



Good Animal Welfare in Norwegian Farmers' context. Can both industrial and natural conventions be achieved in the social license to farm?

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ABSTRACT

This article presents research carried out in Norway, among the population of livestock farmers. It analyses farmers' understanding of animal welfare, and how their different concerns about animal welfare varies across farmers' considerations about the role of the agricultural sector in Norwegian society and animal welfare regulations, material conditions at the farm level, farmers' opinion about animal rights activist groups, and in several individual characteristics. The empirical material was derived from a postal survey conducted in 2020 (n = 745); the analyses were conducted by structural equation modeling (SEM) which has its advantage in identifying latent attitudes. Informed by convention theory, the study shows that two conventions of animal welfare were most prominent among Norwegian livestock farmers. One emphasizing animals' *basic health and feelings* and a second animals' *natural needs*. These two conventions point to a potential split within the livestock farming population. Support for the convention basic health and feelings coincides with efficiency and effectiveness in Norwegian food production and farmers' contribution to feeding the Norwegian population. Support of the convention natural needs coincides with support for enhancing biodiversity and attractive landscapes as important additional values in Norwegian agriculture. The support for the convention of animals' needs to behave naturally was found to be lower than the basic health and feelings and this might slow down or hinder implementation of practices and future regulations aimed at enhancing the natural needs of farm animals, accommodation to public expectations of good animal welfare, and is potentially challenging the farmers' social license to farm animals.

1. Introduction

The aim of this article is to explain how livestock farmers in Norway assess different aspects of animal welfare and how this assessment is connected to aspects of their daily farming life, -practices and their view on food production and agriculture's overall role in society. The discussion of the results is informed by convention theory and how farmers' perceptions of animal welfare might influence on their social licence to operate.

The welfare of animals has become a divisive issue across the world, with questions about the lives led by farm animals being of particular concern. In the western world, changing perceptions of animal welfare based on growing consumer concerns are not new. Ruth Harrison's book *Animal Machines* (1964) inspired the *Brambell Committee* (1965) and promoted the concept of animals' 'five freedoms', which in turn led to the Farm Animal Welfare Council's Codes for animal welfare (1979) in

Great Britain (*Farm Animal Welfare Council 2009*), one of the first attempts at developing a shared vision of what methods would best assure good animal welfare and set the stage for regulations in the food industry. Specifically, the five freedoms are conceptualized as animals' freedom from pain, injury, and disease; freedom from anxiety and fear; freedom from hunger and thirst; freedom from physical discomfort; and freedom to behave in a natural way. The commission stated that the first two points were largely met in modern animal husbandry, while the freedom to engage in natural behavior was poorly safeguarded (*Farm Animal Welfare Council 2009*).

While the five freedoms constitute a recognized statement of fundamental principles of food animal welfare, different stakeholders differ in their weightings of animal welfare, leading to differences in what is understood to constitute a good life for the animal. In 1997 Fraser and colleagues put forth a conception of animal welfare that stated that, for an animal to have good welfare, it should be healthy and

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functioning well (i.e., free of disease and injury), be feeling good, meaning the affective states of the animals (i.e., not in fear or distress), and be able to engage in highly motivated natural behaviors (Fraser et al., 1997). These three major dimensions or criteria of emphasis on animal welfare are visible in social debates about animal welfare, and they are, according to Fraser (2008), ‘sufficiently independent that the pursuit of any one does not necessarily improve animal welfare as judged by the other criteria’ (p. 3).

Over these past five decades, farm animal welfare has become a topical issue and there has been a ‘dramatic expansion and diversification of knowledge, expertise and expectation associated with farm animal welfare’ (Bock and Buller 2013, p.390). This includes societal debates between actors within and outside agriculture about what constitutes a decent level of animal welfare within systems of food production (Fraser 2001). Hence, the Five Freedoms are not freedoms in a purely objective way, but can, according to Buller and Morris (2003, p. 231), be described as ‘socially cast thresholds for animal well-being’, thresholds that, given different weightings by different stakeholders, initiate debates on both the criteria and the emphases that should be placed on which dimensions of animal welfare among academic experts, farmers, and consumers, as individuals and in groups. All scientific inquiries, including those that set out to improve animal health, are carried out within a framework of values and worldviews, given the differences in cultures (Fraser 2003, 2008) and shifting social universe of moral and ethical claims (Buller and Morris, 2003).

How humans relate to farm animals, including their welfare, can be seen as part of a wider perspective that also encompasses the role of nature of a productivist Western food system in general. Key concerns of mid-20th century farming is increasing production, efficiency, and profit (Bjørkhaug and Richards 2008; Wilson 2001; Burton 2004; Ilbery and Bowler 1998). However, in the 1970 and 1980s, the continued drive to achieve maximum efficiency and predation on nature and the environment was increasingly questioned. Relevant for discussions in this article are post-productivist - or multifunctional agriculture policies that evolved, in Europe in particular, to mitigate productivist consequences and externalities (Wilson, 2001). Some key elements in these policies that became important in Norwegian agricultural policy were the acknowledgment that agriculture is a key pillar of society, contributes to the production of food and fiber, but also plays an important role in biological diversity and viable rural communities and contributes to the cultural value of agricultural landscapes (Bjørkhaug and Richards 2008). Norway developed a quite sophisticated policy for a strong multifunctional agriculture (Bjørkhaug and Richards, 2008). The model has been conceptualized as the social contract of agriculture (Rønningen 2020) under which the state provides funding for the farmers, farmers are (socially) licensed to produce food and public goods such as agricultural landscapes and biodiversity, and the public supports the policy. The model facilitates the alignment of regulation and control. Due to the ban on the imports of live animals, there is also a low incidence of infection and disease and with that, also a low consumption of antibiotics. Some of this is also attributed to a varied farm structure and fewer large farms. Regulations on animal welfare follow EU regulations and Norwegian law and the purpose is to promote good animal welfare and respect for animals and reflects the Brambell report and later codes for animal welfare (1979) on animals’ five freedoms.

The Norwegian agricultural model is also understood as the prerequisite for what is known in its own country as providing ‘the world’s best animal welfare which’ again is a common societal good (Government, 2021). Revelations of poor animal welfare at farms have led to uncertainty and the current Norwegian Government was asked by the Parliament to set up a committee to work on a holistic report on animal welfare to be presented to the Parliament. Agriculture and Food Minister Sandra Borch and Fisheries and Oceans Minister Bjørnar Skjæran announced a report to be launched in 2024 (Parliament, 2021). Lack of both political and industry responses might challenge the social license to farm animals.

The article is structured as follows: First we present a review of literature on the social license to operate the farm, and how animal welfare is found to challenge the license. The review continues with literature on farmers’ perceptions of good animal welfare and further perceptions of what might be *better* animal welfare. Second, the articles conceptual framework and the Boltanski and Thévenot (2006) theory of conventions is outlined. Third, data and sampling and analysis methods as well as our operationalization’s are presented. The analyses in this article are carried out by structural equation modelling (SEM) where we first identify latent perceptions of animal welfare by analysing how farmers respond to definite questions about those farm practices which are believed to enhance animal welfare, and further, we identify relationships between animal welfare perceptions and aspects related to the farm, farm practices and policy expressed as conventions on animal welfare. The empirical material is derived from a postal survey conducted in 2020 (n = 745). Fourth, results of the statistical analyses are presented, and finally fifth, results are discussed in relation to convention theory and the social license to operate a farm.

2. Literature review

2.1. The social license to farm and its challenges

Support for the agricultural political model is, as we have pointed out above, an important element in the societal contract in agriculture. The concept of the ‘social licence to farm’ is helpful to structure questions about the relationship between farmers and wider communities. Recently international attention has been paid to the idea of the ‘Social License to Operate’ of potentially contentious industries such as mining (Prno 2013), forestry (Edwards et al., 2016), and fishing (Kelly et al. 2017). Although initially the focus was on extractive industries such as forestry and mining, increased attention is now being paid to the farming sectors, putting into question whether farming will retain its traditional wider community support and legitimacy of action. If farmers’ practices run counter to what the wider community assesses as acceptable (Martin and Williams 2011), the social licence to farm which underpins strong political and cultural support for farmers may weaken. Exposure of poor animal welfare seems to be a particularly potent field threatening the licence.

