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# Normative contestation in transitions 'in the making': Animal welfare concerns and system innovation in pig husbandry

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### ABSTRACT

Previous studies of system innovations mainly focused on historical cases that were driven by commercial motivations of pioneers and entrepreneurs. This article investigates a system innovation in the making that is driven by normative concerns, such as sustainability or animal welfare, initially formulated by outsiders like special-interest groups. Our central research question is: How, when and why is normative contestation of existing regimes effective in influencing the orientation of transitions in the making?

The conceptual framework enriches innovation studies and the multi-level perspective with insights from social movement theory (SMT) and political science. SMT is used to analyze the build up of normative pressure (through framing, resource mobilization, and political opportunity structures). From political science we use the notion of multiple streams, in our analysis a problem, regulatory, market and technology stream.

The research design consists of a comparative case study of pig husbandry systems. One case analyses the sub-sector of pregnant sows where normative pressures, after several decades, led to the changes advocated by the contestants. The second case concerns the sub-sector of pig fattening where normative pressure was less successful.

The difference is partly explained by the normative pressure for pregnant sows being larger than for fattening pigs. The other part of the explanation is that in the first case normative pressure aligned better with the three other streams (regulatory, market and technology) to lead to the changes desired by the contestants.

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### 1. Introduction

This article explicitly introduces the topic of *normative orientation* into the debate about socio-technical transitions and system innovation (Kemp et al., 1998; Elzen et al., 2004; Smith et al., 2005). Many historical cases that have been studied by transition scholars were driven by commercial motivations of pioneers and entrepreneurs, e.g. cars replacing horses (Geels, 2005), mechanical cargo handling machines replacing manual unloading of ships (Van Driel and Schot, 2005), steamships replacing sailing ships (Geels, 2002), jet engines replacing piston engines (Geels, 2006a). While

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normative and cultural changes were often implicated in these transitions, these were not the main drivers. The issue of normative orientation therefore forms a new substantive contribution, which has particular relevance for scholars who are interested in transitions towards societal goals like sustainability (Elzen et al., 2004). In particular, we are interested in transitions where the initial impulse for change consists of normative contestation from regime outsiders (Van de Poel, 2000), such as social movements or concerned researchers, who find certain performance aspects of existing socio-technological regimes normatively unacceptable and in need of change. We call these 'transitions in the making', not because we are able to foresee this will lead to a transition, but because new developments are started that question some of the basic assumptions in the existing regime which may (or may not) eventually lead to a transition.

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<sup>&</sup>lt;sup>4</sup> The hygienic transition towards sewer systems (Geels, 2006b) is an exception.

The topic of normative orientation is particularly difficult for transitions 'in the making', because multiple transition paths often co-exist and are pursued simultaneously by different actors and social groups (Stirling, 2009).<sup>5</sup> Which possible path eventually becomes dominant thus depends on interactions between multiple actors, moves and countermoves, strategic games, shifting alliances, political support, economic success, technological learning processes and changing perceptions.

The article's general research question is: How, when and why is normative contestation of existing regimes effective in influencing the orientation of transitions in the making? By 'effective in influencing the orientation' we mean that the developments in the regime move in a direction that the contestants advocate.

We address this question in two steps. Firstly, we will enrich the multi-level perspective, which provides a useful conceptualization of transitions, with insights from social movement theory (SMT) and political science. We add SMT to conceptualize how outsiders such as animal welfare groups exert normative pressure on existing regimes. From political science, we use Kingdon's (1984) multiple stream model to argue that normative pressure is more likely to lead to regime change if alignments with other developments (in markets, regulations and technology) create a 'package' between problems and solutions that is attractive to various stakeholders.

Second, we investigate two case studies where normative pressures tried to destabilize an existing regime and call for alternatives that might lead to a future transition. The two cases concern two sub-sectors in pig husbandry in the Netherlands and the influence from animal welfare concerns (1970–2008). We have chosen these cases because animal welfare concerns are entirely about normative considerations in contrast to negative externalities that affect people or sectors. They differ from concerns over pig manure, which caused *functional* problems of water pollution, stench, ammonia emissions and acid rain that hindered water companies, local residents and urbanites.

Defining socio-technological regimes as rules and routines (Rip and Kemp, 1998), in tandem with technological artefacts in practice, the two comparative cases are about technical changes in pig husbandry systems (e.g. automatic feeding systems, manure removal systems, and floor design), certain changes in husbandry routines (e.g. feeding routines) and market changes. The regime reconfigurations in both cases are still 'in the making', although one case has progressed substantially while the other has not. We will use our conceptual additions to explain this difference.

In Section 2, we provide a conceptualization of the relevant processes and mechanisms in normatively oriented transitions in the making. Section 3 discusses the data sources of our comparative case study and historical pre-developments that set the scene. Subsequently we analyze and compare two cases that form sub-sectors within pig husbandry: sow breeding and pig fattening. Section 4 describes the first case (sow breeding), where animal welfare pressure led to the large-scale introduction of new, group housing systems. Section 5 describes the second case (pig fattening), where the contestants were less successful. Three innovation projects (Hercules, Comfort Class, and Canadian Bedding) that constitute alternative paths for transitions in the making did not progress much in terms of wider diffusion. The discussion and analysis in Section 6 explains the difference in outcomes with the conceptual perspective. The article ends in Section 7 with conclusions and suggestions for further research.

### 2. Conceptual perspective

In this section we will present our conceptual framework for analysing the influence of normative contestation on the orientation of transitions in the making. As there are no existing conceptual frameworks that address the relation between normative contestation and innovation we will combine some existing approaches to tackle our research question. We take the multi-level perspective as a starting point (Section 2.1) and enrich this with insights from social movement theory (Section 2.2) and political science (Section 2.3).

### 2.1. The multi-level dynamic

The multi-level perspective (MLP) distinguishes three analytical levels (Rip and Kemp, 1998; Geels, 2002; Geels and Schot, 2007). Niches are seen as the locus for learning and experimentation with radical innovation. The socio-technical regime refers to the semicoherent set of rules and actors that reproduce, maintain and incrementally change elements that together fulfil a societal function such as transport or meat production and consumption. The regime is characterized by stability and path dependence because of lockin mechanisms on various dimensions (e.g. costs, shared beliefs, sunk investments, capabilities, user preferences and life styles). The socio-technical landscape is an exogenous environment that influences niche and regime developments. The MLP proposes that transitions, which are defined as regime shifts, come about through interacting processes within and between these levels. Transitions do not come about easily, because existing regimes are oriented towards stability and incremental innovation along predictable trajectories. Radical innovations emerge in niches, where dedicated actors engage in innovation projects to create 'configurations that work' (Rip and Kemp, 1998). Wider diffusion of niche-innovations depends on internal dynamics and on windows of opportunity at the regime level, which may arise from external landscape developments or from normative pressures, as we will show in this article.

We propose a specific operationalization of the socio-technical regime concept to accommodate our empirical focus on pig farmers and the animal husbandry systems they operate in. While pig farmers are our focal group, we use an embeddedness approach (Dacin et al., 1999) to capture the relations with various other actors such as slaughterhouses, supermarkets, consumers, technology suppliers, research institutes and universities, social movements such as the Animal Protection Society, public opinion, and policy. To further conceptualize these relations, we suggest that enterprises such as pig farms operate simultaneously in two environments (Oliver, 1997): (1) a task environment which includes social groups that engage in economic exchanges and transactions with industries (e.g. consumers, suppliers); economic competitiveness, efficiency, and financial performance are dominant selection criteria, and (2) an institutional environment which contains social groups that affect industries in non-commercial ways, e.g. policy makers, social movements, the wider public, media, public opinion; regulatory legitimacy and cultural-normative legitimacy are the main selection criteria (Suchman, 1995). Fig. 1 links the MLP to this conceptualization of socio-technical regimes for pig farming.

