Lessons Learned: Organizing Knowledge in the Friesian Dairy Cluster (c. 1885–1904)

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Abstract

This paper examines the early years of the Friesian Dairy School and is a case study of how knowledge institutions were integrated into a regional economic cluster. The dairy school was the result of cooperation between people and organisations from the economic and political sectors, which inspired the emergence of an industrial dairy cluster. The school had a difficult start because it was not clear whether higher education was a matter of private or public interest. In the discussions about the funding and direction of the school, we can observe how patterns of cooperation in and between the economic sector and the state were shaped. The study shows how cooperative structures originate in processes of trial and error. Cluster evolution can therefore be driven by both discord and consensus within economic networks. The result of such non-linear and multi-scalar developments ultimately reflect a clear differentiation of tasks between economic actors, the state and knowledge institutions.

1 Introduction

The building of cooperative structures between individuals and organisations is given an important position in cluster theories. Geographical proximity eases face-to-face contact, which has a stimulating effect on informal ties. According to this line of thought, regionally entrenched networks instil a group feeling which has a stimulating effect on the establishment of shared knowledge institutions.[1] Many of those involved in current clus-

1 S. Cruz and A. Teixeira, 'The evolution of cluster literature: shedding light on the regional studies – regional science debate', *Regional studies* 44:9 (2010) 1263–1288, 1266.

ter policies concentrate their activities on the establishment of infrastructure for research, development and vocational training. Such strategies have also proved to have influenced the development of economic clusters in the past. As a consequence of the Industrial Revolution, territorially bounded rural production systems were confronted with new technological possibilities for the processing of their agricultural commodities. Production methods became more complex and one way of responding to the challenge this posed was to establish institutions which trained primarily young people in how to exploit these new economic opportunities. Major obstacles, however, were the investment costs of building knowledge institutions. Who should pay for the schools, laboratories, research centres and so on? The answers were far from clear in the last quarter of the nineteenth century. Ideological barriers and practical impediments held back the agricultural knowledge infrastructure in the Netherlands compared to other European countries.[2]

Clusters have helped overcome these barriers and impediments. Professional lobby groups, organised by regional networks, laid the foundations for agricultural schools. The building of a *national* infrastructure was a minor issue for the representatives of these networks, who were embedded in particular agricultural traditions. These actors were driven foremost by the conviction that knowledge was a crucial asset in order to modernize their regional economic production systems. It would be inaccurate, however, to attribute the foundation of schools to regional initiatives alone. Knowledge infrastructures were in fact bolstered by extra-regional forces; knowledge driven development of clusters was not a simple bottom-up process. A recent and critical evaluation of the cluster literature called for a 'further understanding of how factors at different geographic scales interact and influence cluster development paths'.[3] This article aims to contribute to such a multi-scalar perspective on cluster development. Moreover, it wants to study the inevitable dynamics which arise between individuals and organisations who are working together on shared facilities for education and vocational training. Some parts of the cluster literature emphasize the importance of social and cultural aspects, and this may give observers (unintentionally or not) the feeling that cluster evolution comes along with

2 L. van Molle, 'Kulturkampf in the countryside. Agricultural education, 1800-1940: a multifaceted offensive', in: C. Sarasúa, P. Scholliers and L. van Molle, *Land, shops and kitchens. Technology and the food chain in twentieth-century Europe* (Turnhout 2005) 139-169; N. Vivier (ed.), *The state and rural societies. Policy and education in Europe 1750–2000* (Turnhout 2008).

3 M.Trippl, M. Grillitsch and A. Isaksen, 'Perspectives on cluster evolution: critical review and future research issues', *European planning studies* 23 (2015) 2028-2044, 2037.

a sphere of consensus. But among those aspects that influence clusters, many can be characterized by disputes and competition.[4]

The multiple levels and the internal dynamics of cluster development will be investigated with the help of a dairy school built in the Friesian town of Bolsward. It was founded as a private initiative in 1889, closed in 1899 and reopened in 1904 as a state school. We will track the organisational history of the Friesian dairy school, which was characterized by discussions with and between economic actors and the national state. Internal tensions were overcome through a process of trial and error, in which each actor adapted its expectations of the school and of the role each would play. New cooperative structures were built by adapting to new circumstances, thus fostering the emergence of a Friesian industrial dairy cluster with a knowledge institution. Against this background, the central questions addressed by this article focus on actors and the cooperation between them: who was involved in the foundation of the first (1889) and second (1904) dairy schools and how did they cooperate? How did the ideas about and expectations of the dairy school change? The primary sources used for this article – besides newspapers and the archives of the Friesian Agricultural Society – are the archive of the Friesian Dairy School, the archive of the Department of Education of the Ministry of Internal Affairs, and the archive of the National Agricultural Commission. The article is structured as follows. First, we will place the case study more explicitly in its historiographical context. Then we will embark on the ideological reasons for the quite late foundation of a Dutch–Friesian dairy school, compared to other European countries. We will then provide a sometimes quite detailed description of the foundational process between 1885 and 1904. In our conclusion, we will again relate the case study to the broader theme of cluster development.

2 Historiographical overview

In the literature, Friesland is viewed as a core region of the Dutch dairy industry. Its literal basis is the clay and peaty soil in the southwestern and central parts of the province, on which rich pastures could develop. Even in

4 J. Zeitlin, 'Industrial districts and regional clusters', in: G. Jones and J. Zeitlin (eds.), *The Oxford handbook of business history* (Oxford 2008) 219–243, 226.

preindustrial times, these areas specialized in dairy farming, with large and professional agricultural firms distributed evenly across the region.[5] Manually creamed milk was churned into butter, which was sold through market towns such as Sneek and Leeuwarden to urban markets in the western Netherlands. In the eighteenth and nineteenth centuries, the English market developed as a main buyer of Friesian butter, which was shipped from the harbour of Harlingen. The transformation from manual to mechanized dairy production has been described as a process dominated by hesitance: Friesian farmers underestimated the opportunities presented by new technologies. Partly based on sources from critical eyewitnesses, this view entered the historiography through the evaluation in the 1950s of the work of the Dutch 'Danish Commission'.[6] This commission was established in 1878 to learn from German and Scandinavian dairy production. The commission dismissed importing into the Netherlands the system of processing milk from several farms at a central location, as was done in Denmark. According to three elderly commission members, this conflicted with the Friesian butter production methods in medium-sized, family-owned farms. This stance was rather traditional, so in a sense the historiography is correct. However, at that time it would hardly have been possible to foresee the technological breakthrough of 1879, when the Swedish engineer Gustav de Laval perfected an earlier prototype mechanical milk separator.[7] Working with the machinist Alva, this Alva de Laval separator entered the Dutch market in the 1880s.[8] It enabled large quantities of milk to be creamed very quickly and easily, making it profitable to establish dairy companies and separate butter and cheese production from dairy farming. This transformation has been described in many articles and books, and is part of the

5 J.J. Spahr van der Hoek, *Geschiedenis van de Friese landbouw*, dl. 1 (Leeuwarden 1952) 113-122; M. Knibbe, *Lokkich Fryslân: een studie naar de ontwikkeling van de productiviteit van de Friese landbouw 1505-1830* (Groningen 2006).

6 J.P. Wiersma, *Erf en wereld. Over de agrarische toestand in Friesland na 1870* (Drachten 1959) 34-36; Spahr van der Hoek, *Geschiedenis*, dl.2, 234.

7 M.S.C. Bakker, 'Boter', in: H.W. Lintsen (ed.), *Geschiedenis van de techniek in Nederland. De wording van een moderne samenleving 1800*-1890, Deel I. Techniek en modernisering. Landbouw en voeding (Zutphen 1992) 103-133.

8 J. Bieleman, 'The emergence of mechanized dairying in the northern Netherlands, and particularly in the provinces of Drenthe and Friesland', in: Y. Segers, J. Bieleman and E. Buyst (eds.), *Exploring the food chain. Food production and food processing in Western Europe, 1850-1990* (Turnhout 2009).

Friesian historical canon. Many of these works focus on the description of individual companies, or a group of companies. The cooperative movement has been a particular focus of many historical works.[9] Although these works do consider the connections between individuals and organisations, there is still need for a more systematic approach to the connections between the individuals and organisations which made up the Friesian dairy cluster.

This becomes clear when we consider the history of Dutch and Friesian knowledge institutions in more detail. The historiography of agricultural education in the Netherlands is characterized by general overviews and studies of individual schools and groups.[10] Some provide extensive or more concise descriptions of the wide variety of schools, and how they were incorporated in the evolving state educational policies.[11] Of note is the history of the State Agricultural School in Wageningen (*Rijkslandbouwschool*), which was founded in 1876.[12] This school developed into the academic centre of Dutch agriculture in the twentieth century, much to the disappointment of Groningen, where an agricultural school had been founded in 1842. That school was closely connected to the University of Groningen, but it did not succeed in achieving the status of a state school and had to close in 1870, including its practical facilities in the nearby village of Haren.[13] Schools with a focus on particular branches of agriculture were also short-lived. Among them were the Horticultural School in Watergraafsmeer/Amsterdam (1867–1882), the School for Forestry in Frederiksoord (1887–1892), and the Dairy School in Oudtshoorn, which was

9 K. Tjepkema, *Dat is 't kondensfabryk: een halve eeuw coöperatieve condensindustrie in Friesland* (Leeuwarden1963); C.F. Roosenschoon, *Bakens in de tijdstroom. Een kenschets van de Bond van Coöperatieve Zuivelfabrieken in Friesland bij het 75-jarig bestaan, 1897-1972* (Leeuwarden 1972).

10 M. van den Burg, *Geen tweede boer. Gender, landbouwmodernisering en onderwijs aan plattelandsvrouwen in Nederland, 1863–1968* (Wageningen 2002).

11 N.B. Goudswaard, *Agrarisch onderwijs in Nederland 1783–1983* (Culemborg 1986); P. Kooij, '*Het landbouwonderwijs in de twintigste eeuw*', in: M.G.J. Duijvendak, E.H.K. Karel and P. Kooij, *Groen Onderwijs. Terugblik en uitzicht naar aanleiding van het 100-jarig bestaan van de Vereniging voor Hoger Landbouw Onderwijs 1906-2006* (Groningen and Wageningen 2008) 9–42; H.A. Benda, *Weten en laten weten. 100 jaar onderwijs, voorlichting en onderzoek in de landbouw* (The Hague 1976).

12 J. van der Haar, *De geschiedenis van de Landbouwuniversiteit Wageningen* (Wageningen 1993).

13 R. Paping, '*Die waardige man'. Prof. H.C. van Hall (1801–1874), botanicus, landhuishoudkundige en pionier van het hoger landbouwonderwijs* (Groningen 1996) 178. In the small town of Warffum, also located in the province of Groningen, another agricultural school started in 1870 as a division of a school for higher secondary education (HBS), but it closed in 1875.

planned in 1881, opened in 1889 and closed in 1892.[14] Severeal reasons have been offered for these schools' failure in discussing the difficulties they faced, including controversies about the curriculum, financial deficits and a shortage of professional teachers.[15] Only the School for Horticulture in the Drenthe village of Frederiksoord, established in 1884, survived until 2004.[16] The Friesian dairy, which was crucial within the development of the Friesian dairy cluster, was short-lived too. It started in 1889 as a private initiative but was closed in 1899. It opened again in 1904, but this time as an official institute of the Dutch state. It was one of the first schools of higher education in agriculture and agribusiness, but it has not yet been the subject of any in-depth historical research paying attention to its relationships and position in a broader regional economic network.[17]

Occasionally, the cited works do consider the extent to which schools are bound up in regional networks, although this is never the main focus. This might be related to the observation of Segers and Hermans, who stated that 'agricultural education was mainly a top-down affair' in most European countries.[18] However, we can see the influence of regional contexts even within national knowledge institutions.[19] Moreover, literature on agricultural schools from other countries have studied the place based characteristics of educational facilities, and the regional contexts that influenced knowledge infrastructures. The Swedish government, for example, subsidized agricultural schools as early as the 1830s. Institutional frameworks provided broad scope for initiative to local parishes, so that agricultural schools were unevenly distributed across the country.[20] In 1840 the Grand Duchy of Tuscany established an academic institute for agriculture, thus marking the passage from private to public initiatives in

14 R.H. Rijkens, 'Landbouwonderwijs', in: *De Nederlandsche landbouw in het tijdvak 1813–1913* (The Hague 1913) 91–130, 125.

15 Goudswaard, *Agrarisch onderwijs*, 157.

16 F. van der Bij, *Gerard Adriaan van Swieten Tuinbouwschool. Frederiksoord 1884-1984* (Frederiksoord 1984).

17 For descriptive overviews, see: Spahr van der Hoek, *Geschiedenis dl. 2*, 247-250; G.L. Hemink et al. (eds.), *75 jaar levensmiddelentechnologie Bolsward* (Meppel 1979).

18 Y. Segers and R. Hermans, 'Between ideology and science: higher agricultural education in Belgium and the development of a Catholic agricultural network, 1850–1914', *Agricultural History Review* 57:2 (2009) 236–256, 239.

19 For an analysis of how academic research is inspired by the regional contexts of universities, see: K. Melis and M. Molema, 'Wetenschap in een regionale context. Sociologie en economie aan de Rijksuniversiteit Groningen', *Studium* 5:2, 95–109.

20 A. Nilsson and L. Pettersson, 'The state or the people? Government policies and popular movements in education and training in 19th century Swedish agriculture', in: N. Vivier, *The state*, 215–230.

