
Sponsors

University of Minnesota

College of Veterinary Medicine

College of Agricultural, Food and Environmental Sciences

Extension Service

Swine Center

Editors

W. Christopher Scruton

Stephen Claas

Layout

David Brown

Logo Design

Ruth Cronje, and Jan Swanson;

based on the original design by Dr. Robert Dunlop

Cover Design

Sarah Summerbell

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, or sexual orientation.

Pork chain models in Europe

Prof. Dr. Hans-Wilhelm Windhorst

Institute for Spatial Analysis and Planning in Areas of Intensive Agriculture, University of Vechta. P.O. Box 1553, 49364 Vechta, Germany

Introduction

In 1999 European pig producers were confronted with extremely low prices. Since the turn-of-the-year, prices have increased; however, they have not reached the level of 1998. A continuous oversupply within the European single market and a growing competition in the world market for pork have led to a restructuring of pig production and the development of pork production chains in the European Union (EU).

In this paper:

- The present position of pig production in EU member states in the context of world pig production will be analyzed.
- The sectoral and regional patterns of pig production in the EU will be presented.
- The role of EU member states in the global trade of pork will be analyzed.
- Various models of pork chains will be presented.
- A perspective for the swine and pork industry of the EU will be given.

EU pig production in a world setting

Between 1990 and 1998, world pork production rose from 69.9 million t to 88.0 million t or by 25.9%. **Table 1** shows that the rates of increase differ considerably from region to region. Whereas in Asia production increased by 59.0%,

North and Central America as well as the European Union did not nearly reach such high rates. In 1998 China had the largest pig herd and ranked in first place with respect to pork production, followed by the United States, Germany, Spain, and France (**Table 2**). Whereas the United States contributed 9.8% to world pork production, the EU had a share of 20.0% and China alone of 45.1%. These data show that the swine industry plays an important role in three major areas, North America, Europe, and East Asia. As will be analyzed later, these regions also dominate world pork trade. From **Table 2** one can also see that of the ten leading states in pork production, six belong to the EU.

EU member states are also to be found among the leading export and import countries of pork, as can be seen from **Tables 3** and **4**. Of the ten leading exporting and importing countries, six belong to the EU. One has to consider, however, that the intra-EU trade is included. If these volumes would be excluded, the United States would be the leading exporter and Japan the most important importer. In 1998 the EU exported 635.400 t of pork to "third countries," i.e., countries that do not belong to the EU; this is about 21% of the total export volume.

Per capita consumption and self-sufficiency rate for pork in the EU

To be able to understand the broad variety of organizational patterns of pork production in the EU, one has to look at the per capita consumption and the self-sufficiency rates in the member states.

Table 1: The development of world pork production between 1990 and 1998, data in 1000 t^A

Region	1990	1994	1998	Change (%)
Africa	601	748	832	+38.4
North and Central America	9,104	10,392	11,155	+22.5
South America	1,900	2,274	2,731	+43.7
USSR	6,653	-	-	-
Asia	29,599	39,168	44,100	(+49.0)
Europe	21,641	24,742	24,916	(+15.1)
Oceania	405	448	452	+11.6
World	69,905 ^B	77,772 ^B	84,186	+20.4

^ASource: FAO-Database⁸

^BFigures do not match because of rounding

Table 2: The ten leading countries in pork production in 1990 and 1998, data in 1000 t^A

1990		1998	
Country	Production	Country	Production
China	23,820	China	36,930
USA	6,964	USA	8,623
USSR	6,654	Germany	3,750
Germany	4,457	Spain	2,524
Poland	1,855	France	2,300
Spain	1,789	Poland	1,810
France	1,727	Brazil	1,690
Netherlands	1,661	Netherlands	1,675
Italy	1,333	Denmark	1,631
Denmark	1,208	Italy	1,412
Total	51,468	Total	62,345
% of world production	73.6	% of world production	74.0

^ASource: FAO-Database^BTable 3: The ten leading export countries for pork in 1998, data in 1000 t^A

Country	1998	% of world exports
Denmark	841	19.1
Netherlands	637	14.5
Belgium/Luxemb.	525	11.9
USA	357	8.1
France	352	8.0
Canada	289	6.6
Germany	225	5.1
United Kingdom	221	5.0
Spain	196	4.5
China	101	2.3
Total	3,744	85.1

^ASource: FAO-Database^BTable 4: The ten leading import countries for pork in 1998, data in 1000 t^A

Country	1998	% of world imports
Germany	847	19.5
Italy	642	14.8
Japan	505	11.6
France	322	7.4
Russia	281	6.5
USA	217	5.0
United Kingdom	155	3.6
China/Hong Kong	141	3.2
Greece	140	3.2
Mexico	109	2.5
Total	3,359	77.3

^ASource: FAO-Database^B

As can be seen from **Table 5**, per capita consumption of pork reaches a maximum with 63 kg (138.4 pounds) in Denmark and a minimum with only 23.8 kg (52.2 pounds) in the United Kingdom. Germany, with more than 82 million inhabitants and a per capita consumption of 55.9 kg (122.8 pounds), has by far the highest demand for pork in Europe.

A closer look at the self-sufficiency rate for pork in the EU shows a broad variety, too (**Table 6**). Whereas Greece is only able to produce 57% of the domestic demand, Denmark has to export about 80% of the production. Germany has a self-sufficiency rate of 82% and is therefore the most attractive market for pork as well as for live pigs in Europe and the leading importer of pork.

