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Organizational change structures: Exploring the organizational conditions for sustainable change in the agro-industry¹

by

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Abstract

Purpose – The paper starts from an observation of a discrepancy between the ambitions for sustainable change in the agro-industry and the actual changes being implemented. We offer one possible explanation by investigating the organizational structures conditioning change in this industry.

Methodology and approach – We apply a case study methodology, focusing on the Danish pig industry and its organizational conditions for change. Based on interviews and document analysis, and building on systems theory, we develop the concept of *change structures*, understood as decision premises that guide the change of further decision premises.

Findings – The analysis suggests that the pig industry's change structures predominantly enable changes that cut costs and optimize the production, which may conflict with and possibly foreclose the changes needed to realize the industry's sustainable ambitions. This conflict and its implications are not acknowledged by the industry.

Originality – Conceptually, the notion of *change structures* supplements actor-oriented analytical approaches that focus on change agents and sensemaking. Empirically, we contribute with an analysis of the conditions of possibility for sustainable change in an important yet understudied industry in organization studies; namely, the conventional agro-industry.

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Practical implications – The analysis indicates that the industry may be locked in its current form of organizational change. We suggest a way to overcome the lock-in by fostering organizational mechanisms that enable alternative interpretations to emerge internally. Without this, achieving the required sustainable change in the industry may hinge on stronger external regulation and support.

Keywords: agriculture; change structures; decision premises; organizational change; sustainability, Luhmann, social systems theory, transformation

Introduction

This paper explores the organizational structures that condition the sustainable changes implemented in the Danish agro-industry. With current planetary crises, society's capacity for sustainable change is of crucial importance (Millar *et al.*, 2012). Key industries such as transportation, energy, and agriculture talk enthusiastically about sustainability and green transformation. Yet, a continuing increase in greenhouse-gas (GHG) emission and rapid declines in biodiversity indicate that sufficient and appropriate change is not being implemented to meet the sustainability goals, embodied in the UN's 2030 Agenda for Sustainable Development (IPBES, 2019; IPCC, 2022). Despite of stated ambitions, sustainable change is thus not easily achieved, and organizations across the globe often have reason to join Paul the Apostle in saying, 'I do not do the good I want, but the evil I do not want is what I keep on doing' (Romans 7:19).

In this paper, we explore the dynamics that make organizations continue along established paths even when they intend to 'do good'. We focus on the relation between organizational structures and the ability to change in a sustainable direction. To analyse the ability to change, we develop the concept of 'change structures'. Drawing on sociological systems theory (Luhmann, 1995; 2018), we theorize change structures as the decision premises enabling and limiting the particular way an organization changes. Hence, offering change structures as an analytical concept, this paper supplements the literature on sustainable organizational change by drawing attention to how organizations develop structures that condition what decisions can be made, and thus what kind of change can be pursued.

The literature on organizational change and sustainability (Lozano and Barreiro-Gen, 2021; Millar *et al.*, 2012) has focused on proactive changes (Lozano and Garcia, 2020) and the drivers for their successful implementation (Saeed and Kersten, 2019; Stoughton and Ludema, 2012). Studies have focused on individuals, who drive changes in organizations ('change agents') and have, for example, argued that personal attributes and characteristics, such as social skills, political skills, and strong reputations enable or limit their actions toward successful implementation (Gallagher *et al.*, 2020). Authors have also highlighted the importance of identity and identity formation (Cherrier *et al.*, 2012; author), sensemaking (Hübel, 2022; van der Heijden *et al.*, 2012), top-management (Kiesnere and Baumgartner, 2019) and micro-behaviour (Stokes and Harris, 2012) in sustainable change efforts. The ubiquity in this literature of terms such as identity, change agents, sense making, and behaviour testifies to a predominant

focus on the actors of sustainable changes themselves. We complement this actor-oriented focus with an attention to organizational structures. Accordingly, our study approaches organizational decision making, not only as a result of the preferences and capabilities of change agents and other actors, but also as based on structures in the form of decision premises that outline who makes which decisions based on which criteria. We offer the notion of change structures to conceptualize the decision premises guiding decisions about what kinds of changes are made. We thus contribute to and supplement the literature on sustainable change by investigating the organizational structures guiding decisions about change. We find that, in our case, the organizational change structures may counteract the implementation of the sustainable changes that are articulated by the actors and that the industry aspires to.

Empirically, we focus on the case of the renowned Danish pig industry which is the economically most important part of Danish agricultural production. In 2021, agriculture was responsible for more than 25% of greenhouse gas emissions in Denmark (Statistics Denmark 2022), and with current political agreements, this figure is expected to increase to 50% in 2030 (Klimarådet 2023: 156). The agro-industry is also a key factor in the continued decline of biodiversity (Århus universitet 2021), pollution of drinking water (The Danish Society for Nature Conservation 2023) and nitrogen emissions resulting in fishless coastal waters. For the period 2010-2021, the amount of pesticides used and the amount of nitrogen and greenhouse gases emitted did not change (except for annual variations due to different weather conditions). Also globally agriculture – and especially livestock farming – occupies a key role in environmental crises, contributing substantially to escalating climate changes, loss of biodiversity, water pollution, antibiotics resistance, and risks of new zoonoses (IPBES, 2019; IPCC, 2022; MacLeod *et al.*, 2015). In 2019, approximately 19% of total net anthropogenic greenhouse-gases derived from agriculture, forestry, and other land use (IPCC, 2022, p. 7). At the same time, estimations suggest a 50% increase from 2012-2050 in the demand for food and other agricultural produce (FAO, 2017, p. 136). Hence, the agro-industry currently threatens a future, in which it nonetheless remains necessary. Thus, it presents a complex problem, where no easy-fix exists, and where it is crucial to address the structures that condition the industry's possibilities for sustainable change.

