The Organisation of German Industry, 1850-1930: The Case of Beet-Sugar Production

John Perkins
University of New South Wales, Kensington

I

The pioneer German economic historian Werner Sombart stated at the turn of the century: 'It is correctly asserted that the sugar and alcohol industries have been those branches of industry on the basis of which Germany has developed to become a capitalist great power: rather in the manner that the cotton and iron industries have laid the basis of England's greatness'.[1]

This is, of course, an overstatement. However, it does serve to highlight the importance of beet-sugar production, and of potato-alcohol distillation, in the process of modern industrialisation in Germany. By the 1990s, apart from supplying the home market, sugar accounted for about an eighth of German exports to Britain, its major trading partner. On the eve of the First World War approaching half a million workers were employed in beet cultivation and processing, with in excess of 100,000 being occupied in the manufacturing branch.[2]

Effectively originating in the late 1830s, the beet-sugar industry developed in Germany to the point where, by the mid-1860s, its product had completely supplanted cane-sugar as the

[1] W. Sombart, *Der moderne Kapitalismus*, 2 volts. (Leipzig, 1920), II, 14.

[2] H. Ebeling, *Wirtschaftliche Probleme bei dem deutsch-englischen Zuckerhandel* (Karsruhe, 1914), p. 1.; T. Roemer, *Handbuch des Zuckerrübenbaues* (Berlin, 1927), p. 25; T. Schuchart, *Die volkswirtschaftliche Bedeutung der technischen Entwicklung der deutschen Zuckerindustrie* (Leipzig, 1908), p.148.

source of supply to a rapidly expanding home market.[3] By the mid-1870s, when beet-sugar from Germany began to appear in increasing quantities on the international market, the country was the largest sugar producer in the world. For a brief period in the later 1890s and early 1900s, when Cuban output declined dramatically with the Spanish-American War of 1896-1898, Germany was the most important single source of sugar supply to the world market and accounted for around a third of world beet-sugar output.[4] Even thereafter, with the recovery of Cuban production and the rapid expansion of the industry on Java, Germany remained the world's largest sugar producer, marginally ahead of Cuba. In 1913/14 Germany accounted for nearly 14 per cent of "visible" world sugar output and was the third largest exporter.[5]

Analysis of the history of the German beet-sugar industry reveals features that are typically associated with German industry as a whole, as compared at least with common British and American business in the XIXth century. These include a high degree of interdependence and mutual interaction between government policy formation in diverse areas, from the fiscal to the socio-political, and the private entrepreneurial objectives of businessmen. Another typical feature of German industry, as it evolved over the XIXth century, was a high degree of vertical integration of processes of production. This is exemplified by

[3] On the development of the sugar beet cultivation and beet-sugar processing in Germany before 1914, see John Perkins, 'The Political Economy of Sugar Beet in Imperial Germany', in B. ALBERT & A. GRAVES (eds) *Crisis and Change in the International Sugar Economy, 1860-1914* (Edinburgh & Norwich, 1984), pp. 30-45; 'The Agricultural Revolution in Germany, 1850-1914', *Journal of European Economic History*, Vol. X, No.1, 1981, pp. 71-118.

[4] *Centralblatt für die Zuckerindustrie* (Hereafter CBZI) Vol. XXXV, no.35, 27 Aug. 1927; B. AMROGOWICZ, *Die Zuckerindustrie der Provinz Posen* (Berlin, 1903), p.5. In 1896 Germany accounted for 22 per cent of U.S. sugar imports. Cuba and Hawaii, the next most important sources, each provided 11 per cent. (Gesamtrohzuckereinfuhr in die Vereinigten Staaten von Nordamerika, *Neue Zeit*, Vol. XV, Part 2, 1897, p.221).

[5] *CBZI*, Vol XXXVIII, *Festausgabe*, 14 May 1930.

Krupps and other iron and steel firms, which integrated backwards to acquire iron ore and coal mines and integrated forewards to acquire end-users of iron and steel. This was also the experience of the German beet-sugar industry.

A characteristic feature of the early beet-sugar industry in German was a high degree of integration with agriculture. The factories were almost all established by large farmers, or by partnerships of farmers operating large holdings. They were especially concentrated in the central region of the country and in Lower Silesia where such large farms predominated in the structure of holdings, where the soil was most suitable for beet cultivation in the then state of agricultural technique and where coal was readily available for the fuel needs of processing.[6] The factories themselves were located on the farms that supplied the beet and utilised the by-products of pulp and molasses for livestock fodder. At this early stage in the history of the industry the fodder products ranked virtually equally with sugar as the objective in cultivating the crop.

Initially, the factories were mere ancillary activities to farming, on holdings that often also undertook other processing activities, such as brewing, distilling, flourmilling, malting and brick manufacture. Soon, however, the operation of farms possessing beet-sugar factories became overwhelmingly oriented to cultivating sugar beet and manufacturing raw sugar. At the same time factories were established by individuals who bought beet from growers and leased land to cultivate the crop.[7]

[6] For a model factory in the early 1850s fuel accounted for 12 per cent of total costs, as compared with 34 per cent for beet and 11 per cent for wages. (*Zeitschrift des landwirtschatlichen Central-Vereins für die Provinz Sachsen*, Vol. X, No. 10, 1853, p.304). According to an estimate for the mid-1870s, the processing of a tonne of beet required 442 to 764 kilogrammes of lignite or 199 to 241 kilogrammes of pitcoal. (F. Stohmann, *Handbuch der Zuckerfabrikation* (Berlin, 1878), p. 8).

[7] W. Strauss, *Die Landwirtschaft des Kreises Neuhaldensleben* (Diss.: University of Tübingen, 1920) p.99; W. Gerland, 'Die Lage des Kleingrundbesitzes im ehemaligen Fürtstentum Halberstadt', *Schriften des Vereins für Socialpolitik*, Vol. XXIII, 1883, p.148.