It is obvious that the market strategies of pig producers and also of packers are closely related to the self-suffi-

ciency rate. When there is a large surplus and a lot of pork has to be sold within the EU or on the world market, the producers have to be very competitive with respect to quality and price. When, on the other hand, domestic production is not able to meet the demand, packers try to buy as many pigs as possible from farmers in the adjacent production areas or even farther away in order to be able to use as much of the installed slaughter capacity as possible. This very often has the effect that a portion of the slaughtered pigs is of low quality, which again reduces the competitiveness of the companies on the market for pork. High financial losses may be and often are the result. The weak financial situation of a large number of packers in Germany, especially those owned by cooperatives, speaks for this assumption.

Table 5: Per capita consumption of pork in the EU member states in 1990, 1994, and 1998, data in kg^A

Country	1990	1994	1998	% change
Germany	60.1	55.5	55.9	- 7.0
France	37.0	36.1	38.0	+ 2.7
Italy	31.4	33.2	35.6	+ 13.4
Netherlands	45.6	44.3	44.0	- 3.5
Belgium/Luxemb.	44.9	48.9	46.0	+ 2.4
United Kingdom	24.1	23.7	23.8	- 1.2
Denmark	64.2	63.2	63.0	- 1.9
Ireland	35.4	36.8	40.6	+ 14.7
Greece	21.0	22.6	25.1	+ 19.5
Spain	47.1	54.3	61.0	+ 29.5
Portugal	30.2	35.1	41.5	+ 37.4
EU (12)	40.7	40.8	42.6	+ 4.7
Austria	60.0	55.9	58.6	- 2.3
Finland	32.9	29.9	33.9	+ 3.0
Sweden	30.6	33.9	38.7	+ 26.5
EU (15)	40.8	41.0	42.7	+ 4.7

^ASource: ZMP Bilanz: Vieh und Fleisch, various editions⁹

Table 6: Self sufficiency rates of the EU member states for pork in 1990, 1994, and 1998, data in %^A

Country	1990	1994	1998	% change
Germany	94	77	82	- 12.8
France	86	99	104	+ 20.9
Italy	67	68	65	- 3.0
Netherlands	280	286	264	- 5.7
Belgium/Luxemb.	161	193	224	+ 39.1
United Kingdom	69	75	82	+ 18.8
Denmark	366	468	508	+ 38.8
Ireland	129	167	167	+ 29.5
Greece	69	62	57	- 17.4
Spain	97	103	110	+ 13.4
Portugal	94	88	80	- 14.9
EU (12)	105	107	110	+ 4.8
Austria	101	102	103	+ 2.0
Finland	114	113	106	- 7.0
Sweden	111	103	100	- 9.9
EU (15)	105	106	110	+ 4.8

^ASource: ZMP Bilanz: Vieh und Fleisch, various editions⁹

Sectoral and regional patterns of pig production in the EU

It can be assumed that there is a close relationship between the average herd size and the self-sufficiency rate. In **Table 7**, basic data for the EU member states are put together. From these data one can see that, with the exception of the United Kingdom, countries that have a high rate of self-sufficiency also have large average herd sizes. In the United Kingdom only a comparatively small number of pig farmers with small herds is left. In 1997 only 3.7% of all pigs were held in farms with herds less than

200 heads. From **Figure 1** one can see that there is quite obviously a trend towards a particular herd size pattern in the EU which can be described as a process of continuous sectoral concentration. As it looks at the moment, about 80% of all pigs will be held in roughly 20% of the farms in the near future. Those countries that have not yet reached such a size pattern, or one at least close to it, will have serious problems within the next years to be competitive in a globalizing pork market.

A closer look at the regional pattern of pig production in the EU (**Figure 2**) shows that the highest concentration of pigs is to be found in northern Central Europe, reach-

Table 7: Basic data of the sectoral pattern of the EU pig industry (1997)^A

Country	Pigs/farm	sows in herds with more than 100 heads (%)	hogs in herds with more than 1,000 heads (%)
Germany	118	46.0	14.2
France	199	71.2	35.6
Italy	33	75.7	60.9
Netherlands	723	90.9	27.2
Belgium/Luxemb.	626	67.0	25.1
United Kingdom	559	85.2	53.8
Denmark	605	85.5	19.0
Ireland	1,010	93.8	71.9
Greece	45	66.9	52.0
Spain	69	66.5	35.5
Portugal	18	44.0	32.8
EU (12)	105	39.7	32.5
Austria	37	7.1	0.9
Finland	241	23.9	3.8
Sweden	277	59.0	34.6
EU (15)	101	38.3	31.3

^ASource: ZMP Bilanz '99, Vieh und Fleisch¹⁰

ing from Jytland (Denmark) via Lower Saxony and Northrhine-Westphalia in Germany, the southern provinces of the Netherlands to West Flanders in Belgium. Secondary centers have developed in Bavaria (Germany), Katalonia (Spain) and in parts of the Po valley in northern Italy.

A detailed analysis would be able to prove that the centers of pig production also have a very favorable herd size pattern. The process of sectoral concentration has a parallel in a regional concentration. Economic success is one side of the coin, ecological and disease problems the other side. Outbreaks of classical swine fever in the 90s in Belgium, Germany, and the Netherlands caused very high financial losses. These outbreaks also led to a restructuring of the EU swine and pork industry.