In organization studies, extant works on agricultural organizations have focused on alternative frameworks of production, such as organic farming (Siltaoja *et al.*, 2020; Sikavica and Pozner, 2013), conservation agriculture and small-scale farmers (Dyck and Silvestre, 2019),

agricultural cooperatives (Ajates, 2020), community supported agriculture (Watson, 2020), and alternative food networks (Beacham, 2018; Pascucci *et al.*, 2021). These rich and important studies highlight and elaborate on the potential of alternative forms, as well as the challenges they face in establishing a position on the market (Ajates, 2020) or scaling up to affect the global food system (Beacham, 2018; Michel, 2020). However, given its considerable role in environmental problems, there is a remarkable paucity of organization studies that explore the conventional agro-industry and its organizational structures (Böhm *et al.*, 2020). As a result, we still know little about the possibilities and limitations for sustainable change in conventional agricultural organizations.

Addressing this lack, this paper offers an empirical analysis of the ways in which the changes of the Danish pig industry are organized through decision premises. We find that these decision premises favour changes that support an optimization and effectivization of the current production, and that they may foreclose the more ambitious sustainable changes that the industry formally aspires to implement. The paper concludes with a discussion of the possibilities for second-order change, understood as change of current organizational change structures.

Theorizing organizational change structures

In this section, we develop a theoretical understanding of change structures by building on systems theory and Niklas Luhmann's (1995; 2018) notion of 'organization' as consisting of decisions and decision premises. Until the late 1970s, the relationship between structure and change was a core theme in organizational (contingency) theory (Drazin *et al.*, 2004). The birth of institutional macro theory that placed organizations in institutionalized fields marked a change of perspective on structure which became associated with symbolic and normative rather than functional values (Dimaggio *et al.*, 1983; Meyer and Rowan, 1977). Luhmann's distinction between a (macro) theory of society (Luhmann, 2012/13) and a (meso) theory of organizations (Luhmann, 2018) offers an alternative to the institutional macro perspective on structures. The cornerstones of Luhmann's work consist of a general theory of social systems (Luhmann, 1995), a theory of society (Luhmann, 2012/13), and several books on societal function systems such as science, law, politics, economy, and religion (for a general introduction see Borch, 2011). His work has inspired empirical analyses within a broad range of social science disciplines such as law (Kjaer *et al.*, 2011), education (Andersen *et al.*, 2023;

Pors, 2011), social epistemology (authors), and organization theory (Seidl and Becker, 2006; Valentinov *et al.*, 2021).

Through Luhmann's work, organizations can be observed as autopoietic systems that selfreferentially develop their structures (Cooren and Seidl, 2020). As recent studies have shown, Luhmann's framework is thus well suited for the analysis of specific organizations and how they develop structures for their change (see e.g., Andersen and Pors, 2022; Andersen and Stenner, 2019; Lies, 2020; Roth *et al.*, 2018; Sales *et al.*, 2022). In particular, these studies demonstrate the analytical potential in the distinction between *operation* and *structure* for studying how an organizational system changes. According to Luhmann (2018), organizations are constituted through decisions, meaning that decisions are the operations, through which an organizational system reproduces itself. Decisions are contingent and have the form of alternatives (otherwise they would be calculations). Decisions are furthermore momentary operations that occur and then disappear (Luhmann, 1995, p. 287). In contrast to such operations, which are bound to the moment of actualization, Luhmann understands structure as that which endures in time. Structure 'defines more precisely how elements relate across temporal distance' (Luhmann, 1995, p. 282). Or, as Andersen and Stenner write: 'Structure is that which enables events to outlast the transiency of the moment' (2020, p. 83). This is why, for Luhmann, the concept of organizational change concerns the structures of an organizational system, and not its unique operations (Luhmann, 2018, p. 274). In organizations, structures have the form of decision premises, which are defined as decided premises that have significance for more than one decision, that is, decision premises have a regulative character. They create and restrict the decision (Luhmann, 1995, p. 274).

Luhmann distinguishes between different kinds of decision premises, such as programs (defining the conditions for factual correctness of decisions), communication channels (regulating who communicates with whom, and who can make which decisions), and persons (targeting decisions about membership) (Luhmann, 2018, pp. 182ff). Using the pig industry as an illustration, we can understand decision premises as the detailed programs guiding the decisions about breeding (e.g., how to develop genes and breed the optimal production sow) and care (e.g., what kind of fodder to use, which medication, how to nurse weaners, when to cut tails etc.). These are the programs that condition how the industry develops and changes. A sustainable change of the pig industry thus requires a change of these existing programs. In the pig industry, these programs are developed and guided by Research & Development (R&D)

activities. R&D does not occur arbitrarily, but is conditioned by further decision premises. It is these decision premises, guiding the changes of further decision premises, that are of interest in this paper and that we suggest calling ‘change structures’. Change structures are decision premises guiding the change of further decision premises.