The progress of technology in beet processing resulted especially in a rapid increase in the optimum scale of plant. Developments included the continuous expansion of the capacity of steam-engines and steam-boilers, with substantially lower average costs of power according to size. The introduction of field railways, from the 1870s, enabled the bulky raw material to be transported cheaply to the factory from greater distances. The replacement of hydraulic presses by diffusers to extract the juice from the beet, from the 1860s onwards, and the increasing scale of efficient diffusers, also contributed towards increasing the optimum scale of plant.[8]

To illustrate the cost differential according to scale, in the 1898/99 season the average cost of processing a tonne of beet into raw sugar in factories handling up to 25,000 tonnes was *Reichsmarks (RM)* 9.30, as compared with *RM* 6.53 in plants processing from 100,000 to 150,000 tonnes.[9] On a throughput of 125,000 tonnes of beet, at the average cost per tonne, the saving would have been *RM* 346,250 over the cost of production of five small factories with a capacity of 25,000 tonnes, or 42 per cent of the total outlay. A study of the results of the activities of 30 beet-sugar companies, in the quinquennium 1897/98 — 1901/02, reveals the average cost of processing a tonne of beet ranged from *RM* 9.38 in factories with a capacity of less than 5,000 tonnes a season, through *RM* 8.58 in factories handling between 5,000 and 10,000 tonnes and *RM* 7.91 in those processing between 10,000 and 20,000 tonnes, to *RM* 6.52 in factories processing between 20,000 and 50,000 tonnes.[10]

When established in 1858, the factory at Zeitz in Central Germany processed slightly over 4,000 tonnes a season and in that of 1903/04 some 25,000 tonnes of beet were delivered to the

[8] J. BAXA & G.BRUHNS, *Zucker in Leben der Völker* (Berlin, 1967), p.176.

[9] P.M. Grempe, 'Kosten der Rübenverarbeitung', *Neue Zeit*, Vol. XIX, Part 2, 1900, p.60.

[10] H. BIRSCHEL, *Die Bedeutung der Brüsseler Zucker-Konvention für Deutschland* (Berlin, 1909).

factory.[11] This remained a moderate-sized factory. Between the quinqennium 1815/52 — 1855/56 and that of 1901/02 — 1905/06, the average annual volume of beet processed per factory increased from 4,838 to 34,249 tonnes and that of sugar output from 339 to 5,218 tonnes.[12] By the 1900s the largest factory in Germany, that at Kulmsee in the Prussian province of Posen, processed more beet in a season than the 48,298 tonnes handled by the 145 factories operating in 1840.[13] Analysis of the 40 factories that were closed down between 1896/97 and 1907/08 indicates the role of economies of scale in their failure. The average age of the plants in question, at 34 years, was not substantially in excess of the average of 29 years for all factories in 1896/97. On the other hand, the average raw-sugar output of the plants taken out production, at 5,830 tonnes, was only 63 per cent of the average of all factories in 1896/97.[14]

II

One response to the increasing optimum scale of plant in beet-sugar production was for the owners of factories to acquire more and more land, by purchase and/or lease, for the cultivation of beet. The factory established on 70 hectares acquired by two stonemason brothers in the Halle district in the late 1840s was drawing beet from 1,038 hectares owned by the partnership in the early 1870s, when land also began to be leased.[15] However, there were definite limits to the capacity of an individual or partnership to match the progressive increase in the optimum scale of production by acquiring more land for beet cultivation.

[11] H. Herrmann, *Die landwirtschafliche Betriebsverhältnisse im Kreis Zeitz* (Diss.: Univerity of Halle, 1926), p.87.

[12] Schuchart, *op cit.*, pp. 13-14.

[13] B. Brukner, *Zucker und Zuckerrübe un Weltkrieg* (Berlin, 1916), p. 50.

[14] Birschel, *op cit.*, p. 41.

[15] See A. Kobe, *Entwicklung und Betritrebsverhältnisse eines landwirtschaflischen Grossebetriebes der Provinz Sachsen* (Diss.: Univerity Leipzig), 19?, p.4.

The response placed a strain on capital resources that could be more profitably invested in expanding sugar production. The sugar yield of beet grown on land operated by factories was on average greater that of the beet purchased from farmers which, in view of the effect on processing costs, was the major reason for the adoption of this form of raw-material supply. The gains in processing costs, however, were at least partially offset by the higher costs of beet-cultivation on factory land and the practice came to be considered 'more a necessary evil than a source of profit'.[16] Finally, nematode (eelworm) infestations in the middle decades of the century, when the only known means of controlling the pest was to further space out the appearance of beet in rotations, meant that an even larger acreage was required for a factory to supply its own raw material.[17]

In response to the increasing optimum scale of plant and problems arising from meeting raw-material requirements from land directly cultivated in association with factories, various corporate forms of organisation began to emerge in the beet-sugar industry from the late 1840s onwards. An early form of company adopted was the "Open Trade Company" (*Offene Handels-Gesellschaft* or *OHG*). Such firms could be established without requiring official permission, as associations of shareholders (in this case of beet-growers) who did not enjoy limited liability. By 1857/58 there were at least 27 *OHGs* operating in the beet-sugar industry.[18]

Another early type of firm was the registered partnership (*Kommanditgesellschaft*). In this form of company organisation the active directors were liable to the full extent of their property in the event of the failure of the enterprise and only the sleep-

[16] SCHUCHART, *op cit.*, p. 137.
[17] BAXA & BRUNHS, *op cit.*, p. 191.
[18] G.B. HAGELBERG & H. H. MÜLLER, 'Kapitalgesellschaften für Anbau und Verarbeitung von Zuckerrüben in Deutschland', *Jahrbuch für Wirtschaftsgesichte*, 1974, Part IV.

ing partners enjoyed limited liability.[19] The partnership in the Halle district mentioned above became a *Kommanditgesellschaft* in 1884, after the stonemason brothers who founded the enterprise died and their heirs desired to raise capital for expansion. There were three personally-liable directors and eight sleeping partners.[20] The *Kommanditgesellschaft*, however, never became a really popular form of corporate organisation in the sugar industry and by the end of the century there were only five or six such factories in existence.[21] In the 1930s the form experienced something of a revival, through the efforts of the Nazi government to encourage the adoption of types of company organisation which were not protected by limited liability. From four out of 343 factories in 1913/14 and three out of 251 in 1928/29, the number increased to 17 of 220 factories by 1938/39.[22]

Joint-stock corporations with limited liability emerged as early as the late 1830s in the beet-sugar industry in the Duchy of Brunswick and that of Anhalt. They spread to Prussia in the 1850s, after a reform of company law made this development possible.[23] In the joint-stock companies that emerged, shareholders entered agreements to devote an acreage to beet each year that was related to the extent of their shareholding. Obviously,

[19] Kobe, *op cit.*, pp. 7-8

[20] *Ibid.*, pp. 7-9.

