

philippine studies

Ateneo de Manila University • Loyola Heights, Quezon City • 1108 Philippines

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Philippine Studies vol. 40, no. 4 (1992): 411–434

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Fri June 27 13:30:20 2008

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Willem G. Wolters



During the nineteenth century the sugar industry in Java and the Philippines showed strongly divergent patterns of development, due to a number of reasons. In the early decades of the century the point of departure for the two colonial industries was rather similar. In both colonies cane cultivation and sugar processing was carried out in the traditional way, with primitive technology and sugar mills that were known as the Chinese type. In Java, technological innovations were introduced in the course of the century, leading to intensification of the production process. Consequently the number of mills increased slowly from about 70 in the late 1830s to about 100 in 1870 and about 190 in 1900. Sugar mills enlarged their area of cane cultivation, and the production of sugar in tons per factory per year increased from about 700 in the late 1830s to almost 3,000 by the end of the century.

In the Philippines technological innovations were introduced at a much slower pace and limited to a number of factories, while a large number of mills stuck to traditional methods. Increase in production was achieved by extensification, viz., extending the area of cane cultivation, and increasing the number of small mills. Sugar production was spread out over many provinces. In the 1880s (when Java had about 190 well-equipped mills) the Philippines counted no less than 6,194 mills, of which more than 5,000 were small cattle-driven mills.

It is remarkable that production figures for both countries are not that divergent for most of the nineteenth century, at least well into the 1880s (see table 1). Unfortunately a strict comparison is not possible, because, while we do have production figures for the government-controlled sugar mills in Java (the private mills had a much smaller output), we have only export statistics for the Philippines, not the actual production figures. Aside from being exported a sizable part of the total sugar production was marketed in the domes-

Table 1. Sugar Production in Java and in the Philippines (in metric tons) for the period 1830-1930.

Year	Java (production 1830-1896 under government control)	Philippines
1830	6,467 ¹	20,000 ²
1840	47,040	16,815 ³
1850	86,519	29,090
1860	136,153	53,114 ⁴
1862	145,047	80,762 ⁵
1870	152,595	79,152
1880	216,179	181,697 ⁶
1890	399,999	147,526
1893	479,660	261,684 ⁷
1900	744,257	67,536 ⁸
1910	1,278,420	121,472
1920	1,543,923	180,341
1930	2,969,269	743,980
1940	1,675,107	976,474

1. Figures for the period 1830-1940 from Deerr 1949, II: 224-26.

2. Cuesta (1980, 365), quoting the *Estadística de los productos, 1830*. It should be noted that for the Philippines only exports are known. Aside from sugar exports there was a sizable domestic sugar consumption. This means that actual production was much higher. For Java production and exports figures are the same, as the output of the Western sugar mills was not marketed locally. In Java local sugar production (arèn palm production) supplied the local market.

3. Quirino (1974, 39), quoting Keyser (1869).

4. Quirino (1974, 39), quoting Foreman (1906).

5. Data from De Sturler (1863).

6. Quirino (1974, 39), quoting Foreman (1906).

7. Foreman (1906, 640)

8. Quirino (1974, 57-58).

tic market. However, the colonial government did not keep tabs on domestic consumption (Quirino 1974, 39). Probably actual production figures were in the same order of magnitude as those of Java.

The Dutch agricultural expert De Sturler, writing in the early 1860s, compares Java unfavorably with the Philippines. He points to the poor system of colonial government in the Philippines and the much smaller scale of the islands, and remarks that production in the Philippines nevertheless contrasted favorably with production in the Dutch East Indies. To prove his point, he quotes the export

Table 2. Sugar production per hectare in Java and the Philippines in tons/ha. (in Java figures before 1888 pertain to government-controlled mills only)

Year	Java	Philippines
1830		
1840-44	2 ¹	1,6 ²
1850-54	2,9	
1860-64	3,7	
1870	4,3	
1880	4,7	
1890	—	
1900	8,1 ₃	
1910	10,2	1,8 ³
1920	9,9	2,1
1930	14,7	

1. Figures for Java (government-controlled mills) have been taken from Prinsen Geerlings (1924, IV: 174). Pikols per bouw have been converted in tons per hectare.

2. Sinibaldo de Mas (1840) (in B & R V) gives an estimate for the costs of cultivation of 2 *quiñones* with sugarcane. Production was put at 400 pilones, Quirino (1974, 22-25), quoting this calculation incorrectly puts 2 *quiñones* at less than 2 hectares. According to Cushner (1976, 73) 1 *quiñon* equaled 16,9 acres or 6,8 hectares. The *pilon* was estimated at 120lbs. or 54 kg. With these values one arrives at a production figure of 1,6 ton per hectare.

3. The figures for 1910 and 1920, for Java and the Philippines have been taken from Van de Mandere (1928, 34).

figures of sugar for the two colonies: from Java in 1862 2,330,003 pikols, from Manila 1,292,191 pikols (De Sturler 1863, 492 and 1145).

Since the late 1880s production figures for the two colonies continued to diverge rapidly. The Java sugar industry, lavishly provided with capital, developed into the most efficient sugar production system in the world, with scientifically improved cane cultivation, and the most modern processing factories. Philippine production stagnated for years due to the revolution and war, and recovered slowly in the first decades of the twentieth century, when American capital was poured in, and modern sugar centrals were established. In the 1930s, when the Java sugar industry suffered heavily under the Depression, and the Philippines enjoyed a protected market in the United States, production figures became comparable again.