The above provides us with a theoretical understanding of change structures in the Danish pig industry. We observe the industry as autopoietically reproduced through decisions that are regulated by decision premises, and we identify change structures as the decision premises that condition the change of these decision premises. Because the industry organizes its changes through R&D activities, the analysis focuses on these to explore how they constitute the industry’s change structures.

Methodology

The paper is based on a case study (2020-2023) of the Danish conventional pig industry. For more than a century, pig and pork production has been a crucial cornerstone in Danish agriculture. In 2021, 2576 farms produced 18.5 million pigs for slaughter and 14.2 million weaners for export at a value of approx. 4.4 billion Euro. An important element of the industry’s historical and current development is its ability to pool resources and organize R&D activities to the benefit of all Danish pig farmers. In this paper, we investigate the two primary means by which resources are generated and collected for R&D; namely, a production tax and a genetics fee. In table I, we describe the central organizations comprising the industry, which we, inspired by Ahrne and Brunsson (2010), understand as a ‘partial organization’, meaning that it is characterized by central organizational elements such as decisions and decision premises, but it does not have a hierarchy.

Organization	Description
The farmers	The Danish pig production is organized in a sophisticated breeding program arranged as a pyramid. Currently, 23 breeding herds are at the top of the pyramid, selling semen and animals to thousands of multiplication and slaughter farms further down the pyramid. The breeding herds compete internally to offer the best semen and animals.
Danish Agriculture and Food Council (DAFC)	Represents the farming and food industries of Denmark. It is by far the largest commercial organization of the Danish agro-industry, employing more than 500 people. DAFC is organized into sectors. The DAFC Sector for Pigs has a board of 10 members (nine of them are pig breeders, one is an agricultural adviser). Recently, DAFC presented a climate strategy declaring the industry's ambition to be climate-neutral by 2050 (DAFC, 2020).
Danbred	A genetics company that manages, improves, and supplies the genetics for the Danish pig production. DAFC owns the majority of Danbred meaning that the two are closely integrated. For instance, the board of DAFC Sector for Pigs formulates the breeding objectives for the pig breeding program managed by Danbred (DAFC, 2022b).
The pig Production Fund	A government fund owned by the Danish state. The secretariat is housed at DAFC which also de facto appoints the majority of the members of the board. The fund receives taxes based on production and decides which development projects within the industry that should be supported with tax money.
Seges	Is in practice the R&D unit of DAFC, employing approx. 530 people. Seges leads and conducts R&D activities aimed at benefitting the agricultural industry. Its primary funding comes from production funds. In 2022, Seges received more than 99 million DKK from the pig production fund for projects related to pig and pork production. On January 1 st , 2022, Seges Innovation was established as a formally independent organization. It is, though, still tightly coupled to DAFC – even though the exact constellation is still not quite finalized.

Table I. The central organizations of the industry

Data collection

The case study comprised two rounds of data collection. While this paper's analysis is based on data collected in the second round, we proceed by briefly describing the first round, as it nonetheless remains important for understanding the context and background of this paper. In the first round (2020-2021), we followed Bent Flyvbjerg in studying an 'extreme case', as those tend to activate multiple actors and mechanisms in the object or situation of interest. Such cases are thus well-suited for preliminary explorations, as they offer a fertile ground for researchers to uncover information and acquire insights into a new empirical phenomenon (Flyvbjerg,

2006: 229). Our extreme case was the management of the zoonotic disease LA-MRSA in the years from 2008-2017, during which the disease spread in the Danish livestock. This was understood as an extreme case because it dealt with an ‘especially problematic’ and unusual situation for the involved actors (Flyvbjerg, 2006: 230). In other words, what transpired deviated from the organizational norm. Invoking the Danish Freedom of Information Act, we gained access to an extensive archive of documents through which we were able to reconstruct the communication between the central organizational actors around the management of the disease (see authors). This provided us with crucial insight into the workings of the industry, the functions and responsibilities of the organizational actors, and the communication channels between them. Our findings revealed that the industry maintained its position of how to manage the disease even when the official scientific consultants recommended a change in approach. To us, these findings spurred new questions around how the industry organizes, maintains, as well as how it is able to change itself and its position on crucial matters. However, we also knew that it would require additional data to explore these questions. We therefore embarked on a second round of data collection.