This operationalization of the MLP enables us to address the question of normative orientation by investigating how initial normative pressure from the institutional environment, in particular from social movements and public opinion, influences policy and the task environment (consumer preferences, market demand, etc.). It also helps us study how normative pressure influences the various niche-innovations that may help transform the incumbent regime. It thus helps us answer our research question, i.e. to analyze the effectiveness of normative contestation in influencing transitions in the making.

<sup>&</sup>lt;sup>5</sup> There has been work on transition pathways (Geels and Schot, 2007), but this was based on historical case studies where directionality was identified *ex-post*.

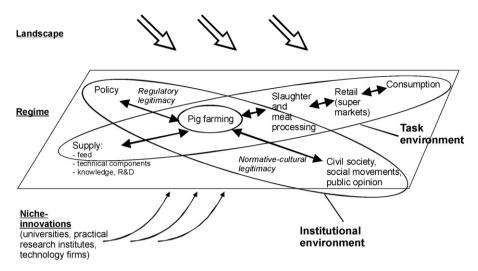


Fig. 1. An embedded multi-level representation of pig farming.

#### 2.2. Increasing normative pressure

To conceptualize normative pressure we mobilize insights from social movement theory. SMT is useful for our research question, because it generally deals with conflicts between established orders and groups that aim to correct some perceived injustice. Because SMT traditionally focused on the labour movement, the civil rights movement, suffragettes, etc., much of the work has a political focus. Recent work by technology-oriented scholars, however, shows that SMT can be usefully applied to technological innovations and industries as well (Lounsbury et al., 2003; Hess, 2005; Smith, 2005). The existing literature suggests that the following three processes from the social movement literature are particularly relevant to understand how movements create normative pressure on existing political regimes: (1) resource mobilization, (2) framing processes, and (3) political opportunity structures (McAdam et al., 1996; Davis et al., 2005).

- (1) The mobilization of resources is important for internal development of a social movement and for external influence on other actors (e.g. public opinion, policy makers). Important resources are: money, members, internal and external networks, expertise, credibility, respectability, and contacts. If social movements mobilize more resources, their (normative) appeals gather strength (McCarthy and Zald, 1977).
- (2) Framing processes are important ways through which social movements aim to influence public opinion and the discourses by which issues are discussed (Hajer, 1995). Issues or problems do not have meaning by themselves. Instead, meaning arises from the frames into which issues are placed, i.e. the "schemata of interpretation" that enable actors "to locate, perceive, identify and label" (Goffman, 1974, p. 21) them. 'Framing' thus is a process through which actors define problems, attribute causality and responsibility, and generally influence the meaning of issues or problems. Framing is consequential because collective constructions of reality make certain actions and response strategies more (or less) likely. Social movements frame problems in ways to enhance their salience and appeal to wider publics. This way they aim to shape the cognitive space in which issues are debated (Eyerman and Jamison, 1991) and influence public opinion, which then exerts credibility pressure on policy makers. Building on Benford and Snow (2000), we propose that the strength or mobilization potential of collective frames is influenced by: (a) their focus (addressing too many issues dilutes the strength), (b) their empirical credibility

- (perceived fit with ongoing events around the issue), (c) their cultural resonance (fit with broader repertoires and discourses), (d) their emotional-normative appeal (often through images, metaphors, etc.).
- (3) Political opportunity structures (e.g. the strength of the state vis-à-vis civil society, the constellation of political parties in power, the structure of the political agenda, etc.) influence the chances for social movements to be effective in bringing about political change. Elections, shifts in political coalitions and the rise of new political parties may create a more (or less) favourable political opportunity structure. While social movement theory traditionally has a political focus, the broader implication of this third point is that it emphasises structural opportunities, while the previous two points place more emphasis on social movement agency. Because we address a broader topic (socio-technical regimes) rather than traditional social movement theory, we need to distinguish broader kinds of opportunity structures. We will address this in Section 2.3 where we discuss alignments between normative pressure with other socio-technical developments.

The normative pressure on regimes increases if these three sub-processes grow stronger. This increase depends on (changing) circumstances and events. Major shocks or accidents, for instance, can push an issue higher on the agenda and strengthen the empirical credibility of particular discourses. Issues also compete for public attention with other problems (Hilgartner and Bosk, 1988) and often experience issue-attention cycles (McComas and Shanahan, 1999; Brossard et al., 2004) with problems rising and falling on public agendas as media and audiences get bored and search for new issues. Increases in normative pressure are likely to have more effect on transitions if they coincide with and can become linked to other developments, leading to a particular 'package' (Kingdon, 1984) that can be pushed through. We turn to these alignments now.

### 2.3. Alignments with other socio-technical developments

Normative pressure, even when it is increasing, cannot bring about substantial regime change on its own. We argue that such regime changes require alignments of normative pressure with other socio-technical developments in Fig. 1, e.g. regulations, consumer demand, or market pressure from supermarkets, nicheinnovations, etc. While social movements may try to influence the developments in other domains (market, technology/innovation,

regulation), these domains also have their own dynamics. From the perspective of social movements, these changes in other domains thus form 'opportunity structures', to which normative pressures can (or cannot) be linked. To further operationalize this alignment, we mobilize some insights from political science, in particular Kingdon (1984), and adapt these for our research question.

Kingdon criticized the linear view on policy making, and instead argued that major policy changes come about through alignments of three streams that have relatively independent dynamics: problem stream, politics stream, and policy/solution stream. Although his multiple stream model has much to offer for understanding political decision making, his focus on policy is somewhat too narrow for our research topic. We therefore adapt some of Kingdon's ideas and propose a broader view on streams, distinguishing four of them. The first stream follows from our interest in normative contestation, the second and third stream are based on the two 'environments' in Fig. 1, and the fourth is relevant because of our focus on innovation. These streams are:

- 1. Problem stream. In our case articulated as the normative orientation in the pressure by social movements.
- Regulatory and political stream. Since we focus on innovation and socio-technical regimes, rather than policy per se, we have merged the policy and politics stream from Kingdon's model.
- 3. Market stream. The dynamics in the system can be affected by consumer preferences (households or businesses). If normative concerns and cultural discourses lead to changes in consumer preferences, then normatively oriented transitions become more likely. But while citizens may publicly express concerns about normative problems, such as animal welfare, they often buy the cheapest products as consumers (Te Velde et al., 2002). Social movements therefore tend to target supermarkets which are often more sensitive to legitimacy and reputation effects. Because supermarkets are important players in the meat chain, changes in their policies may have substantial effects on pig farming practices.
- 4. Technology stream. This generates potential technical solutions through R&D activities and innovation projects. Mainstream researchers with close ties to the regime tend to generate incremental innovations, while researchers that deviate from established regime rules tend to focus on more radical innovations. The latter are what Van de Poel (2000) calls outside professionals, who tend to operate at the niche level in the MLP.<sup>6</sup>

These streams have their own dynamics, but also partially interact. Building on Kingdon, we suggest that the chances for normatively-oriented transitions greatly increase if various streams can be combined into a coherent 'package'. Despite his policy focus, Kingdon (1984: 21) articulates this dynamic eloquently:

"The separate streams come together at certain critical times, solutions become joined to problems, and both of them are joined to favourable political forces. This coupling is most likely when policy windows (opportunities for pushing pet proposals or conceptions of problems) are open. (...) Windows are opened either by the appearance of compelling problems or by happenings in the political stream. (...) Significant movement is much more likely if problems, policy proposals, and politics are all coupled into a package" (Kingdon, 1984: 21).

Windows of opportunity may open up because of crises and disasters (which can act as events that focus public opinion and push problems onto political agendas), elections, national mood swings, the appearance of new political parties, or technological breakthroughs. But windows also close again and problems that may have risen on the agenda because of social movement activities and normative pressures, can also fall down again if they cannot be linked to a technological solution. Kingdon (1984: 210) suggests that (policy) windows may be missed if proposals and solutions "have not already gone through the long gestation process before the window opens".