Types of pork production in the EU

In the following section, four types of pork chains will be analyzed. From the four case studies, one can easily see that pork chains developed in a particular economic setting.

Consorzio del Prosciutto di Parma

Parma ham is a favorite food not only in Italy but also in other parts of Europe, the United States, and Japan. Here, a completely controlled chain of pork production and further processing has developed since 1963. Whereas the production and slaughtering of hogs is to be found in 13 provinces in northern Italy, the curing process (in smokehouses) is concentrated in a small area south of

Parma. In 1963, when the production chain began to develop, only 23 companies worked in this field, producing 53,500 pieces of smoked ham. In 1998 about 8.6 million pieces of ham were produced in 201 companies. They vary considerably in size but the curing process is strictly defined, so that a very special quality and taste can be guaranteed.

The production chain starts with the breeding herds where the piglets are born and raised. About 5500 farms in the 13 provinces are permitted to produce piglets. They are then transferred to the fattening farms which are also located in the 13 provinces. The piglets are marked in the breeding farms so that from the farm to the slaughterhouse and the curing facilities the origin can be monitored. There are also strict regulations for the farmers how to keep the hogs, which feed to use, and how to proceed in case of health problems. In the slaughterhouse, the ham is selected and labeled and then transferred to the curing facilities. After leaving the smokehouses, every single ham is inspected and then it is decided if it can be marketed as Parma ham. About 10% do not meet the standards.

In 1998, the *Consorzio* exported 1.3 million pieces of Parma ham, i.e., 8420 t. The main importers were France (28.1%), Germany (27.6%), and the United States (12.7%). These three countries imported more than two thirds of the export volume. Parma ham is the only uncooked ham that is imported by the United States. The economic importance of this production chain becomes obvious when one considers that 3.4 million hogs were needed to produce Parma ham, which is more than 27% of all hogs that were slaughtered in Italy that year. Qual-

Figure 1:
Changes in the herd-size pattern in pig production of
selected EU member states between 1975 and 1997

(Source: Klohn and Windhorst 1999, p. 172)

