

The willingness of conventional farmers to participate in animal welfare programmes: an empirical study in Germany

H Heise* and L Theuvsen

Georg-August-University of Goettingen, Department of Agricultural Economics and Rural Development, Chair Management in Agribusiness, Platz der Göttinger Sieben 5, D – 37073 Göttingen, Germany

* Contact for correspondence and requests for reprints: hheise@gwdg.de

Abstract

In recent years, poor farm animal welfare (FAW) has been a continual focus of public criticism and, in many European countries, large segments of society have repeatedly demanded higher FAW standards. In spite of these demands, there are hardly any products from pure animal welfare programmes (AWPs) on the market. Given this background, farmers are a very important stakeholder group for the successful implementation of such programmes, but little is known about their attitudes towards the introduction of AWPs. For this study, 657 conventional farmers in Germany were questioned about FAW and AWPs via an online survey. Three clusters (farmer groups) were identified with respect to their attitudes towards AWPs and, based on these clusters, various target groups were determined for participation in AWPs. Cluster A (the 'sceptical animal welfare opponents') (n = 204) is characterised by strong opposition to AWPs and higher welfare standards in livestock husbandry. Farmers in this cluster will probably not take part in AWPs, especially because they do not consider AWPs profitable. Cluster B (the 'undecided') (n = 229) have diverse attitudes towards AWPs. As they do not reject the enhancement of animal welfare standards, these farmers may someday become willing to participate in AWPs. Cluster C, (the 'market-conscious animal welfare friends') (n = 224) have the most positive attitudes of the sample towards AWPs. However, even these farmers have diverse attitudes towards the monetary effects of AWP. Overall, they constitute the most important potential target group for AWPs as they indicate the highest willingness to take part in these programmes. The empirical results have important managerial implications and provide a starting point for the design of tailor-made strategies to increase the market penetration of AWPs.

Keywords: animal welfare, attitudes, cluster analysis, factor analysis, farmers, Germany

Introduction

In the recent past, improving farm animal welfare (FAW) has received growing attention and this topic has caught the interest not only of the media and the general public but also of politicians (Keeling & Kjærnes 2009; Norwood & Lusk 2009; Nocella *et al* 2010; Lusk & Norwood 2012; Keeling *et al* 2013). In several EU member states, reports have indicated the need to improve welfare standards for farm animals in conventional production systems in order to achieve social acceptance (EC 2006; Kjærnes *et al* 2007; Deimel *et al* 2010; Miele *et al* 2013; Wissenschaftlicher Beirat Agrarpolitik BMEL 2015). As a result, some animal welfare programmes (AWPs) have emerged on the market. But, despite the promising signals from market research studies (eg Schulze *et al* 2008), products from these programmes are still very rare and, with few exceptions (eg Switzerland, the UK and The Netherlands), AWPs have not attained any great importance in the European meat market so far.

The long-term success of AWPs is determined by a variety of factors (eg consumer behaviour, acceptance of other stakeholders along the food supply chain) (Golan *et al* 2000; Harper & Henson 2001; Gulbrandsen 2006; Bracke

2007; Buller & Cesar 2007; Deimel *et al* 2010; Theuvsen 2011; Franz *et al* 2012). However, farmers are considered the most important stakeholder group for the successful implementation of enhanced FAW standards. In Germany and in many other European countries, only few farmers are bound by contract with the downstream production stages (except in the poultry sector). Therefore, it is difficult to implement new production or quality programmes if the majority of the farmers have doubts about the system with regard to such aspects as its long-term market success (Bahlmann & Spiller 2008; Deimel *et al* 2010; Franz *et al* 2012; Hansson & Lagerkvist 2012).

Even though many farmers in general have a positive attitude towards FAW, previous studies have shown that only a small number of farmers recognise the need for improvement in the level of animal welfare in livestock production systems (Deimel *et al* 2010; Vetouli *et al* 2012; Franz *et al* 2012).