In contrast to Kingdon, who suggests that the four streams are independent (he only sees somewhat free floating policy entrepreneurs as bringing about linkages), we believe that actors in problem and technical solution streams may actively work on bringing about alignments and linkages. Zahariadis (1999) made a similar criticism. Social movements, such as the Animal Protection Society, may actively support innovation projects that aim to address problems. And researchers, designers, and firms who are engaged in innovation projects, follow and anticipate what happens in civil society, markets and regulations. Innovators are 'heterogeneous engineers' (Law, 1987) who work not only on inanimate physical materials, but also incorporate economic, political, and social dimensions in the specification of their design criteria and goals for innovation projects. Within innovation projects, actors can thus deliberately work on creating a 'package'

With these conceptual additions, and the combinations between social movement theory, political science and innovation studies, we have developed a perspective that is particularly tailored to the issue of normative orientation in socio-technical transitions. This perspective builds on the MLP, but pays more detailed attention to the roles of civil society actors and policy makers, who play an important role in normative transitions, and their interactions with innovation processes and market dynamics. We will use this framework to answer our research question on the influence of normative contestation on transitions in the making by applying it in a comparative case study in the following sections.

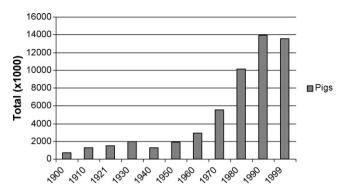
### 3. Data sources and introduction to the case studies

We analyze and compare two cases that form sub-sectors within pig husbandry: sow breeding and pig fattening. Both sub-sectors are characterized by mechanization, specialization, rationalization and economies of scale, which form overarching guiding principles and routines. But they are also different: socially they consist of different networks, with some farmers specializing in breeding and others in fattening; in terms of technological knowledge and routines, sow breeding draws on artificial insemination, breeding research, artificial heating, antibiotics and nurturing, while pig fattening draws on physiological research, food uptake and conversion rates, designer foods, rapid growth and mass production. They also operate on different markets (Geels, 2009). If we are precise, we need to call them sub-regimes since there are also clear links, e.g. with the sows sub-regime providing piglets that are the starting 'material' for the fattening pigs sub-regime. For the purpose of our analysis, however, these relations play no role and therefore we can treat them as two separate regimes, i.e. as two separate

The case studies are based on various technical and economic reports from research institutes, sector organizations and the Ministry of Agriculture.<sup>7</sup> These data sources were supplemented with eight semi-structured interviews, especially to explore the reasons

<sup>&</sup>lt;sup>6</sup> In our case study, most academic researchers worked on incremental change in industrial animal husbandry systems. Some researchers, however, began to develop alternative husbandry systems which paid more attention to animal welfare.

<sup>&</sup>lt;sup>7</sup> The full name initially was Ministry of Agriculture, Nature Management and Fisheries. Later it became Ministry of Agriculture, Nature and Food Quality, allowing continued use of the same Dutch acronym: LNV. In this article we will refer to it simply as the Ministry of Agriculture.



**Fig. 2.** Number of pigs raised in the Netherlands (data from the Central Bureau of Statistics: http://www.cbs.nl).

behind various developments described in the reports. These interviews were recorded and transcribed *verbatim*. We interviewed representatives from the farmers association (LTO), slaughtering industry (Vion), Ministry of Agriculture, Animal Protection Society and researchers who have been involved in various developments described. In the case description these are referred to by giving the interviewee's organizational background. To receive feedback to our initial findings we organized a workshop with sector representatives and agricultural scientists from different disciplines.

Before we dive into the case, we give a broad sketch of the development of pig farming in the Netherlands after the Second World War. Fig. 2 illustrates that the number of pigs expanded rapidly to a total of 14 million in 1990. After the year 2000, the number slightly decreased to about 11.5 million in the years 2005–2007 (De Bont and Van der Knijff, 2007, p. 50). In 2004, about 56% of all pigs were exported (Central Bureau of Statistics: http://www.cbs.nl). Most of these pigs were slaughtered by the Dutch slaughtering industry where a concentration took place in the early 2000s. This led to the establishment of the Vion group that held two thirds of the Dutch market by 2007 and became the largest in Europe.

The growth in pig farming, which turned into an economically flourishing sector, was accompanied by a shift towards industrial animal production systems that were based on guiding principles such as mechanization, specialization, rationalization and economies of scale. During this shift, pig farming developed into an integrated chain with strong ties between animal food providers, pig farmers, slaughterhouses, supermarkets, and consumers (Geels, 2009). Pig farming itself transformed into a factory-like mass production system, with farms of increasing size. The average number of pigs per farm increased from 25 in 1960 to 1300 in 2006 (Table 1). The scale increase in pigs per farm was accompanied by a decrease in the number of farms, from about 120,000 in 1960 to 9040 in 2006, a 92% drop.

Sectoral evolution is characterized by a struggle for survival, with cost-competition driving further scale increases. Consumers and supermarkets contribute to the strong cost focus in the sector. For supermarkets, meat fulfils the role of *traffic generator*: advertised at low prices, meat should seduce customers to enter their shops, assuming they will also buy other products with larger profit margins (Hoste et al., 2004, pp. 7–8). This practice creates strong backward pressure from supermarkets to farmers to produce meat as cheaply as possible.

Scale increase was accompanied by specialization that resulted in two sub-sectors in pig farming: (1) fattening and meat production and (2) breeding, which focuses on sows and piglets. While the Dutch fattening sector was always export oriented, the breeding sector has also become an international player during the past few decades, growing from virtually no exports in the mid-1980s to an annual export of 4.5 million and 5 million piglets in 2006 and 2007, respectively (Bolhuis and Wisman, 2008).

Pigs to be fattened (or porkers) were kept in groups of about a dozen in units separated from each other by metal fences with an average floor space of  $0.7\,\mathrm{m}^2$  per pig until 1998. The floors were typically made of slatted concrete on which the pigs urinated and defecated. By walking around, the pigs pressed the faeces through the slits to be collected in cellars underneath. This made the floors very slippery causing many claw problems. Furthermore, the pigs experienced boredom in the small confinements making them bite the tails of neighbours, resulting in wounds and infection. To reduce this problem, tails were often cut off and teeth commonly clipped.

Pregnant sows were kept differently because of their eating habits. While pigs generally continue to grow when eating more, mature sows do not grow larger but get fatter. This was prevented by giving them limited rations, made possible by keeping them individually, sometimes in boxes separated from each other. Another option were semi-open pigsties with fences between the animals in which they were tethered to the floor with either a chain or a belt fixed around the shoulder.

Since the early 1970s, the shift to industrial mass production methods in pig farming has been accompanied by criticism from special-interest groups that represented new societal values such as animal welfare and the environment. In 1972, the opening of a model pig farm (de Flevohof), intended as the pride of the livestock sector to inform the public about progress in animal husbandry, invoked strong protest against industrialized living conditions of pigs and gave rise to the creation of an action group 'Sweet Animal' ('Lekker Dier'). The same year, the Foundation for Nature and Environment published a critical report called Bio Industry that warned that pigs were no longer seen as living creatures but as resources and input materials for industrial processes. The term 'bio industry' was coined deliberately to frame the damaging effects of industrial methods on farming. The report also drew attention to stench problems, pollution of water and soil from manure surpluses, and damage to the natural landscape (Crijns, 1998).

The Animal Protection Society (APS; 'Dierenbescherming'), a respectable NGO established in 1864 with over 200,000 members and 70 staff members in the early 2000s, (APS website) also saw industrial animal husbandry as a step backward for animal welfare and favoured keeping animals according to organic principles. In the 1970s, organic pig farming constituted a small market niche of about 1%, carried by small subsection of 'moral consumers' who were willing to pay about 30–40% more for organically produced pork. This meat came from animals that were kept in a more 'natural' environment, had room to play and could exhibit their natural behaviour. This organic niche slowly expanded to about 2% in the early 2000s.