[21] Schuchart, *op cit.*, p. 100.

[22] K. A. Scholler, *Die Zuckerrübe in der deutschen Ernährungs und Futterwirtschaft* (Berlin, 1940) p.82. The Nazi authorities encouraged the adoption of the *Kommandit-Gesellschaft* form by means of tax concessions. *(CBZI*, Vol. XLIII, No.13, 30 May 1935). At the same time the introduction of a fixed price to be paid to growers for beet eliminated the possibility of jointstock companies avoiding tax by distributing profits in the form of the beet price paid to grower-shareholders.

[23] Schuchart, *op cit.*, p. 175n. The Sugar Factory Klein Wanzleben in Anhalt was established as an *AG* by 19 farmers in 1838. By the mid-1850s a clear majority of shares had been acquired by Mathias Rabbethge and the reaminder were held by two partners. In 1864, after the departure of one of the partners, the firm became an *offene Handelsgesellschaft* and finally reverted to the *AG* form in 1885. (H. Mosel, *Die Entwicklung der Zuckerfabrick Klein-Wanzleben vorm. Rabbethge & Giesecke AG* (Bernburg, 1925), pp. 14-15.

the main reason for this provision was to guarantee a supply of beet to the factory; although it was also conceived as a means of precluding a takeover of the enterprise by non-growers.[24] The agreements were legally binding on the parties and provided for fines in cases of non-compliance. The grower could only obtain release from the agreement with the concurrence of the board. This was normally only possible where the grower sold the share-holding: a step also requiring the agreement of the board.[25]

Initially, nearly all the joint-stock companies established in the beet-sugar industry were public limited liability companies. *(Aktien-Gesellschaften) (AG).* From the latter part of the century, however, the form of the private limited liability company *(Gesellschaft mit beschränkter Haftung) (GmbH)* became more and more popular. Of the 395 mills operating in 1900, 179 were liability *AGs* and 83 were private limited companies. Over the subsequent period up to the First World War there was a clear tendency for the *GmbH* form to be adopted. By 1906, for example, the number of AGs had declined slightly, to 173, and the number of private limited liability companies had increased from 83 in 1900 to 101: mainly at the expense of individually-owned enterprises and partnerships.[26]

The popularity of the GmbH form of enterprise in the beet-sugar industry from the 1880s onwards stemmed partly from a court decision of that decade, whereby it was declared illegal to link shares in a public limited liability company to an obligation to provide a service to the enterprise: in this case to supply a specified quantity of beet. It was possible to overcome the problem by means of subsidiary agreements with shareholders. Under the commercial code adopted from 1900, in a paragraph specifically inserted to meet the wishes of the sugar industry, it

[24] Gerland, *op cit.*, p. 149.
[25] *CBZI*, Vol. XXXVI, No. 13, 31 Mar. 1928.
[26] Schuchart, *op cit.* p. 100.

became possible to attach an obligation to supply beet to the holding of shares in AGs. In both cases, nevertheless, the agreements were not legally binding where the price paid for beet was made dependent upon the financial situation of the company. The difficulties could be overcome by converting the enterprise into a GmbH, which had the further advantage of not being required to publish annual accounts. However, perhaps the major factor stimulating the adoption of the private limited company form was the Prussian income tax reform of the 1880s whereby the profits of AGs, as well as the dividends issued to shareholders, were made liable to income tax.[27] Double taxation of the earnings of AGs was avoided in many cases by distributing them to grower-shareholders in the form of the price paid for beet. This was not possible, however, where the shareholders included non-agriculturalists. Also, where a firm owned by growers bought additional beet from farmers who were not shareholders, a lower price paid for the latter's crop was likely to cause resentment.

At various times proposals were made to scale the tax on sugar according to that of output from individual factories, as a means of assisting the smaller enterprises that were typically integrated with agriculture. A scaled factory tax was actually introduced in an act of 1896. However, the range of tax, from RM 1.00 per tonne of raw sugar where output was less than 4,000 tonnes per annum to RM 3.00 where output exceeded 14,000 tonnes, was insufficient to halt the process of horizontal integration. (See Table I below). On an output of 14,000 tonnes the factory tax was only 1.5 per cent of the excise duty levied on that quantity of sugar.[28]

The legislation of 1896 for the first time also attempted to control the expansion of the industry. A production quota was

[27] W. Elsmann. 'Rechtsentwicklung der Rübenlieferungspflicht', *CBZI*, Vol. XLV, No.25b, 4-7 July 1937; Strauss, *op cit.*, p. 99.

[28] U. Teichmann, *Die Politik der Agrarpreisstützung* (Cologne, 1955), pp. 335-6.