In general, producers look critically at AWPs because of the high economic risk associated with the adjustment of production systems. Farmers fear that the high investment costs for improved FAW will not pay off; as, for example, marketing by-products at higher prices is still highly prob-

lematic (Skarstad *et al* 2007; Duffy & Fearn 2009; Deimel *et al* 2010; Gocsik *et al* 2015). Long-term delivery contracts with processors could enable farmers to make specific investments in higher animal welfare standards (Deimel *et al* 2010). However, operational controls on farming practices and the loss of independence after signing a contract constitute barriers to farmers' participation in AWP. Extended working hours for additional administrative and practical tasks and limited availability of labour are also obstacles to participation (Hubbard *et al* 2007; Kjærnes *et al* 2007; Menghi 2007; Schulze *et al* 2008; Deimel *et al* 2011; Franz *et al* 2012; Main & Mullan 2012). Moreover, there are concerns that the establishment of a wide range of AWP products could cause discrimination in the market against standard goods (Döring & Wichtmann 2007; Kjærnes *et al* 2007; Skarstad *et al* 2007; Deimel *et al* 2010). The majority of farmers are somewhat critical regarding market opportunities of animal welfare products. These products are considered small niche products as farmers doubt that many consumers are willing to pay more for animal-friendly products (Kjærnes *et al* 2007; Franz *et al* 2010). In addition, many farmers suspect that the real animal welfare level will hardly be improved by additional animal welfare requirements because the practicability of the required welfare criteria cannot always be guaranteed (Kjærnes *et al* 2007).

The principal motive for farmers to take part in AWP is to realise better economic results. Other studies, on the contrary, show that for some farmers internal non-monetary factors, such as taking pleasure in healthy animals, producing high quality products and working under improved working conditions are indeed strong motivators (Bock & van Huik 2007; Hubbard *et al* 2007; Kjærnes *et al* 2007; Valeeva *et al* 2007; Hujps *et al* 2010; Leach *et al* 2010; Main & Mullan 2012; Vetouli *et al* 2012). The opportunity to escape from the pressure of ongoing farm growth by earning more per animal and the chance to stabilise trade relations with processors are also cited as motivations for participation in AWP (Kjærnes *et al* 2007).

However, there are various groups amongst farmers that differ significantly according to their willingness to improve the level of animal welfare (Bock & van Huik 2007; Hubbard *et al* 2007; Kjærnes *et al* 2007; Deimel *et al* 2011; Franz *et al* 2012).

Gocsik *et al* (2014) showed that positive attitudes among farmers towards AWP are closely linked to a high willingness to participate in these programmes. Other studies demonstrated that farmers who attach great importance to natural animal behaviour, outdoor access and dividing bays into different areas for resting and agility are more willing to participate in AWP than those who rate these three aspects as less relevant for FAW. On the other hand, farmers who consider animal performance and health to be of particular importance for FAW tend to be less willing to participate in AWP (Bock & van Huik 2007; Deimel *et al* 2011; Franz *et al* 2012).

Even some personal and operational characteristics influence farmers' willingness to participate. Gender proved to be important; women are more likely to invest in a production system with higher animal welfare standards than men (Franz *et al* 2012). Furthermore, age, experience and investment pattern significantly influence farmers' will to participate in AWP. At the operational level, farm size and production volume play an important role in participation (Gocsik *et al* 2014). Many European farmers believe that participation in AWP is only an option for small-scaled farms working in local niche markets (Bock & van Huik 2007).

Another significant influence on the willingness to participate in AWP is the species of animal the farmer keeps. Skarstad *et al* (2007) showed that the understanding of FAW varies considerably between cattle, pig and poultry farmers and depends on how the animals are kept. These factors also influence farmers' general willingness to participate in AWP (Skarstad *et al* 2007; Hansson & Lagerkvist 2014).

So far, no empirical study has comprehensively investigated the attitudes of conventional poultry, pig and cattle farmers toward FAW and their willingness to participate in AWP. This is a considerable research gap. To contribute to the closing of this research gap and to evaluate the willingness of farmers to participate in programmes that address societal expectations regarding animal welfare, this study seeks to analyse the current attitudes and perceptions of conventional farmers towards FAW and AWP. Research by Coleman *et al* (1998) and Breuer *et al* (2000) showed that farmers' attitudes correlate strongly with their behaviour. Therefore, it is essential to investigate farmers' attitudes towards FAW and AWP to be able to draw conclusions regarding their actual willingness to participate in these programmes.

German farmers were chosen as the subjects of this investigation because livestock production is a very important agricultural subsector in Germany (Destatis 2015a). The country is one of Europe's most important meat and milk producers (BMEL 2011, 2015). Furthermore, the topic of FAW is the focus of intense controversy in Germany. Due to similar controversies and livestock production systems in other parts of the EU, results from Germany can provide important evidence for other European countries. This study focuses on conventional farmers because public criticism mainly concerns intensive production systems, whereas consumers attribute higher animal welfare standards to organic livestock farming (Harper & Makatouni 2002; Makatouni 2002; Busch *et al* 2013).