Italy. The goals and curriculum of the school were highly affected by the agricultural system of Tuscany.[21] The implementation of agricultural education in other countries was rife with complications, though, and initial plans had to be adapted. However, they were all ahead of the Netherlands. This might have been because of the structure of Dutch agriculture. In the early twentieth century the agricultural expert Rijkens stated that the Netherlands lacked an agricultural elite who could stimulate and/or facilitate the emergence of an educational system for agriculture.[22] This could be explained by the low demand for the subject. With reference to enrolment numbers, some historians have argued that there were not many students who wanted to be trained in agriculture.[23] This was most likely true of peasant farmers who trained their children on their own (small) farms. The need for agricultural education may therefore have been low. For the sons and daughters of dairy processors this was certainly true. Before the introduction of new technologies, people were trained entirely on the job. But in the latter quarter of the nineteenth century dairy production methods transformed from manual to mechanical. This transformation increased the complexity of the production process, resulting in a commensurate increase in the demand for sound education.[24] The demand for education could be strongly regionally rooted, as the Friesian dairy school indicates.

3 A change in ideologies

In a literature synthesis the economists Cruz and Texeira sketched out the three 'most relevant' elements of the cluster concept: geographical proximity, social networks and a shared culture.[25] How do these elements express themselves in the Friesian dairy cluster? The Friesian clay and peat soils – the perfect land for growing grass which cows eat and process into milk – were fundamental to the cluster. From the Middle Ages on, Friesians specialized in dairy farming which yielded an excellent export base in

21 R. Pazzagli, 'From private initiative to state intervention: the origins of public agricultural education in Italy', in: Vivier, *The state*, 231–246.

22 Rijkens, 'Landbouwonderwijs', 92.

23 Paping, '*Die waardige man*', 181; Kooij, 'Het landbouwonderwijs', 11–12.

24 In other branches of agribusiness, a similar quest for education was at stake, see for example: M.S.C. Bakker, 'Industrieel onderwijs en de Nederlandse suikerindustrie', *Jaarboek voor de geschiedenis van bedrijf en techniek* 2 (1985) 151–172.

25 Cruz and Teixeira, 'The evolution', 1266–67.

the nineteenth century. In 1865, Harlingen exported over 11 million kilograms of butter, around three quarters of all Dutch butter exports in the period. The majority went in forty-kilo barrels from Friesland to London; England bought forty percent of its imported butter from the Netherlands.[26] Their commercial success gave the Friesian dairy farmers a sense of group identity. Large farm-owners met each other and mixed with notable citizens in the Friesian dairy school, of Agriculture and Cattle Breeding. This association ('the Society') was founded in 1852 and pursued the economic interests of the agricultural community. At its annual meetings, the members of the Society discussed several themes, such as trade policies or new production methods. Organised into thirteen local departments, the geographical reach of the Society was extensive. The Society can be regarded as a social network for the Friesian agricultural sector during the nineteenth century, a network which was characterized by a conscious cultural identity backed by economic success.

In the last 25 years of the nineteenth century, however, a dramatic sense of disaffection took hold over Friesian dairy farmers. Their traditional methods of producing butter on their own farms was challenged by organisational and technological innovations. National competition rose because of the less expensive substitute, margarine, which took some market share from 'real' butter.[27] Moreover, foreign competition increased. The fall in the Dutch market share of English imports offers some indication: it sank to eight percent in 1890.[28] Denmark in particular was regarded as the great competitor. New research into the Danish dairy sector underscores contemporary reports that its success resulted from knowledge-driven measures.[29] Danish knowledge infrastructures were stimulated by the national government, which played a far more active role compared to the Netherlands. For the greater part of the nineteenth century the relationship between the economic sector and the Dutch state was characterized

26 V.R.IJ. Croesen, *Geschiedenis van de ontwikkeling van de Nederlandsche zuivelbereiding in het laatst van de negentiende en het begin van de twintigste eeuw* (Den Haag 1932) 192–196; Spahr van der Hoek, *Geschiedenis*, 484.

27 The substitution of butter by margarine cannot be quantified exactly, but some numbers are telling: butter exports from the Netherlands to England decreased with 66 percent between 1884 and 1888, whereas margarine exports increased with 59 percent in the same period. See: Bakker, 'Boter', 108.

28 Croesen, *Geschiedenis*, 192, 195.

29 I. Henriksen and K.H. O'Rourke, 'Incentives, technology and the shift to year-round dairying in late nineteenth-century Denmark', *Economic History Review* 58:3 (2005) 520-554; M. Lampe and P. Sharp, 'Just add milk': a productivity analysis of the revolutionary changes in nineteenth-century Danish dairying', *Economic History Review* 68:4 (2015) 1132-1153.

by its liberal principles, with politicians adopting a *laissez-faire* attitude. At the time, Dutch politicians were convinced that the state should not be actively involved and that initiatives to improve agricultural education should come from society itself. Once an initiative was serious and well organised, the state would then support it with subsidies based on the 1862 Secondary Education Act.[30]

There was a thin line between state reluctance and the outright rejection of all initiatives, however. Proposals for the foundation of an agricultural school from the local administrators of Franeker (1866) and Dokkum (1880) were refused by the national government.[31] The modest role of the state made it easy for politicians and the responsible ministers not to spent any effort and resources on local initiatives. This political climate explains why the Society was not involved in lobbying for schools in Franeker and Dokkum. Members of the association were rather liberal too, they were self-confident, trusted in their independence and were, on average, not in favour of strong state involvement. The general sense of disquiet from about 1875 onwards was the first sign that the liberal doctrine within the Society was losing ground. Inspired by the loss of market share and the fall in butter prices, a sense of urgency spread within the Society. The insistence on strategic action was expressed by new and in most cases younger members. For example, in the annual general meeting of 1882 the newly elected president, Dirk Fontein de Jong (1836–1898), stated that agriculture deserved 'strong support' from the government.[32] Fontein de Jong was director of a flax factory and also a deputy on the provincial board of the Friesian regional government (*Gedeputeerde*). Moreover, he was a member of the commission which advised the government from 1887 to 1890 on agricultural policies (*Landbouwcommissie*). He became, as we will see, a key figure in the foundation of the Friesian Dairy School.

In the first year of Fontein de Jong's office, the issue of agricultural education was put on the agenda by a young school master called Vitus Bruinsma (1850–1916). In his doctoral thesis in chemistry, for which he

30 Documents of the House of Representatives, 1862-1863, no. XXXIX/2 '*Ontwerp van wet tot regeling van het middelbaar onderwijs*'. Article 19 on agricultural education was amended by parliament, but the possibility of state interventions in agricultural schools survived, see: J.M.G. van der Poel, *Het Landbouwonderwijs in Nederland tot 1918* (Wageningen 1976) 92.

31 *Landbouwcourant*, 21 February 1867; Tresoar Provincial Archive Frieslan (further PA), Archive of the Friesian Agricultural Society (inventory no. 144, further AFAS), dossier no. 928, Letter from the Ministry of Internal Affairs to the Board of the Friesian Agricultural Society, 7 January 1881.

32 Minutes of the annual general meeting of the Friesian Agricultural Society, 15 December 1882, in: *Mededeelingen en Berigten* (from now *MenB*) 15 (1882) 75.

received a PhD in 1875, Bruinsma proposed that education should be compulsory.[33] After his intervention at the annual general meeting of 1882, Bruinsma was invited by the board of the Society to expand his ideas, which he did in a report published in March 1884.[34] Under the Bruinsma plan, agricultural education in Friesland should comprise basic training in physics, chemistry, botany and zoology. Practical education within a three-year course would be conducted on a farm connected to the school. Moreover, both arable and dairy farming would be included in the Friesian curriculum. Investment in the establishment of the school was calculated along with its running costs.

Once the debate on his report began, Bruinsma must have been disappointed with the results.[35] The Society soon agreed on the basic principle that agricultural education should focus on youth. The method of education was highly disputed, however. At the core of the conflict were the different kinds of knowledge. On the one hand, many members of the Society clung to a practical type of knowledge, connected to the craft of farming and the skills involved. On the other hand, some influential members advocated scientific knowledge, which empowered farmers with the ability to deduce and experiment. These different types of knowledge led to discord not only in Friesland, but also at a national level and abroad.[36] Quite a few members of the Society had doubts about the need for theoretical education for future farmers. Their scepticism was increased by the high investment needed for a school and the cost to parents, whose children were the school's targets.

33 V. Bruinsma, *Over de electrolyse van organische stoffen in het bijzonder van zuringzuur* (Leeuwarden 1875), 100.

34 'Een Landbouwschool in Friesland. Rapport aan het Hoofdbestuur der Friesche Maatschappij voor Landbouw over de vraag: Hoe Friesland op de beste wijze kan geraken in het genot van theoretisch en practisch landbouwonderwijs?', in: *MenB* 17 (1884) 8–44. Bruinsma acted as the rapporteur with two other commission members.

35 Minutes of the annual general meeting of the Friesian Agricultural Society, 13 August 1884, in: *MenB* 17 (1884) 68–77.

36 'Verslag van eene vergadering tot bespreking van de meest doeltreffende middelen waardoor het Landbouw-onderwijs, hetzij door de Hooge Regeering, hetzij door provinciën, gemeenten, maatschappijen of particulieren, in Nederland kan worden in het leven geroepen', *Nieuwe Boeren-Goudmijn* (1872) issue 12; J. Harwood, *Technology's dilemma: agricultural colleges between science and practice in Germany, 1860-1934* (Oxford 2005).

4 Caught between economic actors and the state

Certainly, the founding of a Friesian school was not the result of a harmonious process grounded in a stable, conflict-free culture. The situation reminds us of the historical critique of the idea that geographical proximity leads to cultures of trust and cooperation.[37] History abounds with evidence to the contrary, where proximity is accompanied by discord and quarrels. From this critical perspective, the cluster literature idealizes cultural aspects and often overlooks situations of discord and competition. However, in this debate, the development of economic clusters can be regarded in the light of either a consensus or a discord framework. Discord and consensus do not exclude each other; both can have their positive and negative effects on cluster development. Moreover, both can operate at the same time, as happened in the process of founding the Friesian Dairy School.

After Bruinsma left the stage, his leading role was taken over by Dominicus van Konijnenburg (1841–1905). Van Konijnenburg was well-informed on the educational question because he was president of the department where Bruinsma first started lobbying. His departmental presidency also made him a member of the general board of the Society. In addition, he was secretary of the prestigious *Friesch Rundvee Stamboek*, the official register of Friesian cows. As an influential man of good reputation, he intervened in the debate which reopened in 1885.[38] His approach to overcoming the stalemate was to focus on *dairy* education, and thus lower the investment costs. Van Konijnenburg proposed a modest facility for three months of training at the most, similar to German dairy schools (*Molkerei Schüle*) which were private institutions. Young women aged from 16 to 18 would receive practical training, whereas young men would be trained in mechanical dairy processing methods.[39] In addition to the gender-specific training, what is most interesting in Van Konijnenburg's interventions is that he includes both the traditional methods and the new, industrial techniques in his plan. The Van Konijnenburg-plan is therefore typical of the transitional phase of the Friesian dairy cluster. From 1871 on, debate on industrial dairy processing meandered in the Friesian as well as the na-

37 Zeitlin, 'Industrial districts', 'Industrial districts', 226; Lars Nyström, this issue.

38 'Extraordinary meeting of the board of the Friesian Agricultural Society', 25 February 1885, in: *MenB* 18 (1885) 5–26.

39 'Addendum B [memo Van Konijnenburg] of the extraordinary meeting of the board of the Friesian Agricultural Society', 25 February 1885, in: *MenB* 18 (1885) 19, 34-36.

tional agricultural society.[40] Hardly any Friesian farmers had changed their production systems, however, so the Bruinsma plan was only slightly affected by this debate.

In the early 1880s, however, new events meant that industrial dairy processing would soon change from being a futuristic possibility, to a reality which was rapidly taking shape. The first dairy factory, 'Freia', was erected in 1879 in Veenwouden. This town in the east of the province was relatively remote from the cluster's western heartlands. Moreover, it did not use a mechanical centrifuge, which entered the market in the same year that Freia was erected. Three companies were founded in 1882 on the basis of this new technology. Their locations – Leeuwarden, Bolsward and Sneek – were the more central dairy production sites in Friesland.

Illustration 1. The first dairy school (1889-1899) in Bolsward. Mr. K. Tromp was the architect of the building. Source: collection J. Wijma, Bolsward.