Table I
SCALE OF PRODUCTION IN THE BEET-SUGAR INDUSTRY, 1895/96 AND 1900/01

Scale of Output per Factory (tonnes)	Proportion of Total 1895/96 (%)	Raw-Sugar Output 1900/01 (%)
To 3,000	15.8	9.1
3,000 to 5,500	51.1	51.1
5,500 to 14,00	30.6	34.5
Over 14,000	2.5	5.3

Source: U. Teichmann, *Die Politik der Agrarpreisstützung* (Cologne, 1955) p. 336.

set for each factory based upon the average annual output of the previous three years, with the year of lowest production being omitted. Then, on the assumption of average costs of production of *RM* 192.00 per tonne of raw sugar, a duty of *RM* 25.00 per tonne was levied on output in excess of the quota. The purpose of this measure was to protect the state's revenue from sugar, which was being eroded by the growth of exports on which a bounty was paid.[29] The measure, however, had the opposite effect to that intended because the quota was continually revised. At the short-term cost of increased outlay on excise duty, by expanding production companies, gained access to higher quotas.[30]

III

In contrast to the central region of Germany and Lower Silesia, where the initiative to establish the beet-sugar industry came from large farmers, in the west and south of the country it was industrial capital that played the major part in diffusion of

[29] On government fiscal policy in relation to the sugar industry, see John Perkins, 'Fiscal Policy and Economic Development in the 19th-Century Germany', *Journal of European Economic History*, Vol. XIII, No. 2. 1984, pp.311-44.

[30] B. Amrogowicz, *Die Zuckerindustrie der Provinz Posen* (Berlin, 1903), pp. 13-14.

sugar-beet cultivation and processing. This reflected the quite different structure of agricultural holdings and general socio-economic environment of the Rhineland, Hesse, Baden, Württemberg and the Palatinate, where the industry was established by 1914. In these districts peasant farming predominated, with the majority of holdings being of less than twenty hectares in extent. The peasants in general either lacked the capital for investment in industrial undertakings, preferred to use it to purchase more land or were fearful of losing control over their savings. The farms were obviously too small individually to produce sufficent raw material for a mill and a partnership would have required too many participants to have been a viable proposition. A factory operating near Stuttgart, for example, drew beet from 2,312 growers cultivating the crop on a total of 598 hectares in the 1879/80 season. In southwest Germany there were growers with as little as 1/24th of a hectare under beet.[31]

Some factories in western Germany, mostly in areas like Lower Saxony where large peasant farms figured prominently in the structure of holdings, were established as grower co-operatives. One such enterprise was formed at Rethen in Hanover in 1875, with a capital of *RM* 369,000 distributed in 1,230 shares of *RM* 300 each. A decade later another 1,205 shares were issued to raise the capital to *RM* 729,300, with each share carrying an obligation to deliver six tonnes of beet to the factory. The small peasants possessing one or two shares were generally relatives of large farmers, with 50 to 60 shares, who assisted with the provision of teams to cultivate the land for beet and to cart the harvest to the factory.[32]

[31] H. Paasche, 'Die jüngste Entwicklung der Zucker-Industrie und die Reform der Zuckersteuer', *Jahrbücher für Nationalökonomie und Statistik*, Vol. XLIX, 1887, p.287n.

[32] H. Lauenstein, *Die Entwicklung eines niedersächsischen Bauerndorfes in den letzten 100 jaren unter dem Einfluss von Besitzverschiebung, Industrie und Verkehr* (Diss.: Univerity of Jena, 1922), pp. 113-5. See also H. H. Muller, 'Bäuerliche Wirtschaft und Industrialisierung am Beispiel der Zuckerindustrie in Deutschland', *Studia Historiae oeconomicae*, Vol X, 1975, pp. 165-72.

The formation of co-operatives amongst peasants to operate a beet-sugar factory faced inherent difficulties, in terms of reaching consensus amongst the participants, and a degree of reluctance to commit savings to an enterprise beyond the individual peasant's control. It is notable in this respect that a number of co-operatives owed their establishment to the initiative of local personalities who were not of the peasant class. However, what signalled the virtual death knell of this form of company organisation in the beet-sugar industry was a law of 1898, which stipulated that an individual could not be prevented from relinquishing membership in a co-operative.[33] Without a guaranteed supply of raw material, such were not a viable proposition.

Industry in general, as an alternative means of raising capital to co-operatives for investment in beet-sugar milling, was particularly concentrated in western Germany, at the time when a national capital market — like the nation itself — was only in the process of formation. Within the industrial sector, it was sugar-refiners who were especially motivated to integrate sugar-beet cultivation and milling vertically. In 1855, for example, the four largest refineries in the Rhineland, which accounted for about three quarters of the sugar consumed in the area, amalgamated to form a single firm. The initial objective of this combination was to take control of the market and force competitors out of business. Later in the 1850s, the company began to cultivate beet for its own mill. The refinery was partly motivated to enter this area by its growing dependence upon raw beet-sugar from central Germany in place of cane sugar shipped down the Rhine. Another motive was the threatened establishment of beet-factories producing sugar for direct consumption. There was a proposal in 1858, for instance, to establish such a factory at Ehrenfeld. This was never realised but a number of other ventures was proposed in subsequent years.[34]

[33] SCHOLLER, *op cit.*, p. 81

[34] K. C. PFEIFFER, *Geschichte des Zuckerrübenbaues und der Rübenzuckerindustrie in der Rheinprovinz* (Bonn & Leipzig, 1922), pp. 50-51, 87. Western sugar-

Apart from the sugar-refining interest, the investment banks established in western Germany in the wake of the abortive 1848-49 Revolution were important sources of funds for the establishment of the beet-sugar factories in that region. In 1882, for example, the Bank for Commerce and Industry of Darmstadt in 1882 furnished almost 20 per cent of the capital required for the Sugar Factory Wetterau *AG* at Friedberg in Hesse and a third of that required the following year for the Sugar Factory Gross-Gerau *AG*.[35]

Foreign capital, almost entirely from the Netherlands, Belgium and France, and especially from the sugar industries of those countries, played a significant role in the establishment of a number of beet-sugar factories in western Germany. The first plant to be built in Hesse with Dutch capital opened in the late 1870s. The last was the Sugar Factory Rheingau at Worms in 1913, where over half the capital came from the Dutch sugar interest. This factory was built in collaboration with the Association of Beet-growing Farmers of Hesse and the Palatinate, which was in conflict with the existing enterprises at the time over the price paid for beet.[36] With a limited home market for sugar, the Dutch interests responded in order to futher develop their involvement with the sugar industry of Germany.