Thus, this paper complements previous research with a comprehensive empirical study aiming to identify different clusters with regard to farmers' attitudes towards FAW and AWP and their willingness to take part in these programmes within the larger group of conventional German livestock farmers.

Materials and methods

Study design

For this study, German livestock farmers throughout the entire country were surveyed in summer 2014 by means of a standardised online survey. The respondents were recruited via various mailing lists and in collaboration with several German agribusiness trade organisations. After purging incomplete questionnaires and outliers during the analysis, 657 data sets were left for analysis.

The statements regarding farmers' attitudes towards FAW and AWP were mostly measured with the help of five-point Likert scales from $-2 =$ 'I totally disagree' to $+2 =$ 'I totally agree' and $-2 =$ 'very unimportant' to $+2 =$ 'very important'. Furthermore, nominally scaled questions were used to inquire about operational and sociodemographic farmer characteristics.

The questionnaire was divided into several parts. The first part concentrated on farm characteristics. Next, participants were requested to indicate what they consider particularly important for the well-being of farm animals. Then, they were asked to evaluate various statements concerning AWP and the need to enhance animal welfare standards in conventional livestock keeping as well as their own willingness to participate in such programmes. In addition, farmers' were asked to give their personal opinions about the potential market for products from more animal-friendly production. The next part of the questionnaire dealt with farmers' satisfaction with the current situation, the economic and financial position of their farm and the possible effects of increased national legal animal welfare requirements for their farm. The final section requested some sociodemographic characteristics of the participants.

Statistical analysis

The data were evaluated using IBM Statistics 22 (Backhaus *et al* 2011). First, frequency distributions of farm and sociodemographic characteristics as well as the perceived financial farm situation and attitudes towards FAW and AWP were conducted to acquire a brief overview of the participants. These analyses were done for the whole sample but also itemised by kept animal species to enable comparison of the different farm types. Next, an explorative factor analysis was conducted to reduce the number of items and to capture the central dimensions based on farmers' attitudes towards FAW and AWP (Franz *et al* 2012). The analysis contained all Likert-scaled statements mentioned previously. Variables that correlated highly were grouped together in one factor to separate them from less highly correlated groups. Then, Principal Component Analysis was used to summarise the variables that load highly on one factor. All variables that showed loadings of ≥ 0.4 on more than one factor were removed from the analysis because a clear assignment to only one factor was not possible. In order to facilitate the interpretation of the factors, an orthogonal Varimax rotation was used to maximise the variance of the squared factors loadings by column (Backhaus *et al* 2011). The quality of the factor analysis was verified using the Kaiser-Meyer-Olkin criterion and the Bartlett test for sphericity with subsequent reliability analysis (Brosius 2011).

Based on the extracted factors, cluster analysis was used to classify the farmers into groups according to their attitudes towards FAW and AWP. The purpose of this analysis was to build homogeneous groups out of a heterogeneous population (Hair *et al* 2010; Franz *et al* 2012), to which end we applied a hierarchical clustering method using an agglomerative algorithm. According to Franz *et al* (2012), the cluster analysis was conducted in three steps. First, outliers were identified and eliminated through the single-linkage method. During this procedure, the objects with the smallest distances between them were combined. The optimal number of clusters was then identified using Ward's method. The goal of this procedure was to combine those objects that least increase the variance within a group and through which the most homogeneous clusters are formed. The optimal number of clusters was determined through the heterogeneity measure. Depicting the merger process graphically through a dendrogram and applying the elbow criterion helped us find the best solution (Backhaus *et al* 2011). In order to refine the resulting solution, we conducted a *K*-means cluster analysis (Janssen & Laatz 2007; Bacher *et al* 2010) and used a discriminant analysis to check the results of the cluster analysis. The consensus between the grouping result of the discriminant analysis and the cluster analysis is regarded as a relative validity criterion (Backhaus *et al* 2011). To characterise the different groups in depth and to prove significant differences between the clusters formed, *post hoc* tests were used showing no variance equity (Everitt 1998; Brosius 2011).

Results

Sample description

The farmers who participated in our survey are on average 46 years of age, and 84.8% of them are male. They are averagely very well educated, as 34.2% hold a university degree. In comparison, the German national average of farmers holding a university degree is 8.3% (Destatis 2015b). The farmers surveyed have considerable experience, as more than 55% have been directly involved in farming for more than 20 years. The majority of the participants are from Bavaria (23.7%), Lower Saxony (20.1%) and North Rhine-Westphalia (13.7%). According to the agricultural census of 2013, these federal states have the highest number of livestock (Destatis 2014).