40 Van den Burg, *Geen tweede boer*, 107–110.

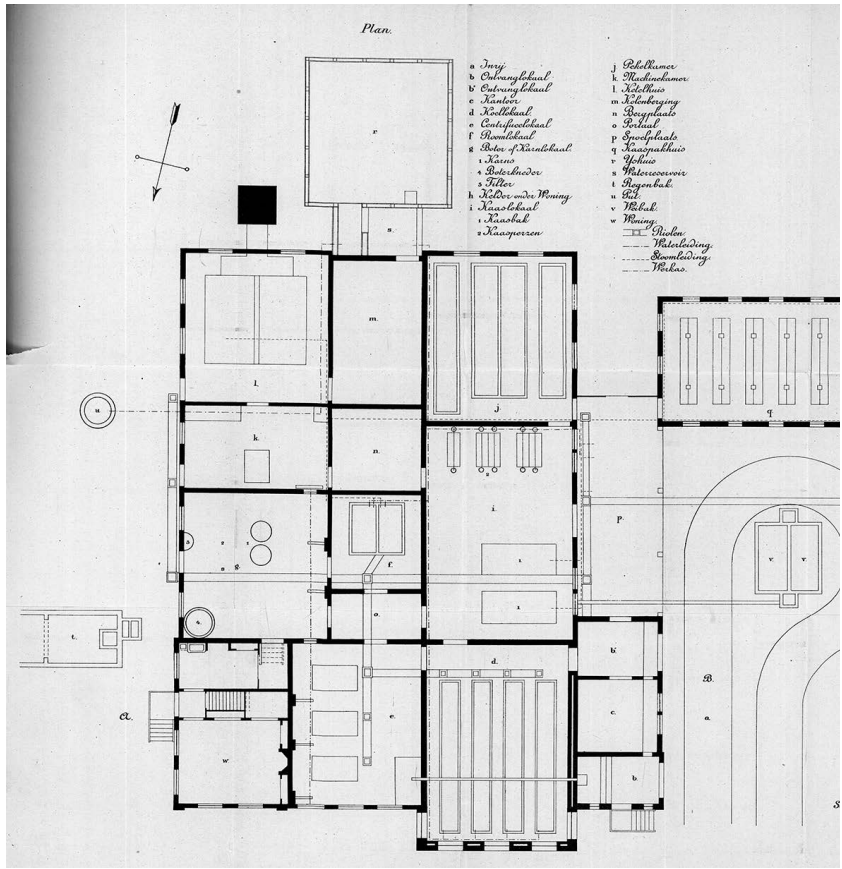


Illustration 2. Map of the first dairy school: both manual and mechanical methods were taught. Source: C. Treurniet en K. Tromp, De Zuivelfabriek. *Ontwerp betreffende etc.* (*Zwolle 1888*).

Against this background, it was easy for Van Konijnenburg to recognize mechanical technologies as the fruits of scientific knowledge. He advocated that Friesians should have access to these boons, just like the foreign competitors.[41] On 15 February 1885, a short article was published anonymously in the Society's newspaper, again emphasizing the need for a Friesian dairy school and pointing to Denmark, Mecklenburg, Prussia, Oldenburg and Hannover, all of which had schools.[42] What was not mentioned

41 Addendum B [memo Van Konijnenburg] of the extraordinary meeting of the Board of the Friesian Agricultural Society, *MenB* 18 (1885) 24-16.

42 'Verbetering der Zuivelbereiding een provinciaal belang', in: *Bijvoegsel behoorende bij MenB,* 15 February 1885.

was that it is unlikely that any of these schools taught industrial dairy processing. The article merely restated that these countries had outsold Friesian dairy products on the English market, meaning that the foundation of a Friesian dairy school was urgent. This article was probably written by Van Konijnenburg, who was a prolific writer of journal articles. Ten days after the publication of the article, the Society's general board decided by sixteen votes to four, after consulting each of the thirteen departments, to commit itself to a school focused on dairy farming, instead of a combination of arable farming and dairy training.[43] An important argument for this choice, we can conclude, was the threat of international competition and the fear of wiping out the Friesian diary.

A commission, established in the spring of 1886, was made responsible for the legal and financial preparation of the foundation.[44] Among its members were the president of the Society, Fontein de Jong, as well as Van Konijnenburg, whose ideas were a leading force in the school's organisation.[45] The school became an independent institution with a dual curriculum: training for manual and industrial processing techniques, just as Van Konijnenburg desired. On 6 March 1888 the King approved the statutes for an 'association for vocational education in dairy preparation in Friesland' ('Dairy School Association').[46] The Dairy School Association was based in Bolsward, because this town in the west of the province made the most attractive bid, offering financial and organisational contributions to the school. Alongside the municipality, the Bolsward-based *Gasthuisfund* backed the initiative with modest financial resources. Bolsward was at the time an important town for the Friesian dairy cluster. It was located in the middle of the traditional 'pasture corner' (*Greidehoek*) and housed one of the first dairy companies.

43 'Minutes of the extraordinary meeting of the board of the Friesian Agricultural Society', *MenB* 18 (1885) 5-26.

44 Minutes of the board meeting of the Friesian Agricultural Society, 23 April 1886, in: *Mededeelingen en Berichten*, 15 May 1886. During 1885 it was decided to publish *Medeelingen en Berichten* on a weekly basis – this changes the way how we will refer to the Society's journal after 1885 too.

45 D. van Konijnenburg, 'Open letter to the board of the Friesian Agricultural Society', *Mededeelingen en Berichten*, 15 February 1886.

46 Addendum *Nederlandsche Staatscourant* no. 85 (10 April 1885) 11.

Table 1. Subsidies for the Dairy School in guilders (1890)

National government	2.000,-
Province of Friesland	1.000,-
Municipality of Bolsward	500,-
Members of the Dairy School Association	445,-
St. Anthony Gasthuisfund	300,-
Other	267,-

Source: National Archives, Archive of Internal Affairs (2.04.10), inv. 683, Financial report 1890 Dairy School.

Most crucial in the foundational process, however, was the state's involvement. The coming together of the economic actors and the state became evident through their financial and organisational ties. The province of Friesland was the first state organisation which was prepared to provide an annual subsidy to such activities in the common good. The national administration was the most important annual financier (see table 1). In order to organise and legitimize the assistance from the Ministry of Internal Affairs, which was responsible for education policy at the time, the Friesian Dairy School had to be incorporated into national political structures. The Friesian initiatives coincided with a national trend for greater state involvement in agricultural matters. In the last fifteen years of the nineteenth century political involvement, instigated by the agricultural crisis of the 1880s, gave rise to a Dutch 'agricultural institutional matrix'.[47] The Agricultural Commission, consisting of twenty-five members selected for their academic, political and agricultural experience, played a central role in this process. During the period from 1887 to 1890 it issued several recommendations on quality control systems, research and development, education and land use. One of its first recommendations was on the provision of help to agricultural schools for vocational training.[48]

This recommendation was crucial for legitimizing state involvement in the Friesian dairy cluster. Regional interests overlapped with the national interest in a strong agricultural sector. Fontein de Jong, president of the Society and a member of the Agricultural Commission, was the main ar-

47 A. Schuurman, 'Agricultural policy and the Dutch agricultural institutional matrix during the transition from organised to disorganised capitalism', in: P. Moser and T. Varley (eds.), *Integration through subordination. The politics of agricultural modernisation in industrial Europe* (Turnhout 2013) 65–85; J. Bieleman, *Boeren in Nederland. Geschiedenis van de landbouw 1500-2000* (Amsterdam 2008) 310–313.

48 'Advies over de wenschelijkheid om landbouwvakscholen van Staatswege te subsidieeren', *Staatscourant*, 14 May 1887.

chitect of this recommendation. As president of the Friesian Agricultural Society, he had contacted the Minister of Water Management, Trade and Industry. The Minister forwarded Fontein de Jong's request for a subsidy to the Agricultural Commission.[49] In a clever double move Fontein de Jong used his own letter to the Agricultural Commission as part of a successful bid to gain backing for the Friesian initiative.[50] As a result the Friesian Dairy School was able to receive assistance before the Agricultural Commission issued its advice on the national system of agricultural education.[51] Thanks to Fontein de Jong, an item for the assistance of agricultural schools for vocational training was included in the state's budgetary plan of 1888. One year later, eight farmers' sons with an average age of twenty-two started their education at the new dairy school.[52]

5 Cultural adjustment

It soon turned out that the school's curriculum was too much a product of compromise to be successful. Originating in the Van Konijnenburg-plan, both the old and the new mechanical techniques for making butter and cheese were taught. We must recall that the author of this plan spelled out this dual character while representing a society many members of which were sceptical about teaching agricultural theory. Nevertheless, theoretical courses in the natural sciences, physics, chemistry, botany and zoology were taught during the afternoon. With hindsight, these theoretical courses were remarkable, because Van Konijnenburg and others had only emphasized the need for practical training. The theoretical courses were, however, a concession to the Ministry of Internal Affairs, whose inspector criticized the limited amount of theory to be taught when he read the draft curriculum.[53] This resulted in the inclusion of more theoretical courses within the three-month course.

Despite these adaptions to the Van Konijnenburg plan, the school still

49 NA, Archive of the Agricultural Commission (inventory no. 2.11.25, further AAC), dossier no. 2, minutes of the board of the Agricultural Commission, 19 January 1887.

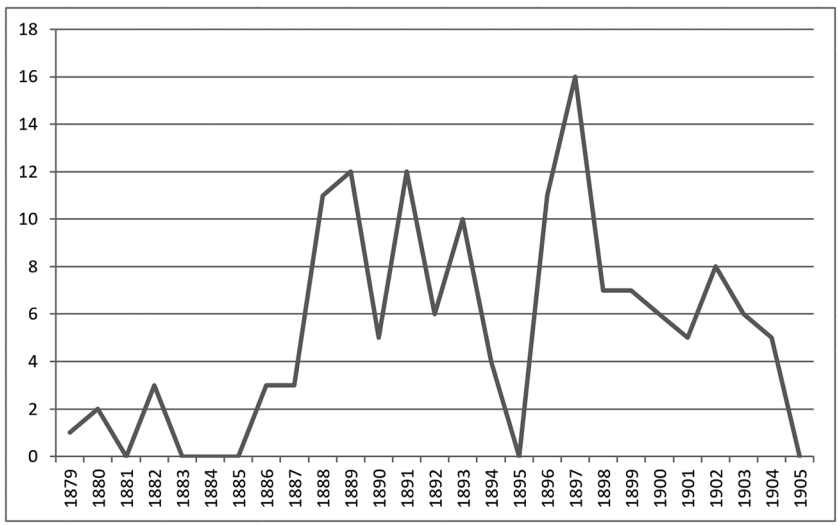
50 NA, AAC, dossier no. 2, minutes of the Agricultural Commission, 4 April 1887.

51 'Advies betreffende de regeling van het landbouwonderwijs', *Staatscourant*, 30 May 1888.

52 NA, Archive of Internal Affairs, dept. of Education (inventory no. 2.04.10, further AIAdE), dossier no. 683, Verslag van den toestand en de werking van de Zuivelschool te Bolsward. 4 november 1889 – 1 maart 1890.

53 NA, AIAdE, dossier no. 683, Nota betreffende het programma van onderwijs & het onderwijzend personeel aan de op te richten School voor Zuivelbereiding, 6 juni 1888.

did not meet its high expectations. Dynamic economic developments increased the mismatch between the goals envisaged by the school's founders and the expectations of the students as well as and particularly of the emerging dairy industry. Industrial dairy companies were growing fast from 1885. The first cooperative dairy factory was erected in 1886, the second followed in 1887 and in 1888, ten cooperative dairy companies were founded in a single year (see Figure 2). However, the curriculum was not substantial enough for the responsibilities required for managing a dairy factory. There was a great deal of discomfort at this, which illustrated how difficult it is to reach consensus in times of change. Expectations of the school were rooted partly in the pre-industrial period, but because of the rapid industrial development, these expectations were disappointed by those stakeholders involved, leading to fresh discussions.



Graph 1. Number of dairy companies erected in Friesland, 1879-1905
Source: Cultuurhistorische Kaart Friesland.

The discussions between the founders of the Friesian Agricultural Society, the Dairy School Association, and the representatives of the state aimed to reach a new consensus. In an attempt to better align educational objectives and societal demands, a reorganisation process was started. The Association board members decided to focus entirely on industrial

dairy processing in November 1892.[54] This dissociation from practical training in dairy processing on the farm was preceded by a recommendation from F.B. Löhnis (1851–1927), who took office as the first inspector of agricultural education in 1892. Löhnis took a broader view. A school linked to a farm had been opened in the province of South Holland, whereas the Friesian school tended more towards training for industrial processing. A national division of tasks helped legitimize the focus on industrial dairy processing in Friesland. The first new course started in July 1894 and was extended from three to six months. Nevertheless, after this first reorganisation the problems were not solved. Students still lacked the practical and theoretical background to understand all their courses. Moreover, feedback from dairy companies indicated that the alumni were not well enough equipped to manage tasks in factories. Dairy product sales were also unprofitable, with the cost of natural resources leading the returns and endangering the school's future. The director of the school complained that he did not have enough time for the theoretical courses, because the milk (which was delivered daily) had to be processed with the students' help.

In an attempt to reach an unified solution to all these problems, a second reorganisation process was started in 1898. The initiator of this process was Johannes Mesdag (1850–1932). Mesdag combined his chairmanship of the Dairy School Association with the his role as dairy counsellor to the Friesian Agricultural Society.[55] Mesdag's academic training was in physics. He was an influential man who stood out for his engagement with students and his knowledge, and for his tenacity. Under his chairmanship, the Dairy School Association flourished and eventually his reorganisation plan was embraced by all stakeholders in the cluster, including Löhnis. Proposals for statutory changes led to a clear mission statement: the school focused 'entirely on theoretical education' and its target group was described as 'those who wish to be appointed as the director of a dairy company' later on in their careers. Admission requirements were expanded. Students had to have practical training in a dairy company for at least one year. This, and other more detailed aspects of the curriculum, were approved by all members of the association.[56] More difficult was the

54 Archival depot of the Ministry of Economic Affairs, Deventer, non-inventoried Archive of the Friesian Dairy School, minutes of the board meeting of the Dairy School Association, 19 November 1892.

55 S. de Boer, 'Bruggenbouwer tussen wetenschap en praktijk: de zuivelconsulent in Fryslân rond 1900', *De Vrije Fries* 96 (2016) 127-144.

56 Idem, General Meeting of the Association, 23 December 1899.

question of whether the school had to move to Leeuwarden or stay in Bolsward. New courses had to be postponed in 1900 in expectation of the reorganisation, which was never reported by the Dairy School Association. The question of where the school should be based was so controversial that the Association was liquidated in 1901 and dairy education in Friesland was taken over by the state.