IV

The increasing optimum scale of plant, and the diffusion of beet-cultivation amongst the peasantry, inevitably brought ab-

refining interests also played a part in the development of the beet-sugar industry in eastern Germany. An outstanding example was the von Rath family from Berg in the Rhineland, which established refineries at Duisburg (1820) Würzburg (1827) and Cologne (1834). In 1850 Carl von Rath purchased two estates in Silesia and built a beet-factory. Three other factories followed in the 1860s, with the Rhineland branch of the family having an interest in all of them. (*CBZI*, Vol. XXI, No. 15, 13 Jan. 1923).

[35] F. Langsdorf, *Die hessische und süddeutsche Zuckerindustrie* (Neuwied, n.d. [1935]), pp. 48, 52-3.

[36] *Ibid.*; *CBZI*, Vol. XXXVI, No. 2, 14 Jan. 1928.

out a decline in the proportion of beet supplied from land operated by the factories *(Eigenrübe)* in favour of that from shareholders in the enterprise *(Pflichtrübe)* and especially from growers who did not participate in the profits of sugar manufacture *(Kauf-erübenbauer)*. As Table II below indicates, already by the mid-1890s over half the beet supplies of factories came from purchases from non-shareholders. Between the mid-1890s and the mid-1900s, the proportion of beet derived from land belonging to the factories declined by two-thirds. The contribution of shareholder-beet, after increasing up to the mid-1900s, stabilised at around two-fifths of the total during the decade before 1914.

Table II
SOURCES OF BEET FOR SUGAR FACTORIES, 1892/93-1913/14

Source of Beet	1893/94 (%)	1903/04 (%)	1913/14 (%)
Factories	15.00	8.42	4.67
Shareholders	33.75	38.91	38.91
Other Growers	51.24	52.67	56.42
	100.00	100.00	100.00

Source: K. Pappe, *Die Entwicklung der deutschen Zuckerindustrie nach dem Kriege* (Diss.: University of Halle, 1926) p. 11.

The predominant industrial-capitalist form of beet-sugar production in the western and southern regions of Germany, and the increasing dependence of companies generally on beet purchased from non-shareholders, was the source of a conflict of interest within the industry. Naturally, the views of processors and growers who did not share in factory profits differed as to what constituted a fair price for beet. They also differed on the nature of the beet to be cultivated. The factories wanted beet with the highest possible sugar content, not only as a means of minimising the direct costs of processing but also because, until 1892, the high excise duty was levied on the volume of beet entering the factories rather than on the finished product. They therefore insisted upon supplying growers with the type of seed, and on procedures of cultivation, that produced sugar-rich beet.[37] The growers, on the other hand, wanted to maximise the fodder yield of beet for their livestock, in the forms of leaves and the fibrous pulp returned from the factories. Another perennial source of friction was the percentage deduction the factories made on the price paid for the beet to take account of the dirt delivered along with it.[38]

Local organisations of peasant growers for collective action against the beet-factories first appeared in the Rhineland. In 1896 the attempt was made to form a central body to co-ordinate action of differences in attitude and approach amongst local organisations. Subsequently, at the end of 1903, a more lasting regional body emerged in the Rhenish Beet-Growers Association. Thereafter, the movement to form associations of growers spread to the southern and also to parts of the central region of the country.

V

The tendency towards the disintegration of beet cultivation and processing before 1914 contrasted with that towards the integration of production of other inputs required to manufacture

[37] By the way of illustration of the stipulations contained in agreements between beet-factories and growers, a Silesian example of 1885 prohibited clover and lucerne as crops preceding sugar beet, as well as the application of sheep manure and top-dressing of nitrate to the growing crop, and limited applications of the latter the previous autumn to a maximum rate of 50 kilogrammes per acre on condition that superphosphate was applied at the rate of 100 kilogrammes per acre. At this time it was believed that excessive nitrogen was harmful to the sugar-forming properties of beet and there had been several explosions at factories which were attributed to nitrogen in the raw sugar. (A.F. Kiehl, *Sechzigjärige Erlebnnisse und Erfahrungen eines alten Rübenbauers* (2nd edn., Berlin, 1918) p. 16).

[38] *Ibid.* p. 9; R. Leonhard, 'Landwirtschaft - Landindustrie - Aktiengesellschaft', *Archiv für Sozialwissenschaft und Sozialpolitik*, Vol. XXXVII, 1913, p.102.

[39] *75 Jahre Rheinischer Rübenbauer-Verband* (Bonn, 1978), p.16.

sugar. In Central Germany, in particular, it was not uncommon for sugar factories to purchase or acquire an interest in the quarries and limekilns from which they drew the material required in filtration.[40] On the other hand, the period from 1850 to 1914 witnessed a growing division of labour between the production of raw sugar and refining. The early plants were all called "white-sugar factories", producing a low-grade refined sugar directly for consumption. By the later XIXth century, in spite of improvements in processing techniques enabling a good quality of refined sugar to be produced directly from beet, "white-sugar factories" accounted for only a small proportion of total output. They only survived in fact where there was an assured local market for the product, which was protected by high freight costs from the nearest refinery.[41]

The direct production of refined sugar from beet had arisen in part, in an area of poor communications, from the distance that separated the refineries (which were located in ports such as Hamburg and Cologne on the Rhine or in centres of concentrated consumption like Berlin) from the punctiformly located beet-factories in the interior of the country. The refineries were also reluctant to handle raw beet-sugar, on account of the technical adjustments required in refining and the lower value of the molasses compared with those from raw cane-sugar.