Farmers generally search for legitimacy in the formal and informal institutional environment but also with respect to social norms (Stenholm and Hytti 2014). As strongly intertwined with their farm practice, animal welfare has traditionally been considered a public good, and a non-competitive issue concerning the whole society (Miele and Evans 2010) as expressed also by the Norwegian Minister of agriculture above.

Complying with current regulations is an essential part of maintaining the farmer’s license. However, regulations, standards and governance have changed over the past decades. A long-standing development in Western food systems is the shift from governmental to private regulations of food production (Clapp and Fuchs 2009; Richards et al., 2013), a development that also includes private animal welfare schemes. In Norway, animal welfare has been governed and regulated primarily by the public’s demand for regulations, standards that are often beyond EU standards (Bock and van Leeuwen 2005). More recently private animal welfare schemes have also begun to emerge in Norway. This development is associated with an implicit transformation from the determination of appropriate treatment of animals through political mechanisms and regulatory channels to a higher extent commodifying the welfare of animals (Degeling and Johnson 2015).

While regulations in western countries follow general principles, such as the five freedoms, perceptions of a regulatory burden connected to animal welfare vary across countries. Bock and Van Huik, 2007 found Norway and Sweden to have stricter regulations for pig welfare than Italy, The Netherlands, France, and the UK. In Norway, farmers prefer to have strict animal welfare regulations, reinforced in large part by their belief that this will maintain consumers’ trust and preferences for

Norwegian products (Bock and Van Huik, 2007). A study carried out in a representative sample of the agricultural population in Norway in 2010, found that 52% of all farmers regarded stricter regulations for animal welfare as something positive for the sector (Logstein 2010). By 2020, the proportion of Norwegian farmers who were positive about stricter regulations had increased to 70% (Zahl-Thanem and Melås 2020). In addition, Norwegian farmers experience a relatively high trust among consumers, compared to their European peers (Kjærnes et al. 2007).

Promoting better animal welfare regulation can be seen as problematic. Compared to European farmers, Norwegian pig farmers felt that it was unethical to promote products as more animal-friendly; they were in general also sceptical about private animal welfare schemes as a strategy to improve animal welfare and had little faith in using higher prices to promote better animal welfare (Bock and Van Huik, 2007; Skarstad et al., 2007). The reason is that such labelling would imply that other products were less animal-friendly, which would be contradicted by the overall high level of animal welfare in the county ensuring good welfare for all animals, in the farmers' view (Skarstad et al., 2017). Skarstad et al. (2007) describe how animal welfare in Norway is an 'invisible attribute' of Norwegian products, in contrast to other European countries that have more private marketing schemes and labelling options to identify animal welfare as an important factor (Bock and Van Huik, 2007).

Farmers competing in the international food market through export have been found to perceive animal welfare as a barrier to competitiveness. For instance, Vogeler (2017) reported that farmers in Switzerland who are overly reliant on the domestic livestock sector were less concerned that higher animal welfare standards would harm competitiveness compared to more export-oriented countries such as Germany and Austria. That the livestock sector in Norway markets most of its products domestically may explain why Norwegian pig farmers have been more accepting of stricter regulations than pig farmers in other countries.

The social license presupposes that farmers can develop an antagonism toward social groups with values and issues that might represent a threat to their farm productivity or be labelled as neglecting animal welfare, (Burke and Running 2019). While little research has been conducted on this issue in Norway, international literature provides some valuable insights; for example, Bock et al. (2010) found that public discussions about animal welfare were worrying farmers because they were experienced as threatening their existence as entrepreneurs, and there seemed to be no end to discussions and new demands presented to farmers. Commenting more broadly on society, Te Velde, Aarts, and Van Woerkum (2002) reported that the 'licence to produce' was important for Dutch farmers, but when animal welfare regulations became stricter and more stringent they commented on the 'feeling that somehow, they are no longer wanted in The Netherlands' (p. 208). Furthermore, other research found that farmers' reception of an 'ethical discourse' among urban consumer groups impacted their sense of self and made them feel like 'alienated partners in the broader project of producing food' (Carolan 2020, p.18), potentially undermining and threatening the constitution of good farming (Singleton 2012).

Similarly, international literature provides insights into farmers' desire to uphold the licence. In their interview-based study, Bock et al. (2010) showed that European (pig) farmers were concerned with making sure that they were using the same interpretation of animal welfare as retailers and non-governmental organizations (NGOs). A Canadian study also revealed that dairy farmers were concerned about meeting public expectations, regarding animal care (Ritter et al., 2020). In Germany, farmers were willing to accept governmental programs to improve animal welfare in the dairy sector if they thought that this could improve their public image (Schreiner and Hess 2017). Also, aspirations to farm responsibly have been reported to coincide with socially desirable visions for agriculture, despite being filtered through institutions that shape, constrain, and drive how farmers act in practice (Baur 2020). Such institutions are rules and standards, market and supply-chain

forces, social networks and norms, scientific knowledge, and available technologies.

Velde et al. (2002) reported a strong relationship between farmers' belief that it was their responsibility to feed the population and how they talked about animal welfare. In this latter example, the authors claim that both livestock farmers and consumers are equally ambivalent about their feelings regarding the care of farm animals in intensive livestock farming. To justify their practice, farmers refer to their practices as simply reflecting the interest and associated demand for cheap food for consumers, and for consumers not emphasizing high animal welfare (Ibid.). Riley (2011) also found that farmers legitimize their animal health practices in terms of consumers' demands for cheap food, industry requirements for profit, or the rules set out by an earlier generation. After studying livestock farmers in Sweden, Hansson and Lagerkvist (2012) claimed that farmers have a limited perception of the risk associated with failure to meet society's demand for specific animal welfare attributes that align with their values, including promoting natural behavior as an integral component of animal welfare and hence food production. To receive public support, food animal production systems must not be out of step with public values since it increases the risk that public trust in animal farming will be eroded (Fraser 2001; Weary et al., 2016).

In the international literature, the concept of social licence to operate captures both the expectations, but also the record of responses to challenges, determining legitimacy in, and acceptance of society (Gallois et al., 2016). The stakeholders who have the most influence on animal welfare in agriculture are the livestock farmers. Given this central and arguably influential role that they play, it is the farmers' perspective on which we will focus in this study. To sustain his/her practice as a food producer, the farmer depends on trust and support from actors and institutions both within and outside the agricultural sector, through formal and institutional arrangements as a food producer, and in the market where consumers make their choices. The range of actors also includes the critics of animal agriculture, who frequently express their views on animal welfare through social and editorial media and the popular press (Shields et al., 2017). Collectively, these actors continue to try to influence and challenge the farmers' social licence to operate.

2.2. Farmers' perceptions of animal welfare

Farmers are the ones who handle livestock as part of their daily practice and farmers' perceptions of farm animal welfare influence how they manage their farms and hence the outcome for animals' health and welfare (Adler et al. 2019; Andreaseen et al., 2020). Moreover, it also impacts their willingness to adopt programs set up to increase farm animal welfare (Lauwere et al., 2020). Therefore, knowledge about and variations in farmers' perceptions of animal welfare, and the origin of their perceptions are of great interest. In this section we present research from Norway and internationally.