This paper’s analysis is based on data from two data sources (documents and interviews) collected between 2022-2023. First, we gathered an archive of publically available webpages, documents, and reports by or about the organizations of the industry, and in particular from DAFC, Danbred, SEGES, and The Pig Production Fund. This material provided us with knowledge of how the industry operates and its internal connections and dependencies. Importantly, it also revealed information about the industry’s own sustainable ambitions and its understanding of whether or how these ambitions can (or cannot) be realized. We then supplemented the documents with in-depth, qualitative interviews with central actors from different organizations in the industry. This interview study comprised eight in-depth interviews with, respectively, one farmer with a large production and 700 sows, three executives from the central organizations, three internal consultants from DAFC, and one external consultant². The informants were selected because – due to their jobs and positions within the industry – they have knowledge of the tasks, functions, and responsibilities of the

² These rather generic descriptions are necessary to ensure the informants’ anonymity. The executives, for instance, have unique job titles, through which they could be easily identified.

specific organizations in the industry. And in particular because they can speak to the organizations' understandings of the objectives and ambitions of the industry, and to how the industry organizes its changes, including the specifics of decision making processes. We identified and established contact through a snowball technique. Our first interviewee was the farmer, who is very well connected and who was able to steer us towards the external consultant and the first executive. From there on, the executive connected us to the two other executives and the internal consultants. The interviews followed a semi-structured guide (Järvinen and Mik-Meyer, 2005) that was revised before each interview to ensure that it remained topical and targeted to the specific interviewee. Table II provides an overview of the details of the data collection.

Round 1: The management of LA-MRSA			
Document study	Sources	Types	Pages
	DAFC, government units, Danish universities	Reports, emails, meeting minutes etc.	Approx. 700 in total
Round 2: The organizational conditions for change			
Document study	Sources	Types	Examples of documents
	DAFC, Danbred, The pig production fund, Seges	Webpages, reports, strategy documents	DAFC, 2020 (28 pages) The pig production fund, 2022b (17 pages) DAFC, 2022 (42 pages)
Qualitative interviews	Informants	Format	Duration
	Farmer	Semi-structured, in-person	01:49:30
	Executive 1	Semi-structured, in-person	01:17:49
	Executive 2	Semi-structured, in-person	01:24:47
	Executive 3	Semi-structured, in-person	01:42:50
	DAFC consultant 1	Semi-structured, video call	00:50:38
	DAFC consultant 2	Semi-structured, video call	01:16:25
	DAFC consultant 3	Semi-structured, in-person	01:01:17
	External consultant	Semi-structured, in-person	01:17:05

Table II. Data collection

Data analysis

Data analysis was conducted in iterative stages and followed a grounded theory approach, through which we moved from detailed empirical observations, comparisons and interpretations, before ending up with our more abstract theoretical concept of ‘change structures’ (Glaser, 2002). First, we conducted an open reading of the data, trying to understand and map the formal structure of the industry. Here, we relied on our archive of published and publicly available documents such as official organizational webpages, reports, and strategy documents. Through this process, we gained insight about the central organizations of the industry, their distinct functions, as well as their understandings of the industry’s sustainable ambitions in terms of stated goals and visions (e.g., in a report from 2020, DAFC states that its vision is that: ‘The Danish food industry will become climate-neutral by 2050’ (DAFC, 2020: 6)). The second stage involved another reading of the documents and of the interview transcripts, specifically aimed at locating and understanding where, how, and by what means the industry pursues such changes. Through this process, we identified the concrete decisions through which the industry changes. We refer to these as care decisions and breeding decisions, respectively, because they relate to the concrete practices of caring for the livestock (e.g., what kind of fodder to use, which medication, how to nurse weaners, when to cut tails etc.) and developing the best genetics for breeding (e.g. which semen and individual animals to use for breeding, how to record genetics data etc.). Here, we also identified the so-called production tax and the genetics fee as the primary ways through which the industry generates the funding for these changes. Next, we identified R&D activities as what provides the decision premises for the care and breeding decisions. More specifically, this means that R&D produces knowledge, programs, innovations, guidelines etc. that condition decisions of care and breeding and thus condition the industry’s change. Finally, we identified the decisions premises that condition the R&D activities, and, given their regulatory and lasting nature, we theorized these decision premises through our notion of ‘change structures’.

Analysis

In the following, we analyse the change structures in the pig industry. Our analysis is structured in two overall sections each tracing how the decisions through which the industry changes – that is, care decisions and breeding decisions – are conditioned by further decision premises and ultimately change structures. We conclude the analysis by summing up the two sections and discussing the implications of the industry’s change structures.

Care decisions and the production tax

To analyze how, and in what ways, care decisions are conditioned, we begin with the so-called production tax and the Pig Production Fund. By ministerial order, it is decided that for every pig slaughtered or exported, the respective farmer pays a production tax to the Pig Production Fund (Ministry of Food, Agriculture and fisheries of Denmark, 2021). The specific amount depends on the measurements of the pigs, but the most common tax per pig is approx. 0.9 Euro (2023). The Pig Production Fund is the largest of the 12 production funds in the Danish agro-industry. According to §7 of the farm subsidy law, the funds are to use the money for sales promotion, research & experiments, product development, and other activities benefitting the industry. Capturing the core logic behind the Pig Production Fund, an informant told us that

... the research in the development of the agriculture in general is financed by tax on the production. (...) The production funds are unique for Denmark. You pay a fee for every pig you produce. The fee enters the fund-system and is then invested in research and development in the entire chain.