Sugar-production Technology

The oldest technology consisted of extracting sugar from the cane by applying pressure and subsequently boiling the juice and reducing it by evaporation. The juice is extracted from the cane by direct pressure. The oldest devices for this purpose comprised vertical stone cylinders or rollers of wood through which the cane was pressed. By grinding the cane several times it attempted to squeeze out as much liquor as possible (Deerr 1949, II: 536).

The iron mill with horizontal rollers was developed in the beginning of the nineteenth century, and improved in subsequent decades. In the 1840s and 1850s systems were developed for multiple milling, whereby a number of rollers were placed in succession, in order to obtain a higher extraction of the sugar juice from the cane. With primitive presses in the first decades of the nineteenth century, up to 50-60 percent of the sugar juice was extracted. The modern sugar mills in the twentieth century extract up to 95 percent of the juice (Kolb 1940, 262-63).

Traditionally cane mills were driven by manual or animal power. The water wheel was used to drive sugarcane mills in areas where water power was available. The use of steam power in sugar mills was developed in the beginning of the nineteenth century through a series of devices and adaptations. However, it took some time before steam power was introduced in sugar producing areas in the colonies. Traditional methods with oxen power were still in use till the middle and the second half of the nineteenth century, and continued to be applied in the native sector of sugar production for the local market.

The oldest way for the evaporation of water and the removal of impurities from the juice was the use of open vessels or pans placed in line in a masonry flue, with a furnace at one end, providing direct heating under the first pan and a lower flame under the other pans. In the French sugar colonies the term *batterie* was used for this set up, while the English spoke of "copper wall," and in Jamaica the word "train" was used. This system of direct heating was used in the cane sugar industry till well into the nineteenth century. The use of steam in the evaporation process was developed in the 1820s. Experiments with evaporation *in vacuo* led to the discovery of the vacuum pan by Howard in 1813. This process improved the quality of the sugar. An important invention was the system of multiple-effect evaporation. This system, which according to Deerr "must have

a place among the world's greatest inventions," was developed in the 1830s, by Rillieux among others. These innovations were gradually introduced in the colonies.

In the traditional system the boiling juice in the first kettle separated out impurities, which came floating to the surface in the form of scum or froth, which could easily be removed by the laborers with a large spoon. When the juice thickened it was precipitated in large pans, where again impurities were separated out. The next step in the old system of processing was the claying of sugar. The boiled juice was poured into a settling clay jar with a conical shape, which had a hole at the bottom through which excess moisture passed on to a smaller jar. On top of these jars was put a layer of wet clay, whence the water percolated slowly through the impure magma of crystals and molasses, displacing the molasses, and carrying them downwards to the second jar.

For the Philippines, Foreman describes the process, which was practised up to the second part of the nineteenth century, as follows:

In the Northern Philippines "clayed" sugar (Spanish *Azucar de pilon*) is made. The *massecuite*, when drawn from the pan, is turned into earthen ware conic pots, containing about 150 lb. weight. When the mass has set, the pot is placed over a jar (Tagalog, *oya*) into which the molasses drains. In six months, if allowed to remain over the jar, it will drain about 20 percent of its original weight, but it is usually sold before that time, if prices are favourable. (Foreman 1910, 273)

The traditional sugar industry produced different kinds and qualities of sugar. The clayed sugar was separated into two parts, the upper part forming the white sugar and the lower part in the teat of the cone, was called *muscovado*. The term *muscovado* seems to have been derived from the Portuguese words *menos*, less and *acabado*, finished. Later the word came to be applied to unclayed sugar, which could resemble the original *muscovado*, and as such it was used in the English colonies in the seventeenth century (Deerr 1949, II: 109). The claying process yielded a third quality, *panela* or low-grade sugar, made from the drainings in the smaller jar. While white sugar, known in Europe as "clayed sugar" or Lisbon sugar, could be marketed directly, *muscovado* was further processed in refineries in Europe, and turned into white or loaf sugar. Raw sugar was also shipped to refineries in Europe and the U.S.A.

In the 1860s and 1870s when technical innovations in sugar mills yielded a better product, the claying process was abandoned. Espe-

cially the use of centrifuges made the claying system superfluous. It should be pointed out that claying was time consuming and labor intensive, and experts calculated that in the process about one sixth of the crystals were dissolved in the percolating water, and carried along with the molasses. These reasons made claying a rather expensive process, an additional reason why it was gradually abandoned in the second half of the nineteenth century.

This method of sugar processing was used for production for the world market. Alongside this modern system of sugar processing, a traditional method continued to be in use, consisting of small factories or home production, and yielding low-grade sugar, which used to be marketed locally, and was known under various names, such as *panela* and *dolce* in the Spanish-speaking world, *gula Jawa* or *gula mangkok* in Indonesia, *gur* and *rab* in India. In world-trading statistics, only the crystal sugar and its by-products are listed, not the products of home industry.