Table 1 shows that for 91% of the participants, agriculture is the main source of income, compared to the German average of only 54% (Destatis 2013). The average farm size is 219.61 hectares and 223 livestock units. The farms in the survey are, therefore, substantially larger than the German average (Destatis 2010). About 12.2% of the participants keep laying hens, 4.7% have broilers and 3.2% keep turkeys. Dairy cows are kept on 51.4% of the farms, and 18.3% keep a herd of beef cattle. Piglets are produced by 17.7% of the respondents, and 32.4% have fattening pigs. Altogether, nearly 20% of the farms surveyed keep more than one animal species. Our dataset includes 44 farms that keep solely poultry, 157 pure pig farms, 288 cattle farms

Table 1 Farm characteristics and finances.

Farm characteristics	Poultry farms ²	Pig farms ³	Cattle farms ⁴	Mixed farms ⁵	Total
Number of farmers (n)	44	157	288	127	657
Farm size (in hectares) ^{ns}	167	229	200	240	220
Number of animals kept (in livestock units) ^{ns}	199	278	208	231	224
Proportion of full-time farms ^{ns}	97.7	95.5	92.0	89.4	91.0
Farm finances					
I am satisfied with the general economic situation of my farm ^{*†}	1.16 ^a	0.90 ^{ab}	0.83 ^{ab}	0.76 ^b	0.86
I would like to enlarge my farm in future ^{ns†}	0.43	0.52	0.25	0.34	0.36
The long-term solvency of my farm is secured ^{ns†}	1.02	0.85	1.03	0.86	0.91
My farm is running so well that I am able to generate equity ^{*†}	0.82 ^a	0.82 ^a	0.53 ^{ab}	0.48 ^b	0.59

* $P \leq 0.05$; ** $P \leq 0.01$; *** $P \leq 0.001$; ^{ns} $P \geq 0.05$ (not significant).

^{ab} Mean values with no common superscript differ significantly (Tamhane's T2 *post hoc* test for $P \leq 0.05$);

[†] Scale from +2 = 'totally agree' to -2 = 'totally disagree';

² Farms keeping only laying hens, broilers and/or fattening turkeys;

³ Farms keeping only sows and piglets and/or porkers;

⁴ Farms keeping only dairy cows and/or beef cattle;

⁵ Farms keeping more than one animal species; n = 657.

and 127 mixed farms, where more than one animal species are kept. Within this sub-sample, 18 farms keep poultry and pigs, 34 farms poultry and cattle and 56 farms pigs and cattle. Furthermore, 19 farms keep poultry, pigs and cattle.

Overall, farmers tend to be satisfied with their operational situation (see Table 1). They generally agree that their long-term solvency is secured and that they are able to generate equity from their farm activities. However, farmers' willingness to enlarge their farms in the years to come varies. Table 1 presents some interesting farm characteristics and farms' financial situation itemised by animal species kept; it also shows significant differences between the sub-samples.

The figures from Table 1 clearly show that mixed farms are, on average, the largest (in hectares) followed by pig, cattle and poultry farms. Furthermore, pig farmers have the largest number of livestock units on their farm, followed by mixed farms and cattle farms. Again, poultry farms host the lowest number of livestock units. In all sub-samples, most of the farms are run full-time. No differences regarding farm characteristics between the sub-samples are significant. When examining farms' perceived financial situation, it becomes obvious that mixed farmers and cattle farmers rate their own situation most negatively, while poultry and pig farmers are significantly more satisfied with their operational situation. Poultry and pig farmers are also more likely to enlarge their farms in the years to come and perceive their long-term farm solvency as better compared to cattle farmers and mixed farmers (no significant differences). Furthermore, poultry and pig farmers are more often able to generate equity from farm activities than are cattle farmers and mixed farmers.

Table 2 summarises farmers' attitudes towards FAW and AWP. Overall, nearly 35% of the respondents believe that AWP are useful for farmers and more than 35%

think that AWP can help to improve the level of animal welfare in livestock production. Nevertheless, more than 27% of the participants in the survey believe that participation in an AWP is not profitable at the moment. Currently, about 20% of the participants agree that the national animal welfare standards in livestock production should be enhanced and nearly 55% would like to improve the level of animal welfare on their own farms. These figures clearly show the cautious optimism among German farmers concerning the animal welfare. If this positive attitude can be converted into effective participation in an AWP, there is great potential for the establishment of such programmes on the supply side.

