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Why Danish pig farms have far more land and pigs than Dutch farms? Implications for feed supply, manure recycling and production costs

Jaap Willems [a], Hans J.M. van Grinsven [a,*], Brian H. Jacobsen [b], Tenna Jensen [c], Tommy Dalgaard [d], Henk Westhoek [a], Ib Sillebak Kristensen [d]

[a] PBL Netherlands Environmental Assessment Agency, Department of Water, Agriculture and Food, PO Box 30, 3720 AH Bilthoven, The Netherlands
[b] University of Copenhagen, Institute of Food and Resource Economics, Denmark
[c] University of Copenhagen, SAXO-Institute, Copenhagen Centre for Health Research in the Humanities (CoRe), Denmark
[d] Aarhus University, Department of Agroecology, Denmark

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ABSTRACT

The Netherlands and Denmark are the two biggest pig meat exporters in Europe, both with a strong focus on the German market. The structure of pig farms is very different: an average Danish pig farm has 3500 pigs, 170 ha of agricultural land on which a major part of the feed cereals are grown, whereas a typical Dutch pig farm has 2500 pigs with only 10 ha. As a consequence, Dutch pig farmers have to purchase all feedstuff and need to dispose nearly all the manure off-farm. A literature based study revealed that the main factors for the contrasting development were a stronger competition for land, resulting in higher land prices, and stimulation of intensive animal husbandry in the Netherlands, while in Demark environmental policies more strongly coupled manure production to land area. As a result the Dutch pig farmers have focused on intensification of livestock production on small holdings using external sources of feed supply, and Danish farmers on efficient production of feed cereals on large holdings. Due to a gradual lowering of manure and fertiliser application standards, Dutch farmers increasingly have to process manure and export manure, further increasing the total costs of pig production. Manure disposal costs per kg of slaughter weight in 2011 were on average 3.5 times higher in the Netherlands than in Denmark. Manure is exported mainly to Germany and France, which also supply the feed cereals. Therefore manure export contributes to closure of nutrient cycles. Danish pig farmers are less sensitive to nutrient policies and feed prices than those in the Netherlands, but the high debt rate makes the sector vulnerable to low pig prices.

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1. Introduction

Pig meat is the most popular meat in the world (FAO, 2013). The annual average pig meat consumption in the EU per capita in 2013 was about 40 kg (BPEX, 2014a). The Netherlands and Denmark have a large pig sector and are the two biggest pig meat exporters in Europe. The economic importance of pig production sectors in Denmark and the Netherlands is similar. The average annual value of the agricultural output of the Danish pig sector in 2013 was 3.2 billion euro and 3.0 billion euro for the Netherlands. Relative to the total agricultural output, the Danish pig sector is more important (29%) than the Dutch pig sector (13%; EC, 2014a, 2014b). Due to a smaller human population (about one third of the Dutch population) export of pig meat and piglets is of greater importance for Denmark. The degree of self-sufficiency in 2013 was 450% for Denmark and 200% for the Netherlands (BPEX, 2014b). Germany is the most important customer of the pig sector in both countries.

The pig sector in both countries has been under public scrutiny since the 1970s. Initially, there were environmental concerns related to ammonia emissions from manure to air and nitrogen (N) and phosphorus (P) to water that cause eutrophication, acidification, groundwater pollution and odour. Over the years both countries have done much to reduce ammonia emissions resulting in a decrease in 2013 relative to the 1990 levels of 41% for the Netherlands and 64% for Denmark (EEA, 2015a). Since 2000, public concerns increased about animal welfare, risks for public health from pathogens resistant to antibiotics (e.g. MRSA, methicillin-resistant *Staphylococcus aureus*), emergence of very large industrial operations or mega farms (Eijsackers and Rabbinge, 2013; Danish Agriculture and Food Council, 2012) and concerns about depletion of global phosphorus reserves (Cordell et al., 2011). Regarding the environmental issues, both countries have chosen for a relatively strict implementation of common EU environmental policies for nitrate and ammonia (Mikkelsen et al., 2010; Dalgaard et al., 2014; van Grinsven et al., 2012; Willems and van Schijndel, 2012).

The size of the pig sector and the technical performance in both countries are comparable but the structure of the pig sector is very different. Today, average pig farms in Denmark are much larger than those

* Corresponding author.
E-mail address: Hans.vangrinsven@pbl.nl (H.J.M. van Grinsven).

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in the Netherlands, both in number of animals and acreage. Many factors may have contributed to a different development of farm size and structure in both countries (Table 1), but at first impression this contrasting structure is surprising as natural conditions appear to be similar, as well as economic and environmental context and policies.

A first aim of this article is to describe and quantify the differences in structure of the pig sector in both countries, to identify the factors that caused these differences in history and to provide an explanation. We do not expect to find the precise underlying cause of developments but rather to present some plausible explanations. Factors considered in our analysis are geography, feed supply, competition with other agricultural sectors for land, national and EU policies for agriculture and environment, inheritance laws and knowledge development.

A second aim is to assess the implications of these differences on feed use and manure handling. Control of losses of N and P and closing nutrient cycles are important issues in the political ambition for sustainable livestock farming in Europe and the world (Thornton, 2010; EC, 2011). Options for more environmentally responsible management of manure and increasing nutrient use efficiency depend on the scale and structure of the pig sector.