Although some farmers make modest reference to the possibility that animals under their care should experience positive emotions and at least express natural behavior, the overwhelming majority of their discussion is focused on basic health and functioning (Balzani and Hanlon 2020). That references to affective states (i.e., how the animal is feeling) are made more frequently than naturalness was not surprising given that the latter is conceptually the most difficult for them (von Keyserlingk and Weary, 2017). In a study of Swedish livestock farmers, the farmers' attitudes to animal welfare largely related to basic health and comfort, with no references made to the animals' natural behavior (Hansson and Lagerkvist 2012). Hansson and Lagerkvist (2012) concluded that 'farmers may have somewhat narrow conceptualizations of animal welfare' (p. 849). Also interesting was the fact that Norwegian farmers (Skarstad, Terragni, and Torjusen 2017) stated that providing an animal with enough food and water and keeping the animals healthy and clean were most important for the welfare of animals welfare, while few

referred explicitly to the animals' need to engage in natural behavior. Velde et al. (2002) found that Dutch farmers focused mainly on animal health, and the provision of food and water when talking about animal welfare.

In contrast, Bock et al. (2010) demonstrated that, when asked, farmers in three European countries often mention several dimensions of animal welfare. These authors showed that when asked to discuss animal welfare, in addition to health, body condition, and housing, farmers also made references to the possibility for their animals to experience positive emotions, social experiences with conspecifics, and positive human-animal interactions. Similarly Vigors and Lawrence (2019) found that Scottish farmers were concerned largely with meeting the animals' needs and reducing negative experiences such as fear and stress. It follows therefore that positive experiences among the animals such as autonomy and play would then arise naturally or indirectly out of this. Kauppinen et al. (2010) identified four specific attitude objects in Finnish livestock farmers' practical work: providing animals with a favourable environment, taking care of animal health, treating the animals humanely, and taking care of the farmer's own well-being.

Vigors and Lawrence (2019) describe farmers' approach to animal welfare as fluid and holistic. By fluid, the authors refer to their understanding of animal welfare being influenced by their animals' current situation, the characteristics of their farms and the wider economic environment. Second, their values and preferences influence their understanding of animal welfare. The practice of animal welfare is deeply rooted within the established social conventions of agriculture that occur through the networks which farmers are a part, such as family, community, veterinarians, and industry experts; this relates to the social and symbolic significance associated with human and animal welfare (Bassi et al. 2019) as well as the norms and culture associated with animal husbandry, surrounding the farmer (Burton et al. 2012). Winkel et al. (2020) found that the opinion of people close to German pig farmers was important for their perception of animal welfare.

Perceptions of animal welfare are also grounded in the fact that the farming of animals is viewed as a service to feed the human population (Velde et al., 2002). In a French study, farmers commented on the experience of good farm production and this was strongly intertwined with a satisfying relationship with their animals (Kling-Eveillard et al., 2020). According to Fraser (2001), farm animals have traditionally been part of human culture but are frequently valued mainly for their utility. In short, they are seen as being worthy of care, but generally in ways that are consistent with their utility with perceptions coinciding with ideals of the farming family (Fraser 2001).

Emotions connected to animal husbandry are found to be a reflection of social norms, but can also act as a catalyst for challenging, re-directing and changing dominant norms and social practice (Bassi et al. 2019). One example is when farmers have highlighted a certain practice that enhances animals' well-being, happiness, or freedom to behave in a natural way, as a way to distinguish themselves from other groups of farmers who in their opinion use less ethically sound practices (Hollo-way 2001).

It was the emergence of organic farming that clearly marked a critique of animal welfare practices in productivist agriculture (Reganold and Wachter 2016). Despite the growth of organic agriculture and other niche markets, the industrial form of production has continued to dominate Western agriculture, while countertrends present alternative pathways. This is also the pattern in Norway.

Storstad and Bjørkhaug (2003) found that in Norway organic farmers were generally more critical of the environmental and animal welfare status of Norwegian agriculture than were conventional farmers. Bjørkhaug (2006) also found that, within Norwegian agriculture, organic farmers were motivated to farm by their interest in nature, while conventional farmers valued economic prospects more highly. This study also indicated that women farmers valued nature, animals, and rural life (rurality) more than their male counterparts who, as a group, more often stressed economic opportunity and independence (i.e., being

self-employed) (Bjørkhaug 2006, p. 200); these dichotomies are also stressed by Peter et al. (2000), who note that in traditional farm systems a conventionally understood masculinity was apparent, whereas, in sustainable farm systems, dialogic masculinity with less focus on the control of nature and more fluid definitions of work and success was fostered.

Quality assurance schemes are used to differentiate animal welfare practices. Bock and Van Huik, 2007 found that pig farmers producing for different quality assurance schemes held contrasting views on animal welfare. Farmers in the basic quality assurance schemes referred to animal welfare in terms of the provision of animals' basic biological needs, such as ensuring that they are provided sufficient good quality feed. By contrast, other farmers who were operating higher quality assurance schemes defined animal welfare in terms of animals' opportunity to express themselves in natural ways. However, in a study of French pig farmers (Kling-Eveillard et al. 2007), the authors failed to note that farmers participated in certain schemes because they saw that animal welfare was important. For farmers to be more positive about participation in welfare schemes, tangible benefits for the individual farmers are important; such benefits would include obtaining a better price for their produce (Hockenhuil et al. 2019; Skarstad et al., 2007).

The literature review of farmers' perceptions on animal welfare research indicates that animal health plays a more dominant role than natural behavior in perceptions of animals' welfare. The research does not, however, provide us with a consistent operationalization of animal welfare among farmers or researchers. In our study, we let the farmers themselves define which aspects of animal welfare practices they emphasize. In the following section we present the theoretical tools of how we explain these practices.

3. Conceptual framework

This article rests on a conceptual foundation built on – and deriving from – a combination of actor and culture-oriented perspectives. To obtain insight into farmers' assessments of animal welfare, we adopt the *theory of conventions* (Boltanski and Thévenot 2006; Storper and Salais 1997). Certain practices of animal husbandry and how much individuals weigh the different dimensions of animal welfare occur within a certain *action framework*. At the heart of collective action, are *conventions*, that are defined as the practices, routines, agreements, and their associated informal and institutional forms that bind together acts through mutual expectations (Salais and Storper 1992). Collective action includes notions of what is worthy, desirable, and right, or in alignment with the common good as understood among individuals who share a certain convention (Boltanski and Thévenot 2006).

Convention theory sees the actors in continual negotiation concerning preferred courses of action. The words employed in making positive claims about something link a certain way of thinking to deeper, universally accepted ideals (Thévenot et al. 2000). The concepts of the good farmer and the social license to farm, mentioned above, can be seen as such conventions.

In addition, Storper's (1997) term 'worlds of production', deriving from the theory of conventions, is a valuable framework to obtain insight into and understand farmers' perceptions of animal welfare. Norms and rules in the farming community, together with a local, personalized set of human relations, are the factors that construct a common set of conventions and collective actions in the world of farm production. Storper (1997) divided food production into two dimensions: The first dimension distinguishes between whether a food product is *standardized* and whether it is *specialized*. The second dimension distinguishes between whether it is *generic* and whether it is *dedicated*. In the world of standardized food production and the world's generic food production, commercialism and efficiency are thought to be associated conventions. In the world of specialized food production and the world of dedicated food production, we expect to find conventions associated with health and ecology (Salais and Storper 1992). With

the summary provided by the review of literature above, attention to animal welfare is evident across all four worlds of production (Storper 1997) yet driven by economic incentives and mainly focused on the absence of animal disease in the first two, while ecology directs attention to the affective and natural aspects of animal welfare in the latter two worlds.

According to Busch (2011), conventions expressed as standards for practices in livestock farming are devices that reflect reality but also impact reality. When certain standards in animal welfare are introduced, they need to be used and accepted. This process of acceptance requires justification and the creation of a new reality as the new standards become adopted and enforced. Justifications for a certain practice and standard relate to the higher principles ‘orders of worth’ identified by Boltanski and Thévenot (2006) and Thévenot et al. (2000). Within different contexts of justification, understandings of how we should treat our animals may differ (Busch 2011). This concept of different conventions to understand how human beings define the relationship between themselves and other species has a parallel in Fraser’s (2001) ‘animal mythology’. His concept refers to ‘fundamental popular beliefs and values regarding animals, often embedded in a culture’s art and stories, which influence how people view animals and what they judge to be proper conduct toward them’ (p.176). According to Sutherland and Darnhofer (2012), it is important for farmers to have a practice which is in agreement with what the farm community defines as ‘good farming’ practice as a way to gain social standing in the farm community. Empirical research can provide insight into what these shared values and practices comprise.