The above quote speaks to the significance of R&D for the development/change of the industry as well as to the 'unique' way in which the industry pools resources for the benefit of the industry as a whole. Moreover, this organizational constellation also performs a certain binding. Through the production tax and the Pig Production Fund, the farmers are connected to each other in a relation of cooperation rather than competition. They all pay the tax, and in return they receive research in the form of evidence-based management programs and guidelines that condition and regulate their care decisions about fodder, medication, stable management, etc. In this model, the number of pigs produced and the amount of money generated for R&D are tightly coupled: The more pigs produced, the more money. We now proceed by exploring how those premises are conditioned by further decision premises (change structures).

The production tax is collected and distributed by the Pig Production Fund, which is managed by DAFC, but which is formally a government fund. It is the Danish minister of Food, Agriculture and Fisheries, who appoints the fund's 12 board members, who are responsible for the overall strategy, and who grant funding for R&D. Eight of the appointments follow recommendations from the industry (DAFC and other agricultural organizations), while the

remaining four are recommended by the Danish consumer council, the Economic Council of the Labour Movement, and Danish research councils. In 2022, nine out of twelve board members were farm owners (The Pig Production Fund, 2022a). Hence, while the appointments are formally the responsibility of the minister, the majority of the board members are, in practice, appointed by the industry.

According to informants, this intricate cooperation amongst the farmers, as well as between the pig industry, the state, research institutions, and consumers, safeguards against a potential disintegration caused by farmers ‘breaking out’ of the industry. ‘Freeriding’ is a well-known problem in relation to cooperatives such as the Danish agro-industry (Candemir *et al.*, 2021; Tortia *et al.*, 2013). This is avoided with the production fund model, because the tax is collected as a mandatory governmental tax, while still being controlled by the industry. Through this model, the Pig Production Fund is given a quasi governmental authority that helps secure a stable income of taxes, provide long-term security, and safeguard the reproduction of the system, without having to rely on voluntary contributions.

This binding of the farmers is then reflected in what the Pig Production Fund is expected to finance using the tax funds; namely, research that increases the capacity and makes the production more efficient. Indeed, the industry and the farmers tend to think of the money as ‘their money’. An informant told us:

Research in the development of the agriculture is financed through the production funds... and they are government funds... and historically, the farmers have perceived them as their money that they should manage... or they believe that they have the right to manage them (...) and they aren't [their money], they are government funds.

This notion that the money is theirs, and that it, therefore, must be used to the benefit of the production farmers is crucial for how the relations between the Pig Production Fund, DAFC, and Seges are established. This becomes particularly evident, when looking at how the fund decides on which research projects and other R&D activities it awards with financial grants. In 2022, the Pig Tax Fund distributed more than 30 mio Euro. Table III shows how the money was distributed.

Overall contribution by function category (in DKK, 1 Euro = 7.5 DKK)	
Research and experiments	136.113.000
Sales promotion	25.685.000
Prevention of diseases	20.652.000
Counseling	1.200.000
Education	1.572.000
Animal welfare	3.200.000
Control	30.812.000
Initiatives within EU-programs	1.851.000
Overall contribution	221.085.000

Table III. The Danish pig production fund's contributions in 2022 (The Pig Production Fund, 2022a).

The receivers of the largest amounts of funding in 2022 were Seges, the Danish Technological Institute, and DAFC (The Pig Production Fund, 2022a). That is the typical distribution. The Danish Technological Institute covers development activities related to the 'dead' pig, that is, activities related to slaughtering, such as e.g., development of robot technology. Seges, on the other hand, works with the living pig. The DAFC Pig Sector has an ongoing collaboration with universities, veterinarians, and slaughter farms, where they exchange information about what kind of problems exist in the herds, what knowledge is lacking, and which aspects of the production need attention in order to preserve or further develop the competitive advantage. Through this process, project ideas are selected and presented to the DAFC Pig Sector board that decides which to submit to the Pig Production Fund for potential funding.

The board of the Pig Production Fund decides which applications to support. The composition of the board is thus an important decision premise. As mentioned above, the majority of the boardmembers are farm owners, appointed upon industry recommendations. The fund's decision premises furthermore include both general criteria, such as, 'Do the results of the project benefit substantial parts of the industry through use of the stated activities?' (The Pig Production Fund, 2022b, p. 10) and criteria specifically related to projects under 'research & experiments', such as, 'Does the project lead to relevant and application-oriented knowledge?' (The Pig Production Fund, 2022b, p. 11). However, these premises do not indicate what kinds of benefits and knowledge are deemed relevant. This, however, becomes evident in the fund's purpose statement:

The Pig Production Fund's purpose is to further activities that strengthen the entire sector's sustainability, development, and competitive position. The use effect of the fund's grant operations must go to Danish primary producers within the pig sector, and grants can, thus, be given to projects within the entire pork value chain – from stable to produce to a safe quality product. (The Pig Production Fund, 2022b, p. 3)

Moreover, the fund's strategy includes five focus areas, comprising climate and sustainability; productivity; animal welfare and health; health, quality and food safety; market access and development. On climate and sustainability, it states that

