.

X. FISCAL TREATMENT OF SUGAR

The aforementioned organizations, particularly Vinasugar No. 2, exercise monopoly control over the import of raw sugar. The import duty is from 3 to 7 per cent.

The import of white sugar, which is partially in private hands and is subject to duties of 15 to 20 per cent, represents competition for the national product to the degree that import licences are granted.

XI. TECHNICAL AND ECONOMIC EVALUATION

Viet Nam has made great efforts, but in an unsustained manner, to increase its production of centrifugal sugar. If it were not for the lack of resources, the country could produce as much as 130,000 tons of centrifugal sugar and refine nearly 100,000 tons. The consumption of centrifugal sugar could treble.

Viet Nam claims to have an agricultural production capacity of 1 million tons of sugar a year.

For the moment, there are two scenarios:

- A low or "realistic" scenario calling for the construction of several new units with a capacity of 500 to 1,000 t.c./d, producing from 5,000 to 10,000 t.s./year each;

- A scenario relying on greater resources, largely from abroad:

  - Agricultural restructuring;
  - Extension of the irrigation systems;
  - Road-building for greater supply coverage;
  - One or more production units with a capacity of 3,000 to 4,000 t.c./d.

CONCLUSION

Prospects for cooperation

Viet Nam is well positioned for cooperation with French industrialists in very many areas (for the existing technologies, which are primitive, do not match the excellent technical expertise widely available in the country) on the condition that adequate financing can be found.

VIET NAM - 1991

MILLS LOCATION AND DAILY CAPACITIES (Tc/d)