Initially, pig farmers downplayed and ignored animal welfare concerns. In the late 1990s, however, the sub-sector of pregnant sows, which initially kept sows in individual boxes, began moving to group husbandry systems, which entailed the adoption of new

**Table 1**Number of pigs and farms (Groenestein, 2003; De Bont and Van der Knijff, 2007).

	1960	1970	1980	1990	2000	2006
Number of pigs (million)	3.0	5.5	10.1	13.9	13.1	11.6
Number of farms with pigs	119469	75674	44127	29210	14520	9040
Average number of pigs per farm	25	73	230	480	900	1300

technical feeding systems and new farming routines. National and EU regulations reinforced this shift, mandating that this transformation should be completed for the whole subsector by 2013. In contrast, changes in the fattening pigs sub-sector have been less substantial, consisting mainly of regulatory changes that specify somewhat more space for pigs (from 0.7 m<sup>2</sup> to 0.8 m<sup>2</sup> in the early 2000s) and some other provisions. These limited changes were not for lack of efforts, because researchers, technology firms and outsiders developed a variety of alternative paths, including new husbandry systems under the names of Hercules, Pigs in Comfort Class and Canadian Bedding. We will use these contrasting development paths and outcomes for a comparative case study that illustrates the influence of normative pressure on the orientation of transitions in the making. We first describe the sows case (Section 4) and then turn to fattening pigs (Section 5). The main results of the two cases in terms of alignment of the various 'streams' distinguished in Section 2 (normative, regulatory, technology and market) are summarised in Tables 2 and 3 in Section 6.

### 4. Animal welfare and innovations in pregnant sow husbandry systems

### 4.1. Rising expectations on group housing (1980–1990)

In 1973, the Ministry of Agriculture established a commission "Animal husbandry – animal welfare" to investigate how pregnant sows were kept. In 1975, the committee published a report that concluded that sow husbandry had some weaknesses, which could be remedied with various technical means (NRLO, 1975). In practice, however, little changed in the following years.

The debate intensified in the early 1980s. In 1982 the APS released a study that was very critical of sow husbandry, focussing on chained sows stating: "The short chain only allows the sow to stand op or lie down. Turning around or walking a few steps is out of the question" (Dierenbescherming, 1982, p. 7). The study concluded that the way sows were kept in the Netherlands was 'completely unacceptable' (p. 41). With various campaigns, the APS tried to generate public awareness. To this end they framed the problem using the catchy term 'chain sow' for the pregnant sows that were tethered to the floor. This term and the accompanying images struck an emotional chord in public opinion which felt that these animals deserved better treatment (Fig. 3; Interview APS).

Shortly after the release of the APS report, the Ministry of Agriculture set up a new commission for pig welfare issues. Its 1984

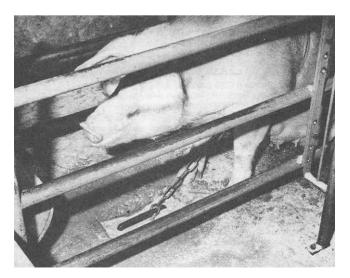


Fig. 3. 'Chain-sow' (Dierenbescherming, 1982, p. 26).

report was quite critical on sow husbandry (Commissie Welzijn Varkens, 1984). The APS started discussions with the ministry and the pig industry on how to proceed. In 1986, they came to a joint agreement that individual housing of sows should become forbidden as soon as 'acceptable systems for group housing would be available' (Dierenbescherming, 1999, p. 21).

To realise this, the ministry started working on future legislation (Werkgroep, 1988). Furthermore, all research into housing of sows was integrated in a national programme. In the period 1987–1990 a research project was carried out at the Research Institute for Pig Husbandry at Rosmalen, comparing individual systems with a group housing system. For the latter, the main innovation needed would be a system to feed the sows individually. Such a system already existed for cows and was adapted for pregnant sows. The initial design consisted of an open space where the sows were kept in groups that was connected to an electronic sow feeding station with individual boxes via access gates where each pig was fed a specific ration. After feeding, the sow would have to step out to the shared space and the next one could enter to be fed. Various changes were made to the feeding station in the course of the project (Bokma, 1990).

During the same period, triggered by the public and political discussion, several pig farmers agreed that individual sow housing was not very friendly to the animal. In the late 1980s, in parallel to the research programme, some of them started to convert their pigsty to a Rosmalen-like system. Their numbers grew at a modest rate until a total of several hundred, some 5% of the total, by 1990 (Interview animal researcher).

### 4.2. Stagnation and decline (1990–1997)

Gradually it became clear, however, both in research and practice, that group housing had serious problems. The reason was that the basic design was copied from the cattle sector, without taking into account that pigs behave differently from cows. While cows tend to wait their turn to be fed, sows are prepared to fight for more food and eat as much as they can. If one sow was eating, for instance, a stronger sister might bite her in the rear to chase her away to start eating a second ration.

In the early 1990s, many pig-farmers, who had moved to group housing, shifted back to the individual system. About half of them, however, stuck to group housing. These pig farmers had developed specific farming skills for successfully keeping pigs in groups (Interview animal researcher).

Scientists at the Rosmalen research institute continued to investigate group housing systems. The fact that some 2% of the farmers had no serious problem with the group housing suggested that the system could work despite its bad image. APS and the scientists also referred to the UK where group-housing was more widely applied and where a new bill would enforce it by the end of the decade. In the early 1990s, the scientists occasionally interacted with the ministry and the APS on research findings and on shaping further research. By 1996 they had developed and tested a second generation of group housing systems. They concluded that group housing was now ready for practical use but that it would require new managerial skills and competencies from the pig farmer (Backus, 1997).

The sector and the ministry, however, showed little interest. At the time, there was much more societal concern for disposal of manure and emissions from the bio industry than animal welfare which was rather low on the political and societal agenda (Interview animal researcher). Thus, in terms of our conceptual vocabulary, the political opportunity structure that had been favourable to group housing in the late 1980s, had disappeared in the mid 1990s.

According to one involved researcher it was almost taboo to talk about group housing in the mid 1990s. In his view this was due to a surplus of eagerness to move to group housing in the 1980s, pushed by certain pig farmers and the ministry. They used crude concepts adapted from the cattle sector and then found these did not work very well. This eventually led to sector-wide hostility towards group housing of pregnant sows in general which was difficult to counter with results from further research, no matter how hard the scientist tried to show that the second-generation system worked well (Interview LTO).

### 4.3. Swine-fever: the aftermath of an external shock (1997–2007)

After 4 February 1997, the political opportunity structure turned completely due to an external shock. The trigger was an outbreak of swine-fever that spread rapidly. On numerous pig farms, all pigs were killed and cranes were used to load dead pigs onto huge trucks to take them to destroyers. These scenes were broadcasted widely on Dutch television and stimulated a lively societal debate. In total, over 11 million pigs were killed including almost 3 million 3–17 day old piglets (Ministry of Agriculture data, cited in Dierenbescherming, 1999, 47). Many, including politicians as well as the public, felt something really had to change in pig husbandry.

Within a few months, new legislation was drafted that would make group-housing compulsory in ten years, i.e. in 2008. The sector protested heavily but did not stand a chance against the societal and political pressure and determination. LTO, the sector representative, realised that it made no sense to fight this change further and that it had to find ways to inform farmers on how to make a smooth transition. They organised meetings with pig-farmers throughout the country at which the Rosmalen researchers were often invited to inform the attendees of their findings. The unrest lasted about half a year and then gradually disappeared (Interview animal researcher).