6 Cluster dynamics

To understand the turmoil surrounding the decision as to where the Friesian Dairy School should be based, we should take into account the establishment of Leeuwarden as the centre of the Friesian dairy cluster. Because of the rise of the industry in the last fifteen years of the nineteenth century, several regional organisations were founded and located in Leeuwarden. The most important of them was the Union of Cooperative Dairy Factories, which was established in 1897. This was led by pioneers of the Friesian dairy industry. The board of the Union of Cooperative Dairy Factories consisted of outspoken and self-made men, who appointed a secretary to look after the interests of cooperative dairy factories on a full-time basis. The union was not that enthusiastic about the school.[57] Led by autodidacts, the union's board believed that training on the job was by far the most effective way of becoming the boss of a dairy factory.[58] Because of their scepticism, they demanded that the school be moved to Leeuwarden in return for their cooperation. This cooperation was greatly needed, because a crucial part of Mesdag's reorganisation plan was the training of students in dairy factories. This preparatory phase required close cooperation between the school and dairy factories, a cooperation which could be managed by the Union of Cooperative Dairy Factories.

Moving the school to Leeuwarden would be a blow to Bolsward, so in late 1899 it was put to a vote at a general meeting of the Dairy School

57 Idem, Meeting between the board of the association and the board of the Union of Cooperative Dairy factories, 8 March 1899.

58 Wiersma, *Erf en Wereld*, 147–148.

Association, where it was decided by 25 votes to 13 to remain in Bolsward.[59] This decision provoked strong opposition from the Union, as well as the Friesian Agricultural Society, whose headquarters were also in Leeuwarden. They protested to the Minister of Internal Affairs.[60] The Minister, however, sought advice from the Friesland administration. He wrote to the King's Commissioner, the highest state official in the Dutch provinces. In his reply the Commissioner ignored the question of where the school should be based. He felt the fundamental problem was its private nature, which he saw as the reason why it had been ailing for years. In order to establish an adequate educational system, he felt that the school should become a state institution.[61]

In 1900 the Friesian Dairy School reached a crossroads: should it continue as a state subsidized, private institution or be completely financed and directed by the state? The question was delegated from the Minister to H.J. Lovink (1866–1938). Lovink was the highest official (director general) of the Department of Agriculture, which was founded in 1898 under the umbrella of the Ministry of Internal Affairs. This was one of the results achieved by the Agricultural Commission which advised the government from 1887 until 1890. Under Lovinks leadership a series of state institutions for agricultural research and education were founded.[62] He pushed for the Friesian Dairy School to become an official state institution. Investment was set aside in the 1901 budget for the establishment of the school.[63] Lovink's Minister of Internal Affairs did not have to defend the investment, but he did have to explain why the school had to be located in Leeuwarden. He explained: 'The factory directors gather on a weekly basis in Leeuwarden, the butter inspections take place there, physics and bacteriology are taught there, and the centre of the whole Friesland dairy movement is there'.[64] This time, however, the Minister was overruled by Parliament.

59 Archival depot of the Ministry of Economic Affairs, Deventer, non-inventoried archive of the Friesian Dairy School, general meeting of the association, 23 December 1899.

60 NA, Archive Ministry of Agriculture, dept. of Agricultural Education (inventory no. 2.11.35, further AMAdAE), dossier no. 365, Letter from the Friesian Agricultural Society to the Minister of Internal Affairs, 5 October 1900; Idem, Letter from Th. Van Welderen Rengers, Van Konijnenburg, Veeman and others to the Minister of Internal Affairs, 17 January 1900. Rengers and Veeman signed as members of the Dairy School Association, but were also influential in the Union of Cooperative Dairy Factories.

61 NA, AMAdAE, dossier no. 365, Commissioner of the King to Minister of Internal Affairs, 17 May 1900.

62 Biographical Dictionary of the Netherlands, lemma Lovink, http://resources.huygens.knaw.nl/bwn1880-2000/lemmata/bwn2/lovink, accessed 7 July 2015.

63 *Proceedings of the States General* (from now *PSG*) 1900–1901, Appendix A, 2. V. 14, 49–50.

64 *PSG* 1900–1901, 35th meeting on 13 December 1900, 705.

Abraham Bouman, Member of Parliament for the district of Harlingen (to which Bolsward belonged), proposed an amendment on 13 December 1900, as the great majority of the assembly wanted the school to remain in Bolsward.[65] As the Minister of Internal Affairs and his civil servants clung to their preference for Leeuwarden, a second amendment for Bolsward was submitted. Jan Schokking, a clergyman in a village near Bolsward and Bouman's successor as MP for Harlingen, continued the parliamentary battle for Bolsward. His amendment of 24 December 1902 was again accepted by a majority.[66] The Minister of Internal Affairs then declared that he would implement the amendment. Bouman and Schokking were motivated by the local interests of Bolsward and the west of Friesland, but there was also a more ideological reason for their amendments. Driven by the cooperative movement, Leeuwarden was becoming the capital of the Friesian dairy cluster. This provoked opposition, instigated by concerns about the balance of power. This balance was partly geographical, since the other cities of Friesland were irritated by the fact that Leeuwarden was accruing increasingly many facilities to itself.[67] Another part of the concern resulted from the feeling that cooperatives had become too powerful, which could harm individual entrepreneurs and the 'private' companies. Therefore, even after the reorganisation of the dairy school was almost complete, the Friesian dairy cluster was not freed from internal tensions.

Construction of the school nevertheless started in Bolsward and on 1 October 1904 the second dairy school opened its doors to ten students. Before embarking on their courses, which lasted for eighteen months, they were carefully selected through an admissions procedure. Eight were examined in March 1906 and received certificates afterwards. They successfully followed the curriculum which had been so carefully prepared in the preceding twenty years. One year later it was reported that two of them had become directors of dairy factories and six of them assistant directors.[68] The long-discussed theoretical education for the dairy industry had achieved its aim. Meanwhile, the Union of Cooperative Dairy Factories started its own on-the-job training. It lasted for a period before the cooperative leaders in Leeuwarden resigned themselves to the political decision. But the debate about the school's natural location lasted throughout

65 Idem.

66 O. Santema and K. de Vries, 'De eenmansfractie Schokking in de Tweede Kamer tijdens het ministerie Kuyper (1901–1905)', *Christelijk Historisch Tijdschrift* 5 (1967) 9–17.

67 *PSG* 1900–1901, 35th meeting on 13 December 1900, 703.

68 Department of Agriculture, Industry and Trade, *Verslag over het landbouwonderwijs over 1904/1906* (The Hague 1907), 54.

the entire twentieth century. Only in the late twentieth century did it succumb to the centralization of powers within the Friesian cluster. The school lost its independence and merged with a larger organisation in Leeuwarden, which is today called the Van Hall Larenstein University of Applied Sciences.[69]

Table 2. List of examined courses (1906)

No	Course
1	Dairy preparation
2	Bacteriology
3	Chemistry
4	Physics
5	Mathematics
6	Nutrition and Health
7	Accounting
8	Dutch trade correspondence
9	French trade correspondence
10	German trade correspondence
11	English trade correspondence

Source: Students book, archive of Friesian Dairy School

7 Conclusion

The foundation of the first dairy school was a collective strategy of the Friesian Agricultural Society, the province of Friesland and the national state, intended to keep pace with competitors from neighbouring countries and regions. The foundation and failure of this first school were part of a learning process. Various tasks and responsibilities for achieving collective goals such as the improvement of the dairy *industry*, became clearer due to the disappointments experienced through the school's failure. Economic actors became used to a knowledge institution being an autonomous organisation responsible for educating people over a considerable period. At the same time, people involved in the dairy system expected the state to finance the school and control its direction. The same is true of politicians and agricultural policymakers, for history had shown that quality and continuity were at risk if direction was left in private hands. These lessons

69 R. Plantinga, 'Een opleiding van formaat. Een beeldverhaal over de Bolswarder zuivelschool (ca. 1880-1996) *De Vrije Fries* 96 (2016) 145-162..

were implemented in the second dairy school, which opened in 1904 and became the central location for the education of managers and directors of the Friesian dairy industry throughout the twentieth century.

The way connections between economic actors and the state were built was a whimsical process. As such, it underscores the necessity of unique narratives on singular cases. We can identify a more general mechanism also relevant to the debate on cluster development. During the experimental phases, people from various sectors reshaped their expectations of each other. Due to these fundamental discussions over how to proceed, patterns of cooperation between the business domain, the state and knowledge institutions became more clear. The inevitable frictions helped define each party's role. It is in these exploratory and tentative phases that differentiation of tasks becomes settled, based on everyone's new role expectations. The Friesian dairy school makes clear how such role expectations are produced during a dynamic process of trial and error. Moreover, this case-study showed the importance of a multi-level perspective in the study of cluster evolution. Bottom-up initiatives became fully profitable only after the State developed a framework in which the dairy school was embedded. The logical connection to this national framework provided the financial and organisational support from the Government, thus securing continuity and a standing reputation of the school.

We would also expect to find such learning processes and multi-scalar interactions in other clusters (including in agribusiness) where economic actors and the state have sought to establish knowledge infrastructures to help regional networks adapt to changing circumstances. Identifying and comparing these experimental stages may not only enhance our understanding of cluster development but also stimulate new research into how entrenched knowledge institutions are in regional networks of economic actors and the state.

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Economic Clusters, Knowledge Networks and Globalisation: Fruit Growing in Dutch Limburg, 1850-1940

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Abstract

This paper unravels and analyses how the fruit sector in the province of Limburg (The Netherlands) reacted to growing (inter)national competition between 1850 and 1940. Entrepreneurs, private and public organisations created shared facilities which operated on a regional scale, such as auctions and a state horticultural consultancy, to respond to this global competition and to stimulate the formation of a regional fruit cluster. This process of economic development is embedded in the emergence of knowledge networks, in which scientific and economic know how, mainly regarding product and processing quality, circulated between various actors. Initially, the fruit cluster operated mainly in a regional network, but from the First World War onwards it became increasingly integrated in a national network, steered by the government and agricultural associations.

1 Introduction

The rural economy in Western Europe and in The Netherlands underwent a structural transformation between 1850 and 1940. A first key factor was the switch from a farming system dominated by arable farming to animal husbandry and horticulture. The importance of fruit growing increased considerably during this period: the acreage expanded, production and yields increased, thanks to investments fruit cultivation took on a more commercialised and specialised character, fertilisation and disease control received more attention, etc. Of course, this was a gradual process and not all farmers participated equally. A second important development was the internationalisation and world wide integration of the agricultural and

food markets. This process of globalisation created opportunities for farmers to export their produce, but would also lead to growing competition on the internal market.[1] In The Netherlands the fruit sector expanded in some specific regions. The most prominent were South Beveland, Walcheren, the western part of North Brabant, Betuwe and South Limburg. In this contribution I analyse how the fruit cluster in Limburg, mainly concentrated on the plateau between the rivers Geul, Maas and Voer, reacted to this modernisation and globalization process. I choose this region for two reasons. Firstly, it was one of the core regions regarding fruit cultivation (acreage, production, etc.). Secondly, the specific peripheral location (caught between Belgium and Germany) makes it a good case to study the impact of globalisation.[2]

In order to unravel and understand the agricultural development of the fruit sector in South Limburg, I use ideas and concepts from economic geography.[3] To explain the success of a region, traditional theories refer to the importance of natural resources and efficient transport options in order to account for the establishment of companies and the concentration of economical activities (for instance von Thünen's regional land use model). But these insights only partially manage to analyse and clarify the cumulative processes involved. Furthermore, the classic theories only partly help to explain the socio-economic dynamics of a region, when for instance the natural advantages became less decisive, due to technological innovations. Moreover, these theories do not explain why companies establish themselves near other (similar) companies and entrepreneurs, and therefore engage in cluster-forming. The New Economic Geography of the 1990s offered new conceptual frameworks. According to Krugman firms-consumers linkages were central: workers migrate to a region where an important company is active, and once there they generate new demand impulses as consumers, which in their turn generate new economic activity.[4] Venables on the other hand advanced input-output linkages: compa-

1 Y. Segers and E. Karel, 'The Low Countries, 1750-2000', in: E. Thoen and T. Soens. (eds.), *Struggling with the environment: land use and productivity* (Turnhout 2015) 285-289.

2 Y. Segers, 'Globalisering, staatscontrole en kennisnetwerken. De fruitteelt in Limburg, 1850-1940', in: P. Timmers e.a. (eds.), *Limburg. Een geschiedenis* (Maastricht 2015) 397-416.

3 T. Martinez-Fernández, J. Capó-Vicedo and T. Vallet-Bellmunt, 'The present state of research into industrial clusters and districts. Content analysis of material published in 1997-2006', *European Planning Studies* 20 (2012) 281-304.