Gradually, under the force of the circumstance of the tariff, the spread of the railway and the upgrading of roads, as well as the improving efficiency of beet-sugar poduction, the refineries were attracted to processing raw-beet sugar. In response, in the existing state of beet-processing technology and of consumer preferences for highly refined sugars, the beet-factories were motivated to concentrate upon producing raw sugar for the refineries. By confining their activities in this respect, the factories did not have to meet the cost of maintaining an organisation to

[40] SCHUCHART, *op cit.*, pp.133-4.
[41] *Ibid.*, p.123.

market a relatively small output of refined sugar. Where the entire processing of beet to refined sugar occurred in a single enterprise, with continual flow production to maximise returns, a technical hitch in refining disrupted production at the earlier stages of processing. Yet it was necessary to process the beet harvest as rapidly as possible, before the sugar content diminished with storage or the frost ruined the crop. Finally, where a beet-factory incorporated refining it was necessary to change over to purchased raw sugar outside the beet season, occupying only 80 to 100 days of each year, in order to utilise fully the refining capacity. However, the changeover required technical modifications of the plant, the adoption of new work procedures and the acquisition of additional equipment that was only employed for part of each year.[42]

VI

The First World War had a decisive impact upon the German beet-sugar industry. It would in fact be true to say that no other major industry was as affected by wartime legislation and administrative actions, as well as by developments that were initiated or accelerated by that conflagration.[43]

On August 1914 the sugar futures markets at Magdeburg and Hamburg were closed. Thereafter, the wholesale price of sugar was fixed by administrative decree. At the same time the export of sugar, a quarter of the output of the coming season before 1 January 1915, was prohibited.[43] These were the first

[42] *Ibid.*, p.123.

[43a] On the experience of the German beet-sugar industry between 1914 and 1933, see J. PERKINS, 'An industry in Crisis: Beet-Sugar Production from World War I to the Nazi Seizure of Power', in H. AHLFELD (ed.) *Sugar: Essays to Mark the 125th Anniversary of F. O. Licht* (Ratzeburg, 1989), pp. 27-36.

[43b] *Correspondenzblatt der Vereinigung zur Hebung des Zuckerverbrauches*, No. 11, 1917, pp. 400-5; BRUNKER, *op cit.*, pp. 14f.; *Zeitschrift des Vereins der Deutschen Zuckerindustrie* (hereafter *ZVDZI*) Vol. LXVI, 1916, *Allgmeiner Teil*, p. 121; K. PAPPE, *Die Entwicklung der deutschen Zuckerindustrie nache dem Kriege* (Halle, 1926), p. 15.

steps towards the replacement of an essentially free-market in sugar by a state-regulated economy, the so-called *Zwangswirtschaft* that survived into the early 1920s.

The ban on the export of sugar was designed to create the largest possible reserve of foodstuffs (sugar being one of the few that could be stored for any length of time) as well as to create problems of sugar supply for the United Kingdom. In 1913/14 Germany had accounted for around 80 per cent of the sugar imported by Britain and it was believed that stocks in Britain were sufficent for only two months' consumption. In practice the measure created as many problems for Germany as it did for Britain. When war broke out in 1914 stocks on hand at the refineries stood at 450,000 tonnes, or more than double the usual reserve carried over as a buffer against a shortfall in the harvest commencing (for accounting purposes) on 1 September. A forthcoming level of production in the region of the previous year's record 2.720 million tonnes was anticipated for 1914/15, whereas domestic consumption in 1913/14 had only been 1.5 million tonnes. Actual sugar output in the 1914/15 season was 2.510 million tonnes.[44]

Although sugar consumption increased markedly in 1914/15, the government saw no alternative but to order a 25 per cent reduction in the beet acreage for 1915/16.[45] In fact the acreage declined by nearly a third as a consequence of developments other than the government directive. A critical shortage of labour, draft animals and artificial fertilisers emerged and sugar beet was

[44] *Correspondenz des Vereinigung zur Hebung des Zuckerverbrauches*, No. 24, March 1917, pp. 613-4; K. Sewering, *Zuckerindustrie und Zuckerhandel in Deutschland* (Stuttgart, 1933) p.161; Pappe, *op cit.*, p. 15. See also W. Schultz, *Die Entwicklung der deutschen Zuckerindustrie unter dem Einfluss von Zuckersteuergesetzbung und Zwangswirtschaft* (Diss.: Univerity of Erlangen, 1926), p. 52n; *Correspondenz der Vereinigung zur Hebung des Zuckerverbrauches*, No. 16, 1916, p. 479; H. Wallbaum, *Die deutsche Zuckerwirtschaft, ihre Entwincklung und ihr Beitrag zur Stärkung des deutschen Wehrpotentialis* (Diss.: Technische Hochschule Berlin, 1943), pp. 108-9.

[45] *ZVDZI*, Vol LXI, 1915, *Allgmeiner Teil*, p. 104.

a crop that required substantially more of these inputs than any other.[46] As a consequence of the state-regulated price for beet being fixed too low in relation to the retail price of sugar, many growers processed at least part of their beet into a juice that served as a substitute for sugar. In response to a decree of September 1915 compelling factories to sell 25 per cent of beet-pulp to non-growers, a large quantity of beet was used directly for livestock fodder on sugar-beet holdings and growers took to "topping" beet further down from the leaves to produce more fodder.[47]

For the duration of the war sugar production was maintained at around 1.5 million tonnes, or the level of domestic consumption in the immediate pre-war years. Thereafter, it declined dramatically to 0.702 million tonnes in the 1919/20 season, or slightly over a quarter of the level of output in 1913/14. Part of the fall was accounted for by the loss of 29 factories, or about 10 per cent of the total, to Poland under the terms of the Treaty of Versailles.[48] A loss of production was also caused by a number of factories remaining in Germany having previously relied for their beet supplies upon farms now in Poland. The loss of the Alsace-Lorraine market especially affected beet-factories and sugar-refineries in southwest Germany. Most of the decline, however, was attributed to the prolonged strike of agricultural labourers in 1919, to the absence of foreign seasonal workers and to the shortage of artificial fertiliser.[49]

The recovery of the beet-sugar industry after 1919/20, and more especially after 1923/24, was rapid. By 1926/27 German sugar once more appeared on the world market and by 1930/31 output was only seven per cent below that of the record year of 1913/14.[50] Over the intervening years, however, the situation in

[46] BRUKNER, *op cit.*, p. 40; SCHOELLER, *op cit.*, p.110.
[47] *ZVDZI*, Vol LXVI, 1916, *Allgemeiner Teil*, p. 126.
[48] *ZVDZI*, Vol. LXXII, 1922, *Allgemeiner Teil*, pp. 62-3; PAPPE, *op cit.*, p.22.
[49] PAPPE, *op cit.*, pp. 20-3.
[50] SEWERING, *op cit.*, p.11.

the international sugar economy, and the legislative framework within which the industry operated in Germany, had changed dramatically.