Table 2 also shows farmers' attitudes towards FAW and AWP itemised by animal species kept. Farmers keeping more than one animal species belong to the fourth category, mixed farms. Poultry, pig, cattle and mixed farms differ significantly in farmers' responses to all statements concerning attitudes towards AWP. Pig farmers have the most negative attitudes, while poultry farmers rate most of these statements most positively. Only the statements concerning the economic efficiency of AWP are rated most optimistically by cattle farmers. The farmers' own livestock production is rated positively by all sub-samples, with cattle farmers being most self-critical concerning animal welfare on their farms. Animals' opportunity to engage in natural innate behaviour and the structural-technical systems used in barns are perceived as most important by cattle farmers, followed by poultry farmers. Again, pig farmers have the most negative attitudes towards the underlying statements.

Even the market effects of higher animal welfare standards are rated most pessimistically by pig farmers. The effects of enhanced national animal welfare standards on livestock

Table 2 Results of the factor analysis and means of statements divided into animal species kept on the farm.

Factors and statements	Poultry farms ² (n = 44)	Pig farms ³ (n = 157)	Cattle farms ⁴ (n = 288)	Mixed farms ⁵ (n = 127)	Total (n = 657)
<i>Attitudes towards animal welfare programmes (Cronbach's alpha = 0.868)</i>					
In principle, I am willing to participate in animal welfare programmes ^{**k1} (FL = 0.870)	1.00 ^a	0.24 ^b	0.43 ^b	0.42 ^b	0.42
I plan to participate in animal welfare programmes in future ^{*k1} (FL = 0.856)	0.39 ^a	-0.18 ^b	-0.17 ^b	-0.11 ^{ab}	-0.12
In principle, animal welfare programmes are useful for farmers ^{*k1} (FL = 0.838)	0.34 ^{ab}	-0.11 ^a	0.22 ^b	-0.02 ^{ab}	0.11
Animal welfare programmes can help improve animal welfare for farm animals ^{***k1} (FL = 0.745)	0.43 ^a	-0.24 ^b	0.22 ^a	-0.04 ^{ab}	0.08
Farmers can make more profit by participating in animal welfare programmes ^{***k1} (FL = 0.670)	-0.41 ^{ab}	-0.83 ^a	-0.32 ^b	-0.58 ^{ab}	-0.51
Farmers can gain competitive advantages by participating in animal welfare programmes ^{*k1} (FL = 0.485)	-0.10 ^{ab}	-0.40 ^a	-0.07 ^b	-0.20 ^{ab}	-0.18
The national animal welfare standards for conventional livestock production should be enhanced ^{†***k1} (FL = 0.437)	-0.50 ^{ab}	-0.66 ^a	-0.25 ^b	-0.25 ^b	-0.33
Given reasonable remuneration, I would be willing to adapt my barns to provide more comfort to my livestock ^{***k1} (FL = 0.412)	0.77 ^{ab}	0.24 ^a	0.89 ^b	0.80 ^b	0.68
<i>Perception of own livestock husbandry (Cronbach's alpha = 0.830)</i>					
The animals on my farm are kept in animal-friendly conditions ^{ns1} (FL = 0.920)	1.66	1.52	1.43	1.44	1.56
The livestock on my farm feel comfortable ^{*k1} (FL = 0.919)	1.75 ^a	1.62 ^{ab}	1.50 ^b	1.53 ^{ab}	1.64
<i>Animal behaviour and husbandry system (Cronbach's alpha = 0.669)</i>					
The structural-technical systems used in barns are particularly important for animal welfare ^{***k1} (FL = 0.865)	0.86 ^{ab}	0.69 ^a	1.18 ^b	0.99 ^{ab}	1.00
An animal must be able to show its natural behaviour; only then it can feel comfortable ^{***k1} (FL = 0.817)	0.64 ^{ab}	0.50 ^a	1.01 ^b	0.91 ^b	0.85
<i>Animal welfare and the market (Cronbach's alpha = 0.640)</i>					
Higher national animal welfare requirements will lead to competitive disadvantages for German farmers on international markets ^{***k1} (FL = 0.780)	1.43 ^{ab}	1.45 ^a	1.13 ^b	1.23 ^{ab}	1.25
German livestock production will move abroad if higher national animal welfare standards are required ^{*k1} (FL = 0.710)	1.00 ^{ab}	1.00 ^a	0.74 ^b	0.74 ^{ab}	0.84
Products from more animal-friendly production systems will always occupy market niches only ^{***k1} (FL = 0.648)	0.91 ^{ab}	1.21 ^a	0.79 ^b	0.87 ^b	0.90
Consumers are unwilling to pay more for products from more animal-friendly production systems ^{***k1} (FL = 0.522)	0.93 ^{ab}	1.27 ^a	0.92 ^b	0.98 ^{ab}	1.00