Boltanski and Thévenot (2006) defined six orders of worth. The six orders of worth (as listed by Finsch et al. 2017, pp. 75) are: ‘the market (in which “worthy” objects are considered in terms of profit maximization and competition); the industrial (emphasizing science, productivity and instrumental relationships); the domestic (which values attachment, hierarchy and honesty); the civic (emphasizing civic solidarity, the collective and delegation); the inspired (emphasizing charisma, creation and uniqueness) and an order based on fame (reputation, public opinion and success).’ Thévenot et al. (2000) also elaborated a green order of worth -the ‘Natural worth’ emphasizing nature’s own value.

We are further inspired by the work of Murdoch and Miele (1999) on how ‘instrumental and non-instrumental perspectives on nature [play themselves] out in the contemporary food sector’ (p.481). This refers to a double structure that is given practical expression within food production. With reference to Eder (1996), Murdoch and Miele (1999) describe how the human relationship with nature is both dominating, being an object to be utilized in accordance with human aspirations and a zone apart from us, imbued with its own moral authority. Murdoch and Miele (1999) built their analyses on an assertion that ‘the contemporary food sector is bifurcating into two main “zones” of production: standardized, industrialized global food networks on the one hand, localized, specialized production processes on the other’ (p. 469). Within the first perspective, food production aims to marginalize nature by replacing natural production processes with industrial ones. In the second, nature is something to be nurtured and maintained outside the simple instrumentalizations which underlie industrial production (Murdoch and Miele 1999). This can also be relevant in analyses of how farmers perceive different dimensions of animal welfare, and how these are associated with other aspects of their farm production.

4. Methods

In studies that intend to measure farmers’ assessment of animal welfare and use broader concerns for animal welfare such as the dimensions of Fraser, we claim results probably will depend to a high extent on how farmers understand the welfare concerns in question, such as basic health, affective status, and animals’ rights to pursue natural behavior. Welfare concerns as concepts and definitions probably

are more known in academia than within the farm population.

In this study, we use variables where farmers are asked to assess the importance of farm practices in how animals are treated at the farm level. Next, we analyse farmers’ response on the different farm practices and see how groups of farm practices might serve as indicators of the different categories of animal welfare, such as the well-known dimensions basic health, affective states and natural behaviour.

We do this by using the technique of identifying latent variables to the measurement model that will be applied in analysis. Constructing a latent variable is of high value in a study of attitudes and is a part of the group of statistical methods or data analyses called Structural Equation Modeling (SEM).

The logic is that an attitude is an underlying factor, a latent construct, and this underlying factor gives rise to something observable. The observable is how important farmers consider different practices for enhancing animal welfare at the farm level to be. From the literature, we expect that several dimensions of animal welfare are visible among farmers in their assessment of animal welfare. Therefore, the measurement model will probably consist of several latent variables, but with expected covariance between them. The latent variable consists of the variance the items have in common (Sharma 1996; Muthén 2002).

After we have operationalized farmers’ assessments of animal welfare by developing a measurement model, we aim to study how farmers’ assessments of animal welfare relate to different livestock productions and other material conditions at the farm level, farmers’ considerations about the role of the agricultural sector in Norwegian society and animal welfare regulations, their opinion about animal rights activist groups, and, finally, several individual characteristics. The last of these includes rural-urban distinctions regarding where one grew up, one’s educational level, one’s competence in livestock, and one’s gender and age.

Within SEM, we establish and test a structural model. The latent variables within the measurement model become the dependent variables, and we analyse how several independent variables are associated with the dependent variables.

In a structural model, the researcher estimates several regression analysis equations simultaneously, and SEM is therefore a robust and realistic framework for analysing complex issues (Davis 2012). As several variables are ordinal and are not normally distributed, all estimations were done using the Satorra-Bentler (SB) scaled chi-squared test (Ringdal and Wiborg 2017).

4.1. Sample

The sample consisted of 3028 self-employed Norwegian farmers from a postal survey in 2020. These farmers were randomly selected from a Norwegian register of farm businesses. The inclusion criteria were that they were registered as single principal owner-operators. A total of 1170 farmers agreed to participate (39%) and the sample was found to be representative of the population of Norwegian farmers (Zahl-Thanem and Melås 2020). Our analysis includes farmers who answered the survey with livestock production (n = 762).

4.2. Measurements

4.2.1. Measurement model

As a starting point to explore farmers’ understanding of animal welfare, a team of researchers within the disciplines of ethology, veterinary medicine, sociology, and political science identified, deliberated about, and agreed upon 13 practices at the farm level that can enhance animal welfare. The different practices were identified in the scientific literature on animal welfare, and visible in the public debate on that subject. In addition, the research team members covered what they understood as farm animals’ Five Freedoms (Farm Animal Welfare Council 2009) and Fraser’s (2008) three dimensions of animal welfare. One question addressed to farmers in the survey was “How important do you think the following conditions are to ensure what you understand as

good animal welfare in Norwegian agriculture?” The response options ranged from *not so important* (1) to *crucially important* (5) on each of the 13 conditions.

For this study, we decided to use nine of the 13 variables to develop a measurement model for animal welfare, as we think they relate to the three dimensions of animal welfare. We tested different measurement models. To know which measurement model represents the empirical data best, we consider several goodness-of-fit measures. In this study, we use the root mean squared error of approximation-Satorra-Bentler (RMSEA-SB), comparative fit Index (CFI), the Tucker-Lewis Index (TLI) and Standardized Root Mean Square Residuals (SRMR). These indices measure how much better the model (the latent variables) fits the empirical data, than if we had no model at all. In developing a measurement model, we select the model with the best goodness-of-fit measures. The final measurement model with the best fit consisted of the two dimensions and with a covariance between them. We got the following goodness of fit statistics: RMSEA-SB = 0.042, CFI_SB = 0.967, TLI_SB:0.949, SRMR:0.036. All factor loadings for each item on the dimension were greater than 0.60, and the variables are reliable indicators for the construct they intend to measure (Sharma 1996).

The first dimension consists of the following six claims: ‘Animals are treated in such a way that they avoid fear’ (fear), ‘Animals have adequate access to food and water’ (food & water), ‘Animals have suitable shelter’ (shelter), ‘Animals are kept in a suitable living environment with access to a comfortable lying area’ (rest), ‘Animals are treated for pain’ (pain), and ‘Animals have prompt treatment for disease and injury’ (disease). Therefore, we named this dimension ‘basic health and feelings’.

In testing different measurement models, the best solution arrived when we decided to include fear as an indicator of the same construct as the items of for instance food and water. That happened despite an expectation that fear of animal welfare relates to something different than items more focused on basic health of the animals.

The second dimension consists of the following item ‘Animals have the freedom to express natural behavior’ (natural), ‘Animals get to go outdoors as much as possible’ (outdoor), and ‘Animals have opportunities for contact with animals of the same species’ (species). This dimension was named ‘Natural needs’. We present the descriptive statistics of the nine final items in the result section (5).

4.2.2. Explaining variables

In the following section, we present the ratings assigned by the farmers to the different dimensions of animal welfare. All details are presented in appendix 1. Variables are grouped by material conditions: type of animal production; production style; economic resources, and labor aspects. Other variables related to farmers’ assessments of political and regulatory aspects; assessments of animal welfare NGOs; characteristics of the farmer (e.g., rural affiliation); farmers’ own evaluation of their competence in livestock farming; their educational level; sense of duty to uphold the farm; age; and gender. The distribution of all these variables is available in appendix 2.