4 P. Krugman, 'Increasing returns and Economic Geography', *Journal of Political Economy* 99 (1991) 483-499; P. Krugman, 'What's new about the new economic geography', *Oxford Review of Economic Policy* 14 (1998) 7-17.

nies only establish themselves close to each other because of economies of scale for purchasing and sales of intermediary goods, the bundling of energy and transport costs, the advantages relating to transfer of technology, information, knowledge etc. Or in other words: proximity is put forward as core element for regional economic innovation and competitiveness.[5] More recent insights continue to build on the role of knowledge transfer and the existing social relationships between entrepreneurs, authorities and other actors to explain the innovative strength of a region. In this way Scott, Storper and Cooke put forward the manner in which entrepreneurs consciously and unconsciously exchange information as the key to success. These so-called 'information spill overs' then generate knowledge and practices which cannot be found anywhere else. Individuals and organisations with a different background learn to know each other better, and joint initiatives are set up through intensive, personal contacts. In such a sphere of mutual trust, innovative clusters can more easily be established, and knowledge and all kinds of facilities are shared. In addition to economic factors, social and cultural proximity also played a role.[6]

Broadly speaking the institutions and actors involved in cluster formation can be classified in three groups, also called the 'triple helix': 1) economic actors such as fruit growers, cooperative auctions, syrup factories; 2) knowledge institutes such as research stations, schools, and 3) governmental initiatives and organisations such as the Ministry of Agriculture. In this contribution I explore how these groups in South Limburg reacted to the globalisation and internationalisation processes. Which actors took the lead in the formation of a fruit cluster, and which characteristics did it have? Which (common) strategies were developed and which innovations took centre stage, allowing South Limburg fruit growing to maintain, or even strengthen its position? A central theme in my analysis is the role of knowledge and the (evolving) connections and interactions between the actors or groups. For this I refer to the concept of agricultural 'knowledge networks'. Herewith rural historians such as Segers and Van Molle refer to the complex mechanisms of knowledge production and diffusion in the

5 A. Venables, 'Equilibrium locations of vertically linked industries', *International Economics Review* XXXVII 4 (1996) 341-360; S. Decaigny, 'New economic geography als bedrijfshistorische invalshoek: de transformatie van de kanaalzone ten noorden van Brussel tot een industriegebied in het interbellum', *Belgisch Tijdschrift voor Nieuwste Geschiedenis* XXXIII 3-4 (2003) 535-575.

6 M.A. Porter, 'Clusters and the new economics of competition', *Harvard Business Review* (1998) 77-90; A.J. Scott, *Regions and the world economy. The coming shape of global production, competition and political order* (Oxford 1998); M. Storper, *The regional world. Territorial development in a global economy* (New York 1997).

primary sector. They underline that (scientific) knowledge is not static or just a collection of facts, but must be seen as a way of communication between scientists, experts and farmers, whereby the latter can have an active role too. Since the middle of the nineteenth century, private and public institutions in Western Europe invested more money and energy in knowledge networks as a base for innovation and economic success.[7] But surprisingly, until now scholars paid little attention to the importance of agricultural research, extension and education and to the evolution of fruit cultivation in the Netherlands.[8]

This paper demonstrates that globalization resulted in the gradual establishment of a complex network of organisations and individuals in South Limburg, which increasingly cooperated and supported innovation. However, not all farmers participated from the beginning. The focus has been on generating and especially transmitting relevant knowledge and improving product and processing quality in order to strengthen its position on the internal and foreign markets. Gradually, more producers joined the activities of the cluster. Initially, it operated mainly regionally, but from the First World War onwards the Limburg cluster became increasingly integrated in a national network, steered by the national government and agricultural associations.

7 Y. Segers and L. Van Molle, *Knowledge networks in rural Europe since 1700. Historiographies, concepts and theories* (Leuven 2014) unpublished paper.

8 J. Bieleman, 'Dutch agricultural history c. 1500-1950: a state of research', in: E. Thoen and L. Van Molle (eds.), *Rural history in the North Sea area. An overview of recent research* (Turnhout 2006) 283-294; J. Bieleman, *Boeren in Nederland. Geschiedenis van de landbouw, 1500-2000* (Amsterdam 2008); P. van Cruyningen, 'Dutch rural history c. 1600-2000: debates and selected themes', in: Thoen and Van Molle (eds.), *Rural history in the North Sea area*, 295-320.

Figure 1. Map of the province of Limburg and its municipalities

2 An embryonic cluster and elitist knowledge networks, 1850-1880

If we base ourselves on the productive surface, Southern Limburg was the most important fruit region in the Netherlands: in 1833 there were 6,345 hectares of fruit trees, mainly apples, pears and plums (or 35 percent of national acreage).[9] Soil and climate were natural assests. The loam soil was rich in nutrition, specifically potash and lime, which required less fertilisation in order to achieve a good yield. The water-bearing capacity of the loess was optimally suited for fruit growing in meadows. In comparison with other Dutch regions, South Limburg enjoys a better climate. The loess soils are less hot in summer and less cold in winter than for instance the sandy soils in the North. The average temperatures in South Limburg are higher, which causes the fruit to ripen earlier. Or in other words, the

9 Bieleman, *Boeren in Nederland*, 453; P. Brusse, *Provincie in de periferie. De economische geschiedenis van Zeeland* (Utrecht 2005) 185; P. Priester, *Geschiedenis van de Zeeuwse landbouw, circa 1600-1900* (Wageningen 1998) 209-213.

relatively excellent natural conditions (soil and climate) were the basis for the development of an early fruit cluster.

Although many farms, and certainly the larger enterprises, had various fruit trees on the farmyard, or even had an orchard, fruit growing remained a sideline for a long time. Farmers gave little attention to the care of the trees and the quality of the fruit. The harvest was often already sold in spring, directly or through public auctions, to traders who took the responsibility for picking and packaging. The fruit was mainly destined for own consumption and for the handcrafted production of syrup.[10] Agriculture in South Limburg was also characterised by traditional mixed activities, and differentiated itself in various areas from the agrarian system in other parts of the province. Around 1850 almost all available acreage had been brought into cultivation: 68 percent was arable land, 22 percent pastures, orchards and horticultural land, and only 10 percent consisted of wasteland and woods. In South Limburg the farms were on average larger. The region had more tenant farms, with farm labourers and maids living in, and the enterprises usually had their own livestock, with cattle and horses for draft. In comparison with the North of the province and with many other regions in the country, the agricultural sector in South Limburg was commercial and export oriented in character. The region around Luik (in Belgium) purchased an important part of its grain from South Limburg as early as the seventeenth century. However, this made the Limburg farmers and horticulturalists very vulnerable, especially after the Belgian independence in 1830 and the division of the province in Belgian Limburg and Dutch Limburg (in 1839). This left no important interior markets nearby, except for Maastricht, and the transport infrastructure also left a lot to be desired. The peripheral location in the Netherlands made the farmers in Limburg highly dependent on the economic and trade policies of neighbouring countries.[11]

10 J. Wachelder, *Geschiedenis van de tuinbouw in Limburg*, volume 2, part 1 (Maastricht 1970); E. Niesten and Y. Segers, *Smaken van het land. Groenten en fruit, vroeger en nu* (Leuven 2007) 21-22; H. Vermooten, 'De landbouw op de rivierklei en in Zuid-Limburg', in: Z.W. Sneller (ed.), *Geschiedenis van den Nederlandschen landbouw, 1795-1940* (Groningen-Batavia 1943) 302.

11 J.F.R. Philips, J.C.G.M Jansen and Th.J.A.H. Claessens, *Geschiedenis van de landbouw in Limburg, 1750-1914* (Assen 1965) 19 and 158-159; W. Rutten, 'Boeren', in: F. Hovens e.a. (ed.), *Kleine geschiedenis van Limburg*, deel 15 (Zwolle 2009) 76-85.

Illustration 1. Picking, weighing and packaging the fruit harvest in orchards was a difficult and labor-intensive job. Picture taken in the Voer region, around 1910.

Source: Collection Centrum Agrarische Geschiedenis, Leuven.

2.1 Purchasing power and foreign markets

Nevertheless, from about 1850 new chances appeared for the South Limburg fruit growers. Due to the urbanisation and the increasing purchasing power of the population, the demand for fresh fruit increased. The development of small syrup factories in South Limburg between 1850 and 1880 (for instance in Schinnen, Beek, Meersen, Eijsden and Maastricht) also caused the demand for fruit to flourish.[12] However, according to agricultural historian Jan Bieleman it was foreign demand, boosted by the free trade movement, which stimulated the fruit sector in various Dutch regions from about 1850. The price development profited from this: between 1846-1855 and 1871-1880 the price of apples rose by 58 percent. The value of all exported horticultural products rose between about 1850 and 1875 from 0.7 to 5.8 million Guilders, and mainly went to the neighbouring countries.[13] The Limburg fruit growers were focussed on London and on the booming industrial regions around Luik and in the Ruhr area. However, accurate

12 Vermooten, 'De landbouw op de rivierklei', 306; S. Langeweg, *Stroopstoken in Limburg: van ambacht tot fabriek* (Z.p. 2003).

13 D. Pilat, *Dutch agricultural export performance, 1846-1926* (Groningen 1989) table C.S.C; Bieleman, *Boeren in Nederland*, 442; D. van Marrewijk, 'Fruit in glas: opkomst en ondergang van de druiventeelt in het Westland', *Historisch Geografisch Tijdschrift* (1998) 37.

information concerning the size and destination of the export and even of the Dutch production before the start of the twentieth century is not available. The most important market places in the period 1854-1876 were Maastricht, Eijsden and Venlo; the main growing centres were the southerly cantons Meerssen, Heerlen and Gulpen, where the natural conditions were optimal.[14]

Of equally crucial importance was the improvement of transport links with the other parts of The Netherlands and the neighbouring countries. Due to low water levels, the navigability of the Maas was often problematic until 1930-1940, leaving the economic potential of the river underused.[15] Therefore the construction or extension of canals and railways from about 1850 was extremely important. The canal from Maastricht to Luik was dug in 1850, and was swiftly followed by the construction of the railways Maastricht-Aachen (1853), Maastricht-Hasselt-Brussels (1856), Maastricht-Luik (1861), and the Maastricht-Venlo line, which connected to the line between Eindhoven and the port of Vlissingen (1865). In later decades even better connections with Germany followed. Furthermore, the construction of trams and urban railways during the latter quarter of the century ensured an even better infrastructural connection to the rural areas of Limburg and a further reduction of transport costs. Exports to Great Britain also benefitted from the introduction of steam ship connections between London and the continent (Rotterdam, Vlissingen, Amsterdam, Antwerp and Ostend) from the 1850s onwards.[16]

2.2 Early knowledge networks

Notwithstanding the increased market opportunities, the (scarce) data available suggests that the size of the fruit growing area in South Limburg remained stable during the period 1840-1870/1890. According to contemporary sources the growers and traders paid scant attention to innovation. Specialisation in fruit growing was slowed down by a lack of knowledge and the fact that a majority of the farmers were tenants. Because Dutch legislation did not guarantee compensation for any improvements made by tenants, they probably hesitated to invest in the establishment of (rather expensive) orchards. A new orchard can only achieve a top yield

14 M. Knibbe, *Agriculture in the Netherlands, 1851-1950. Production and institutional change* (Amsterdam 1993) 87-93.

15 T. Bosch, "Kanaliseert de Maos. Doot et. Noe of Noets'. Acties voor de bevaarmaking van de Maas in de provincie Limburg (1839-1925)', in: *Studies over de sociaal-economische geschiedenis van Limburg* LIII (2008) 31-53.

16 H. Boersma, *Eijsden, een Maasdorp in ontwikkeling, 1851-1860* (Maastricht 2011) 70-71.

after ten to fifteen years. Moreover, during the third quarter of the nineteenth century farmers on the loess soils not only profited from good fruit prices, but also from a favourable price evolution of wheat, meat and dairy products. Their income was increasing anyway, so why would they make new, risky investments? These observations are of course also partially an explanation for the low response of active growers to the initiatives of the first agricultural organisations to modernise horticulture.[17]

These societies mainly addressed an elitist public. The 'Maatschappij van Landbouw' [The Society of Agriculture], established in 1849, united a group of prominent citizens, large landowners and gentleman farmers. They organised exhibitions, competitions with agricultural tools, lectures and courses, and published a journal for members. In this way they wanted to circulate new ideas, techniques and practices. The number of members fluctuated strongly during the 1850s: 800 in 1857 and about 300 in 1859. The main sticking point was the low participation of ordinary farmers and fruit growers (in 1859 circa 25,500 farmers were active in Limburg). For this reason the so-called 'casinos' or local branches were established, in order to lower the threshold for membership. In 1870 the appointment of G.F.R. Corten (1833-1917) as 'walking teacher' or agronomist followed, which was very early compared to other regions in the Netherlands, thanks to a subsidy from the provincial authorities. His job was to 'bring the farmers more into contact with scientific insights'. The following years Corten travelled around the entire province, and gave easily accessible lectures and courses on a variety of themes such as plant biology, artificial fertilisers, harvesting and preservation techniques. Not only Corten, but later other agronomists too, would play a key role in stimulating innovation and cooperation, and thus contributing to the formation of a fruit cluster in South Limburg.