Market forces also played a role in the change towards group housing. The crucial economic factor was the export of Dutch pork to the UK. As of 1 January 1999, pregnant sows in the UK would have to be kept in groups. UK pig producers, animal welfare and consumer organizations put pressure on British retailers to sell only bacon and other pig meat that came from pigs whose mothers had been kept in groups. They were successful and because the UK formed a large export market, the Dutch slaughter industry became interested in ensuring that a significant share of Dutch pregnant sows would be kept in groups (Vermeer et al., 1999). This made Dumeco, then a major slaughter company that later became part of the Vion group, give a bonus to farmers who kept pregnant sows in groups (Interview LTO). Thus, the normatively driven innovation in the niche aligned with market developments in the regime.

Also at the European level, pig husbandry increasingly became a matter of concern. The European Commission enacted new regulations that resembled the Dutch although they lagged a few years. New EU regulation forbade keeping pregnant sows on chains as of 2005 (2001 in the Netherlands) and by 2013 all pregnant sows in the EU should be kept in groups. The Dutch pig sector argued that this meant unfair competition as for them group housing was compulsory by 2008 and to comply, the date has been changed to 2013 in the Netherlands as well (Enting et al., 2006). In anticipation of this new regulation, by 2008 about half the pig farmers had already changed to group housing.

Thus, in terms of our conceptual framework, we see that normative pressure was exerted from the 1980s onward, although with varying strength. The regulatory opportunity stream showed more variation and gained an enormous boost after an external shock, the outbreak of swine fever. The technology stream showed a hypedisappointment cycle with high expectations in the late 1980s, disappointment in the early 1990s and development of a second

generation of feeding systems in the mid 1990s. Concerning the market stream, the direct market for piglets (the farmers who subsequently fattened them) was hardly affected but in the late 1990s indirect market pressure came from the UK. In the late 1990s, all these streams came together and from then on the regime started to transform in the direction that the contestants advocated.

### 5. Animal welfare contestation and innovation in pig fattening

### 5.1. Downplaying criticism (1970–1997)

In the early 1970s, animal welfare groups criticized pig fattening husbandry systems on a range of issues:

- Keeping large numbers of pigs in small units;
- Not allowing pigs to go outside;
- Bare, concrete floors where pigs could not root;
- Cutting tails and clipping teeth;
- Castration without using anaesthetic;
- General aversion towards the bio industry (treating animals as commodities rather than living beings).

Representatives from the sector claimed either that problems were not that bad or that economic pressures made it impossible to change. For instance, letting pigs outside would make them more susceptible to diseases and make the controlled disposal of manure, urine and atmospheric emissions problematic. Covering the floor with straw would also worsen the manure problem and make cleaning more difficult.

For the Dutch government, economic considerations prevailed over animal welfare concerns. Internal criticisms were silenced by the Ministry. In 1972, one researcher at the Institute for Animal Husbandry Research wrote a report that noted that pigs were biting each other's tails and ears because of boredom and stress, related to confinement in small spaces. The Ministry stopped publication of the report and forbade the author to speak about it in public (Crijns, 1998).

Animal welfare received little political and social attention in the 1980s and early 1990s because the agenda was dominated by exacerbating manure problems. In 1984, stench and water pollution problems were visible, smellable, and pressing. That year, the CBS (Central Bureau of Statistics) published a manure report that the Ministry of Agriculture had tried to hold back for many years (Frouws, 1994). This report crystallized societal frustration and led to high political pressure for change in relation to environmental issues.

Animal welfare concerns, however, were placed on the backburner. An EU-directive mandated a minimal space of  $0.65\,\mathrm{m}^2$  per pig, just enough for a  $110\,\mathrm{kg}$  pig to lay down. The Dutch standard was slightly better,  $0.7\,\mathrm{m}^2$  per pig. This did not damage Dutch competitiveness because, as experience indicated, pigs do not grow well if they have too little space (Hyun et al., 1998). The APS frequently argued for further increases of floor space to enhance animal welfare. The sector representative LTO opposed this, arguing that additional costs would undermine the Dutch export position and the Dutch ministry concurred.

### 5.2. Renewed contestation and gradual transformation (1997–2000)

After the 1997 swine fever outbreak, NGO and public protest against the bio industry intensified. The same year, two new NGOs emerged with a more radical agenda than the APS, notably Awake Animal ('Wakker Dier') and Pigs in Despair ('Varkens in Nood'). Both

groups sought to end the bio industry altogether. In this context, animal welfare concerns rose rapidly on the public and political agenda. The societal pressure and the political determination led to a slight tightening of rules, which triggered a gradual regime transformation path. Although economic considerations remained prominent for the government, more attention was given to animal welfare issues.

To understand the discussion on regulations it is relevant to know that many laws and regulations in the pig sector are communal, meaning that regulation is laid down in directives of the EU. Member states have to translate these into national legal and administrative measures. In relation to pig welfare, the relevant EU directive is 91/630/EEC that specifies a minimum floor space of 0.65 m² per pig (Enting et al., 2006). Since 1994, the Netherlands had specified a somewhat stricter rule, notably demanding 0.7 m² per pig. Furthermore, the Dutch ruling ('Varkensbesluit') specified that in due course it would be forbidden to keep pigs on floors that were 100% slatted (to collect manure and urine in underlying cellars). For new pigsties, 0.3 m² per pig would have to be solid and by 2003 fully slatted floors would be prohibited (Spoolder et al., 2003). The EU directive does not have such a provision

Shortly after the outbreak of swine fever the Dutch government decided that in 1998 the floor space standard would be raised to  $1 \text{ m}^2$  and that by the year 2000 the mandated solid floor area would be  $0.6 \text{ m}^2$  (LNV, 1999). The sector protested heavily as this implied they could keep 35% fewer pigs in the same area as their European competitors. The Dutch government conceded and the rules were somewhat relaxed. As of 2008, new pigsties would have to provide  $0.8 \text{ m}^2$  per pig which would increase to  $1 \text{ m}^2$  by 2013 with a solid area of  $0.4 \text{ m}^2$  (Enting et al., 2006).

Another new rule, specified in the EU directive, was that as of 1 January 2003 pigs should have permanent access to a sufficient quantity of material "to enable proper investigation and manipulation activities, such as straw, hay, wood, sawdust, mushroom compost, peat or a mixture of such" (Enting et al., 2006). As stated, member countries had to make their own interpretations of these directives and the Dutch ruling was far less precise. The typical solution in the Netherlands was to hang a chain in the sty that pigs could bite in and pull on, something that Dutch regulators allowed (Interviews APS, Animal researcher).

Pig farmers were anything but happy with the new regulations, especially the 2013 rule of 1 m<sup>2</sup> per pig. They argued that this would undermine their competitive position in the international market. Going from the minimum of  $0.7 \, \text{m}^2$  for existing pigsties to  $1 \, \text{m}^2$  was expected to  $\text{cost} \in 75 \, \text{per pig-place}$  which added 2.8 eurocents per kilogram to the price of meat. Because this was more or less the farmer's profit margin, this was not considered economically viable (Interview LTO).

## 5.3. Further contestation and the development of new husbandry systems (2000–2008)

A concentration of animal diseases in the late 1990s and early 2000s (swine fever, BSE, foot and mouth disease, avian flu) further deteriorated the public image of industrial animal production. In 2002 it led to a new political party that exclusively focussed on animals. This Party for the Animals ('Partij voor de Dieren') participated in the 2003 general elections but won no seats. In 2006, they were more successful, gaining 2 parliamentary seats out of 150. They were supported by a wide variety of public figures including authors, artists and TV personalities. This strategy of network building increased their visibility and legitimacy, and enabled them to influence the public debate.

Since 2006, the party has bombarded the ministry with parliamentary questions on all sorts of issues relating to animal welfare

(cf. website http://www.partijvoordedieren.nl). Their visibility also required other political parties and the Minister of Agriculture to become more outspoken on animal welfare issues. In 2007, animal welfare issues also received more attention at the European level, leading to debates about raising the EU floor space standard from 0.65 m² to about 0.75 m² by 2013 (Interview LTO). Thus, a new political opportunity structure developed for animal welfare issues and innovations.