Technologically modern equipment became available by the middle of the nineteenth century. Of far-reaching importance was the invention of the centrifuge by several people in the 1830s and 1840s. Traditionally the adhering syrup was only partly removed from the sugar by drainage. With the application of centrifuge the separation of the crystals from the adhering molasses could be done faster and more thoroughly. The centrifuge consists of a fast rotating basket made of small-mesh wire-netting. The centrifugal force lurches the mass of *cuite* against the wire-netting which lets the syrup through, but holds the crystals.

Around 1860 modern sugar mills could make use of the following machines. They were many-roller sugar presses, driven by a steam-engine; steam-engines with high-pressure steam kettles; big iron pans for boiling the sugar; vacuum pans for evaporation (or as an alternative to pans, triple-effect evaporators to replace the open pans, using vacuum pans and the application of steam in the evaporation process); centrifuges; machines for crumbling lumps of crystal sugar; steam-engines for operating the centrifuges, and several other small implements.

The introduction of these technological innovations required large capital outlays for the purchase of the machinery. In addition, entrepreneurs moving in this direction faced several difficulties. As breakdowns and mechanical faults could easily occur in the various machines, a repair shop had to be installed, manned by experienced engineers and workers. The day-to-day operation of the factory also

required the presence of experienced staff. Till far into the nineteenth century, the most advanced European machine-building factories did not have warehouses with machinery and equipment and experienced personnel in the colonies. All this made the shift to technologically more advanced machines rather risky.

Introduction of Cane-Processing Technology

In the course of the nineteenth century technological improvements were introduced in the sugar production in Java and the Philippines, but the pace of change in the colonies was different. In Java the introduction of innovations seems to have been faster than in the Philippines. Under Commissioner-General Du Bus de Gisignies (1826-30) the traditional wooden press-rollers were replaced by iron rollers. During the early 1830s two types of mills were in use: *watermolens* (water-driven mills) operated by European entrepreneurs, and *trekmolens* (cattle-driven mills) used by Chinese entrepreneurs (Van Deventer 1866, II: 693).

The use of the steam-engine went along with the installation of vacuum pans. In 1836 both a steam-engine and vacuum pans were introduced by the English mill-owner Etty in Probolinggo (residency Besuki). He had received a government advance, to be paid by the delivery of sugar. The quality of sugar was supposed to be better with the use of this machinery (Van Deventer 1866, II: 702-3). In 1847 twenty of the ninety-five factories had these appliances; in 1856 fifty-four of the ninety-five factories; in 1877 all factories were equipped with steam engines and vacuum pans (Van Gorkum).

Under the Cultivation System the government demanded the introduction of steam engines, especially in those areas where the right to waterpower had to be revoked (Helfferich 1914, 27). In 1835 the centrifuge was introduced in a factory in Surabaya, and the new invention was soon adopted in other factories. Of great importance was the introduction of multiple-effect evaporateurs in 1872-73. These apparatuses saved time, space and energy.

In addition to these new machines, a number of new processes were introduced, viz., the defecation of juices, filtering methods and new accessories were introduced. In 1877-79 the patent concretor was introduced, a flat pan with rotator for the boiling and condensation of the juice. The organization of the mill was also rationalized. In the Netherlands, machine building engineers, Paul van Vlissingen en

Dudok van Heel, had designed project-drawings for the establishment and lay-out of a sugar-factory, which were followed widely in the 1860s and 1870s.

In the Philippines technological innovations were slowly adopted during the nineteenth century, and their spread was more uneven, creating a gap both between regions and between the modernized mills and the traditional ones. The traditional or Chinese system was based on the crushing of cane between stone rollers turned by the power of a carabao, the boiling of the juice, and the draining of the juice in large earthen pots called *pilones* (Larkin 1972, 67-69). The general term for sugar processed in this fashion was muscovado (Larkin 1972, 69), which seems to be a deviation from the terminology used in the West Indies.

This traditional system was followed by a large number of producers till the end of the century. The main innovation in the muscovado process seems to have been the use of steam cane-grinding mills. The traditional vertical cattle mills of wood or stone were still in use by the end of the nineteenth century. Steam cane-grinding mills were introduced during the 1830s by hacendados in the provinces to the south of Manila, viz., Laguna, Batangas and Cavite. In 1834 the hacendado Domingo Rojas bought a horizontal iron hydraulic mill in London and set it up in his hacienda in Calauan (Laguna). Other hacendados in the surrounding provinces also bought new iron mills, both steam and hydraulic driven.

In Pampanga, to the north of Manila, the first steam mill of English manufacture was set up in 1858. In 1870 there were 31 steam mills, 94 iron mills, 16 hydraulic mills and 619 stone trappiches (Cavada 1876, I: 161). In the whole of the Philippines in 1887, there were 239 steam-driven mills, 35 water-driven and 5,920 cattle-driven mills (Walker 1919, 156; quoted in Deerr II: 554).

On the island of Negros it was the British trader and vice-consul Loney who introduced modern machinery in the islands' expanding sugar industry in the early 1860s. The first thing he did was to replace the wooden crane crushers operated by animal power and the Chinese-made boiling kettles. Loney pointed out that this way of processing was very inefficient:

... only about 40 per cent of the juice is produced from the cane with about 10 per cent of sugar; whereas, by more efficient crushing and evaporating fully 70 per cent (juice) can be obtained, with 16 to 20 percent sugar (Loney to Farren, quoted in Souza 1977, 54).