The extra attempts of the Maatschappij to integrate and involve ordinary farmers in its activities were also prompted by the appearance of a competing organisation. In the middle of the 1860s the 'Vereeniging ter bevordering van Tuin- en Landbouw in het Hertogdom Limburg' [Association for the promotion of horticulture and agriculture in the Duchy of Limburg], also established in Maastricht, had been started. The aim was: 'Mainly the encouragement, development and improvement of everything concerning horticulture'. Both the provincial and the national authorities granted (albeit limited) subsidies, allowing the Vereeniging to develop many activities. The strong influence of Belgian experts was characteristic herein, although this should not be surprising. The growing conditions

17 Bieleman, *Boeren in Nederland*, 359.

were the same in both regions and the same fruit varieties were cultivated. The differences with other Dutch growing centres were larger. Furthermore, at that time the Belgian horticultural education was of a high level.[18] The vegetable and fruit growing courses of the Vereeniging were given by Belgian teachers who had obtained a horticulture diploma at the state horticultural schools of Vilvoorde and Gentbrugge (among others A.C. Ide, then director of the Gerard van Swietens Horticulture school in Frederiksoord, Emile Rodigas and Frédéric Burvenich). For these courses they followed the official Belgian curriculum. The organisation purposefully aimed at knowledge transfer. For instance, in 1870 and 1871 it sent three students each year to the internationally renowned horticulture school in Vilvoorde at the expense of the association.[19] It also set up the same type of activities as the Maatschappij. It published a free members' journal, distributed free seeds, plants and trees of improved or new fruit varieties to its members, and maintained an experimental garden. In 1867 the Vereeniging started organising annual vegetable and fruit exhibitions in Maastricht. In this the influence from Belgium is also striking. For instance, no less that 92 Belgians participated in the exhibition in 1868, compared to 72 Dutchmen. Until the 1880s most prizes were won by Belgians; later the Dutch/Limburg farmers took the starring roles. But despite the student scholarships and the initiatives of the rural elite, the Vereeniging mainly reached prominent citizens and pomologists. In 1872 only 11 of the 404 members were active horticulturists. Reasons for this were multiple: the high membership fees and the fact that many activities took place in or near Maastricht. And also the social and cultural differences between the ordinary farmers and the the regional elite have to be taken into account.[20]

18 In the Netherlands the first State horticultural school was founded in 1896. J.C.G.M. Jansen and W.J.M.J. Rutten, *Geschiedenis van de landbouw in Limburg in de twintigste eeuw* (Leeuwarden 1992) 136-137; E. Van Leuven, *Bijdrage tot de tuinbouwgeschiedenis. De Belgische groenteteelt, 1830-1914* (Aartrijke 1990) 75-78.

19 *Ibidem*, 177-180; V. Jacobs, *Limburgs-Haspengouw, een fruitstreek met traditie* (Borgloon 1997) 140-146.

20 J. van Lieshout, *En de boer hij gardeniert voort… De geschiedenis van de Coöperatieve Veiling-Vereeniging (1915-1946) en de Coöperatieve Venlose Veilingvereniging (1946-1990)* (Grubbenvorst 1991) 21-22; J. Korsten, *Standhouden door veranderingen. De Limburgse Land- en Tuinbouwbond als behartiger van agrarische belangen, 1896-1996* (Nijmegen 1996) 24-25; A. Schuurman, 'Agricultural policy and the Dutch agricultural institutional matrix during the transition from organized to disorganized capitalism', in: P. Moser and T. Varley (eds.), *Integration through subordination. The politics of agricultural modernisation in industrial Europe* (Turnhout 2013) 65-85.

3 Globalisation, cooperation and clustering, 1880-1916

At the end of the 1870s the economic and agrarian boom faltered. The process of increasing free trade and globalisation no longer only created chances for Dutch and Limburg farmers, but also threats. Cheap agricultural and food products were exported on a large scale to Western Europe from countries across the sea, such as the United States. The improvement of maritime transport with steamships and the extension of a dense railway network, as well as the availability of modern preservation and cooling techniques ensured that the markets for perishable products and foodstuffs (such as fruit) strongly integrated on a worldwide scale. The result was an increased international competition and, consequently, a sharp price drop of food. In Western Europe this development led to specialisation and reorientation towards livestock breeding and horticulture.[21] The Dutch agriculture and horticulture started to feel the consequences of the agricultural depression caused by this 'agricultural invasion' from 1878. Under the pressure of the farmers' organisations the authorities installed an Agriculture Commission in 1886, which had to study the situation in depth, and give advice on how to tackle the crisis. Notwithstanding the farmers' calls for protective measures, the Dutch government continued to opt for free trade during the next decades. And this while neighbouring countries Germany, France, and to a lesser extent also Belgium, opted for a protectionist policy. However, crucial in the Dutch plan was the attention given to the organisation of agricultural research and education, the establishment of an agriculture and horticulture extension service (with as key figures the state agronomists) and specialised experimental stations. The way out of the crisis had to be through innovation and cooperation, the creation and distribution of new insights and knowledge.[22]

What were the consequences of these developments for the fruit cluster and its actors in South Limburg, a region which was uniquely trapped

21 J.A. Morilla, A.L. Olmstead and P.W. Rhode, 'International competition and the development of the dried-fruit industry, 1880-1930', in: S. Pamuk and J.G. Williamson (eds.), *The Mediterranean Response to globalization before 1950* (Londen 2000) 199-232; V. Pinilla and M.I. Ayuda, 'Foreign markets, globalisation and agricultural change in Spain, 1850-1935', in: V. Pinilla (ed.), *Markets and agricultural change in Europe, from the 13th to the 20th century* (Turnhout 2009) 173-176; Y. Segers and L. Van Molle, *Leven van het land. Boeren in België 1750-2000* (Leuven 2004) 50-51; Bieleman, *Boeren in Nederland*, 277-279.

22 K.H. O'Rourke, 'The European grain invasion, 1870-1913', *Journal of Economic History* 57 (1997) 775-801; Knibbe, *Agriculture in the Netherlands*, 161-167; P. Brusse, A. Schuurman, L. Van Molle and E. Vanhaute, 'The Low Countries, 1750-2000', in: B. van Bavel and R. Hoyle (eds.), *Social relations. Property and power* (Turnhout 2010) 216-217.

between neighbouring countries who were operating in an increasingly protectionist manner? It is apparent from many contemporary sources that the South Limburg farmers initially performed relatively well. They continued to combine arable farming (mainly bread wheat) with livestock farming and fruit growing, and during the first decade they could continue to rely on the relatively high prices for (breeding) cattle, dairy products and fruit. When however from the middle of the 1890s more and more livestock products streamed into the country, the income of the Limburg farmers came under increasing pressure. From that time on fruit growing proved, more than ever before, to be an interesting option. Or, as expressed in the report of the state commission from 1886: 'It is generally known that since there is a notorious slump in agriculture, those farms which had a substantial fruit harvest at their disposal, could maintain the balance in the otherwise so much reduced agricultural proceeds of the land'.[23] Table 1 clearly illustrates that between 1851 and 1904 the price of fruit, both hard and soft fruit, in the Amsterdam market remained firmer than the price of rye and butter. It was therefore not surprising that in South Limburg more and more arable land outside the village centres was converted into 'fruit meadows', which were more suitable for a combination of commercial fruit growing and livestock farming.[24]

The orientation towards fruit growing and extensive livestock farming was also an answer to the increasing shortage in manpower. The upcoming industrial regions in Germany and Belgium, with their high wages attracted many rural workers from South Limburg.[25] This labour shortage also explains why fruit growers in Limburg held on to the extensive system of 'fruit meadows' much longer than elsewhere in The Netherlands.[26]

23 Quoted in Wachelder, *Geschiedenis van de tuinbouw in Limburg*, volume 2, part 1, 57.

24 Between 1875 and 1921-1925 the wheat acreage in the province Limburg fell from 14,200 to 5,900 hectares. Bieleman, *Boeren in Nederland*, 362.

25 Bieleman, *Boeren in Nederland*, 362.

26 In 1912 as little as 0.8 percent of the orchards in Limburg would have had underplanting; in Zeeland at that time it was already 33 percent and in Gelderland approximately 5 percent. Brusse, *Provincie in de periferie*, 187.

Table 1. Average prices of fruit in the Amsterdam market, 1851-1904 (1860-1869 = 100)

	Apples	Pears	Cherries	Strawberries	Rye	Butter
1851-1859	98	99		79	98	83
1860-1869	100	100	100	100	100	100
1870-1879	136	119		149	97	112
1880-1889	109	103		83	84	105
1890-1899	112	103		134	65	89
1900-1904	198	138	183	192	65	95

Source: J.L. van Zanden, *De economische ontwikkeling van de Nederlandse landbouw in de negentiende eeuw, 1800-1914* (Wageningen 1985) 309.

How fast the fruit acreage expanded is not really clear. Reliable figures about the evolution of the fruit acreage at the provincial level only become available from 1900 (see table 2). This information suggests that before 1900/1906 little to no expansion took place; only between 1906 and 1912 would the acreage in The Netherlands and in the province Limburg have increased. Unfortunately these figures say nothing about the importance of the various types of fruit which were grown, or about the yield. It is in any case certain that the fruit acreage consisted mainly of apples, pears and cherries. Plums were not commercially grown. Until the First World War, the system of mixed planting in the orchards remained prevalent in Limburg. In the same orchard one row of cherry trees was alternated with a row of apple or pear trees. The advantage of this method was in the faster return: the cherry trees were indeed much faster productive.[27]

Table 2. The evolution of fruit growing in The Netherlands and Limburg, 1900-1940 (in hectares)

	Netherlands	Limburg	Share Limburg
1900	18,379	5,820	31.7%
1906	19,014	5,870	29.5%
1912	24,430	7,323	30.0%
1919	25,698	7,600	29.6%
1927	33,937	10,225	29.8%
1940	54,565	13,304	24.4%

Source: Wachelder, *Geschiedenis van de tuinbouw in Limburg*, volume 2, part 1, 85.

27 Bieleman, *Boeren in Nederland*, 366-368.

An important dynamic behind the expansion of the fruit acreage was the increasing demand, at home and abroad, for fresh table fruit and especially factory fruit.[28] Shortly before the turn of the century the manufacture of syrup went through a process of mechanisation, upscaling and concentration. It was one of the most important rural industries in South Limburg and a dynamic actor in the regional fruit cluster (although very little is known about its activities). In 1889 there were about 300 small, artisanal syrup factories in the province, 6 industrial syrup factories remained in 1920 (of which 5 in the fruit region around Maastricht). The preserves industry, witch developed from the 1890s onwards in the Betuwe and in the region of Breda (on the British model), was less important in Limburg.[29]

3.1 New sales systems

Table 3 presents some of the scarce data concerning the export of fruit in 1896 from some municipalities in South Limburg (specifically from Eijsden, Beek and Bunde). It is noticeable that pears and apples went mainly to Germany. Cherries were destined for the Dutch market in limited amounts, and were exported to Great Britain. During top seasons more than 350,000 kilos of cherries were sent from Eijsden each week. The fruit trade was in the hands of Limburg and Belgian traders, whereby Antwerp traders played a key role in the export to Great Britain. An important part of the trade was organised through consignation. In this system the grower remained owner of a fruit lot until it was sold. But he had to trust the merchant: the farmer was not sure about the exact quantities sold and the market price; he had to partly pay for the transport and also paid a commission to the trader.

28 A. van Otterloo, *Eten en eetlust in Nederland, 1840-1990. Een historisch-sociologische studie* (Amsterdam 1990); J. Jobse-van Putten, *Eenvoudig maar voedzaam. Cultuurgeschiedenis van de dagelijkse maaltijd in Nederland* (Nijmegen 1995).

29 Van Marrewijk, 'Fruit in glas', 38-41; H.A. Muntjewerff, 'Het ontstaan van de Bredase jamindustrie, 1900-1921', *Industriële Archeologie* (1991) 20-21; Jansen and Rutten, *Geschiedenis van de landbouw in Limburg*, 149; Langeweg, *Stroopstoken in Limburg*.

Table 3. The export of fruit in 1896 from some municipalities per month, in tons and per destination

Eijsden and surroundings	June	July	August	Septem-ber	October	Novem-ber	Destination
Cherries	17.8	274.3					GB
Plums		19.0	13.9				GB
Nuts				71.9			GB
Pears			72.6	55.7			Germany
Apples				765.8	940.3		Germany
Beek and Bunde							
Plums		11.2	20.05				GB+ Germany
Apples			215.3	461.1	746.2	101.8	Germany
Pears			163.0	181.9	143.9		Germany

Source: Wachelder, *Geschiedenis van de tuinbouw in Limburg*, volume 2, part 1, 103.

Around the turn of the century growers and the local casinos increasingly developed initiatives to strengthen their influence on the (export) trade. The most important advantage of this direct trade was of course that the profit margins of all intermediaries were omitted and farmers received a better price in this way. But this, of course, required consultation and the willingness to cooperate. It was not by accident that these initiatives were developed in a period during which the prices came under pressure, partly because of increased competition on the worldwide fruit market. Especially the United States increased their export of apples to Europe very strongly during these years. The developments caused more and more countries, such as Germany, to opt for tighter protectionism. In 1903 this led to the following remark from dr. Poels: 'Belgium and Germany close their borders or impose charges, but our Limburg is open on all sides for Belgians and Germans and all strangers; we cannot move without somehow, to the left or to the right, colliding with a custom house'.[30] Furthermore other countries started to set higher quality requirements. For instance, the British authorities invoked the *Public Health Act* to have fruit of lesser quality destroyed. When, in 1899, large batches of Dutch soft fruit (strawberries, berries and raspberries) were rejected this led to a lot of protest. Many newspaper commentators condemned this in the press as a veiled form of protectionism, but the Dutch Chamber of Commerce in London surprisingly saw things differently. The fruit growing sector re-

30 Quote from Philips, Jansen and Claesen, *Geschiedenis van de landbouw in Limburg*, 281. See also H.A. Poels, *Een zestal redevoeringen; uitgave van de Limb. R.K. Werkliedenbond* (Heerlen z.j.) 29-34.

ceived the advice to give more attention to 'cleanliness and correct weight of all it is sending abroad'.[31] In sending this message the organisation touched on a crucial sticking point: the fruit for export was not always of a good quality, the transport often caused considerable damage, and some growers hid low quality fruit at the bottom of the baskets, bags or barrels. In contrast to, for instance butter, Dutch authorities did not yet require a quality label. This could be a partial explanation for the decreasing importance of the British market for the Dutch fruit growers around the turn of the century.[32]

Dutch fruit growers developed two types of initiatives to upgrade the export trade. First of all there were the shipping associations such as for instance the 'Bond Westland' (1898) and 'Gelria' in the Betuwe (1897), but these could only deploy a modest activity. Auctions, organised on a cooperative basis or not, were more successful, among others because they required less investment and market knowledge than shipping associations, which were responsible for the transport to and sales in the foreign countries. The first Dutch cooperative horticultural associations were established during the 1880s.[33] The oldest auction in the province Limburg was the small cherry auction in Gronsveld, established in 1906 and housed in a warehouse near the station. From 1910 a 'Verzendvereeniging Eijsden' [Shipping association Eijsden] was also active, established with the encouragement of state horticultural consultant A.M. Sprenger and some prominent citizens, but it stopped its activities at the outbreak of the First World War.[34] Sprenger formulated the goals and points of attention as follows: 'Therefore finally, nothing else can be done than becoming organised and through organisation strengthening oneself against the trade: firstly by introducing uniform packaging; secondly by sorting and inspecting the fruit offered, and thirdly by trading at good prices with the highest bidder'. Cooperation between growers and agricultural institutions was necessary and possible, especially on a local level. Thanks to the activitities of the casinos (e.g. the organisation of lectures, courses and fruit expositions) and the intermediate role of the state or provincial agronomists, the fruit growers in Limburg got to know each other better and

31 *Het vernietigen van Nederlandsche fruit bij aankomst in Engeland gedurende den zomer van 1899* (*Nederlandsche Kamer van Koophandel*) (Amsterdam 1900) 11-17.