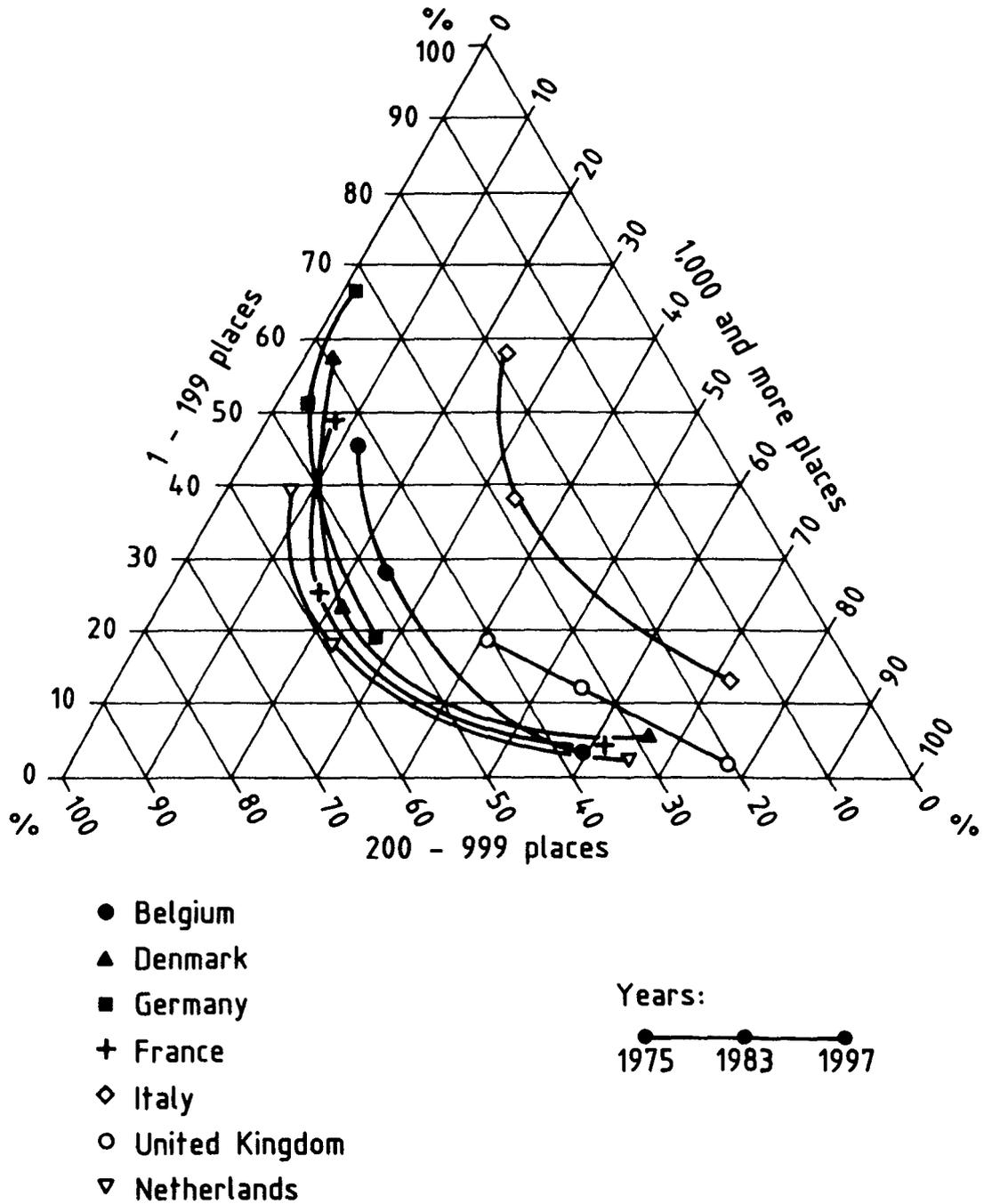
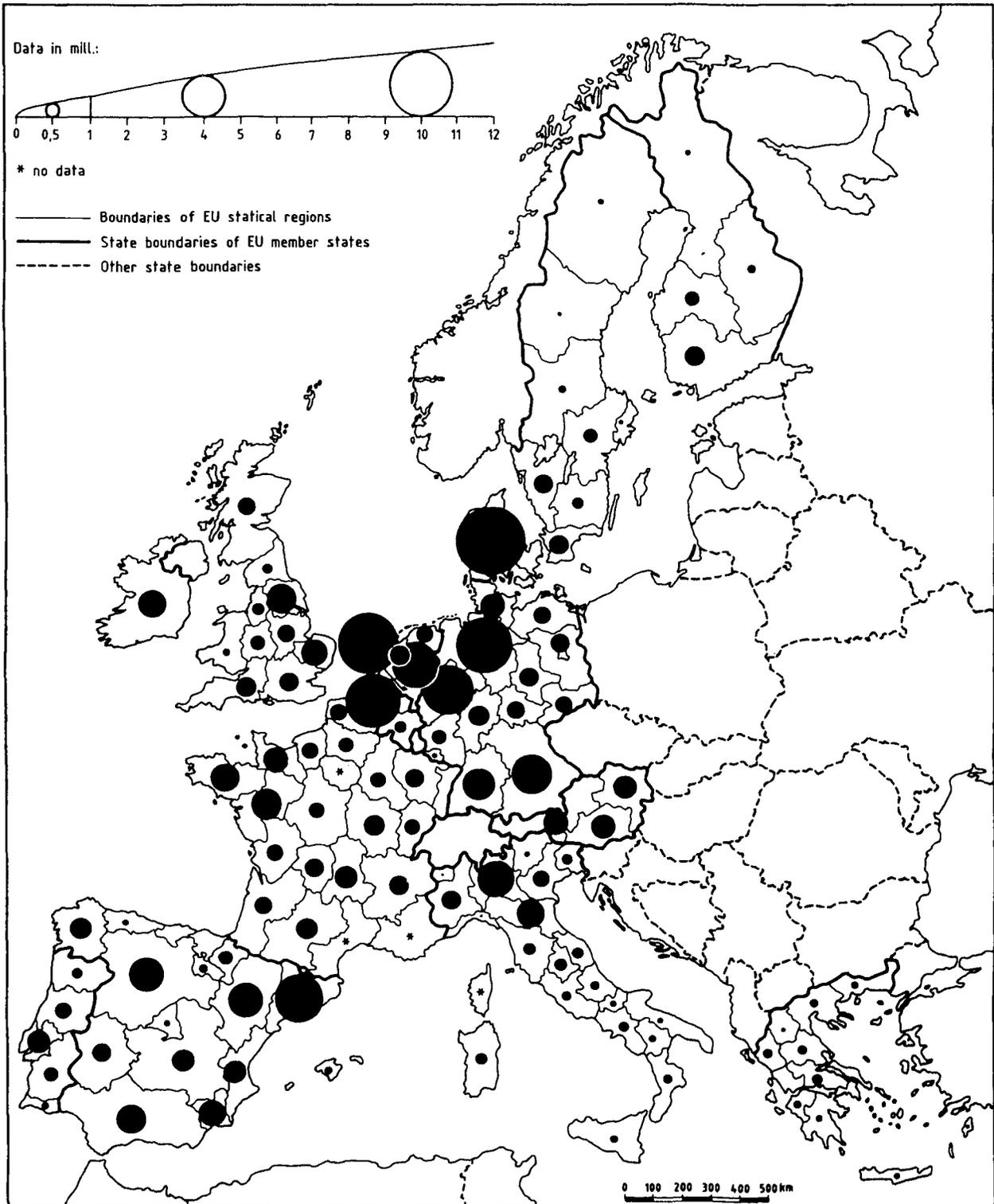


Figure 2:
Pig population in the EU (1995/1997)
(Source: EUROSTAT)



ity assurance and a closed production chain are the basic parameters that explain the lasting success of *The Consorzio del Prosciutto di Parma*.

Danske Slagterier2

In the late 60s and early 70s a decision was reached in Denmark that, within the next two decades, Danish pig producers, slaughterhouses, and marketing organizations would try to become the number one exporting country for pork. It was the task of *Danske Slagterier*, the federation of pig producers and slaughterhouses, to develop a strategic concept and to realize it.