Finally, we will address some implications for production costs and future competitiveness of the pig sector in both countries. This assessment was a desk study using historical and recent census data from the national statistical services in Denmark and the Netherlands, and information from the ministries responsible for agriculture and environment and from affiliated government institutes.

2. Historic development

2.1. Number of pigs

The development of the total pig population in Denmark and the Netherlands since 1900 is quite similar, but the trend of change is quite different (Fig. 1). If we focus on developments after WWII, we can see that Dutch pig numbers showed an important and continuous growth in the period 1965–1990 which exceeded the Danish growth rate. However the Dutch growth rate slowed down at the end of this period. This slowdown coincides with the introduction of environmental policies and the subsequent increase of farm costs as result of these measures. The increase in Denmark after 1973 can be attributed to the membership of Denmark of the EC which resulted in an increase of the export to Germany (Christensen, 1980). At the end of the 1970s the introduction of new foreign pig breeds combined with access to investment support further expanded the Danish pig sector (Kærgård et al., 2002; Kærgård and Dalgaard, 2014). The growth of the Danish pig population after 1995 is caused by the loss of a part of the Dutch share of the German market to the Danish pig farmers after the classical swine fever (CSF) outbreak in the Netherlands (de Winter et al., 2008). This caused a sharp decline in the Dutch pig population and the subsequent buyout of pig production rights by the Dutch government. Overall, the trend of change in the pig population in Denmark and Denmark after WWII appears to be countercyclical, with three distinct cycles, illustrating that both countries operate on the same competitive market. A recent trend is a shift from export of pork to export of piglets which increases added value while reducing national environmental impacts. For further detail see Supplementary material p 1–4 and Fig. A1.

2.2. Farm numbers, size and regional distribution

Since 1950 the total number of farms with pigs in both countries decreased from more than 200,000 to about 5000 pig farms in Denmark in 2010 and about 7000 in the Netherlands (Fig. 2). These are mostly specialised pig farms.

The average number of pigs per farm increased from around 15 in Denmark and 7 in the Netherlands in 1950 to over 2000 in 2010 in Denmark (Fig. 2). In 1950/1951 20% of the pigs in Denmark was kept on farms smaller than 10 ha, as compared to 54% of the pig population in the Netherlands (Fig. 3). Nowadays about 70% of the Danish pigs can be found on farms with an acreage of 170 ha and more, while in the Netherlands 70% of the pig population is kept on farms with an acreage less than 30 ha (Fig. 4). Both in Denmark and the Netherlands about 8% of the pigs are bred on virtually landless farms. In the Netherlands, pig densities (pigs/ha) are in general much higher than in Denmark and comprise the highest regional pig density in Europe (Michel, 2004; Eurostat, 2008a, 2008b, 2010).

In 2012, 94% of pig population in the Netherlands was located in regions in the south and east of the country, with a high share of sandy soils. In Denmark Jutland is the most important region for pig farming, however pigs are also produced in other parts of the country. Both in West and East Jutland the highest pig densities occur. Pig farms are located both on sandy soils in western Jutland (Fig. 5) and on loamy soils in eastern Jutland. The production of feed is hence higher on the loamy soils in terms of yield per ha, but the sandy soils use irrigation. Dairy farms are mainly located on sandy soils in Jutland. Sandy and loamy soils are prone to nitrate leaching (Oenema et al., 2005). For further detail see Supplementary material page 4–5 and Fig. A4.

Table 1
Summary of national and international events since 1950 which were or could have been relevant for livestock farming in Denmark and the Netherlands in general, and in particular for pig farming.

Year	Country	Event
1957	EU (NL)	Treaty of Rome, establishing the European Economic Community (EU-6); member states Belgium, France, Italy, Luxembourg, the Netherlands and West Germany.
1958	EU (NL)	Start of the EU Common Agricultural Policy (CAP)
1963	EU (NL)	Dillon Round US & EC (GATT) high level tariff on grain import but a zero level import tariff on oilseeds, oilseed products and non grain feed ingredients leading to the "gap" of Rotterdam.
1972	EU (NL)	Directive on the modernization of farms (72/159/EEC).
1973	DK	Denmark becomes a member of EU, together with the United Kingdom and Ireland (EU9).
1984	NL	Interim law prohibiting the expansion of animal husbandries (poultry and pigs; start of Dutch manure policy).
1987	NL	Dutch manure and soil protection laws (manure production rights; P-application standards).
1987	DK	First action plan on the aquatic environment.
1991	EU	Nitrates directive (91/676/EEC) published.
1992	EU	Mac Sharry reform of CAP: no more price support for crops, but direct payments to farmers.
1997–1998	NL	Classical swine fever in the Netherlands: partial loss of Dutch export market share to Danish pig sector.
1998	NL	Law on restructuring the pig sector; introduction of tradable production rights with national and regional ceilings.
1998	DK	2nd action plan on the aquatic environment; introduction of the harmony rule and application limit of 170 kg/ha manure-N (140 kg/ha for pig manure).
2001–2002	NL	Buying up of 15% of pig production rights.
2003	EU	CAP reform (Fischler); introduction of the single farm payment (SFP), decoupling a large share of CAP support from production.
2004	DK	3rd action plan on the aquatic environment (more attention for reducing P-surplus).
2006	NL	3rd action plan for implementation of the EU Nitrates Directive.
2014	NL	Introduction of mandatory manure processing for all livestock farms with a manure surplus; a share of the surplus needs to be processed.

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