Loney introduced iron mills and European-built steam kettles. A number of hacenderos bought these steam iron mills in 1861. The use of steam to run the mills was generalized in the subsequent years. The vacuum pan was introduced in the Philippines in 1879 (Deerr 1949, II: 562). In 1890 five haciendas in Luzon had vacuum pans installed in their mills. One refinery was installed in Malabon (Quirino 1974, 43).

It was only after the Philippines had become an American colony (1898), that the sugar industry was modernized, and partly brought up to international standards. The first modern sugar central was introduced on the island of Mindoro in 1910. The second mill was built in San Carlos on Negros in 1912. All these big mills were financed by outside capital (Kolb 1940, 263). The large centrifugal sugar mills (sugar centrals) were introduced in Luzon in the 1920s. With this technological innovation, and the creation of sugar-milling districts in the mid-1930s, the organization of sugar production "took on a hierarchical aspect," as McLennan has pointed out (1980, 102). With the establishment of large-scale mills, sugar production became localized in the most efficient production areas. The old muscovado mills, small in size but numerous and widely spread over Central Luzon, were abandoned. The planters henceforth delivered the sugarcane to the centrals, or if the distance was too large, they shifted to other crops. Sugarcane cultivation disappeared from the provinces of Nueva Ecija and Bulacan, and became concentrated in Pampanga and Tarlac (McLennan 1980, 211).

Sugar Production in Java

The East Indies Company (VOC) exercised in Java the functions of both merchant and sovereign (ruler). There was a gradual trend from a sole reliance on trade (buying goods) to tribute (demanding deliveries in kind, i.e., export crops). In the last decades of the eighteenth century the Company officials in Java were under pressure to increase the shipments to Amsterdam. As there were limits to what could be acquired via the system of forced deliveries (both in total amount and in kinds of products) Company officials attempted to organize production themselves via the indigenous rulers, but they encountered severe constraints in these attempts. They found that neither the peasants nor the officials were interested in the cultivation of cashcrops. Under the prevailing system the chiefs were only

interested in direct tax gains, and not in the cultivation of products which could yield little profit to them. The peasant turned out to be mainly interested in rice for daily subsistence.

In the first decades of the nineteenth century there were several models available for the production of exportable agricultural commodities in Java: promoting the voluntary cultivation of such crops by Javanese peasants; cultivation by European planters, renting waste land for which they paid the government a rent; cultivation by European private planters contracting with Javanese princes for the lease of their appanage holdings, including the right to demand servile labor from the inhabitants; or cultivation by European or Chinese owners of private estates, exercising seigneurial rights over their lands and the people on them. None of these systems was considered suitable for the development of a Javanese export sector. Peasants would not voluntarily produce enough cash crops to supply the export trade. Planters operating rented land would not be able to borrow capital, since they did not have titles to the land as security. Besides they would have difficulties in recruiting indigenous labor, as Javanese peasants showed little inclination to work for wages. Land leasing of appanage holdings which took place on a large scale in the Principalities, did not lead to the cultivation of export crops, as the entrepreneurs clung to the traditional arrangements. Finally, the private estate owners in West Java kept intact the indigenous system of rice production, restricting themselves to imposing a tribute on the peasantry.

After a period of vicissitude in its government policy towards the East Indies, the Netherlands in the late 1820s resorted to a policy of state intervention and monopolistic control of production and trade. The Dutch king and the government, observing the increasing trade activities of American and English merchants on Java's shores, decided that they wanted to avoid a situation in which the costs of government would come from the Dutch, while the economic benefits would go to foreigners. In order to nationalize the trade in the Indies, the Dutch government established in 1925 the Dutch Trading Company (*Nederlandse Handel Maatschappij*), a private company intended to recapture the trade in Indian products, and to promote the exports of Dutch products to the East. The trading Company acquired a new function when it was linked to the government controlled production system in the Indies, called the Cultivation System, which had come from the creative mind of Van den

Bosch, who had been appointed governor-general of the colony in 1830. Van den Bosch had won the king's confidence by presenting a scheme ("Systhema") for the increase of export production in Java. The main reasons behind this new mercantilistic policy were the fiscal needs of the mother country.

The Cultivation System, introduced in 1830, in brief operated as follows. The natives were to devote a certain proportion of their land and labor-time to the cultivation of cash-crops, to be sold to government agencies. With the payment for these products they would be able to pay the land tax, or stated differently, with the performance of these production requirements they had the land rent remitted. The government would thus receive, not a large amount of rice as payment for the land tax, but export crops, to be disposed of in the European markets. The Cultivation System remained in operation until the late 1860s. In 1870 a new law on agrarian holdings opened the possibility of private entrepreneurs to operate plantations in Java.

Under the Cultivation System, sugar production was promoted and partly organized by the government. The main outlines of the system are well known. The crops produced by the Javanese villagers under the supervision of government officials, were brought to factories or warehouses. The villagers were obliged to cultivate cash crops on part of their land as a substitute for the payment of land rent or the performance of labor services to the government.