* $P \leq 0.05$; ** $P \leq 0.01$; *** $P \leq 0.001$; ^{ns} $P \geq 0.05$ (not significant).

^{ab} Mean values with no common superscript differ significantly (Tamhane's T2 *post hoc* test for $P \leq 0.05$);

¹ Scale from +2 = 'totally agree' to -2 = 'totally disagree';

² Farms keeping only laying hens, broilers and/or fattening turkeys;

³ Farms keeping only sows and piglets and/or porkers;

⁴ Farms keeping only dairy cows and/or beef cattle;

⁵ Farms keeping more than one animal species; n = 657.

production in Germany are viewed especially critically. Furthermore, pig producers most strongly disagree that there is a broad market for products from AWP; they are firmly convinced that consumers are not willing to pay more for these products. Poultry and cattle farmers are also critical towards the market effects of enhanced animal welfare standards. Nevertheless, poultry farmers are comparatively most optimistic that animal welfare products will become a broad market segment, and cattle farmers rate consumers' willingness to pay more for products with higher animal welfare standards more highly than poultry and pig farmers do. The attitudes of mixed farm owners lie between those of the other sub-samples.

Results of the factor analysis

We conducted an explorative factor analysis to reduce complexity and to find the most important factors for farmers' attitudes towards FAW and AWP. The final factor solution included four factors with 16 variables (see Table 2). The first factor, 'attitudes towards AWP', describes the general attitudes of the farmers towards such programmes, combining statements concerning the usefulness of AWP, farmers' general willingness to participate in such programmes and the programmes' expected effects on the profitability of their farms. The second factor, 'perception of one's own animal husbandry', summarises two statements about how farmers perceive the livestock-keeping on their own farms. The third factor, 'animal behaviour and husbandry system', combines two statements about the relative importance the farmers attach to the possibility of animals displaying natural innate behaviours and to the structural and technical equipment of their barns for the level of FAW. The fourth factor, 'animal welfare and the market', comprises variables that reflect the farmers' positions towards the market effects of higher animal welfare standards and the products of more animal-friendly husbandry systems.

The tests conducted to examine the quality of the factor analysis indicated that all factors meet the common requirements. The factor analysis explained 60.65% of the total variance among the 16 variables. These variables are well suited for the factor analysis as the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO MSA) is relatively high at 0.824. Additionally, Bartlett's test of sphericity was statistically significant, yielding correlation coefficients for the population with values different from zero. The reliability analysis showed that the internal consistency of the factors is adequate (Bühl 2010; Backhaus *et al* 2011). The determined factors were used as cluster-building variables to define target groups for participation in AWP.

Results of the cluster analysis

Based on the factors identified, a cluster analysis was conducted. The aim was to define the farmers into clusters according to their attitudes towards FAW and AWP and to derive different target groups for participation in an AWP. The cluster analysis was conducted in several steps. First, the single linkage method was applied in order to eliminate six outliers from the sample. Since the scree test and the

dendrogram did not clearly show the optimal number of clusters, additional plausibility considerations were undertaken to determine the optimal number of clusters, yielding a three-cluster solution (Backhaus *et al* 2011). The approximate solution of Ward's method was optimised by eleven iterations using *K*-means clustering (Brosius 2011).

Several criteria indicate that the solution reached is of high quality. The clusters are quite homogenous as all the *F*-values are less than 1. Additionally, $\eta = 0.63$, on average, showing that there are significant differences among the cluster-building factors and the variance within the clusters is low. Furthermore, $\eta^2 = 0.51$, indicating that, on average, the cluster-building factors can explain 51% of the variance between the clusters. Moreover, discriminant analysis was used as a relative validity criterion and confirmed that the accuracy of classification is 98.3% and, therefore, meets the requirement stipulated in the literature (Backhaus *et al* 2011).