4.2.3. Material conditions

Most farmers are meat (beef) producers (54%), followed by sheep farmers and dairy farmers, 47% and 40%, respectively. Pig production accounts for 8%, and poultry for 5% of the farmers surveyed. Some have mixed productions. The research above showed that farmers’ relationship with their animals might correlate with the species, stock density and production system. We included three independent dummy variables for dairy, sheep- and pig-raisers in structural model. Those farmers in one of these groups were coded 1 and everyone else were coded 0. Beef production did not contribute to the model and was therefore not included as an independent variable in the final model. In our material, 6% are organic farmers, and 91% are running their farms in a conventional style. The remaining farmers are either converting to an organic production system or considering it (3%). In the analyses, this variable

appears as a dummy variable where organic and in the process of change are coded as organic (1), and those who are not and those considering adopting organic methods are coded as conventional (0).

In this section, we add self-reported income level, workload in farming, and access to relief workers. It is plausible that these resources impact farmers’ views of the importance of basic health and feeling, and natural needs for their animals. They may impact how easy or difficult farmers assume different practices to be. We asked farmers to report net farm income in 2019 (farm income), and the proportion of household total net income from farming (share of household income). 63% of the farmers collect less than 50% of their household income from farming. We also asked the farmers to report hours worked in 2019–53% worked more than the workload ‘norm’ (+1700 h) - and to add responses to the statement ‘It is difficult to get a relief worker when I need it.’ An equal share (35%) agrees and disagrees on this issue. All these variables are included as ordinal variables in SEM.

4.2.4. The role of agriculture in society

Farmers were asked to assess political and regulatory aspects and the role of animal welfare NGOs on agriculture. Several questions to the farmers assessed their views on the prioritization of agriculture (as a societal function) in years to come. The aspects reflect factors in Norwegian agricultural policy, ensure increased value creation, ensure sustainable agriculture, ensure food production throughout the whole country, ensure cost-effective food production, ensure food security, ensure settlement in rural areas, manage cultural heritage, manage cultural landscapes/biological diversity, ensure consumers safe food, ensure consumers Norwegian food, ensure consumers cheap food, and reduce carbon dioxide emissions from agriculture. The response categories range from weak prioritization (1) to very strong prioritization (5).

We ran exploratory factor analyses to determine whether some questions reflected one or more dimensions. The result was two dimensions and we computed two indices. The first index captures the content of a cross-political agreement on the role of Norwegian agriculture: to ensure increased value creation in agriculture, ensure sustainable agriculture, ensure food production in the whole country, ensure food security, ensure settlement in the whole of Norway, and ensure consumers Norwegian food, the latter four with 60 and more support to the category considerably stronger. The index is given the label *Norwegian food production* in the analysis. The Cronbach alpha was acceptable (0.779). The second dimension consists of landscape and nature elements that emerged in the multifunctional agricultural policy in the 1990s: administration of cultural heritage and administration of cultivated landscape/biological diversity, and we labelled it *Multifunctional agriculture*. The Cronbach alpha was acceptable (0.840).

Our next question addressed the role of stricter animal welfare regulations in agriculture. 70% reported that stricter regulation on animal welfare would positively impact on Norwegian agriculture. Another question asked whether animal welfare organizations create unnecessary problems for the farmers: 80% agreed. These variables are included as ordinal variables in SEM.

4.2.5. Characteristics of the farmers

Rural-urban distinctions often apply to animal welfare issues and might apply to farmers with diverse backgrounds. We asked farmers to describe the characteristics of the areas where they grew up. 70% grew up on the farm they are running today. An additional 12% were raised on a different farm and 12% in rural areas. 5% spent little or no part of their childhood in rural areas. In our analyses, this dummy variable indicates rural (0) and non-rural (1) background. Somewhat related to background, is the question of what extent a sense of duty to uphold the farm influenced the decision to become a farmer. 22% reported that duty was of great importance, and 39% said that this was of some importance. We acknowledge that duty might have positive and negative connotations relating to farming.

We used two variables to measure farmers’ knowledge base. The first is farmers’ educational level in general: 47% of the farmers reported upper secondary vocational education. This education could involve agronomics among other fields of study. 32% completed university/college education, and 7% completed only primary education. The second variable measures available competence in livestock production at the farm. 45% reported general knowledge as good, 49% as very good and 0.4% reported that their competence was bad or very bad. The last three variables are included as ordinal variables in SEM.

Finally, gender and age are added as variables that in literature are found to influence valuation and perceptions of animal welfare. Female farmers constituted 16% of the sample in this study and gender is included as a dummy variable (female = 0). Farmers’ mean age is 54 years. Age is a ratio scale in SEM.

5. Results

The literature review showed results from studies of farmers’ perceptions of animal welfare, farmers’ practices regarding animal welfare, and variations across groups of farmers in their perceptions and practices. An important factor in many studies was the identified connections between farmers’ interpretations of society and their responses to those who regulate farming, to uphold the licence to farm. Farmers in our study generally value animal welfare as important. However, by inspecting the means values of the different items we used for constructing the dependent variables, we found that farmers in general assess basic health and feelings as more important than natural needs of the animals (Table 1).

In the following structural model, the aim is to analyse what impact farmers’ assessment of the importance of the dimensions we operationalized in this study, basic health and feelings, and natural needs.

We work with two dependent (latent) variables and 19 independent variables (Fig. 1). The gamma (γ) values in the structural equation model represent the mean change in the dependent variable for one unit change in the predictor variable, while holding other predictors in the model constant. We consider them significant at $p < .05$. In the model (Fig. 1), we present only standardized values. The interpretation is similar to standardised ordinary least squares regression coefficient. The results are also presented in the format of tables in appendix 2.

The following section reports on the results of the explanatory variables. The first group of explanatory variables consists of **material**

Table 1

The distribution of different claims about farm practice constituting the two dimensions of animal welfare: Basic health and feelings, and natural needs (%), and the mean value and standard deviation of each item (sd).

	Not so important (1)	2	3	4	Crucial important (5)	Mean value (sd)
Basic health and feelings						
Fear	1	1	3	25	71	4.64 (.64)
Food and water Shelter	0.4	0	0.4	5.5	94	4.92 (.37)
Rest	1	0.5	4	20	75	4.68 (.64)
Pain	0.1	0.2	5	29	66	4.60 (.62)
Disease	0.3	0.4	2	17	80	4.76 (.53)
	0.3	0.1	0.3	13	86	4.85 (.42)
Natural needs						
Natural	0.8	1	12	32	54	4.38 (.80)
Outdoor	3.6	6	21	36	32	3.87 (1.05)
Species	1	2	10	35	51	4.32 (.85)

conditions. Different livestock productions - dairy, sheep farmers, and pigs – do not contribute significantly to explaining differences in emphasizing either the perception of ‘Basic health and feelings’ or ‘Natural needs’ as important to ensure good animal welfare in Norwegian agriculture. A significant difference was found in organic farmers significantly emphasizing ‘Natural needs’ more than the conventional farmer (.103**), while the difference was not significant for ‘Basic health and feelings’.

Other material conditions such as farm income, the proportion of household total net income earned from farming or workload was not associated with farmers’ responses to ‘Basic health and feelings’ or ‘Natural needs’. Difficult access to relief workers was associated with weaker emphasis on ‘Basic health and feelings’ (-0.160**) compared to farmers who have easy access. Access to relief workers had no significant effect on emphasizing ‘Natural needs’.

Second, we included different measures of farmers’ opinions about the relationship between the agricultural sector and society that reflects on the social license to farm.

Farmers who regard the political construct ‘Norwegian food production’ to be more strongly prioritized in the years to come, are more likely than those who do not to view ‘Basic health and freedom from fear’ as important to ensure good animal welfare (.142**). The association between ‘Norwegian food production’ and ‘Natural needs’ was not significant.

Farmers who regard the political construct ‘Multifunctional agriculture’ as important also consider ‘Natural needs’ as more important (0.195**). The equivalent association between ‘Multifunctional agriculture’ and ‘Basic health and feelings’ was not significant.