The main targets of the strategic concept were:

- to initiate a sectoral concentration process in primary production.
- to reduce the number of cooperatives which owned the slaughterhouses.
- to develop a spatial pattern of primary production, slaughtering, and further processing which would minimize transportation time, reduce transportation costs, and improve meat quality.
- to develop a quality management system that would be able to guarantee a high standard of pork and reduce the cost of meat inspection.
- to develop a marketing concept that would be able to win market shares in Central Europe.

After 25 years of concentrated work in these fields, one can say that the initial plan could be realized.

From **Table 8** one can see how Danish pig production was restructured within two decades. In 1998, only 5% of the pig farmers held one third of the pigs. The number of large and very large farms has increased continuously. The same process can be observed in the restructuring of the slaughterhouses. In 1970, 50 cooperatives and four

private owners had 54 slaughterhouses; in 1998 only three cooperatives were left, and they ran 22 slaughterhouses. The market leader is *Danish Crown*, a merger of *Danish Crown* and *Vestjyske*, with 16.3 million slaughtered pigs in 1998 and a market share of 80.1%, followed by *Steff Houlberg* (14.3%) and *TiCan* (5.6%). In total the three cooperatives slaughtered 20.4 million hogs.

Parallel to the restructuring of pork production, a vertically-integrated production system was developed, organizing the flow of materials and information from the breeding herd to the slaughterhouse and meat processing plant. A quality management system was installed that became the model for production chains in Europe. Today several hundred parameters can be measured automatically in the slaughterhouse with the so-called Autofom-system, 32 are used for the evaluation of the carcass.³

About 98% of the Danish pigs are produced on a contract basis. The pig farmer guarantees that he will only deliver his hogs to the cooperative with which he has a contract and to the indicated slaughterhouse. The slaughterhouse guarantees that it will accept the delivered hogs. The grading and payment system is rather simple. All slaughterhouses in Denmark pay according to the weight of the hogs (optimum 67 to 80 kg) and the meat percentage (basic: 67%); at the end of the year, a bonus may be paid according to the economic success of the cooperative.⁴ It can be expected that with the introduction of the Autofom-system, the grading system will change dramatically and lead to a completely different valuation of the carcass, as the value will then be calculated according to the value of the cut-up parts.

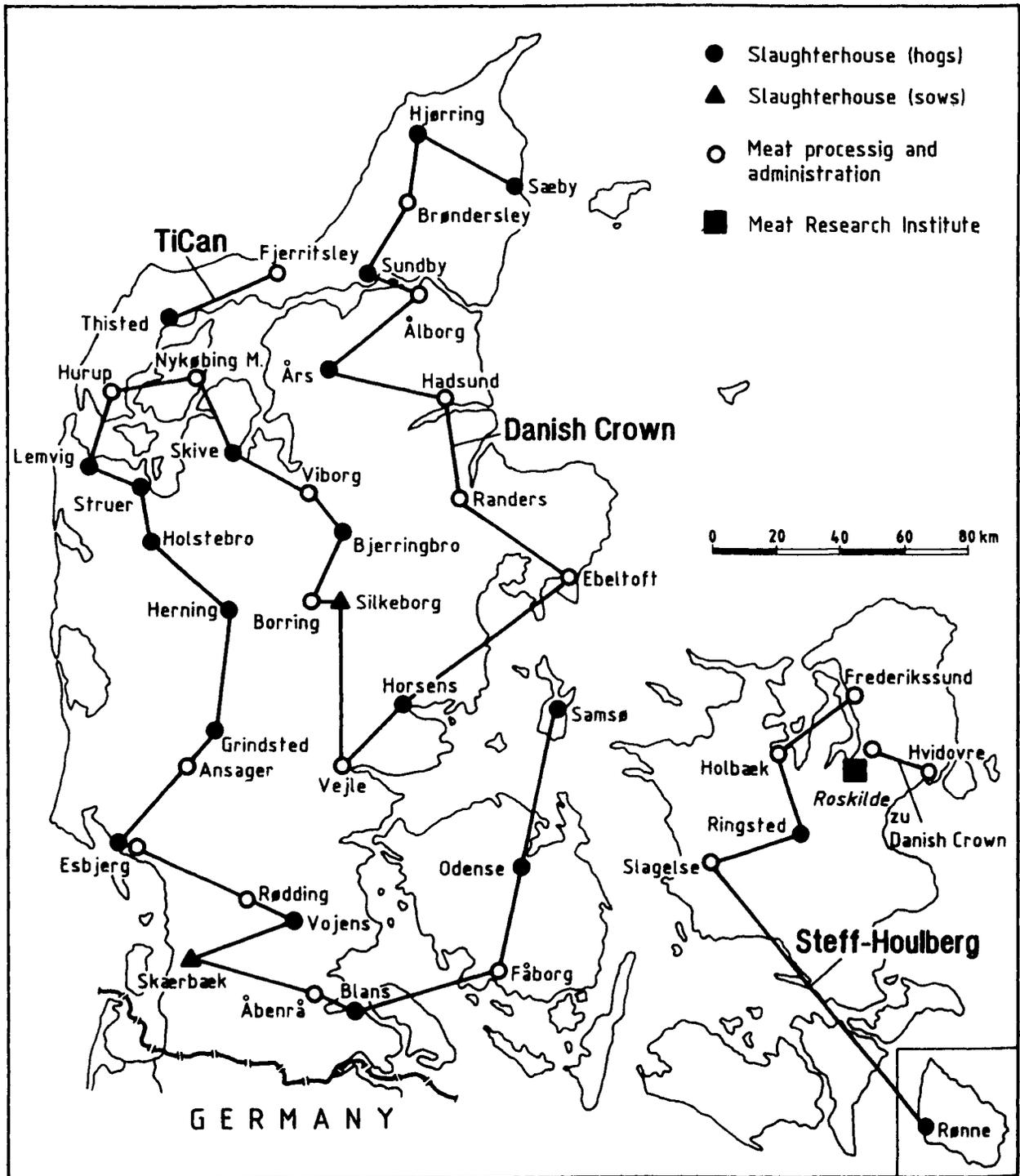
The quality management system, contract production, and optimizing the material flows within the production chain by means of a particular spatial pattern (**Figure 3**) reduced the production cost; the quality management system guaranteed a continuously high quality, which ex-