To describe the clusters, means' comparisons were conducted using one-way analysis of variance (ANOVA) based on the factors. To describe the clusters in greater detail, the individual variables in the factors were also used for variance analysis. In order to examine significant differences between the means of the clusters, Tamhane's *T2 post hoc* comparisons complemented the cluster description (Everitt 1998; Backhaus *et al* 2011). Table 3 gives the results of the cluster analysis, showing the means of the cluster-building factors and the underlying variables.

The first cluster (cluster A) is characterised by strong opposition to AWP and higher welfare standards in livestock husbandry. The farmers in this cluster are therefore called the 'sceptical animal welfare opponents'. With 204 participants, this cluster is the smallest. They disagree with all statements concerning AWP, the enhancement of animal welfare standards and the monetary benefits of AWP (mean [\pm SD] = -1.20 [± 0.73]). They perceive their own livestock husbandry as good (0.54 [± 0.51]). In comparison to the other clusters, these farmers attach relatively little importance to providing opportunities for animals to engage in natural innate behaviours and to the use of structural-technical systems in barns that increase the level of animal welfare (-1.02 [± 0.95]). Furthermore, they are critical of the market for more animal-friendly products and see major problems in the implementation of higher national animal welfare standards (0.90 [± 0.54]).

Cluster B can be described as 'undecided'. With 229 farmers, this cluster is the largest. Their attitudes towards AWP are diverse (0.07 [± 0.74]) as the means of the statements in factor 1 are mostly in the zero range. On average, therefore, the farmers in cluster B have neither a negative nor a positive attitude towards AWP. In comparison to the other clusters, these farmers are the most critical of their own livestock husbandry. The opportunity for animals to display natural innate behaviour and the use of animal-friendly structural-technical systems in barns are somewhat important for group members of cluster B. However, they view the market for animal welfare products with some scepticism (0.18 [± 0.73]).

Table 3 Results of the cluster analysis.

Factors and statements	Cluster A (n = 204)	Cluster B (n = 229)	Cluster C (n = 224)	Total (n = 657)
<i>Attitudes towards animal welfare programmes</i> ***	-1.20 ^a	0.07 ^b	0.23 ^b	-0.27
In principle, I am willing to participate in animal welfare programmes*** ¹	-0.41 ^a	0.67 ^b	0.92 ^c	0.42
I plan to participate in animal welfare programmes in future*** ¹	-0.88 ^a	0.13 ^b	0.31 ^b	-0.12
In principle, animal welfare programmes are useful for farmers*** ¹	-0.73 ^a	0.43 ^b	0.55 ^b	0.11
Animal welfare programmes can help improve animal welfare for farm animals*** ¹	-0.88 ^a	0.45 ^b	0.58 ^b	0.08
Farmers can make more profit by participating in animal welfare programmes*** ¹	-1.27 ^a	-0.26 ^b	-0.08 ^b	-0.51
Farmers can gain competitive advantages by participating in animal welfare programmes*** ¹	-0.82 ^a	0.04 ^b	0.18 ^b	-0.18
The animal welfare standards for conventional livestock production should be improved*** ¹	-1.13 ^a	-0.08 ^b	0.13 ^b	-0.33
Given reasonable remuneration, I would be willing to adapt my barns to provide more comfort for my livestock*** ¹	-0.08 ^a	1.16 ^b	0.88 ^c	0.68
<i>Perception of own livestock husbandry</i> ***	0.54 ^a	-1.28 ^b	0.58 ^a	-0.07
The animals on my farm are kept in animal-friendly conditions*** ¹	1.80 ^a	0.77 ^b	1.85 ^a	1.46
The livestock on my farm feels comfortable*** ¹	1.89 ^a	0.90 ^b	1.89 ^a	1.54
<i>Animal behaviour and husbandry system</i> ***	-1.02 ^a	-0.25 ^b	0.39 ^c	-0.27
The structural-technical systems used in barns are particularly important for animal welfare*** ¹	0.39 ^a	1.03 ^b	1.52 ^c	1.00
Animals must be able to display its natural innate behaviour; only then it can feel comfortable*** ¹	0.29 ^a	0.85 ^b	1.36 ^c	0.85
<i>Animal welfare and the market</i> ***	0.90 ^a	0.18 ^b	0.15 ^b	0.39
Higher national animal welfare requirements will lead to competitive disadvantages for German farmers on international markets*** ¹	1.70 ^a	1.06 ^b	1.03 ^b	1.25
The German livestock production will move abroad if higher national animal welfare standards are required*** ¹	1.25 ^a	0.61 ^b	0.69 ^b	0.84
Products from more animal-friendly production systems will always occupy market niches only*** ¹	1.43 ^a	0.69 ^b	0.64 ^b	0.90
Consumers are unwilling to pay more for products from more animal-friendly production systems*** ¹	1.36 ^a	0.91 ^b	0.77 ^b	1.00

* $P \leq 0.05$; ** $P \leq 0.01$; *** $P \leq 0.001$; ^{ns} $P \geq 0.05$ (not significant).