As far as the government controlled sugar industry was concerned the government entered into two kinds of contracts; the first of which was with the desa-people ("dessa-volkeren"). High-level government officials, the residents, were to conclude contracts with the desa-people to the effect that they made their land available (one-fifth of the area), that they would work the land and cultivate sugarcane, that they would deliver this cane to the mill, and in addition would deliver the necessary amount of firewood, and would provide laborers to work in the mill. The government would pay for the cane and the firewood delivered by the peasants, against fixed prices. Work in the fields was to be carried out under the supervision of the village headman and his helpers, and of government officials (the controller).

The second contract was that which the government concluded with the mill-owners, stipulating that the mill-owners agreed to sell their sugar to the government warehouses. The government also

provided interest-free advances to the mill-owners, to be repaid in refined sugar at a price predetermined by the contract between the government and the entrepreneurs.

During the first few years of the Cultivation System, it was difficult to find manufacturers who would work as contractors. In the beginning the government concluded contracts with Chinese entrepreneurs who were already operating small sugar mills. Although these entrepreneurs were no longer allowed to lease whole desa's, they were supported by residents who persuaded village heads to enter into contracts with the Chinese. In addition, the Chinese entrepreneurs received money advances free of interest. There were also contracts between the government and Javanese villages which planted and processed sugarcane and did the processing themselves. It should be kept in mind that during that period sugar processing technology was still within the reach of small entrepreneurs and even of Javanese village heads and their people. At this juncture of Javanese history there still was the possibility that an indigenous sugar industry would develop, such as was the case in the Philippines.

The first European entrepreneurs became interested when it turned out that by the middle of the 1830s the Chinese made fortunes out of their contracts. Sugar contracts became very popular, and the government henceforth concluded contracts with European entrepreneurs only. There was no tender for contracts, but these were allotted to friends and protégés of government officials. In the 1840s there was stiff competition for the allocation of contracts. The contractors became rich. At the same time the government lost on the sugar business.

The contracts turned out to be very advantageous to the contractors. The government guaranteed the contractor an interest-free advance of 200,000 guilders for twelve years, to pay for the building of the factory and warehouses; it promised to provide labor power during the first two years, to provide free firewood; it allowed the importation of machinery duty-free, allowed the use of government mail-horses, and promised support and advice in the purchase of European machinery. As a result of this support, between 1832 and 1837 sixty-one sugar mills were built in Java, which yielded each owner a yearly profit of at least 15,000 guilders. In 1841 the number of factories was 111. After 1840 the government withdrew its support, and by 1860 all risks had been shifted to the entrepreneurs. Not only the maintenance of the mills, but also the procurement of

firewood, transportation and laborers rested with the manufacturer (Reinsma 1955, 138–39).

During the time of the Cultivation System (1830–1870, though the system of government contracted sugar mills continued to exist till the 1880s), there was a strong increase in production and also of productivity per mill. This increase was primarily the result of improvements in cane processing and sugar manufacturing. There was no big improvement yet in the cultivation of cane. The main reason for this was the fact that under the Cultivation System control of sugarcane cultivation and of the factory did not rest in one person. The factory owner did not have control over the planting and harvesting of cane. It was only after the abolition of the system that both planting and milling were united in one person. This meant that harvesting and milling could be finely tuned to each other, and also that the factory could introduce scientific methods of planting to the field.

During the 1820s several innovations in the sugar factory became available, i.e., they could be purchased in the machine-building industry in England. There were steam engines and metal cylinders for cane-crushing, to replace the old Chinese implements, the oxen-driven mills with stone cylinders (Loman 1828). However, this technological shift required larger capital, which was not available for private entrepreneurs in Java.

If we compare the sugar factories of government contractors with those of private entrepreneurs in the 1850s, the contrast is striking. The government contractors were far ahead in factory technology. Given the fact that the point of departure around 1830 was the same, it becomes clear that the strong government support during the Cultivation System, caused this difference. The picture is very clear from the Umbgrove Report (1857), which contains a series of appendices with precise description of individual factories, both government-controlled and private ones. In the 1850s government contractors had mills with a cultivated cane area of about 500–600 *bouw*, or 350–420 hectares. Private mills were much smaller: European-owned mills sometimes reached 200–300 *bouws* (140–210 hectares), while Chinese mills had about 40–60 *bouws* (28–42 hectares).

In private mills the processing of cane was usually done in the traditional way, with open pans. Most of the mills were carabao-driven (*trekmolens*), or water-driven (*watermolens*), and only a few had steampower for the crushing of cane. Only two mills (in Kra-

wang and Pasuruan) had steampower for vacuum pans. At that time half of the government mills were equipped with this type of apparatus. It is clear that the government-contractors had a much better access to credit, while the private mills continued to operate on a much lower capital basis. In addition to this, government mills had free use of laborers from the *desa* for the cultivation of cane.

In the course of the nineteenth century the system of sugar production became more pronounced in two directions: while the factory became more and more capital-intensive with modern machinery, the plantation operations became more labor-intensive. The remarkable feature of Java's sugar industry in the last decades of the century was the combination of the highly capital-intensive factory with the most labor-intensive cropping system. The reason for this two-pronged strategy was that land was the scarce factor in those parts of Java which the industry had chosen as its location, but that labor was plentiful and cheap, while capital was available on a limited scale in the period from the 1830s till the 1870s, and became more abundant in the 1870s and 1880s.