Table 8: The changing sectoral pattern of pig production in Denmark between 1978 and 1998^A

Pigs per supplier (head)	1978		1998	
	Suppliers	Pigs	Suppliers	Pigs
1-200	60,990	3,084,044	9,034	544,788
201-500	9,994	3,117,221	2,758	911,064
501-1,000	3,733	1,556,001	2,402	1,751,706
1,001-2,000	1,121	1,472,999	2,725	3,896,434
2,001-3,000	129	303,291	1,371	3,346,073
3,001-4,000	37	122,468	745	2,575,500
4,001-5,000	18	92,730	408	1,818,783
5,001-10,000	-	-	528	3,514,961
10,000 and more	-	-	84	1,090,079
Total	76,022	10,748,754	20,055	19,449,388

^ASource: Danske Slagterier¹¹

Figure: 3
The spatial pattern of Danish pork production (1999)
(Source: Danske Slagterier Statistics 1999)



plains the success of the Danish marketing organizations in the international market for pork.

DUMECO (Dutch Meat Company)⁵

The success of the Danish marketing organizations, especially in Central Europe, led to serious financial problems in some of the leading cooperatives in the Netherlands. It became obvious in the first half of the nineties that Dutch pork producers would lose market shares without restructuring the pork production sector. The most important challenges the cooperatives and private companies were confronted with can be summarized as follows:

- The lack of production chains
- The lack of quality management systems
- A high over-capacity in the slaughterhouses
- A high financial burden for many pig farmers in the southern provinces because of the manure surplus

In spite of the low feed cost and a favorable herd size pattern, the Dutch swine industry lost market shares. Pork and pork export to Germany, the most important market for the Netherlands, decreased from 327,245 t in 1992 to 279,616 t in 1998. Without solving the above-mentioned problems, a further loss of market shares was indicated.

In 1995, a new company, DUMECO (Dutch Meat Company) was founded. It was a merger of two cooperatives (COVECO and ENCEBE) and a private company (GUPA). The new company closed several small slaughterhouses in order to adjust primary production and slaughterhouse capacity and reduce production costs by using the full capacity of the facilities. At the moment DUMECO runs five slaughterhouses with an installed capacity of 6.5 million hogs per year and one slaughterhouse for cattle (Figure 4). In 1996, the last year before the disastrous outbreak of Classical Swine Fever in the Netherlands, DUMECO slaughtered 6.2 million hogs, that is about 35% of the Dutch production, using almost 95% of the capacity.

Within a short time, DUMECO installed a vertically-integrated production system and an effective quality management system. The most important elements are:

- I & R (Identification and Registration)
- IKB (Integrated Quality Control)
- HACCP (Hazard Analysis Critical Control Points)

There are further regulations for transportation, feed, and veterinary medicine based on guidelines of the *Produktschap Vee, Vlees, en Eieren* (Product Board for Livestock, Meat, and Eggs).

The production system combines all elements from primary production to food outlets. The main elements of the system are:

- The farmers, as primary producers of hogs and cattle
- DUMECO Breeding b.v., a company that organizes breeding of pigs and cattle
- Coöperatie DUMECO u.a., a company which has the task to intensify the cooperation between primary producers, slaughterhouses, and meat processing facilities
- DUMECO b.v., is the core element of the integrated system, it organizes slaughtering, cutting, and bacon production
- DUMECO Retail is the marketing element; it organizes the international as well as the domestic trade; to this company belong about 300 food stores in the Netherlands and Belgium

DUMECO had almost completed the reorganization of pork production when the outbreak of Classical Swine Fever in the southern provinces of the Netherlands led to high financial losses because of the shortage of hogs. More than 11 million pigs had to be killed in 1997 and 1998. In total, Dutch pig farmers, pork producers, meat processors, and feed mills had to face losses that almost reached 4 billion Dutch guilders (US \$2 billion). The farmers were compensated for most of the losses by the EU; DUMECO and the rest of the pork industry did not get any subsidies, however. Astonishingly enough, the pork industry has recovered from this cut back rapidly, so that in 1999, production figures came close to those of 1996.⁶ It can be assumed that because of the quality management system DUMECO was able to win back the market position which it had held before the disease outbreak.