Farmers emphasizing that strict animal welfare regulations impact positively on Norwegian agriculture rated both ‘Basic health and feelings’ and ‘Natural needs’ as important (0.153** and 0.223** respectively). A third factor impacting the societal function of agriculture is animal welfare organizations. Those who believe these organizations create problems for farmers regard ‘Natural needs’ to be less important to ensure good animal welfare (-0.089**)

The last group of variables embraces **characteristics of the individual farmer.** Farmers who grew up in rural areas regard ‘Natural needs’ to be less important to ensure good animal welfare (-.089**). A feeling of duty to uphold the farm does not provide an explanation, and educational level does not contribute significantly to the model. Farmers who consider their competence in livestock production to be good, regard ‘Basic health and feelings’ as more important to ensure good animal welfare (0.100**), while the association was not significant for ‘Natural needs’.

Female farmers regard ‘Basic health and feelings’ as more important for good animal welfare than male farmers (0.108**), while age made no significant contribution to explaining differences in the dimensions of animal welfare.

To estimate how well the structural model fits with the reality (the empirical data), we used the same measures as we did for the latent variables, and the fit was acceptable: RMSEA-SB = 0.032, CFI_SB = 0.933, TLI_SB:0.911, SRMR:0.031. In all, 12.5% of the variance in the dependent variable ‘Basic health and feelings’ was explained by the model, while 24.2% of the variance may be found in the dependent variable ‘Natural needs’.

6. Discussion

6.1. Farmers’ understanding and valuation of good animal welfare

In his oft-cited typology for understanding animal welfare, Fraser (2008) explains how people’s concerns generate different criteria and components reflecting different sets of values: Basic health and functioning, Affective states, and Natural living, and ‘... that these involve considerable but imperfect overlap and, [further,] that the pursuit of any one criterion does not guarantee a high level of welfare as judged by the

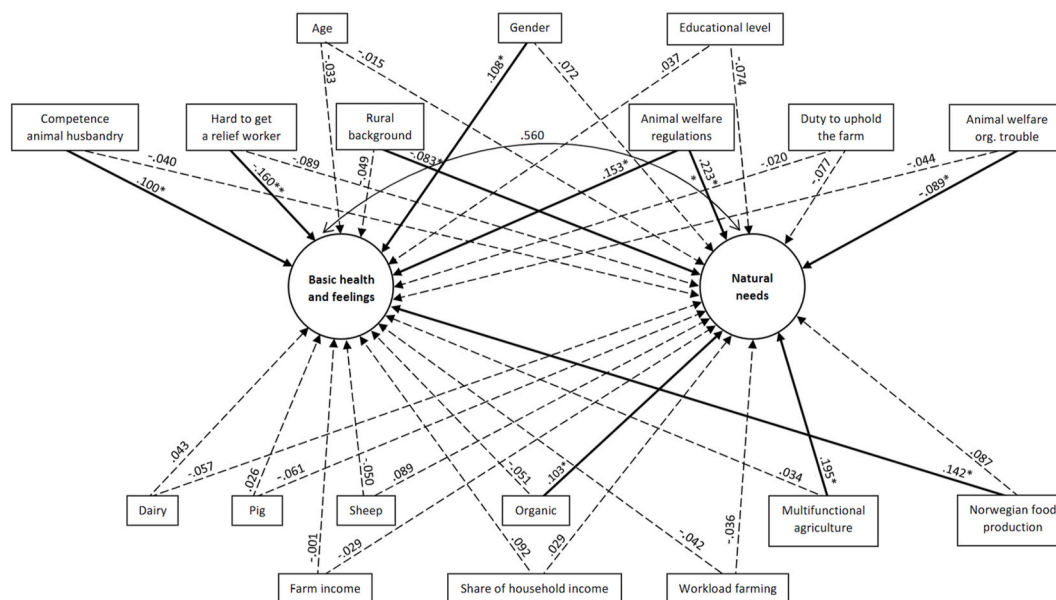


Fig. 1. Structural estimation model. Prediction of two dependent variables; Basic health and feelings, and natural needs, by exploratory variables. Standardized coefficients. *P < .001.

others’ (p. 3). Fraser presented these criteria in three circles, where overlap was seen in the middle intersecting parts.

In our study, we started out by developing several indicators that were intended in different ways to capture the three criteria, and we saw that different people in different professions, evaluated the content differently. In addition, we found little consistency through the literature review as to how to measure farmers’ understanding of animal welfare. This justified our choice to carry out an analysis in which we sought insight into the differences between the various criteria, as evaluated by the farmers on an aggregate level.

Our first ambition was to achieve insight into the farmers’ appreciation and emphasis on practices that they believed would ensure better animal welfare. In our study, Fraser’s three circles became two. Our analysis was based on the Norwegian farmers’ answers and identified two categories, where one captured two of Fraser’s criteria - emphasis on the animals’ ‘health and feelings’ and the other captured emphasis on what can be understood as the animals’ natural needs. Hence our study shows that farmers regard health, pain, feelings, and natural needs as important dimensions of animal welfare, while the latter was seen as least important.

To sum up our argument: If Norwegian livestock farmers had weighted all the criteria as equally important, the analysis would have returned only one dimension as to how animal welfare is perceived. If Fraser’s three different criteria had been exposing substantially different values, the analysis would have returned three dimensions. Our analysis returned two dimensions that can be interpreted as emphasizing basic health and feelings and as something other than emphasizing animals’ natural needs in animal welfare. This is an important finding that expands previous interpretations of farmers’ understanding and valuation of good animal welfare. It also indicates persistent difficulties in integrating animals’ freedom to behave in a natural way in livestock production.

6.2. Conventions on animal welfare

The capacity of our natural environment and our impact on it as human beings have received greater focus recently and farmers have been told to adapt over time. In parallel with the criticism of the effects of industrialized agriculture on nature, the industrialization of animal husbandry and animal welfare have also received attention. When

Fraser (2001) describes different actors’ emphasis on the various criteria for animal welfare, he refers to the anchoring these have in values, and how these have changed over time: Rules, norms and values change inside the agricultural sector as well as outside in society overall. We propose that so will farmers’ relations with their animals, and what they think is the proper treatment of their animals; however, changes can be slow.

A convention can be understood as a practice that is carried out based on legitimized and justified attitudes (Storper and Salais 1997). These attitudes are justified, and we follow Boltanski and Thévenot (2006) in thinking that attitudes will find their justification in the value regime, the ‘order of worth’. We do not have data on real practices and have no information about how the animals are doing. Convention theory can therefore be a good framework in the study of animal welfare as a socially co-constructed reality (Buller and Roe 2018, pp. 85), and hence we can study how different attitudes and opinions about possible practices are justified (see e.g. Busch 2011).

With convention theory we translate the two dimensions identified in our analysis, the ‘Basic health and feelings’ and ‘Natural needs’ to be part of two different (yet interrelated) conventions of how animal welfare should be practised on Norwegian farms. The translation is connected with the links that arise between the latent variables and explanatory variables in the model which clarify the anchoring in the associated worths (re Boltanski and Thévenot (2006). To legitimate these conventions, farmers take advantage of value (worth) orders and according to Busch (2011, pp.23) ‘a farmer might give several reasons in hopes that one will satisfy the questioner and thereby truncate debate’ (Busch 2011, p. 23). The arguments must nevertheless be rooted in some empirical standards of practice that are moral and ethical (Busch 2011). When we elaborate on how these conventions are anchored in worths (above) and worlds (Storper and Salais, below), it is significant correlations in the model that inform our discussion.

The two conventions of animal welfare can be argued to belong to different economic worlds of production (Storper and Salais 1997; Diaz-Bone and Salais 2011). The ‘Worlds of production’ framework has been influential and has been successfully implemented in studies of quality differentiation in the food system, including in Norway (see e.g. Borgen 2009; Stråte 2004). Borgen has shown how food branding strategies followed Storper’s (1997) dimensions, distinguishing between 1) the food product being *standardized* or *specialized* and 2) whether the

producer has a *generic* or *dedicated* marked approach. Within this ideal-typical model, we will, based on our analysis, derive content within at least two of the quadrants.