A climate and environmentally sustainable production is crucial to secure support for the industry and backing of pork sales in Denmark and internationally. Therefore, the fund prioritises amongst else: new solutions that reduce resource use and promote value creation; attractive workplaces and a good work environment; reduction of the pig production's climate and environmental impact by e.g., influencing phosphorus, nitrogen, smell, and CO₂; Generation of scientific evidence of the sector's climate footprint; improvement of the pig's digestion in relation to the climate and fodder efficiency. (The Pig Production Fund, 2022b, p. 5)

As the purpose statement and the focus areas suggest, there is certainly an emphasis on climate and environmental issues. This also seems to be reflected in the projects that receive grants from the fund. Looking at the titles and headlines of the projects from 2020, 2021, and 2022, there is no shortage of projects that in some way or another concern climate and environmental initiatives. However, as the above excerpt also indicates, the fund observes the value of sustainable initiatives in relation to the optimization of the production (e.g., 'reduce resource use and promote value creation' or improve 'fodder efficiency'). This is also the case when looking more in depth into the projects that have received funding. Here, sustainable change is tied to a reduction of costs and a more efficient production. For example, one of the projects that have received the largest grant in the last three years is entitled 'reduction of environmental impact'. On the project's webpage, it is stated that 'The objective is to create a sustainable pig production, without compromising productivity or expenses related to fodder' (Seges, 2022). Looking further into the project, we learn that it was about developing ways to feed weaners without zinck, which the EU had prohibited (Seges, 2022). So, while the purpose of the project is to reduce environmental impact, this is to be achieved by finding ways to feed weaners

without zinck, meaning that while the project may lead to a reduced environmental impact, it is only allowed to do so insofar as the changes it precipitates do not compromise productivity and cost.

The above shows that R&D activities within the pig industry are guided by a line of change structures that condition the kind of change enabled by the R&D activities. The change structures are:

- The Farm Subsidy Law determining the composition of the board of the Pig Production Fund, thereby regulating who makes the decisions related to the tax and the projects it supports.
- The Ministerial Order on Production Tax on Slaughtering and Export of Pigs stating that the amount of resources for R&D is to be based directly on the level of production (Ministry of Food, Agriculture and Fisheries of Denmark, 2021).
- The bylaws of the Pig Production Fund stating that the purpose of the fund is to strengthen the developmental possibilities and the competitiveness of the pig industry.
- The strategy of the Pig Production Fund determining its current priorities.
- Formal and informal communication channels connecting DAFC, Seges, the Pig Production Fund, and the farmers.

Breeding decisions and the genetics fee

Two overall factors shape the life and growth of the pigs, thereby also shaping how the pig industry changes. As we explored above, the first is how they are cared for, and as we shall now see, the second is the development of their genes. The development of the genetics relies on farmers in the breeding herds, who must make decisions about e.g., which pigs to mate and inseminate. These decisions are informed by highly sophisticated breeding programs developed through further R&D activities. The change structures related to breeding decisions consist of decision premises regulating the development of these breeding programs.

While the production tax finances the development of the premises guiding care decisions, the change decisions related to breeding are financed and structured by the genetics fee model. The genetics fee model is what establishes the relations between the breeding farmers, DAFC, and Danbred. The DAFC Pig Sector receives a genetics fee every time genetics (animals or semen) are sold from breeding herds further down the production pyramid (in Denmark and abroad).

This is the pig sector's largest source of income, generating between 25 and 27 million Euro annually. An informant told us how this money is spent:

Just south of 13 million go back to the breeders... then it costs around 5 million to manage, research, and develop... it is actually here that [the industry] is most research heavy... that's our breeding and genetics, which are financed in-house (...) then around 4 million are spent on remuneration of the board, executive salaries, political lobbying etc. which are also financed through the genetics fee.

The breeding herds are contractually bound to DAFC. They receive around 13 million Euro annually as well as access to the Danbred genetics database, and in return, they pay genetics fees and commit to only sell semen and animals within the industry's system. The genetics fee is imposed on every transaction, and it thereby establishes the unique relation, in which the breeding farmers own the animals but DAFC own what is 'inside' the animals:

They own the animals, I mean the breeding farmers own the animals, but [DAFC] own the genetics that are inside. [DAFC] own the breeding core, which is a very large database (...) and you can't be a breeder, if you can't get... Every week, you report the production statistics on each animal, and if you have nothing to compare it against, then you can't use it for anything.

Using these statistics, and according to the breeding objectives, Danbred provides the required infrastructure enabling the farmers to breed and select the best animals to improve the genetics for the production. The breeding objectives consist of the economically most important qualities in the pig production, and they are an important decision premise for the decisions regarding breeding (DAFC, 2022). An informant elaborated on the logic of the breeding work:

So, you've got a breedingsystem, where you determine the breeding objectives unequivocally according to what benefits the Danish farmer; how can he produce one kilogram of meat in the cheapest possible way.