EGO (Erzeugergemeinschaft für Schlachtvieh Osnabrück eG)⁷

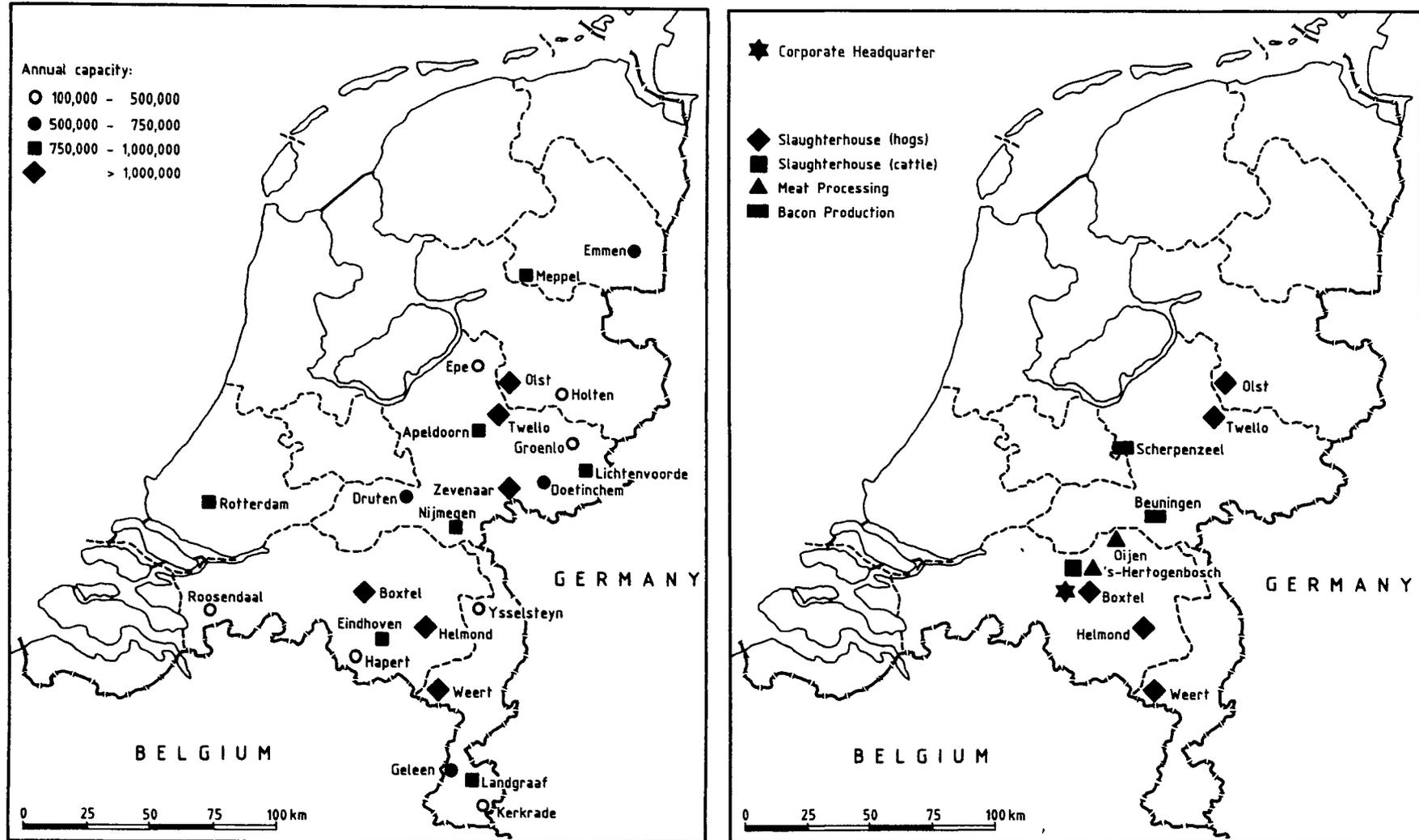
As mentioned before (Table 6), Germany is not able to cover the demand for pork by domestic production. The self-sufficiency rate hovers around 80%, so that for almost 16 million inhabitants pork has to be imported. It is surprising that German pig producers and slaughterhouses are not able to reach a higher self-sufficiency rate. The main reasons for the lack of competitiveness of German producers are:

- An unfavorable herd size pattern of most pig farms
- The lack of production chains
- The lack of quality management systems
- A high surplus capacity of the slaughterhouses compared to domestic hog production
- Environmental problems in the centers of pig production in north-western Germany

Even though there are no exact figures available concerning the amount of pork that is produced in chains that

Figure 4:
Slaughterhouses with an annual capacity of 100,000 hogs and more in the Netherlands and the spatial pattern of the integrated production system of DUMECO (1998)

(Source: Product of Livestock, Meat and Eggs 1999; Dumeco, Annual Report 1998)



reach from breeding to cutting, one can assume that the percentage is less than 10%. As the installed capacity of the slaughterhouses is about 35% higher than the domestic production of hogs, farmers have been able, so far, to sell their hogs at an attractive price without being forced into contracts. It is becoming obvious, however, that the meat processors and the big food chains are putting pressure on the packers to install production chains that will add to quality and product safety. If this problem cannot be solved within the next two or three years, German pig and pork producers will lose further market shares as there is sufficient pork available on the EU market that stems from production chains.

There is only one production chain for pork and meat products in Germany that has developed a standard which can be compared with Denmark. It was founded in 1969 as a cooperative and has been very successful in the market since then. In 1970 only about 25,000 hogs were slaughtered; in 1999 the number had increased to 440,000; the annual turnover of the production system reached a total of 440 million DM (about US \$220 million).