Our analysis show that the animal welfare convention ‘Basic health and feelings’ is built on farmers emphasizing that animals should have access to enough food and water, receive treatment for pain and illness, have a suitable living environment and be free from fear. These are arguments that are anchored in the industrial worth (Boltanski and Thévenot, 2006), that in real life can be followed up through health standards, rules for furnishing barns, and number of cattle slaughtered.

Furthermore, this convention is anchored in support for Norwegian food production (the Norwegian agricultural policy), which also appeals to the industrial worth with its expectations of maintaining production, and associated efficiency and effectiveness contributing to Norwegian food security, feeding the Norwegian population. We also find an appeal to domestic worth the values of which are tradition and attachment to farm life, as well as agriculture’s contribution to employment and living settlements. The convention is also anchored in civic worth, in its support for animal welfare regulation, which, in the absence of scandals, triggers trust in Norwegian farming.

Expertise in animal husbandry - often based on experience - further strengthens this convention. The convention has great support and does not divide farmers across productions or systems. We can argue that it reflects an understanding of animal welfare that harmonizes with ‘what moral and ethical standards apply’ amongst ‘good farmers’ (Burton et al., 2021). Women farmers give somewhat more support than men to this convention. The convention is standardized among the Norwegian population - a generic approach to good animal welfare.

In another quadrant - diagonally placed in relation to the previous one, we find the convention ‘Natural needs’. This convention emphasizes what is perceived as animals’ natural behavior, their need to socialize with other animals and the possibility of farm animals being outside. These arguments can be anchored in what Thévenot et al. (2000) conceptualized as ‘Natural worth’. This convention is also anchored in civic worth (Boltanski and Thévenot 2006): Regulation is positive, as in the previous convention, but we do not ask about degree, or differentiated regulation or standards.

Furthermore, and as we saw for the previous quadrant, this is rooted in another part of the policy field, the ‘Multifunctional agricultural policy’, the fact that agriculture also produces values other than food and fiber, such as biodiversity and attractive landscapes. This area is, as outlined in the introduction, an important part of the Norwegian agricultural policy from the 1990s; however our analysis indicates that these are policy goals and apply to a subgroup of farmers rather than to the majority.

Like the convention on ‘Basic needs and feelings’, the convention on ‘Natural needs’ does not divide farmers across what kind of animals they produce but separates organic farmers as supporters from farmers not identifying as farming organic. The difference we find between conventional and organic farmers on the emphasis of natural needs, indicates how the understanding as to how one should treat farm animals can be interpreted as part of viewing nature as something that is nurtured, not recognized (Murdoch and Miele 1999) an ecological attention in the world of production (Storper 1997). Supporters of this convention are also farmers without a rural upbringing and those who do not allow themselves to be provoked by animal welfare organizations.

The convention expresses a concept of animal welfare that can be perceived as recognized and may require a dedicated market adaptation. We can imagine that these are attracted by recognized animal welfare brands. However, the future will show how important this convention will be. Progress of a certain standard, such as animal products labelled to indicate that the natural needs of the animals are safeguarded, has the potential to become an important element within standardized quality conventions, if natural needs of the animal, as a new standard or condition, become important for competitiveness in the food market (c.f.,

Borgen, 2009).

Further, animal welfare practices that strive to achieve criteria for animals ‘Natural needs’ may not be recognized as ‘good farming’ in the wider farming and rural community but in subgroups across different communities, with interest groups in urban areas, and might indicate a latent conflict or tension in and between different farming practices (c.f., Singleton, 2012).

The dichotomy that our analysis revealed can be associated and resonate with the ‘bifurcation thesis’ presented by, for example, Murdoch and Miele in 1999. The convention ‘Basic health and functioning’ is rooted in industrial parameters (healthy animals make for a better economy) while ‘natural needs’ links to ‘another’ view of nature. However, our data do not support the idea that different ways of justifying what is good animal welfare are determined by place, such as local-global, in either convention.

In our analysis, it is obvious that we have data that elaborate conventions in two of the quadrants within Storper and Salais’ (1997) worlds of production. When we do not want to write off the existence of other conventions, it lies in a recognition that our data might be too limited and our explanatory variables too spacious to produce further differentiation. Another explanation may be that it is not actually the farmers who produce greater differentiation in worlds of production, but rather that differentiation is driven by the industry and retailers’ expectations of increased demand due to diverse understandings and valuations of animal welfare parameters in the population.

7. Conclusion

Previous research, located in the western industrialized agriculture, concluded that farmers emphasize animals’ health, affective status, and natural needs as important for animal welfare, but at the same time place less emphasis on natural needs, and more on basic health and the affective status of the animal. The literature further revealed that farmers relate their practices to opinions of social groups outside agriculture and have a high level of willingness to farm to sustain the social license to farm. Studies identified a frustration among farmers with social groups outside agriculture who demand that farm animals be treated better than conventional agriculture do.

In this article, we studied Norwegian farmers’ assessment of animal welfare and how it is associated with their view of the societal role of food production practices in which they are involved. First, a team of researchers agreed about farm practices in the treatment of farm animals reflecting farm animals’ Five freedoms and Fraser’s three different criteria of animal welfare. Next, we identified farmers’ conceptualization of animal welfare, as it became visible through their responses on the different practices in livestock farming and finally, we explored what impact farmers’ assessment of different dimensions of animal welfare can have.

In Norway, farmers experience in general high trust in the population, and this study showed that skepticism about stricter regulations for animal welfare is low. Supportive factors for animal regulations include an interest to uphold the social license to farm in a context where Norwegian farmers produce food mainly for the Norwegian market and do not compete for the most part with farmers outside Norway who produce food at lower costs. Farmers’ view of animal welfare, including what dimensions they emphasize, can be located within two different conventions for food production and ‘worlds of production’ (Storper, 1997), across material constraints, conditions and resources at the farm level, and in individual farmer characteristics and their valuation of ecological factors.

In this study, we found that practices for animal welfare which focus on giving animals sufficient food and water and on reducing animals’ disease, pain, and fear, conceptualized as the convention ‘Basic health and feelings’, reflected a majority farmers’ view of good animal welfare. ‘Natural needs’ were found to be a second convention reflecting animal welfare aspect connected to the natural lives of farm animals, and had

less support.

Within the first convention, farmers emphasize the importance of further value creation in Norwegian agriculture in economic terms, enhanced food security, and agriculture’s contribution to employment and viable rural communities. In addition, high knowledge about animal husbandry among farmers, and a commitment to be positive regarding stricter animal welfare regulations, are located within this convention. Within the second convention, we identified organic farmers and farmers who value the agricultural sector as important for additional values besides the production of food, such as enhancing biodiversity and maintaining attractive landscapes. Farmers who respect this convention have more often *not* a rural upbringing and they are less provoked by animal welfare organizations. Equal to farmers supporting the basic health and feelings convention, these farmers are positively disposed toward a stricter regulation of animal welfare in Norwegian agriculture.

We observe a growing interest in animal welfare in Norwegian society and some potential for disagreement or conflict across farmers what is good farming and some social groups outside agriculture that can cause breaches in the social license to farm animals. This study revealed a potential for a split within the agricultural population where animal welfare is concerned, and the point of conflict or disagreement seems to be about the role and safeguarding of animals’ natural needs.

When we find that the animals’ freedom to engage in natural behavior is not emphasized by what we can understand the majority of Norwegian farmers, our findings are in line with the international literature and also reflects shortcoming identified by the Brambell Commission more than fifty years ago (Farm Animal Welfare Council 2009). When animals’ freedom to engage in natural behavior still is less articulated and supported as being part of the animal welfare criteria’s, or that there is poor attention to the meaning of this freedom in farmers’ perception of good animal welfare practices, several problems are likely to evolve. First, different understandings of aspects of animals’ natural needs within the agricultural sector, can hinder a successful implementation of practices and future regulations aimed to enhance the dimension of farm animals’ natural needs. Second, society’s understanding and requirements for livestock production are changing and the social license to farm animals can become challenging to uphold.