Danbred performs regular DNA-tests of all breeding animals and uses these data in highly sophisticated genome-selections. As one informant told us: 'I mean the quantity of data... I'm not kidding, we've bought NASA-servers just to hang on calculation-wise'. Danbred's database is thus an essential part of the breeding work. It is a very sophisticated system that

secures the industry's leading position in the world market, and it guarantees the cooperation of the breeding farmers, who depend on it for the development of their product (genetics) and its sales.

Hence, through the genetics fee, a contractual relation is established between the breeding farmers, Danbred, and DAFC. This relation works as an important decision premise as it guides who can make which decisions in the breeding work. The relation furthermore secures funding for all R&D activities related to the development of the genetics, which is the basis of the Danish pig industry's leading competitive position. The amount of money generated is contingent upon the production. The more production, the more 'genetics' are needed, and thus the more money is generated. This funding model also works as a decision premise as it produces an overall incentive for the R&D work around breeding and genetics; namely, economic value for the production farmers.

As described above, the development of the breeding programs is guided by decision premises (change structures) such as:

- The contracts between the breeders, DAFC and Danbred, which establish the direct coupling between money for R&D and the amount of genetics sold. The contracts also outline, who can make which decisions. For instance, it is decided that the board of the DAFC Pig Sector decides the breeding objectives.
- Breeding objectives, which outline the overall goals of the breeding.

These change structures guide the decisions about changes and development of the breeding programs that condition the breeding decisions. As with the change structures related to care decisions, these change structures are imbued with a logic of optimization that shapes the trajectory of the changes: The existing breeding programs are changed according to the aim of producing meat in the cheapest possible way.

Summing up

The change structures of the Danish pig industry consist of decision premises in the form of government orders, strategies, contracts and organizational structures that guide decisions about R&D activities, thereby ultimately conditioning care and breeding decisions. The industry's specific change structures result in tight couplings between a production of quantity

and R&D activities, which creates an obvious incentive to make and change care and breeding decisions so as to increase and optimize the production in terms of quantity and costs. The logic is: The more pigs produced and the more genetics (semen and animals) sold, the more money for R&D. Overall, our analysis suggests that the change structures create a situation, wherein the industry is aiming towards sustainable change, but seems unable to decide on changes beyond the frame of the current production system.

Given these change structures, sustainable change seems limited to initiatives aligned with a continued optimization of the current system of production (e.g., changes that reduce production costs or changes that reduce climate impact as much as it is possible without compromising production efficiency and costs). With increased productivity, production can support a ‘relative’ sustainability (Hastrup et al. 2022). More can be produced with less, and the industry can claim to be greener than pig industries abroad. However, as Hastrup et al. (2022, p. 3) argue, a relative ‘better than others’ sustainability does not mean a production that supports an absolute ‘good enough’ sustainability in terms of planetary boundaries. Moreover, relative sustainability is at odds with the industry's absolute goal of being carbon neutral by 2050.

This creates a potential conflict between, on the one hand, the optimizing and cost-reducing change structures, and on the other, the industry’s ambitious sustainable change objectives, such as becoming climate-neutral by 2050 (DAFC, 2020). Indeed, DAFC concedes that at the moment it ‘cannot say exactly how it can be achieved’ (DAFC, 2020, p. 5). Based on our analysis, we would argue that this is partly because its change structures currently do not support changes that take into consideration phenomena such as climate change, biodiversity, or water pollution. In this sense, the industry might be caught in its own change structures, which in effect foreclose its possibility of achieving its own sustainable ambitions. This situation actualizes the question of *second-order change*, that is, change of current change structures. We discuss this in the following.

Discussion: Second-order change

In an agricultural context, Ajates (2020) has pointed out that a transformative potential can be lost because of pressure to remain competitive in a global food system (see also Michel, 2020). More generally, organizational path dependency theories have demonstrated how path-building processes may lead to organizational inertia, rigidity, lack of alternatives, and inflexibility

(Koch, 2011; Sydow *et al.*, 2009). Taking a structural, rather than the process approach common to path dependency theory, we have demonstrated how decision premises may lead to lock-in. Our analysis highlights the crucial role of change structures in understanding and explaining potential discrepancies between sustainable ambitions and change. We proceed with a discussion of how the industry can change its change structures.

Luhmann has proposed to conceptualize the mechanisms through which systems may change dysfunctional, internal structures as ‘immune mechanisms’ (Luhmann, 1995, pp. 370ff). Immune mechanisms are, in this perspective, mechanisms serving to safeguard the system from itself, that is, from internal structures badly aligned with ecological or social conditions (Andersen and Stenner, 2020). Luhmann thus reverses the everyday notion of immunity as protection against external threats by suggesting that immunity is about change rather than protection; immune mechanisms are about changing the system to cope with the environment. Contradictions and conflicts are central examples of immune mechanisms (Luhmann, 1995). In theory, organizational systems may thus enable a change of their decision premises (including change structures) by enabling conflicts and contradictions to emerge internally.