Within 30 years, the production system was continuously completed; now it is a fully integrated system from breeding to food outlets, using a special brand, *Eichenhof* ("Oak Farm") for the products that reach the market.

The following elements form the production chain:

- EGN (*BHZP Erzeugergemeinschaft Niedersachsen-West*), the breeding organization for sows (founded in 1988)
- EGF (*Erzeugergemeinschaft für Qualitätsferkel eG*), the cooperative that produces quality piglets for the fattening farms (founded in 1974)
- EGO (*Erzeugergemeinschaft für Schlachtvieh eG*), the cooperative that produces slaughter pigs and also cattle (founded in 1969)
- EGO-Slaughterhouse (*EGO Schlachthof*), the slaughterhouse of the cooperative with a daily capacity of 1000 hogs (built in 1989)
- Kinnius Meat Processing, bought in 1992
- Pieper Slaughterhouse and Meat Processing, bought in 1995
- Fleischerfachgeschäfte (meat specialties stores), 167 authorized outlets for fresh meat and sausages

The quality management system was developed parallel to the production system. Its main elements are:

- Regulations for the transport of sows, piglets, and hogs
- Regulation for the feed mills that deliver the feed
- An integrated veterinary monitoring system

- An identification and registration system which makes it possible to trace a piece of meat back to the fattening farm and even breeding farm
- A monitoring system in the slaughterhouse which makes it possible to identify individual carcasses with health problems (milk spots, pneumonia, pericarditis, etc.)

The above-mentioned pressure of the food chains and the meat processing companies to purchase only meat that was produced in production systems with integrated identification and registration methods and quality management systems initiated an activity by the former CEO of the EGO cooperative. In December 1999, six slaughterhouses and meat processing companies with an annual capacity of 2.4 million hogs declared that they would cooperate in the future under the regulations and guidelines of the EGO cooperative. This is indeed a major step towards the implementation of quality management systems and the formation of pork production chains in Germany.

Discussion: The future of pork production in the EU

Pig producers, slaughterhouses, and meat processors in the EU are confronted with the same challenges, but the reactions are very different as can be seen from the case studies. Denmark, the leading exporting country for pork, developed a production system that made it possible to deliver large amounts of pork with a guaranteed quality and an attractive price to international markets. The economic success forced the producers in the Netherlands to reorganize the Dutch pork production system. DUMECO followed the Danish example and could win back lost market shares. The same is true for Belgium. In Spain, pig and pork production is growing with astonishing rates. The most recent development, especially in Catalonia, follow the Danish model. Germany, the leading import country for pork, has not been very successful so far. Only a small amount of pork is produced in chains; the import volume has been increasing continuously over the last years. Besides the over-capacity of the slaughterhouses, the opposition of many farmers to produce hogs on a contract basis is the main obstacle for a progressive and innovative pork production in Germany that meets the demands of the food chains and the meat processors. Initiatives, as demonstrated in the case study, are singularities so far. Further losses of market shares seem to be inevitable. Pig and pork producers in northern Italy decided to follow another direction. They were very successful with the development of a chain for a very special product, Parma ham. Apart from this regionally concentrated production system, Italian pork producers have not been able, so far, to install quality management systems that reach the Danish or Dutch standards.

Some questions remain unanswered, however:

- Will pig and pork production in the EU, even in those countries where pork chains have been developed, be competitive in a global market?
- Will EU producers be competitive in spite of higher production costs, for example, with producers in the United States or Brazil?
- What impacts will new EU regulations for pig-keeping or for reducing the disease risk in densely populated livestock areas have on production costs?
- Will new centers of pig and pork production develop in Poland, Hungary, and other Eastern European countries after they have joined the EU?

References

1. Michel I. Densely Populated Livestock Areas in Selected EU Member States, a Comparative Study. (unpublished data from a Ph.D. project, University of Vechta).
2. Windhorst H-W. Räumliche Verbundsysteme in einer weltmarktorientierten Genossenschaftswirtschaft – Das Beispiel der dänischen Schweinehaltung. In: Windhorst H-W, ed. Räumliche Verbundsysteme in der Agrarwirtschaft. Vechta: Vechtaer Druckerei und Verlag; 1993-111-125.
3. Personal information from Danske Slagterier, Copenhagen.
4. c. f. Reference 2.
5. DUMECO, ed. Annual Report 1998. Boxtel 1999.
6. Product Board for Livestock, Meat and Eggs, ed. Livestock, Meat and Eggs in the Netherlands 1999. Rijswijk; 1999-22-23. See also: Vorerst mehr Schlachtschweine in Holland. AGRA-EUROPE, 2000, No. 14, Markt und Meinung: 9-10.
7. Laumeyer S. Die Erzeugergemeinschaft Osnabrueck (EGO) als räumlicher Produktionsverbund. Vechta, 1998. (unpublished thesis).
8. <http://apps.fao.org>
9. Zentrale Markt- und Preisberichtsstelle, ed. ZMP-Bilanz: Vieh und Fleisch. Bonn.
10. Zentrale Markt- und Preisberichtsstelle, ed. ZMP-Bilanz: Vieh und Fleisch. Bonn; 1999-194-195.
11. Danske Slagterier, ed. Danske Slagterier Statistics 1998. Copenhagen; 1999-4.