32 J. Bos, *Vijftig jaar Nederlandse fruitteelt* (Amsterdam 1948) 169-171; Bieleman, 'Dutch agriculture, 1850-1925', 19-20.

33 J.H. van Stuijvenberg, *Economisch-historische aspecten van de ontwikkelingen van het veilingwezen in de afzet van Nederlandse agrarische producten* (Haarlem 1954) 16-17.

34 Wachelder, *Geschiedenis van de tuinbouw*, volume 2, part 1, 163-164.

became more and more convinced that cooperation was the best answer to the growing challenges in the fruit markets. Mutual trust was of great importance. Especially a better fruit quality was required to maintain market share abroad as well as to enter into competition with American and exotic fruit in the domestic market.

Illustration 2. Young apple trees 'Schone van Boskoop', in Meerssen, Limburg. Photo taken about 1920.

Source: Collection Centrum Agrarische Geschiedenis, Leuven

3.2 A basis for knowledge networks

From the 1880s onwards, research, education and information were deployed as an answer to the globalisation and increasing competition in the fruit markets abroad and at home. Agricultural associations, increasingly supported by the government, undertook new initiatives to distribute new scientific insights and agronomic practices to the ordinary growers. The creation of a modern, and especially an accessible agrarian knowledge network manifested itself before the First World War not only in The Netherlands, but was also a crucial element of the agricultural policy in other Western European countries.[35]

In Limburg a remarkable role was reserved for agronomist Corten. He gave countless lectures and presentations about more rational fertilisation, pruning and maintenance, customised fruit varieties which took into ac-

35 N. Vivier (eds.), *The state and rural societies. Policy and education in Europe, 1750-2000* (Turnhout 2009); L. Van Molle, 'Kulturkampf in the countryside. Agricultural education, 1800-1940: a multifaceted offensive', in: C. Sarasua, P. Scholliers and L. Van Molle (eds.), *Land, shops and kitchens. Technology in the food chain in twentiethcentury Europe* (Turnhout 2005) 139-169.

count the taste of the consumer, transport and tenability and a better disease control. From the 1880s Corten changed his approach. He left the general introductory courses to the local village teachers, who, according to him were closer to the rural dwellers, had a lot of authority and so held a key position in the transmission of agricultural knowledge and the stimulation of cooperation in the Limburg fruit cluster. He started to organise two specialised courses per year, which included twenty lessons each, and which provided more in-depth insights. In cooperation with the local agricultural societies he started empirical education, among others through the establishment of demonstration and experimental fields. These courses proved to be of great importance (as were the winter schools) for the modernisation of fruit growing. They had a relatively low accessibility threshold, were cheap, offered theoretically underpinned vocational education at a high level and were as much as possible adapted to regional needs. 233 persons participated in the fruit courses between 1872 and 1900. Gradually the Limburg knowledge network for fruit could start to operate without the input from Belgian experts. Under Corten's impetus the number of local agricultural associations in the province of Limburg also rose strongly: in 1896 there were 45 casinos which together had some 1,450 members. Most of them functioned as cooperative purchasing and sales associations: they purchased all sorts of products such as chemical fertilisers, fodder, seeds, seedlings, agricultural tools and machinery and even breeding animals. At the same time the provincial and national authorities broadened their support of agriculture and fruit growing. They gave financial support to the agricultural societies, and from 1895 Corten was employed as state horticultural consultant. But despite these efforts the Maatschappij still did not succeed in reaching a large public.[36] It was to be surpassed by the 'Limburgsche Christelijke Boerenbond' [Limburg Christian Farmers' Union], established in 1896. Thanks to the help and support of among others the local clergy, this new association quickly became successful, and was able to establish a branch in most municipalities and villages. In 1901 the Maatschappij and the Limburgsche Christelijke Boerenbond decided to merge into the 'Limburgse Landbouwbond' [Agricultural Union of Limburg].[37] This farmers' union, as was happening elsewhere in The Netherlands and in Belgium too, would act as political representative for, and defender of the interests of, the farmers and horticulturists of their region[38].

36 Van Lieshout, *En de boer, hij gardeniert voort…*, 28-30.

37 Korsten, *Standhouden door veranderingen*, 45.

38 Brusse, Schuurman, Van Molle and Vanhaute, 'The Low Countries', 211-212.

The influence of the knowledge offensive described above is difficult to estimate, although most scholars consider it as rather limited. According to Jansen and Rutten there was less progress after 1880 in South Limburg than in other regions, among others because of the scant attention for applied research and the establishment of experimental fields. Van Zanden stated that the transition to modern fruit growing only progressed in small steps and that it remained a typically secondary activity.[39] According to state horticulture consultant A.M. Sprenger (active in Limburg from 1907 to 1917, and from 1918 professor in Wageningen), in 1910, there was still a long road to go and the management in many farms was below par: 'Very few fruit growers know whether their orchards are profitable or not. How fast would the interest in fruit growing not disappear if one could compare the expenses with the income? (…) The combination of livestock farming and fruit growing has not been a happy affair in Limburg and certainly has led to disadvantages for fruit growing'. One of the results of this failing management was the relatively low fruit quality. Only after the First World War were structural measures taken to remedy this, through a more intense cooperation between all actors, whereby the Dutch authorities would take on a more dirigiste and directing role.[40]

4 National policies and strategies, 1916-1940

It is difficult to overestimate the influence and the importance of the First World War on the agriculture and horticulture sector in the Netherlands and Western Europe. The war disrupted profoundly existing trade circuits. However initially, very little changed for the South Limburg fruit growers. The export to Great Britain continued as normal and Germany even opened a trading bureau in the Netherlands in order to purchase more foodstuffs. The scarcity of agricultural products however caused substantial price rises on the Dutch market. In 1916 the government intervened, in order to ensure the national food supply and to protect the Dutch consumer from overly high prices. The export of food was limited (through the so-called consent policy), maximum prices were introduced and the pro-

39 Jansen and Rutten, *Geschiedenis van de landbouw in Limburg*, 162-163; J.L. van Zanden, *De economische ontwikkeling van de Nederlandse landbouw in de negentiende eeuw, 1800-1914* (Wageningen 1985) 243-245.

40 R. Lijsten, 'De Nederlandse fruitteelt, 1888-1948', *Tijdschrift der Nederlandsche Heidemaatschappij* 59 (1948) 198-201; Vermooten, 'De landbouw op de rivierklei', 311; Wachelder, *Geschiedenis van de tuinbouw in Nederland*, volume 2, part 1, 236.

duction was also directed. For instance, the growing of soft fruit such as berries and plums for conservation was significantly expanded. The distribution also increasingly became controlled by the state, and the government introduced an auction requirement for horticultural products. In South Limburg this led to the establishment of several new vegetable and fruit auctions, among others in Beek, Bunde, Sittard, Gronsveld and Wijlre, which together formed the auction association 'Zuid-Limburgse Coöperatie' [South Limburg Cooperative].[41]

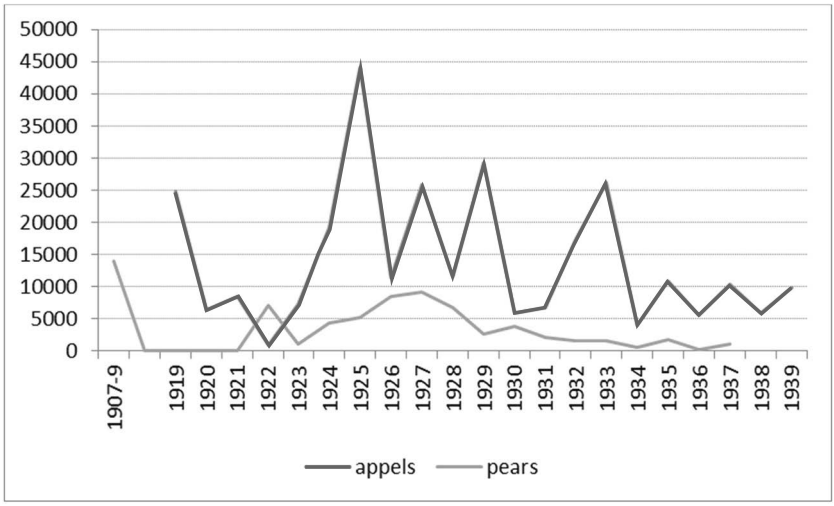
The Dutch government's new strongly regulating policy was subject to a lot of criticism. Fruit growers wanted to profit from advantageous prices in all liberty. They cursed the government control and the limitation of their freedom as entrepreneurs. They therefore hoped, in 1918, to be able to return to the pre-war situation as soon as possible. The auction requirement was indeed rescinded, but the fruit export recovered slowly. Graph 1 perfectly illustrates this.[42] A first reason for this was the strong position of the Dutch Guilder. The value of the Belgian Frank and German Mark had been substantially reduced, and this hindered the export to these countries. A second cause was the reduced demand for Dutch fruit. In Germany purchasing power had dropped significantly, and the Dutch market was only a limited alternative, also because some varieties did not appeal to the domestic consumers. Out of necessity the Dutch and Limburg fruit growers went in search of new markets such as Scandinavia, but that only resulted in a limited and temporary upturn.

A third cause was the strong competition from Mediterranean fruit (specifically oranges) and especially from the United States. American apples were extremely beloved in Western Europe due to their low price, good quality and the care taken in sorting and packaging.[43] The Dutch fruit sector tried to enter the competition battle, preferably through the auctions, but initially this was not simple. After the war many growers had turned their backs on the auctions, and some auctions had to close down. Especially in Limburg the popularity of the auctions decreased. A clear explanation for this is not available; maybe because fruit growing was no more than an extra for most farmers at that time? Or were the conditions

41 Lijsten, *De Nederlandse fruitteelt*, 201 and 210; J.P. Planje, *Vijftig jaar Limburgse land- en tuinbouw 1901-1951* (Roermond 1951) 136; Korsten, *Standhouden door veranderingen*, 46; Bieleman, *Boeren in Nederland*, 288-290.

42 Wachelder, *Geschiedenis van de tuinbouw*, volume 2, part 3, 349-360.

43 Pinilla and Ayuda, 'Foreign markets, globalisation and agricultural change'; C. Dimitri, 'Contract evolution and institutional innovation. Marketing Pacific-grown apples from 1890 to 1930', *Journal of Economic History* 62 (2001) 189-212.