Let us have a closer look at the production factors capital, labor and land. The sugar industry needed increasingly substantial *capital* resources, not only for the establishment of buildings and the purchase of machinery, but also as working capital. After 1830 under the Cultivation System the government provided the contractors with interest-free loans. The provision of these loans was terminated in 1847, because the factory owners made large profits. The question arises of where the mill owners got their credit in the 1850s, 1860s and 1870s. Around 1860 the amount of capital needed to operate a sugar mill was 300,000 guilders. At that time the government advised mill owners to modernize their mills and to buy modern sugar apparatuses.

Reinsma (1955) has convincingly argued that free planters and government contractors had very few institutions to turn to for the provision of credit. The Factory of the NHM at Batavia did have a large amount of capital at its disposal, but was reluctant to extend its operations too much, and provided credit only to seventeen sugar contractors. Capital owners in the Netherlands at that time preferred state funds rather than investment in cultivations overseas. Reinsma disagrees with authors such as Stokvis and Furnivall who have stated that the decaying Cultivation System had been pushed aside by new full-blooded capitalists in the Netherlands, ready to replace government monopoly with liberal free enterprise. According to Reinsma

not much capital came from the mother country. Also Dutch banks, established in the 1860s and 1870s, although they did invest capital in cultivations, were not able to provide credit on a sufficient scale. Reinsma arrives at the conclusion that planters received credits from merchant houses established in Java (notably in Batavia, Semarang and Surabaya). These merchant houses were owned by Dutch and British merchants, were capital-poor, and most of them did not last long. These houses started in the 1830s with advances on the harvest and moved on to long term credit, although their financial resources hardly allowed them to do that. The Java Bank, established in 1828 in Batavia, was behind many of the merchant houses, providing them with credit. It turned out during the financial crisis of 1860 that the Java Bank was deeply involved in investing speculative capital in the cultivations, via the merchant houses (Reinsma 1955, 166-72).

Under the Cultivation System labor was to be provided by the government, making use of indigenous systems of tribute and dependency. It is not quite correct to characterize these relationships as "traditional feudal bonds," as the Cultivation System to a large extent restructured existing bonds in Javanese society. Whereas prior to the introduction of the Cultivation System Dutch rule primarily rested on the traditional bureaucratic hierarchy, with the regent (*bupati*) at the top of the indigenous pyramid, and numerous intermediate chiefs between him and the peasants, the Dutch officials managing the Cultivation System brushed aside the regents and directly mobilized the village chiefs. The village head's assistance was usually bought with a percentage of the crop, a piece-rate per laborer or by bribes. Turning the traditional tribute relationships in the village into an efficient labor gang for the export plantations, meant a thorough restructuring of the village population. At the basis of the traditional bureaucratic pyramid was a local group (probably not really a well-organized village in the later sense of the word) which was strongly stratified, with a chief at the top, a stratum of well-to-do peasants (*sikep*) around him, followed by a stratum of less prosperous people, and numerous unmarried youngsters and servants at the bottom. Under the Cultivation System (especially in the areas where cash crops had been introduced) the bureaucratic pyramid above the village had lost many of its functions, and the local group was directly managed by the lower level Dutch officials. A stronger group of local supervisors was necessary: it is noticeable in the 1830s that about one-fifth of the villagers were exempted from *corvée* la-

bor, which was the *perintah* system, the mandoores of the labor gang, the helpers and supporters of the village head. Within the village some sort of flattening took place. The number of serviceable peasants was increased (often at the suggestion of the Dutch officials). They were given equal shares of the village rice land and were thus made liable for labor services. Still the old system of stratification did not disappear, because in each village a group of landless poor continued to exist, or soon reappeared.

The abolition of the Cultivation System in 1870 meant the transition to what was called "free labor." This change took place in a gradual and carefully managed way. The system of government coercion was replaced by one of silent coercion. Bureaucratic influence continued to facilitate the coming out of laborers. Probably the pressure exerted on the population connected with the sugar industry was hardly less after 1870 than before.

In the 1860s and especially after the abolition of the Cultivation System in 1870 (Agrarian Law), the Java sugar industry came more and more into the hands of private entrepreneurs. In 1881 a world-wide crisis occurred in sugar trade, as a result of increased beet sugar production in the European countries. Sugar prices went down and the Java sugar enterprises and the Cultivation Banks which had financed them, suffered heavy losses.

A financial restructuring of the Cultivation Banks in the Netherlands and the almost complete takeover of the sugar industry by finance capital, gave the sugar industry a new lease on life. From the late 1880s onward large amounts of capital were injected into the sugar industry. The cultivation of sugarcane was carried out with new scientific insights. The factories started to increase their scale of operations in the 1890s and 1900s. The result was that the Java sugar industry became the most productive and most efficient sugar producing system in the world (Koningsberger 1948, 289).