In relation to the Danish pig industry, this means that sustainable change may depend on the ability of the industry to allow contradictions and conflicting interpretations of its decision premises. We find that this ability is challenged by the industry’s close integration on various dimensions. Functionally, it is integrated by means of positive feed-back (Sydow *et al.*, 2009); the more pigs produced, the more money for R&D is generated, which in turn further optimizes the production. The positive feed-back is also closely related to functional dependencies (Pfeffer and Salancik, 2003), as the different organizations in the industry depend on resources from each other. Furthermore, the industry is integrated by means of complex systems of representation, where the same people hold multiple roles in the different organizations, resulting in porous boundaries between the organizations that make up the industry. For example, according to one of our informants, the members of the different boards are ‘one big family’, and members typically sit in several boards at the same time, while also working as farmers. Structures of representation are in general highly developed and rooted in the cooperative tradition of the Danish agriculture. This characterizes the company-structures, where the farmers also own the dairies and slaughteries and thus directly influence the election of board members. It also characterizes the political structures, where, for example, the

majority of the board of the production fund is elected based upon nominations from the industry.

The result of the positive feed-back mechanisms, the functional dependencies, and the complex systems of representation is an organizational configuration which makes it less likely that any of the organizations will develop alternative interpretations that contradict the existing change structures. Hence, on the one hand, the close integration is a strength, because it enables a streamlined cooperation between the different organizations of the industry. However, on the other hand, it may be a barrier to sustainable change, as it hinders the emergence of internal contradictions of current change structures.

Conclusion

This paper departed from Paul's paradox unfolding in organizational sustainability efforts: Core industries do not change according to their sustainable ambitions, but keep on going along established trajectories. We have offered the construct of change structures as a concept apt to explore the organizational structures guiding decisions about what to change and how. We conceptualized change structures as the decision premises guiding how other decision premises are changed.

In our analysis of the Danish pig industry, we found that the change structures establish a tight coupling between the current production and financial resources for R&D. This coupling supports changes that cut costs and optimize the production, and it limits sustainable change to only include initiatives that do not compromise production efficiency or costs. Hence, the industry's paradoxical failure to implement more ambitious initiatives and thereby potentially realize its own sustainable goals is rooted in the way in which it has organized its changes related to care and breeding. Given this situation, we proceeded by discussing possibilities for second-order change, that is, the industry's ability to change the change structures. Here, we introduced the concept of immune mechanisms as means through which organizational systems change their (dysfunctional) structures by encouraging conflicting interpretations to emerge internally. Due to the strong integration of the organizations, the pig industry may be lacking immune mechanisms. This lack maintains and enforces the lock-in of the industry in its current form of change.

The paper contributes to the literature on organizational change for sustainability (Lozano and Barreiro-Gen, 2021; Lozano and Garcia, 2020; Millar *et al.*, 2012). Expanding upon this literature's emphasis on actors and sensemaking (Cherrier *et al.*, 2012; Hübel, 2022; Stoughton and Ludema, 2012; Van der Heijden *et al.*, 2012), our study delves into the importance of change structures. It illustrates how change structures bind together actors across various organizational levels in positive feed-back loops that reaffirm and reenforce the current form of production. The paper thus brings a sound supplement to more actor-oriented analytical approaches that focus on agents and their individual attributes and characteristics (Gallagher *et al.*, 2020; Kiesnere and Baumgartner, 2019; Saeed and Kersten, 2019; Stokes and Harris, 2012). And it accentuates the importance of understanding the organizational conditions under which change decisions are made. Change structures thus provide one explanation to Paul's paradox: It highlights that change decisions are already guided by a line of decision premises, which do not necessarily point in the direction of sustainable changes.

The article also contributes to organization studies focusing on the agriculture and sustainable change (Böhm *et al.*, 2020). While studies have investigated alternative frameworks for agricultural production (e.g., Ajates, 2020; Beacham, 2018; Siltaoja *et al.*, 2020), this article has demonstrated that we need to supplement the investigation of alternative organizations with analyses focusing on the conditions for transformations of the conventional production into alternative forms of production. An important element of this is to investigate current organizational change structures and how they impede and/or enable changes towards alternative and more sustainable forms. Hence, whilst this article has focused on the Danish pig industry, we believe that it has wider implications. It demonstrates that it is crucial to produce concrete, empirical analyses of change structures to understand the organizational conditions of possibility for sustainable change of the key industries in the green transition. Future research has an important task in investigating the relationships between organizational change structures and sustainable change. This is not least the case when it comes to agricultural organizations. Due to the vast differences between the organizations of agro-industries, there is an urgent need for specific analyses of the change structures of the major agricultural organizations within and across national boundaries.

Practical implications

Finally, our analysis raises practical questions concerning how such lock-ins or path dependencies can be overcome. No easy answers can be given to this question, but history

shows that path dependencies or lock-ins can be broken and new paths created (Stache and Sydow, 2023). One way of starting the development of new structures is through introspection and reflection upon existing structures. Such self-reflections can be qualified by our notion of change structures, which may help the industry better understand its own slowness and inertia when it comes to the realization of its sustainable ambitions. We fully acknowledge that new change structures, better aligned with the sustainable ambitions of the industry (and the majority of the public), do not develop easily. Yet, considering that the most feasible alternative seems to involve more stringent external regulation pushing for sustainable changes, it could still be the wiser path for the industry to trail — to the benefit of both the industry itself and the environment.

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