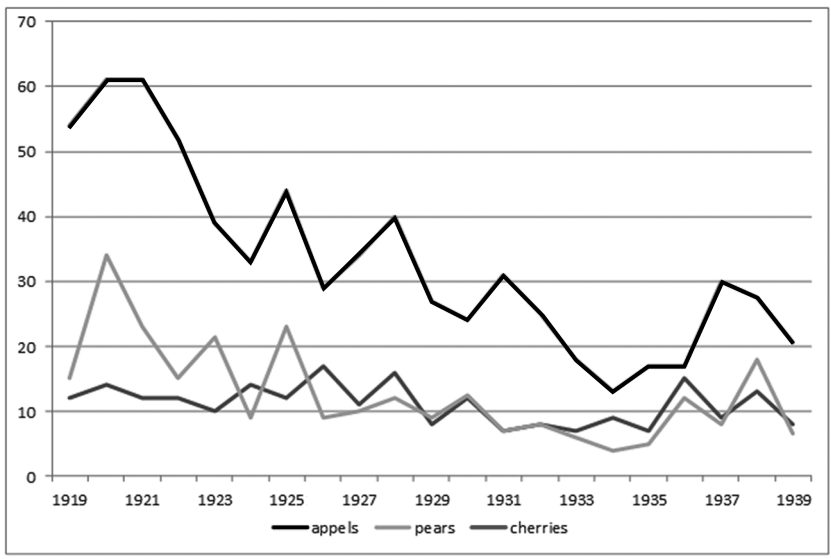


Graph 1. The export of apples and pears to Germany, 1907-1939 (*in tons*)
Source: Wachelder, *Geschiedenis van de tuinbouw in Limburg*, volume 2, part 3, 350 and 352.

and the willingness to cooperate less in South Limburg? Nevertheless, the auctions which were still operating continued to work together in a 'Bond van Zuid-Limburgse fruitveilingen' [Union of South Limburg fruit auctions], and at the start of the 1920s some new initiatives emerged in Oostrum (1921) and Oefelt (1922). In the meantime the fruit acreage in The Netherlands and in the province of Limburg was substantially increased. Between 1919 and 1927 it grew from about 26,000 to 34,000 hectares on a national level, and in Limburg from 7,600 to slightly more than 10,000 hectares (see table 2). Not only did the existing growers in Limburg extend their acreage; many wheat farmers also started growing fruit as a response to the substantially decreasing grain prices. The Limburg auctions started various initiatives, in cooperation with state horticulture consultant Van der Kroft, in order to improve the fruit quality. Again it was an agronomist or consultant from the state who acted as intermediary, as an advocate of cooperation. During the early 1920s the union ordered 7,000 fruit crates aimed at improving and standardising packaging. The material was made available to transporters and traders. At the national level there was also awareness that the export position could only be improved by better quality. For this reason, in 1924, the Uitvoer Controle Bureau [Export Control Bureau] (UCB), an initiative of the Centraal Bureau van de Tuinbouwveilingen [Central Bureau of the Horticultural Auctions] in The Netherlands and the exporters unions, had introduced a quality label. The aim was to 'bring unity in and supply guarantees for the quality, sorting, packaging,

sizes and weight of agricultural and horticultural products destined for export'. Those who met the requirements were eligible for the voluntary quality label. The auction boards also surveyed quality increasingly sternly. In 1927 Thei Derkx, director of the Venlo auction, quoted as the cause of the sometimes lower quality of the fruit delivered mainly the many new fruit growers.[44] The Venlo auction acted firmly against this. The sorting of apples became mandatory, and those who hid too low a quality in the crates had to start sorting again under surveillance of the auction staff. At the initiative of the same auction the first American sorting machines were bought in 1929.[45]

However, the fruit sector continued to struggle during the end of the 1920's. The prices of fruit were under increasing pressure around the world as well as in The Netherlands (see graph 2) and in 1928 the harvest failed. The closure of the auction in Oeffelt is characteristic for the atmosphere of crisis at the time. The economic and financial crisis which gripped the world from 1929-1930 reinforced the difficulties to sell the fruit in the foreign markets even more.



Graph 2. The average auction price of apples, pears and cherries per kilogram (in Guilder-cents), 1919-1939

44 Van Lieshout, *En de boer, hij gardeniert voort…*, 52-53.

45 Jansen and Rutten, *Geschiedenis van de landbouw in Limburg*, 172; Van Lieshout, *En de boer, hij gardeniert voort…*, 59 and 79-80.

Source: Wachelder, *Geschiedenis van de tuinbouw in Limburg*, volume 2, part 3, 362.

In the period 1930-1931 the export of Dutch apples to Germany considerably decreased (see graph 1), also because import duties were raised. The exceptional importance of the German market was aptly expressed by chairman Wiel Driessen during the annual meeting of the Venlo branch of the LLTB in March 1932: 'The Venlo horticulture cannot live without Germany as a market. All enterprises are organised for it and are united with it. We must be able to sell to Germany, even if we had to smuggle it across the borders'. The sales problems also increased in other markets such as Great Britain (which devalued the British Pound and left the Gold Standard in September 1931), in Belgium and in France, which strongly limited the imports of fruit by means of a quota system.[46] In this period the total value of the export of vegetables, fruit and potatoes markedly shrank from 96 million Guilders in 1928 to 75 million in 1930 and barely 49 million Guilders in 1932. Three years later the export was worth only 27 million Guilders. Table 4 shows a similar trend for the turnover of the most important South Limburg cooperative auctions. Only at the end of the 1930s did the turnover recover somewhat.

Table 4. The turnover of some cooperative auctions in South Limburg (x 1000 Guilders), 1931-1939

	1931	1932	1933	1934	1935	1936	1937	1938	1939
Bunde	231	285	124	141	114	89	107	137	150
Grons-veld	145	124	64	105	96	45	106	29	148
Wijlre	183	230	97	130	102	70	82	120	205
Sittard	69	89	47	112	81	51	62	63	116
Beek	262	296	139	144	119	63	104	148	152

Source: Planje, *Vijftig jaar Limburgse land- en tuinbouw*, 188.

Initially the Dutch government remained aloof, and assumed that the problems would only be temporary. However, pressed by the agricultural organisations and parliament, it launched a series of measures. In 1931 it introduced the Wheat law, which guaranteed the arable farmer a fixed sale price which was double the world market price. In autumn 1932 the Horticulture support law followed. Through a premium on the auction prices the government paid no less than five million Guilders in support in order

46 Quoted in van Lieshout, *En de boer, hij gardeniert voort…*, 64. Bieleman, *Boeren in Nederland*, 457; G. G. Minderhoud, *De Nederlandse landbouw* (Haarlem 1952) 33-34.

to compensate the continuously dropping prices. Finally, in May 1933, the Agriculture crisis law followed, which grouped existing and a number of new measures, and which gave the government far reaching powers concerning price formation, production limitation, distribution and international trade. The impact of this law was substantial: between 1933 and 1936 the Agriculture crisis fund annually spent about 200 million Guilders, or no less than a quarter of the total state budget.[47] What effect did the crisis law have on the fruit growing sector?

On 23 Augustus 1933 the Dutch 'Groenten- en Fruitcentrale' [Vegetable and Fruit Exchange] was established. This exchange regulated the import. Traders could only import vegetables or fruit if they had obtained a permission to do so from the Centrale and had paid the so-called monopoly charge. The main aim of this measure was to restrict the influx of high quality cheap horticultural products such as American fruit. After all, between 1930 and 1933 the supply of apples on the Dutch market had risen by almost a factor of 5. An observer noted: 'As the Dutch public is not only sensitive to foreign labels, but also appears to find products which come from further away better tasting than what is grown domestically, foreign fruit is serious competition for the Dutch grower'. Pushing back the import could give the Dutch fruit growers some breathing space. In a certain sense the sales in the Dutch market compensated for the shrinking of its own export markets. In 1934 the government also placed the Dutch export under control, in order to keep the price setting even firmer in hand. Only those who had a permit could export. At the same time the auction requirement was re-imposed for vegetables and fruit, except for apples, pears and cherries which were directly supplied to industry and consumers. The quality could be more strictly surveyed through the auctions. Finally, in 1936-1937 the government, within the framework of the Agriculture Export law, would impose minimum quality requirements for the export of among others apples and pears. Inspectors of the auctions ensured the necessary verifications. Indeed, foreign markets could only be conquered with products of high quality.

In contrast to other agricultural sectors the national government did not impose a limitation on the production or the fruit acreage (except for some types of small fruit). The relatively favourable fruit prices caused the fruit acreage to increase even more between 1927 and the breaking out of the Second World War than in the preceding decade. In The Netherlands the fruit acreage grew from almost 34,000 to approximately 55,000 hec-

47 Van Zanden, *De economische betekenis van de Nederlandse landbouw*, 128.

tares. The increase was mainly situated in the Betuwe and in Gelderland. The province of Limburg's performance was less strong, although the acreage here also increased by more than a third, from just over 10,000 to almost 13,500 hectares.[48]

During the 1930s measures to boost demand were also taken, mainly on a national level. Especially private associations, such as the Nederlandsche Heidemaatschappij [Dutch Heather society], took the lead in this.[49] In 1934 it organised a fruit exhibition on the occasion of the opening of the Central Market halls in Amsterdam. In the bar, the consumption of 'sweet most' or fruit juice was promoted. A year later it distributed fruit calendars and a set of coulour post cards to housewives and schools. In the same year the 'Better Dutch fruit' campaign also started. The Commission of Fruit experts of the 'Centraal Bureau van de Tuinbouwveilingen' [Central Bureau of Horticultural auctions] wanted to promote well sorted and packaged fruit by means of this campaign, among others during the national fruit exhibition in the Apollo-hall in Amsterdam in 1937.[50] Auction boards organised so-called 'elite and first quality auctions', during which only first class fruit was offered. These were all initiatives aimed at improving the quality of the fruit, and at finding a destination for the continuously increasing production. The efforts to support the fruit processing and to optimise the preservation of fruit also fitted within this framework. In 1936 A.M. Sprenger, who had in the meantime become professor Cultivation of Horticultural Plants in Wageningen, started an institute for research in the field of processing and preservation of vegetables and fruit. He intensively worked together with the fruit processing industry, which had expanded during the interwar years and which proved to be a crucial player. Fruit processing companies at that time were buying about one fifth of the Dutch harvest in order to produce among others syrup, jam and fruit juices. [51]

4.1 Knowledge and product quality

Sprenger's work illustrates the increasing efforts to deal with the economic and technical problems of the fruit sector. Agricultural associations, the national government and the auctions joined forces and developed initiatives around marketing, research, information and education. First and foremost more attention was paid to the maintenance of the orchards:

48 Knibbe, *Agriculture in the Netherlands*, 90-91; Brusse, *De economische geschiedenis van Zeeland*, 193; Bieleman, *Boeren in Nederland*, 192-193.

49 Bos, *Vijftig jaar Nederlandse fruitteelt*, 5-7.

50 Lijsten, 'De Nederlandse fruitteelt', 210-213.

51 Bieleman, 'Dutch agriculture, 1850-1925', 38-39.

judicious pruning and fertilising (with calcium, nitrogen and potassium) were required. State horticultural consultant Van der Kroft, supported by the auction in Venlo, set up experiments concerning fertilisation and spraying against diseases and insects, in a private orchard. In 1932 the same Van der Kroft was the driving force behind the establishment in Maastricht of the first fruit growing vocational college in The Netherlands, where older students with practical experience could study further and specialise in 'modern fruit growing'. The end of the 1920s also saw the arrival of new disease fighting techniques. The application of glue bands around the trunks was promoted and especially the (communal) usage of motor sprayers and other spraying equipment, imported from the United States. In this way the Jonge Boeren en Tuinders Bond (JBTB) [Young Farmers and Horticulturists Union], among others, stimulated the mechanisation and specialisation of fruit growing. For this the mixed planting had to disappear. Old orchards were pulled up and replaced by more modern varieties, adapted to the preferences of consumers at home and abroad. From the middle of the 1930s growers in South Limburg increasingly replaced standard tree orchards by low growing trees. This implied that the combination with livestock farming became more difficult, but this trend (which anyway would only become stronger after the Second World War) did result in increased production and productivity.[52]

5 Conclusion

This article unravels and analyses the response of the fruit growing sector in Southern Limburg to the extensive process of globalisation and increasing international competition. This long-term analysis enables us to evaluate the strategies and (knowledge) initiatives being developed by various actors at the regional and national level, and their interrelationships. In a first phase the main dynamism could be found with private agricultural organisations: through information, education and demonstration they stimulated innovation. However, the results were rather limited. These elitist associations, which received support from provincial and national authorities, had little contact and empathy with ordinary farmers. The foundation of the knowledge network was at an early stage and to a large extent based on Belgian expertise. Overall, cooperation (and its impact) between the actors in the fruit cluster (or 'triple helix') remained limited.

52 Bieleman, *Boeren in Nederland*, 372.

The agricultural depression at the end of the nineteenth century caused a number of innovations to gain momentum. The various actors within the economic cluster increasingly started to collaborate in this second phase. Farmers became organised (encouraged by local and regional elites, with a prominent role of the state agronomists or consultants), and established organisations with a low threshold and auctions. A shared awareness emerged that a competitive fruit sector required science-based practices. From the 1890s both the provincial and national authorities and farmers' organisations addressed the growing competition in the agricultural markets through the formation of an agrarian knowledge network, and not through protectionism. Education and information initiatives (set up by state agronomists, but also village priests and teachers) were to familiarise farmers with modern cultivation practices and commercial insights, whereby attention to process and product quality was central. These efforts ensured that Dutch farmers and fruit cultivators could compete rather successfully on the domestic and foreign markets.[53] Knowledge related initiatives, in which actors from the various domains participated, ensured a strong foundation on which innovation in the cluster could flourish.

Remarkable was the changing role of the national government. Initially, it limited itself to (financial) support and active participation in the emerging knowledge network. The exceptional circumstances during the First World War and the 1930s did cause policy makers to change their course. In a third phase, a protectionist agricultural policy, designed on a national level, was drawn up after consultation with the sector. Increasingly other forms of cooperation between actors and institutions on the regional and especially the national level were set up, such as cooperative auctions, quality labels, initiatives to develop market directed research, etc.[54] The auctions in Limburg had only limited success. Not all farmers participated; the imposition of mandatory quality standards did not go smoothly. Why this was the case, is not easy to explain, inter alia, in the absence of source material that allows the analysis of the decisions of individual farmers. However, the present study is not necessarily an end, in that it has the ambition of providing inspiration for new research. For instance, the Limburg case can be compared with the development of other regional fruit clusters in the Netherlands and abroad. Or the participiation of the processing industry in the cluster can be analysed more in detail.

This article shows how the Limburg fruit sector or cluster became in-

53 Knibbe, *Agiculture in the Netherlands*, 230-231.

54 Bieleman, *Boeren in Nederland*, 313-314 and 571-572.

creasingly integrated in a more national oriented and organised cluster and knowledge network, within which the government was responsible for clear regulations, offering financial incentives or setting up forums in which private and public institutions and actors from the various domains could meet each other. Therefore it illustrates that not only regional clustering of economic activity or 'proximity' plays a role in stimulating innovation and knowledge diffusion. Essential knowledge sharing takes place in social networks and these do not have to be spatially concentrated.[55]

About the author

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55 P. Cooke, 'Introduction. Regional assymetries, knowledge categories and innovation intermediation', in: P. Cooke and A. Piccaluga (eds.), *Regional development in the knowledge economy* (New York 2006) 8.