In response to these new social and political pressures, the pig sector set up image campaigns like 'Pigs in Sight' ('Varkens in Zicht'). Some pig farms were equipped with sky boxes where the public could watch pigsties and the behaviour of pigs. This campaign was intended to convince the public that pigs were treated well and that there was no reason for change (Interviews LTO, animal researcher).

While political actors and pig farmers focused on framing and regulations, several outside actors worked on innovative projects. These innovations involved new components and husbandry systems (mainly developed by engineers and scientists in various research institutes) and new market segments (mainly developed by new retailers). We first discuss two more radical concepts, the Hercules pigsty and Pigs in Comfort Class, and then a concept that is closer to the mainstream, Canadian Bedding.

### 5.3.1. Hercules pigsty

Researchers at WUR started the Hercules<sup>8</sup> project in 1998. Their approach was based on the expectation that emission standards would be tightened in the future and that, especially after the 1997 outbreak of swine-fever, tighter animal welfare rules would also be imposed (Ogink et al., 2001).

Processing of manure became a focal point in the design and communication on the Hercules project. In a conventional pigsty, most of the floor space is slatted. Manure and urine fall on the floor and are pressed through it by the pigs walking around. It is collected in underground cellars and disposed of. Because of the large slatted area it is problematic to use straw since this will clog up the openings. For animal welfare reasons, the government intended to mandate an increase of the solid floor area. Farmers were not happy with this because the larger the solid area made cleaning more difficult.

One of the focal points in Hercules was to design a system for separation of manure and urine in order to lower the emissions of ammonia. The technical approach was to develop a slightly convex moving manure belt under a row of pigpens. The liquid fraction (the urine) would drip from the sides and was collected underneath while the solid fraction (the manure) was collected at the end of the belt in a concentrated form (Ogink et al., 2001).

Although the Hercules design was primarily inspired for environmental reasons it also had various animal welfare benefits. In view of costs, this moving belt could not be too wide implying that the slatted part of the pigsty, where pigs should relieve themselves, should also be smaller. This had the advantage that there was more solid floor space. The concept provided 1 m² of floor space per pig (25% more than the regulated standard) of which 75% was solid. This floor could be cooled or warmed by running either cold or warm water through hoses in the floor. An increased area of solid floor could also be better combined with the use of straw which had become an icon in animal welfare. Pigs like to play with straw, chew on it and root in it. Part of the Hercules design was a device called the 'straw swing'. Pigs could play with it with their snout for which they were rewarded with some straw. Because of these

<sup>8</sup> Named after the Greek hero who was awarded the divine status for his heroic deeds one of which was to change the course of two rivers to clean the king's pigsties. For a detailed description and analysis of the Hercules project see Bos and Grin (2008).

provisions the Hercules concept was expected to be some 5–10% more expensive than a conventional pigsty. After several years of research and development the ensuing Hercules system was considered "complex but feasible" (Van den Top et al., 2005).

The business studies school from WUR explored the market introduction of Hercules. In parallel with the technical research they carried out surveys among pig farmers to assess their judgement. These farmers were quite positive about the reduction of emissions and the processing of manure. They also thought the concept was close to what consumers desired but had serious doubts about energy use (the concept used various active systems that consumed energy) and economic profitability (Joldersma, 2003).

By 2005, when the technical research was finished, the world of pig farming had changed significantly compared to the late 1990s. Although animal welfare and environmental concerns were still present in the societal and political debate, they were less prominent. The sense of urgency that had followed the 1997 outbreak of swine fever and other animal diseases had largely disappeared. In 2003, a new government had taken office that strongly emphasised deregulation. So, when the Hercules concept was considered ready for practical use, the alignment between the political process and normative pressure had weakened considerably. Consequently, the project results were shelved.<sup>9</sup>

### 5.3.2. Pigs in comfort class

In the year 2000, the APS proposed an activity on 'animal centred design' to the Ministry of Agriculture within its long-term programme on 'Animal Production 2030'. The ministry agreed and a desk study was started by APS and WUR-researchers (another group than the one working on Hercules) to explore this. They took pig husbandry as an example to elaborate the methodology. The methodology started by identifying ten basic needs of pigs that were subsequently translated into various technical solutions which, together, defined the pigsty concept. The main conclusion was that it was possible to take animal welfare as a starting point to design pigsties in which animals could be kept in an economically viable way. APS proposed to LTO that they could try to build such a pigsty together, to prove that it could indeed be done. LTO, feeling the societal pressure to develop new forms of husbandry, accepted (Interviews LTO and APS).

Although they agreed on building the pigsty there were differences in the visions of the partners. LTO saw the project primarily as a research project that might have an impact in the long term. APS, however, aimed for a pigsty that could operate within the existing system and be economically viable (Interviews LTO and APS). Eventually, a compromise was developed between aiming for the long and the short term. First, a demonstration pigsty would be built to demonstrate the technical viability. Then pigs would be introduced to demonstrate that they were actually better off in the new pigsty. After that, five pig farmers would be sought to use the new design principles in their own pigsty and demonstrate the economic viability. Thus, it was not only a research project but it would also have to operate in practice (LTO and Dierenbescherming, 2006). This eventually led to the development of a new pigsty concept called Pigs in Comfort Class (PCC) with a term derived from the aviation sector. <sup>10</sup>

The PCC-approach specifies the 10 basic needs of pigs, but it does not prescribe technical solutions to satisfy these needs (LTO and Dierenbescherming, 2006, 4). To give an example, in a popular vision pigs have a need to be outside and roll in the mud, allegedly

because they are dirty animals. The PCC approach, however, looks at the reasons behind this behaviour. Pigs do not roll in the mud because they are intrinsically dirty but because it serves two very useful functions: it helps them to cool down when it is warm and it frees them from skin-bugs which they pick up walking around. When kept indoors, however, pigs are hardly pestered by skin-bugs and cooling down can also be realised by various technical solutions, e.g. by cool air, a cooled floor or an occasional cold shower (Interview animal researcher).

In Raalte, in the province of Overijssel, the demonstration pigsty was built in 2006. The specification of needs resulted in a floor space of  $2.4\,\mathrm{m}^2$  per pig, three times the regulated standard. WUR animal scientists considered this area necessary to provide pigs with various functional areas for eating, sleeping, playing and relieving themselves (De Lauwere and Luttik, 2006). LTO was convinced that the large floor space could not be upheld in practice on economic grounds but it wanted to stretch the design for the demonstration project to assess what this might lead to (Interview LTO).

The next step would be to gradually strip the design of some of its features until a concept would be reached that was considered economically viable. The first results indicated that this was possible at least in some respects as pigs tend to mix function areas and would therefore need less space (Interview LTO).

Mid 2007, five farmers were chosen to implement the PCC concept in their own pigsties and receive a subsidy for the extra cost they would have to make. They did not build new pigsties but refurnished some units, rather than the whole pigfarm. Following the PCC philosophy of specifying needs rather than solutions these farmers applied various techniques to satisfy the needs. Some chose a different type of bedding, another applied natural ventilation, again another just used a conventional pigsty and made a few small modifications. Strikingly, none of them implemented anything near the 2.4 m<sup>2</sup> per pig considered necessary by the scientists and that was used in the Raalte demonstration project (Interviews APS and LTO).

The Dutch Ministry of Agriculture had high expectations of the PCC concept. Late 2007, the Minister of Agriculture published a white paper on animal welfare which set the goal of keeping 5% of the animals in 'integrally sustainable' husbandry systems in 2011 (LNV, 2007, p. 5). It was not specified what this meant but for pigs the solution favoured by the ministry was Pigs in Comfort Class (Interview LNV ministry). The sector, however, was less enthusiastic because the PCC concept would make pork more expensive. As a result, stakeholders in the pork chain, including farmers, slaughtering industry and supermarkets were not keen on moving in this direction (Interviews Vion, LTO).