Sugar Production in the Philippines

Spain maintained the mercantilist principle that colonial trade should be a monopoly of the mother country until the first decades of the nineteenth century. Under these principles foreigners were excluded from the colonial trade and the production of certain local products was forbidden, to stimulate the import of Spanish goods. Towards the end of the eighteenth century the Spanish government

attempted to establish a monopolistic trade channel between the mother country and the colony, by creating a commercial Company (Royal Philippine Company), financed by private capital, with the exclusive privilege of trade between Spain and the Philippine Archipelago. This Company functioned on a limited scale till 1834, when heavy financial losses forced it to close down. Apparently Spain had not been able to do what the Netherlands was doing at the time: establish a profitable commercial link between the mother country and the colony. One can surmise that Spain as a semi-peripheral state in the world system lacked the means of control to maintain a monopolistic position in its Asian colony. An important factor was that the company had not been able to realize a vertical integration of production and trade, of the sort the Dutch had established in Java at the time.

During the last decade of the eighteenth century and the first decades of the nineteenth century the Philippines were opened to free trade with the whole world. During the 1790s American ships traded at the port of Manila, although the official restriction on foreign merchants was still in operation. In the 1820s American firms started to open permanent agencies in Manila. Several provincial ports were opened to foreigners during the 1830s and until the 1860s. The number of merchant houses in Manila increased rapidly. During the 1820s, seven English and American firms began to operate in Manila, and during the 1850s a large number of foreign commercial houses were active in Manila. Foreign trade, both imports and exports, increased from the 1820s to the 1890s. The main export crops were sugar, Manila hemp, coffee and tobacco.

McMicking, writing in the late 1840s, pointed out that there were no large plantations in the islands, only a few of small size. Commercial crops were only produced by small cultivators:

The whole of the production of the islands were raised by the poor Indian cultivators, each from his own small patch of land, which they till with very simple, though efficient, implements of agriculture (McMicking 1950, 98).

McMicking pointed out that this system, coupled with traders buying the produce, was far more efficient than a system of large plantations, for the small farmers expended more for labor on their own land than a large planter would do. Under high wages of labor and comparatively cheap land, plantations were cultivated ex-

tensively, because that yielded a higher return than to cultivate a small surface of ground intensively. McMicking was clearly in favor of small holdings.

During the nineteenth century the Philippine economy shifted from a subsistence agriculture to an export economy. Legarda has given an original view on the dynamics of this process:

It is held by some that the two principal means by which such agricultural export economies were built up in this area of the world were large-scale plantation agriculture and government pressure on the peasantry to produce for export. This, however, was not true of the Philippines, since neither was present in sufficient degree during most of the period under consideration to account for the change. When various alternative factors are examined which might afford an explanation, it becomes clear that the leading role must be assigned to the activities of private entrepreneurs. (Legarda 1957, 142)

The foreign merchant houses were officially merely commission merchants, but they were more than that. They went into banking and insurance, they traded on their own account, were agents or consignees for shipping lines, had shares in other enterprises, owned real estate and plantations, engaged in foreign exchange operations and received deposits and made capital advances. In short they were merchant-bankers. (Legarda 1957, 150-51)

Of great importance were the advances made to crop growers at interest, in fact agreements to buy the crop in advance at an estimated value. This system of money lending was not meant to make a profit on the loans themselves, as was the habit of the Spanish and Filipino banks (Regidor and Mason 1905, 25). The main purpose of this arrangement was to control supply and to forestall competition by other merchant firms (Legarda 1957, 150). Although the institution of advances to cultivators was older, the merchant bankers undertook it on a much larger scale. The two American firms were very active in this line of activity, because they were primarily concerned with export trade rather than with imports. It should be pointed out that this was the only way for foreign merchants to get hold of agricultural produce. Until 1863 it was prohibited for foreigners to own land and to engage in agriculture themselves.

A remarkable feature of this way of operating was that foreign capital not just bought produce from petty commodity producers, but extended its influence over the whole production process. It is there-

fore not correct to state in general terms that mercantile capital remained outside the sphere of production, restricting itself to the sphere of circulation, and thereby leaving intact the existing system of production, the petty commodity mode of production. As Fegan has remarked:

... rent capitalist operations did transform the sparsely populated monsoon lowlands of Burma, Thailand and the Philippines, from forest, swamp and grassland, in only three generations, into developed and densely populated agricultural lands. This enormous transformation of the landscape and the people was achieved in each case, when the relation between foreign Asian rent-capitalists and tribal peoples or impoverished peasantry, linked those societies into the Asian segment of the world market. (Fegan 1981, 4)

Capital was scarce in the Philippines during the nineteenth century. The Spanish colonial government did not provide credit to entrepreneurs in the sugar industry. Religious confraternities controlling the charitable endowment funds moved to financial business by offering credit to Spanish traders. These confraternities were either lay brotherhoods connected with religious orders or organizations of secular priests. In 1851 the confraternities were amalgamated, into a new institution, the Obras Pias. The Obras Pias was compelled by the authorities to undertake the less remunerative part of banking business and to lend to native Filipinos and Spaniards only, accepting mortgages on real estate. In 1852 the government established the Banco Español-Filipino, geared to the promotion of Spanish trade interests in the Islands. These Spanish banks controlled by the government and the Friars, were not willing to lend money to Filipino farmers for cultivating crops destined for consumption abroad. The Filipino farmers could only rely on loans from foreign merchant houses (Regidor and Mason 1905, 23-25).