VII

One of the major developments in the beet-sugar industry in the early 1920s was the creation of combines through a process of vertical and horizontal integration. Refining became integrated with raw-sugar production and regional combines of beet-factories emerged. By the mid-1920s 12 combines had been established in the industry and they accounted for about 90 per cent of sugar production.[51] In central and eastern German the initiative to form integrated concerns emanated from the beet-factories. This development was preceded in western and southern Germany by a movement stemming from the refineries to integrate raw-sugar production.[52]

Several factors contributed to the vertical integration movement of the early 1920s. There was a feeling in some quarters of the industry that the separation of beet-processing and sugar-refining was a product of historical developments that were no longer relevant to the postwar situation. By the 1920s some beet-factories were sufficiently large to meet the raw-sugar capacity of a refinery operating at minimal average costs. With the regulated economy a state organisation, the *Reichszuckerstelle*, had taken over the orderly marketing of sugar that had formerly been a function of the refineries. Consumer taste favoured white crystal sugar, which beet-factories were capable of meeting, with the addition of ultramarine in processing. In response, the number of "white-sugar factories" increased. This motivated refineries to integrate beet-processing, either to halt

[51] H. Spohr, *Die Marktordung der deutschen Zuckerwirtschaft in der Nachkriegszeit* (Diss.: University of Göttingen, 1936), pp. 22, 25: Wallbaum, *op cit.*, p.43.

[52] Scholler, *op cit.*, p.81.

the growth of white-sugar production in beet-factories or to profit from it.[53] The introduction of a two per cent turnover tax in the later years of the war, which was continued by Weimar governments, stimulated the direct production of refined sugar in beet factories and a vertical integration movement as a means of minimising payments to the revenue.

The decline of raw-sugar output during the war and early postwar years, and the loss of beet-factories rather than refineries in the east to Poland, created a situation of considerable excess capacity in the refining sector. In the 1920/21 season, for example, with a refining capacity of 2.2 million tonnes, only 1.05 million tonnes of raw sugar were available.[55] The excess capacity was especially concentrated in the refineries of western Germany, which had previously drawn a large proportion of their raw material from eastern Germany. In response to the considerable falling off of supplies from the east, the western refineries began to purchase local beet-factories in order to obtain assured supplies of raw sugar.[56]

In their efforts to gain access to raw sugar by means of vertical integration, the western refineries were assisted financially by payment arrangements for raw sugar in the conditions of hyperinflation that prevailed in Germany in the early 1920s. Before the war refineries had secured their supplies of raw sugar by making advances to the beet-factories during the season to enable them to pay growers for beet. With the advent of the state-regulated sugar economy, the official *Reichszuckerstelle* took over the distribution of raw sugar to refineries during the

[53] PAPPE, *op cit.*, p.23; SPOHR, *op cit.*, p.12. Refineries began to produce crystal sugar of 98.8 polarisation, or percentage sucrose content, by refining, or simply washing raw sugar to remove most of the molasses. (*CBZI*, Vol. XXXIII, No. 26, 27 June 1925).

[54] *ZVDZI*, Vol. LXXII, 1922, *Allgemeiner Teil*, p ?; *CBZI*, Vol. XXXII, No. 53, 4 Oct. 1924; SPOHR, *op cit.*, p.24; SCHOLLER, *op cit.*, p.80.

[55] *Die deutsche Zuckerwirtschaft*, Berichte über Landwirtschaft, New Series, Supplement 18, (Berlin 1931), p.54.

[56] SPOHR, *op cit.*, p. 22.

season from October to January and paid the beet-factories' invoices some months later in considerably devalued currency.[57] The refineries, on the other hand, gained privileged access to central bank credit through the *Reichszuckerstelle* and were able to dispose gradually of the finished product at current inflated prices.[58]

Initially, in the early 1920s, the formation of combines based on beet-factories in central and eastern Germany was partly motivated by surplus capacity for raw-sugar production. The acquisition of refineries also provided some access to the privileged financial arrangements available to that sector of the industry. On the other hand, although there was some resistance amongst the refineries to being taken over by companies of beet-factories, most had no choice but to accept the situation on account of the excess capacity in the sector.

One of the largest of the combines to emerge was the Union of Central-German Raw-Sugar Factories *(Vereinigung mitteldeutscher Rohzuckerfabriken)* formed on 5 December 1921 and embracing 31 factories in the Halle district. As a tactic to acquire the Sugar Refinery Halle *AG*, the combine announced the intention to build a refinery of its own and the Halle concern was informed that it faced a choice of either selling out to the combine or being starved of local raw-sugar. The refinery chose the former alternative and its shares were acquired by the combine, the cost being distributed amongst the beet-factories on the basis of their output of raw sugar.[59]

By October 1923 an additional nine individual beet-factories had joined the combine, along with another combine comprising nine factories and the Refinery Holland (a converted "white-sugar factory") As a consequence, the refining capacity of the combine became inadequate and steps were taken to acquire the shares of the Refinery Rositz *AG*: again of the cost being borne

[57] *ZVDZI*, Vol LXXI, 1923, *Allgemeiner Teil*, p.309; Pappe, *op cit.*, p.31.
[58] Spohr, *op cit.*, pp.11-12.
[59] See Pappe, *op cit.*, pp.47-50.

by the factories according to their raw-sugar output. A year later the modern refinery at Alten was acquired from another combine, the Rhenish Share-Association for Sugar Manufacture. The Alten refinery had a chocolate factory attached to it. A saw-mill was then purchased with a capacity sufficient to meet the combine's needs for packing cases. In addition, the combine purchased lignite mines to supply the fuel to the participating factories, as well as limestone quarries and sack manufactories.[60]