In terms of our conceptual approach, the timing of PCC better aligned with the regulatory dynamic than Hercules. In 2007, three streams came together, notably the problem, regulatory and technology stream. However, there was still a serious mismatch with the market stream.

### 5.3.3. Canadian bedding

Trying to find other routes to improve the keeping of animals the APS has worked with a relatively new Dutch retailer, Jumbo supermarkets. Jumbo is a family owned company, a relative outsider in the supermarket world that seeks to profile itself with low prices and care for quality and sustainability. On its website, Jumbo has several pages addressing "responsible food" which also provides information on how animals are kept for some of its 'responsible' products and contrasts this with the bio industry. <sup>11</sup>

 $<sup>^{9}\,</sup>$  More precisely, Bos and Grin (2008) have identified five factors why it didn't take off.

Regular sties were basically designed according to economic criteria, thus housing pigs in 'economy class'. In contrast, the new stables were called 'comfort class', because pigs were much better off. (Interview APS)

<sup>&</sup>lt;sup>11</sup> http://www.jumbosupermarkten.nl/Homepage/Assortiment/Gezond-Verantwoord/Diervriendelijkheid/.

Following its discussions with the APS, Jumbo started to sell a special type of pork, in addition to regular pork, that comes from pigs that are kept in so-called Canadian Bedding pigsties. This concept was developed in the Vancouver area in western Canada where the lumber industry produces a lot of sawdust that local pig farmers use as a bedding in their pigsties. This is soft for pigs to lie on and gives them something to root in and chew on. This concept has also been adopted by a small number of Dutch pig farmers. Jumbo has embraced the concept and now sells meat from pigs from one farmer who houses pigs in these pigsties, calling it "Jumbo conscious pork". APS has designed a special quality label that Jumbo is allowed to use. This meat is about 15% more expensive than typical supermarket pork. In 2006, Jumbo started to sell it in six shops and in 2007 did so in all of its over 100 outlets<sup>12</sup> (Interview APS).

In this case, three streams aligned, notably normative pressure, technology (Canadian Bedding) and market. There are no indications that regulation played a serious role in developing this concept. It can hardly be stated that this started a transformation as the husbandry concept was already used and the market share of this pork at the time of writing was so small that it did not lead to an increased use of the Canadian Bedding concept.

### 6. Analysis and discussion

Our research question was: How, when and why is normative contestation of existing regimes effective in influencing the orientation of transitions in the making? We can now answer this question for the two empirical cases, explaining the different outcomes with the conceptualizations from Section 2.

In the case of pregnant sows, normative contestations from NGOs and animal scientists reached their aspired goals. By 2009 about half the pig farmers had converted to group housing systems and the others will soon follow because group housing will be legally enforced as of 2013. In the case of fattening pigs, normative contestations had less success, leading only to gradual changes in floor space (from 0.7 m² per pig via 0.8 m² for new pigsties as of 2008 and 1 m² in 2013), a slight increase in solid floor space in 2013 and the provision of toys. Various alternative husbandry concepts were developed but did not diffuse widely. To explain these differences, we will look at two main processes: (a) increasing normative pressure, and (b) alignment of normative pressure with economic, regulatory, and technological niche developments.

### 6.1. Increasing normative pressure

To analyze normative pressure, Section 2 proposed three concepts: (1) resource mobilization, (2) (political) opportunity structures, and (3) framing, which was sub-divided into focus, empirical credibility, cultural resonance and emotional appeal. We will apply these concepts in turn.

(Ad 1) Resource mobilization occurred more or less similarly in both cases. The Animal Protection Society (APS) sought to mobilize public opinion and exert political pressure for both sub-sectors. The APS interacted frequently with policymakers and sector representatives, stressing that animal welfare required a change of husbandry concepts. Networks between social movements and (outsider) animal scientists were also present in both cases, with the scientists also voicing criticisms and developing alternatives. In the fattening

- pigs case, APS performed additional work by teaming up with LTO, the (pig-) farmers representative, to demonstrate an alternative concept (PCC). Until 2009, this had relatively little effect on wider diffusion.
- (Ad 2) Political opportunity structures were also more or less the same for both cases. Until the turn of the century, the structural characteristics of the political constellation relevant for animal welfare changed relatively little. This changed with the advent of the Party for the Animals in early 2007. It succeeded in pushing animal welfare concerns high on the political agenda and these have remained there since.
- (Ad 3) Framing by animal welfare organizations differed considerably for both cases. Firstly, the framing had more *focus* for pregnant sows, both in terms of problems (the 'chain sow') and solutions (keeping pregnant sows in groups). For fattening pigs, the framing was less focused, because a wide variety of animal welfare problems struggled for attention. Furthermore, animal welfare problems competed with sustainability issues related to emissions (ammonia) and manure disposal. This multitude of problems limited the focus and strength of framing processes for the fattening pigs case.
- (Ad 4) Secondly, framing processes had stronger emotional appeal for pregnant sows, especially through the catchy term and images of 'chain sows'. The public, policy makers and even some farmers agreed that a sow with a chain or belt around the shoulder was unfriendly to the animal. The APS used this powerful image to articulate a moral framing of unacceptability. The alternative (group housing) was also well framed by linking it with notions of pigs as sociable animals. For fattening pigs, in contrast, the framing was less successful in terms of emotional appeal. Furthermore, the pig farmers, especially their representative body LTO, were more successful in counter-framing for fattening pigs than for pregnant sows. For fattening pigs, the farmers argued that strong international cost-based competition prevented them from adopting the more substantial animal welfare innovations that would raise costs and reduce competitiveness. Initially, in the early 1990s, a counter-framing strategy also worked successfully for pregnant sows ("experience shows pregnant sows in groups is a disaster") even though proponents pointed to 2% of the sow farmer's population who had successfully implemented the alternative in practice.
- (Ad 5) In the late 1990s, a sequence of external shocks changed the context drastically. These included the swine fever outbreak in 1997 and a number of other animal diseases and food scandals shortly thereafter. This considerably reduced the strength of the LTO counter-framing while the general problem framing by animal welfare groups gained *empirical credibility* and *cultural resonance*. This strengthened general concerns about industrial animal production and mobilized public opinion as an additional resource to put pressure on political and regulatory processes.

The overall dynamic of the normative pressure in both cases is depicted in Tables 2 and 3 below. These tables also show how this pressure aligned with other relevant dynamics that will be discussed in the next section.

### 6.2. Alignments with other socio-technical developments

Building on Kingdon's (1984) multiple streams model, we proposed to investigate the alignments between four streams: (1) problem stream (articulated as normative pressure by social movements), (2) R&D and technology stream, (3) market stream, (4) regulatory/policy stream.

<sup>&</sup>lt;sup>12</sup> A brief history of this episode and the APS involvement can be found at the APS website: http://www.dierenbescherming.nl/dier-en-welzijn/bio-industrie/varkens/jumbo-bewust-varkensvlees Jumbo's perspective can be found at the website in the preceding note.

**Table 2**Dynamic of various streams in the pregnant sows case (0 = absent or weak; += moderate; ++ = strong) and their alignment (- = negative (at least one stream does not align); += positive (all streams align)).

Period/stream	Before 1990	1990–1995	1995–1997	After 1997 (after swine fever outbreak; group housing legislation)
Normative pressure	+	+	+	++
Regulatory opportunities	+	0	0	++
Market opportunities	0	0	0	+
Technology opportunities	+	0	+	+
Alignment of streams	_	_	_	+

The shift to group housing for pregnant sows entailed a change in practices—the management of sows required farmers to develop some new routines (e.g. to manage sows in groups), which many of them initially resisted, as well as development and adoption of new technical components (especially new feeding systems that separated eating sows from each other). Thus, technological change was important, especially the development from first generation (late 1980s) to second generation feeding systems (mid-1990s). The technology experienced a hype-disappointment cycle, with farmers having high expectations in the late 1980s when about 5% of sow farmers shifted to group housing. However, teething problems with the first generation feeding systems led to disappointments causing a decline in group farming to about 2%. Around 1995, when second generation systems were developed, negative perceptions of group housing had hardened, which frustrated further diffusion.