In Negros, hacenderos attempted time and again to set up organizations with the purpose of raising capital among the wider public. Cuesta characterizes the results as follows:

The failure of these projects resulted in a scarcity of cash and hence the modernization of the technology employed in the cultivation of sugar cane and the manufacture of sugar was hindered. Many hacenderos failed to use fertilizers and better seeds, to build dams and canals for irrigation, to purchase modern machines or to adopt more

advanced management methods, because they feared to go deeply into debt. They preferred to continue as they were or at best to introduce slight improvements rather than to attempt to carry out costly projects, where success was not certain. Their social and cultural environment persuaded them that this was the best way. Consequently, their fields did not produce much and their sugar was full of impurities. The consolation of the sugar industry of Negros and the enrichment of many of the hacendados can only be explained by an accumulation of favorable factors such as the cheapness and relative fertility of the land, the low cost of labor, the continual growth of demand and very low taxes. (Cuesta 1980, 405)

In the two sugar regions in the Philippines, Central Luzon, and the Visayan islands of Panay and Negros, labor relations have developed in a different way. We will only discuss the situation in Pampanga.

In the Central Luzon province of Pampanga, aside from small cultivators sugar was cultivated on tenanted land. The sugar contract was widespread, concluded between a landlord and a tenant (*aparcerero*):

In the sugar contract, the proprietor supplied the land, the cuttings for cane for planting, the use of the milling machinery, mill hands, and when necessary, cash loans to the tenant. The tenant brought to the arrangement his own labor, tools, and carabao (water buffalo). He was responsible for the planting and harvesting of the crop and payment and feeding of whatever hands had to be hired. The tenant transported the crop to the sugar mill and assisted in the milling of the cane. The proprietor concluded the sale of the finished sugar with the Chinese merchant from Manila. Proceeds from the sale of harvest were then divided 50-50 between the parties. Certain items in the contract changed under different circumstances. The cost of cuttings was sometimes split between the tenant and the landlord, and if the landlord had to supply the carabao, the tenant received only 25 percent share. All transactions were in cash. (Larkin 1971, 791)

The expansion of the sugarcane area in the Philippines was the main thrust behind the increasing production, and increasing exports during the nineteenth century. In the two regions where sugar expanded rapidly during the century, Pampanga between 1830 and 1846, and Negros after about 1860, there was no shortage of land. In both regions new land could be opened up to sugar cultivation

without crowding out the traditional rice land (Larkin 1971, 789). For the Philippines the period between 1820 and 1920 can be characterized as "the century of the frontier" (Larkin 1982), with large numbers of Filipinos moving on to interior flatlands and bringing land under cultivation (McCoy 1982).

Land for sugarcane cultivation could be obtained in various ways. In Pampanga, land was either purchased outright or obtained through the *pacto-de-retroventa* mortgage. Renting land for sugarcane cultivation was seldom practiced in Pampanga. It probably had its drawbacks. Sugar cultivation required relatively large investment (work animals, milling devices, possibly a steammill). Short term leases did not offer a sufficient guarantee to the stability of this investment (Roth 1977, 143). It should be pointed out that the existence of large landownership promoted the opening up of new land. Whereas small cultivator and especially landless people would not have the savings to move to new areas and to open up land, landlords are in a position to send their tenants to do the clearing and the cultivating, while the landowner is able to provide them with a living in the meantime.

Conclusion

In Java the main problem for the Dutch government and European entrepreneurs in the early decades of the nineteenth century, turned out to be that foreign entrepreneurs could not attract labor power without the assistance of the indigenous bureaucracy. This meant that establishing export plantations in land which was not yet inhabited, was not a viable strategy. Javanese peasants would not migrate to these areas to work for wages. This meant that export crops had to be cultivated close to or within populated areas, where labor could be attracted with the help of native chiefs. But the problem was that in these areas the existing population did have claims to the land, and it required a special policy to insert the export crop production into this agricultural system.

One option would have been the promotion of a native export industry, in which native entrepreneurs using indigenous labor arrangements, and sharing the benefits with the laborers/tenants (via sharecropping) would bring about a sizable export production system. This is in fact what happened in the Philippines.

However, in Java this would have led to a situation in which native producers would have sold their produce to foreign merchants, leaving the Dutch with the costs of the colonial administration, without the profits of its production and its trade. As the Dutch colonial government consciously attempted to avoid this situation, actual developments went in another direction. The Dutch introduced the Cultivation System connected with the monopolistic trading company, the NHM, and promoted the activity first of Chinese, later of European contractors. The native option was cut short.

While the Java sugar industry thus came entirely into the hands of European entrepreneurs, and later of European Cultivation Banks, the Philippine sugar industry remained in the hands of Filipinos. In the Philippines, sugar production and exports increased steadily throughout the nineteenth century. It is a remarkable feature of the Philippine sugar industry that its output for a long time had been on a scale which was comparable to that of Java, viz., roughly one-half to two-thirds of the Java production figures. This happened, despite the fact that in the Philippines capital was scarce, and only available for day-to-day operations, not for technological investments. The expansion of Philippine sugar production was the result of the abundance of land which could be brought under cultivation. Production per hectare remained stagnant throughout the period under discussion, but the expansion of the area devoted to cane cultivation, and of the number of mills processing sugarcane, led to a steady rise in overall production.

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