In August 1923, in order to raise capital to finance production, takeovers and investment in expanding raw-sugar output, the Central-German combine established its own bank, the Sugar Credit Bank *AG*. This was the first bank to be formed during the hyperinflation on a $US basis: its share capital being denominated in "fixed Marks" at the rate of 4.2 to $US 1. Backed by the firms in the combine, and the Darmstädter and National banks, an initial loan of 12 million "fixed Marks" (i.e. $US 2.857 million) was floated.[61] As with German Sugar Bank *AG* that was established by another combine around the same time, the Sugar Credit Bank became heavily dependent upon short-term U. S. capital flowing into Germany.[62]

By contrast with the movement towards vertical integration in the sugar production branches of the industry, the emancipation of the industry from integration with agriculture preceded apace, after a temporary suspension during the war and early postwar years. As Table IV below indicates, direct cultivation of beet by the sugar companies, which accounted for a minute fraction of total output by the early 1920s, declined by a further 27.5 per cent between 1923/24 and 1930/31. The proportion of beet supplied by shareholders reached an historical peak in the mid-1920s, at around 50 per cent of the total, before declining to about a third by the end of the 1920s. Beet cultivated by grow-

[60] *Die deutsche Zuckerwirtschaft, op cit.*, pp.54-5; PAPPE, *op cit.*, pp. 51-4; SCHOLLER, *op cit.*, p. 80.

[61] PAPPE, *op cit.*, pp. 47-50.

[62] *CBZI*, Vol. XXXIII, No. 23, 8 Mar. 1924.

Table III
SOURCES OF BEET FOR SUGAR FACTORIES,
1923/24 - 1930/31

Season	Company beet (%)	Shareholder beet (%)	Puchased beet (%)
1923/24	4.0	51.0	45.0
1924/25	4.0	49.0	47.0
1925/26	4.0	48.0	48.0
1926/27	3.5	44.0	52.5
1927/28	3.3	40.9	55.8
1928/29	3.1	40.3	56.6
1929/30	3.0	37.5	59.5
1930/31	2.9	35.6	61.5

Source: *Die deutsche Zuckerwirtschaft* (Berichte über Landwirtschaft, New Series, Supplement 18, Berlin, 1931) p. 49.

ers unconnected with sugar production on the other hand, reached over 60 per cent in 1930/31.

The increasing proportion of purchased beet in total supplies to factories was to some extent a product of the interwar drift of the industry towards the west and south of the country, where peasant farms predominated in the structure of holdings. In part this was a consequence of the loss of factories and beet-growing land in the east through the Treaty of Versailles. In part it reflected a tendency of the industry to locate in close proximity to concentrated domestic markets, with the disappearance and subsequent limited recovery of the export market after 1914.[63]

The move towards the full utilisation of the beet-capacity of factories from the mid-1920s was more conveniently met by purchases of beet than by share issues involving an obligation to supply beet or negotiations with shareholders to increase the beet-supply obligation per share. This was particularly the case

[63] K. Switittl, 'Die räumliche und zeitliche Abhängigkeit der Weltzuckerproduktion von geographischen faktoren', *Weltwirtschaftliches Archiv*, Vol. XL, 1934, p.582. Between 1925 and 1930 the proportion of the sugar-beet area located in western and southern Germany increased from 8.5 to 16.9 per cent. *(Die deutsche Zuckerwirtschaft, op cit.)* p.34.

with relatively low beet prices and even more depressed grain prices that motivated non-shareholders to grow beet, as well as a general shortage of capital amongst agriculturalists. Given the latter situation, the increasing optimum scale of plant stimulated a search for alternative non-agricultural sources of capital to expand existing or build new factories on a larger scale. In 1924/25 the average volume of raw sugar produced per factory was 5,991 tonnes. By 1929/30 it had increased to 8,340 and to an exceptional 10,851 tonnes in 1930/31.[64]

The continuing disintegration of sugar-beet cultivation and processing, combined with the problems sugar faced in the market worldwide from the mid-1920s onwards, stimulated the revival of a conflict of interest in the industry. The situation was further exacerbated by the formation of regional combines of factories, whereby the overhelming majority of growers lost their former bargaining power derived from factories competing for beet.

On this occasion the revival of the open conflict of interest between buyers and sellers of beet had far more serious political consequences than in the immediate pre-war years. The Nazi party made a particular effort to obtain the support of beet-growers.[65] In contrast to the *ante-bellum* era, the organisation of beet-growers spread beyond western and southern Germany to the central and eastern regions where the industry was especially concentrated. In the mid-1920s the emergence of a grower organisation in Central Germany brought the response of a Union of Sugar Factories embracing most establishments in the region.[66]

The militancy of growers by the later 1920s began to exceed even that expressed during the so-called "Sugar-Beet War" in

[64] SEWERING, *op cit.*, p.11.

[65] See JOHN PERKINS, 'The German Beet-sugar Industry and the Nazi Machtergreifung of 1933', in B. ALBERT & A. GRAVES (eds.) *The International Sugar Economy in War and Depression* (London, 1988) pp. 26-35.

[66] *CZBI*, VOL.XXXIII, No. 5, 24 Jan. 1925.

the Palatinate in 1913.[67] With a falling sugar price, the combines endeavoured to survive by reducing the price paid for beet to unremunerative levels. The Social Democratic party *(SPD)* attracted the hatred of growers for its demand for an even lower sugar price in Germany, as prices continued to fall on the world market, and this hatred extended to Weimar democracy as a whole. By 1933, 'The Imperial Association of German Purchase-Beet Growers, and the incorporated associations of Central, East, South and West Germany, [had come to] stand, unanimous and determined, behind the National-Socialist leadership of German Agriculture'.[68]

[67] See LANGSDORF, *op cit.*, p.130.
[68] *CBZI*, Vol. CLI, No. 22, 3 June 1933.