The swine fever shock in 1997, however, provided a window of opportunity, which advocates of group housing took advantage of. Alignment with public opinion led to strong normative pressure on policy makers. Policy makers then issued regulations that made group housing compulsory in 10 years time. Farmers protested, arguing that this was not possible and would reduce competitiveness (counter-framing) but NGOs and policy makers could overrule these protests by pointing both to technical progress (second generation) and the 2% of farmers who showed that such concepts could be applied successfully. Market forces also played a role, especially from UK supermarkets (which faced pressure from more radical animal rights groups) which in 1999 demanded group housing in relation to imported bacon. This dynamic of the various streams is summarised in Table 2.

As Kingdom noted, the coming together of various streams at the same time to form a coherent package greatly enhances the chances for regime change. In the case of pregnant sows, this is what happened in 1997. It was particularly crucial that the second generation of technical alternatives were sufficiently developed when the window of opportunity opened (due to the swine fever shock) and that 2% of farmers had demonstrated economic feasibility. Both aspects enabled policy makers to issue strict regulations that pushed the alternative through.

For fattening pigs, the development of alternatives such as Hercules, Pigs in Comfort Class (PCC) and Canadian Bedding resulted in stabilized concepts in the early 2000s. At the time of the 1997 crisis, however, such concepts were not available because most innovation efforts in the 1980s had not focused on animal welfare, but on

manure problems. So there were no well-developed alternatives when the 1997 window of opportunity opened. By 2005, when the Hercules project was finished the political interest had gone and the concept was shelved. Two years later, with the upcoming of the Party for the Animals the interest rose again and the PCC concept, that was then in the middle of its development, gained a better reception, thus reinforcing the conclusion about the importance of creating a package.

Furthermore, regulatory pressure was weak in the case of fattening pigs, partly because there were no available alternatives that could be pushed through when the normative pressure was high, and partly because the counter-framing strategies of farmers (welfare innovations would reduce competitiveness) were more successful. Market demand was also weaker in this case, with mainstream consumers not translating moral concerns into purchasing decisions, buying the cheapest meat in supermarkets instead. The 2008–2009 attempts by Jumbo, then a relative fringe actor in the supermarket sector, to create an intermediary 'animal friendly' segment (between organic and regular pork) are interesting in this respect, but have not produced major successes at the time of writing. In sum, while these alternatives might constitute the onset of a transition path, the lack of alignment with regulatory and market processes hindered broader diffusion.

As a result, the overall development path in the fattening pig sub-sector has been gradual change, driven primarily by somewhat stricter regulations in response to normative pressure and public concerns. Following the 1997 crisis, and in response to the accompanying public outrage, government regulations mandated increased floor space from 0.7 m<sup>2</sup> to 0.8 m<sup>2</sup> per pig for new pigsties which will increase to 1 m<sup>2</sup> by 2013. Further regulations also specified the introduction of toys and and a minimum area of solid floor.

Table 3 summarises the dynamic of the various streams for different periods in the pig fattening case. Normative pressure from outsiders was present throughout de studied timeframe although with different strength for the various periods. The dynamic of the other streams shows more variation, esp. from 2002 onward.

Comparing Tables 2 and 3 we conclude that the 'coherent package', to use Kingdon's term, that developed in the sows case did not develop in the fattening case, neither in terms of problems nor in terms of solutions. In the case of sows there was a rather uniform problem definition of keeping sows separate, using the

Dynamic of various streams in the fattening pigs case (0 = absent; 0/+ = small; + = moderate; ++ = strong; two scores connected by an arrow indicates that the score changes during the period) and their alignment (– = negative (at least one stream does not align); –/+ = weak alignment of all streams).

Period/stream	Before 1997	1997–2002	2002-2007	2007-2009
Normative pressure	+	++→+	+	+
Regulatory opportunities	0	$++ \rightarrow +$	$+ \rightarrow 0$	$0 \rightarrow \pm$
Market opportunities (for Canadian Bedding only)	0	0	0	$0 \rightarrow 0/+$
Technology opportunity 1; Hercules	0	0	$0 \mathop{\rightarrow}\nolimits \mathop{\div}\nolimits \mathop{\rightarrow}\nolimits 0$	0
Technology opportunity 2; PCC demo	0	0	$0 \rightarrow \pm$	+
Technology opportunity 3; Canadian Bedding/Jumbo conscious pork	0	0	0	$0 \rightarrow 0/+$
Alignment of streams in technology 1 and 2 cases	_	_	_	_
Alignment of streams in technology 3 case	_	_	_	_/+

'chain sow' as a strong symbol for framing. In the fattening pigs case, many animal welfare issues competed for attention like little room per pig, no possibility to root and play, cutting tails, clipping teeth, castration without using anaesthetic. Moreover, there were also environmental concerns in connection with manure disposal, (ammonia) emissions and stench. Concerning solutions, in the sows case there was a clear way to go, i.e. to move towards group housing. For pig fattening, the variety in problem definitions also led to a variety in (technical as well as market/institutional) solutions. In this case no coherent package could therefore be offered that could be 'pushed through' with the proper alignment of different forces.

#### 7. Conclusions

This article has introduced the topic of normative orientation into the debate on transitions and enriched the multi-level perspective with insights from social movement theory and political science. More specifically, it investigated the question how normative contestation of existing regimes can influence the orientation of transitions in the making. Our analysis shows that there are two sides to this question: the first concerns the dynamic of the contestation process, the second concerns the alignment with three other processes or streams in our analysis.

Social movement theory was helpful in analysing the contestation dynamic. Three key concepts (resource mobilization, (political) opportunity structures, and framing) were useful to analyze how contestation by regime outsiders may lead to increased normative pressure on regimes. One conclusion from our study is that the existence of a variety of problem definitions may considerably weaken the normative pressure. But our cases also show that the strength of normative pressure forms only part of the explanation.

The second part of the explanation is that ongoing processes may create 'opportunity' structures that allow normative pressure to be effective. Building on Kingdon and the multi-level perspective, we suggested that four 'streams' are relevant to determine this opportunity structure, notably a problem, regulatory/policy, technology and market stream. Each of these streams has its own dynamic although various actors involved make explicit attempts to link them. As a general conclusion, normative contestation has its largest impact when the other streams become aligned at a certain point in time to create what Kingdon calls a 'coherent package'. Because the four streams have their own dynamic the issue of timing is critical for the creation of such a package.

Interestingly, in our case we see that a variety of problem definitions in the fattening pigs case is accompanied by a variety in technical solutions (Hercules, PCC, Canadian Bedding). It seems that this variety on the problem side and variety on the solution side both weaken the possibility of alignment and hence the onset of a transformation process. Using a term from innovation studies, we presume that the creation of a successful package increases if preceding innovation processes have resulted in a 'dominant design' that can be linked to problems if a policy window opens. If various designs exist, this linkage is more difficult. More research would be needed to analyze how this works exactly.

This article has addressed the topic of normative orientation with a conceptual framework and a comparative case study. Our findings therefore have a 'proof of principle' character. To generalise the findings and elaborate the perspective, we hope that other studies will further investigate these topics. On a more general note, we think that these topics also have relevance for the field of innovation studies, which has produced substantial knowledge about factors that influence general innovativeness (often related to economic issues of competitiveness and profitability) and the speed of technical trajectories, but paid less attention to questions surrounding directionality and normativity (Stirling, 2009).

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