Our study therefore also has advice for policy. When laws and regulations are not understood according to the intention, they cannot be

complied with. The goal of achieving the animals’ freedom to engage in natural behavior must be given a realistic and comprehensible content. Next, effort must be placed on building knowledge to strengthen farmers ability to achieve these requirements in their daily animal welfare practices.

Author statements

Both authors contributed in all parts of the process of final study and manuscript. This include planning the survey, working with the statistical analyses, literature review and writing the final manuscript.

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Ethics approval statement

The study was approved by NSD- Norwegian centre for research (application number 927275).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix1. Descriptive characteristics of the various variables included in analysis

Table 1
Variables for constructing dependent (latent) variables

How important do you think the following conditions are to ensure what you understand as good animal welfare in Norwegian agriculture? Response alternatives: No important (1)- Crucial important (5). In percent. Number of respondents (n)						
Claim	1	2	3	4	5	n
Animals are treated in such a way that they avoid fear	1	1	3	25	71	745
Animals have adequate access to food and water	0	0	0	6	94	740
Animals have suitable shelter	1	1	4	20	75	742
Animals have the freedom to express natural behaviour	1	1	12	32	54	739
Animals get to go outdoors as much as possible	4	6	21	36	32	747
Animals have opportunities for contact with animals of the same species	1	2	10	35	51	749
Animals are kept in a suitable living environment with access to a comfortable lying area	0	0	5	29	66	750
Animals are treated for pain	0	0	2	17	80	751
Animals have prompt treatment of disease and injury	0	0	0	13	86	747

Table 2
Distribution of explaining variables. Percent (%), mean value (mean), standard deviation (St.dev) and number of respondents (n)

Variables	%	Mean	St.dev.	n
1. Material conditions				
1.1. Animal Production				
1 Dairy	40			305
2 Beef	54			408
3 Sheep	47			359
4 Pig	8			59
5 Poultry	5			39
6 Fur	0			3
7 Other productions	5			39
1.2 Animal Production				747
1 Conventional	91			679
2 Organic	6			45
3 In process of change	2			14
4 Under consideration	1			9
1.3 Net income NOK				740
1 No income	8			
2 1-49 999 NOK	9			
3 50 000–99 999 NOK	10			
4 100 000–149 999	11			
5 150 000–199 999	10			
6 200 000–299 999	12			
7 300 000–399 999	13			
8 400 000–499 999	12			
9 Above 500 000	16			
1.4 Share of household income				736
1 0	8			57
2 1–24%	34			247
3 25–49%	22			162
4 50–74%	19			138
4 75–99%	11			82
4				
5 100%	7			50
1.5 Farm workload (hours a year)				750
1 No farm work	1			
2 1–199	4			
3 200–849	20			
4 850–1699	23			
5 1700–2549	28			
1 More than 2550 h	25			
1.6 Difficult to get relief worker when I need it				743
1 Totally agree	18			
2 Agree	17			
3 Either or	29			
4 Disagree	20			
5 Totally disagree	15			
2. Political and regulatory aspects				
2.1. Agriculture's role				
1 Norwegian food production (17–30)		26.23	3.16	733
2 Multifunctional agriculture (2–10)		7.50	1.81	748
2.2 Do you think more strict animal welfare regulations will have a negative or positive impact on the Norwegian agricultural sector (AW regulation)				754
1 Very negative	6			
2 Somewhat negative	14			
3 Of no importance	12			
4 Somewhat positive	39			
5 Very positive	31			
2.3 Animal welfare organizations create unnecessary problems for farmers (AW organizations)				743
1 Totally disagree	2			
2 Partly disagree	4			
3 Either or	14			
4 Partly agree	29			
5 Totally agree	51			
3. Farmer characteristics				
3.1. Non-rural background				762
0 Grew up on farm or in rural area	95			
1 Non-rural childhood	5			
3.2 Education				748
1 Primary and lower secondary education	7			
2 Upper secondary education (vocational)	47			
3 Upper secondary education (gymnasium)	13			
4 University/college up to four years	21			
5 University/college more than four years	11			
3.3 Knowledge of livestock production				747
1 Very bad	0			

(continued on next page)

Table 2 (continued)

Variables		%	Mean	St.dev.	n
2	Bad	0			
3	Either or	5			
4	Good	45			
5	Very good	49			
3.4 Duty to uphold the farm (How important are the following factors for you to be a farmer?)					722
1	Great importance	22			
2	Some importance	39			
3	Of less importance	24			
4	No importance	16			
3.5 Gender					722
1	Female	16			
0	Male	84			
3.6 Age					747
		54	11.3		

Appendix2. Prediction of the dependent variables. SEM (estimation results, R Squared and goodness of fit)

Table 3

Prediction of dependent variable 'Basic health and feelings', by exploratory variables. Standardized coefficients (estimate), standard error (SE), p-value (sig. value) and 95 confidence interval (5% conf. interval).

Variable	Estimate	SE	Sig.value	95% conf. interval
Dairy	-.043	.060	0.470	-.074-.160
Pig	.026	.070	0.481	-.047-.099
Sheep	-.050	.064	0.436	-.176-.076
Organic	-.051	.039	.189	-.127-.025
Farm income	-.001	.056	0.984	-.110-.108
Share of household income	.092	.066	0.162	-.037-.222
Workload farming	-.042	.063	0.503	-.167-.082
Hard to get a relief worker	-.160	.045	0.000	-.244-.073
Norwegian food production	.142	.049	0.004	.046-.238
Multifunctional agriculture	.034	.045	0.454	-.055-.123
Animal welfare regulations	.153	.061	.012	.034-.272
Animal welfare org. trouble	-.044	.039	0.251	-.120-.031
Rural background	-.049	.036	0.176	-.118-.022
Educational background	.037	.040	0.361	-.042-.116
Competence animal husbandry	.100	.038	0.010	.024-.171
Duty to uphold the farm	-.020	.039	0.599	-.096-.055
Gender	.108	.038	0.004	.033-.182
Age	-.036	.053	0.497	-.140-.068

Table 4

Prediction of dependent variable 'Natural needs', by exploratory variables. Standardized coefficients (estimate), standard error (SE), p-value (sig. value) and 95 confidence interval (95% conf. interval).

Variable	Estimate	SE	Sig.value	95% conf. interval
Dairy	-.057	.064	0.368	-.182-.068
Pig	-.061	.042	0.151	-.143-.022
Sheep	.089	.052	0.086	-.013-.120
Organic	.103	.036	.005	.031-.174
Farm income	-.028	.065	0.665	-.153-.082
Share of household income	.029	.079	0.714	-.126-.183
Workload farming	-.036	.060	0.552	-.153-.082
Hard to get a relief worker	-.089	.047	0.059	-.181-.003
Norwegian food production	.087	.051	0.090	-.014-.187
Multifunctional agriculture	.195	.054	0.000	.089-.301
Animal welfare regulations	.223	.061	.012	.034-.272
Animal welfare org. trouble	-.089	.044	0.043	-.175-.003
Rural background	-.083	.038	0.030	-.158-.008
Educational background	-.074	.046	0.107	-.164-.016
Competence animal husbandry	-.040	.046	0.388	-.130-.051
Duty to uphold the farm	-.077	.045	0.088	-.165-.011
Gender	.072	.044	0.101	-.014-.158
Age	-.015	.049	0.762	-.115-.083

Table 5
R Squared, covariance (standardized) between ‘Basic health and feelings’ and ‘Natural needs’, and goodness of fit

	R Squared
Basic health and feelings	.125
Natural needs	.241
Covariance	.560
	Goodness of fit
Santorra-Bentler (SB) scaled test Chi square	237.35
Degrees of freedom, p-value	149, P < .001
SB_Root mean squared error of approximation	0.032
SB_Comparative fit index	0.933
SB_Tucker-Lewis index	0.911
Standardized root mean squared residuals	0.031

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