^{abc} Mean values with no common superscript differ significantly (Tamhane's T2 *post hoc* test for $P \leq 0.05$);

¹ Scale from +2 = 'totally agree' to -2 = 'totally disagree'; n = 657.

A total of 224 farmers belong to cluster C, the 'market-conscious animal welfare friends'. In comparison to clusters A and B, these respondents have a mostly positive attitude towards AWP (0.23 [\pm 0.72]). However, even these farmers have diverse attitudes towards the monetary effects of AWP. Compared to the other clusters, these farmers perceive their own livestock husbandry as particularly positive (0.58 [\pm 0.44]). Furthermore, they attach the greatest importance to appropriate animal behaviour and the use of structural-technical systems in barns to raise the level of FAW. Similar to the respondents in cluster B, these farmers look critically at the market for products from particularly animal-friendly production. But, compared to the other clusters, they have the most optimistic attitude (0.15 [\pm 0.78]). Nevertheless, these farmers agree that higher national animal welfare standards will cause problems for German farmers and that animal-friendly

products will occupy only niche markets in future. They even view consumers' willingness to pay a price premium for more animal-friendly products with some scepticism.

The clusters differ in some interesting sociodemographic and farm characteristics, which are shown in Table 4. The 'market-conscious animal welfare friends' are the cluster with the highest proportion of women. Furthermore, these farmers are slightly younger than the farmers in clusters A and B. Nevertheless, these differences in sociodemographic characteristics are not significant. It is the farm characteristics that differ significantly among the three clusters. The participants in cluster C own the largest farms, with an average of 282.4 hectares. However, the number of animals kept (in livestock units) does not differ significantly among the three clusters. Averaging 220 livestock units, cluster C lies between clusters A and B. Furthermore, there are highly significant differences between the clusters concerning the

Table 4 Sociodemographic and farm characteristics of the clusters.

Sociodemographic and farm characteristics of the clusters	Cluster A (n = 204)	Cluster B (n = 229)	Cluster C (n = 224)	Total (n = 657)
Age ^{ns}	47	46	46	46
Share of women (%) ^{ns1}	13.2	13.5	18.8	15.2
Average farm size (in hectares)*	174 ^a	199 ^{ab}	282 ^b	220
Average number of animals kept (in livestock units) ^{ns}	207	242	220	224
Assured succession in the next generation (%) ^{**1}	51.0 ^a	36.2 ^b	45.5 ^a	44.0
Type of animal species kept ^{***1}				
Poultry farms (%) ^{ns2}	7.7	4.3	9.5	7.1
Pig farms (%) ^{***3}	40.3 ^a	21.9 ^b	15.2 ^b	25.5
Cattle farms (%) ^{***4}	31.1 ^a	52.9 ^b	55.2 ^b	46.8
Mixed farms (%) ^{ns5}	20.9	21.0	20.0	20.6

* $P \leq 0.05$; ** $P \leq 0.01$; *** $P \leq 0.001$; ^{ns} $P \geq 0.05$ (not significant).

^{abc} Mean values with no common superscript differ significantly (Tamhane's T2 *post hoc* test for $P \leq 0.05$);

¹ Nominal scale: significance in accordance with Chi-square;

² Farms keeping only laying hens, broilers and/or fattening turkeys;

³ Farms keeping only sows and piglets and/or porkers;

⁴ Farms keeping only dairy cows and/or beef cattle;

⁵ Farms keeping more than one animal species; n = 657.

animal species kept on the farms. Participants in cluster C keep poultry on their farms disproportionately most often (no significant difference to the other clusters). Furthermore, cluster C farmers keep cattle on their farms more often.

Farmers with comparatively small farms (averaging 174.02 hectares) make up cluster A, the 'sceptical animal welfare opponents'. They also keep the smallest number of animals, averaging 207 livestock units (no significant difference to the other clusters) and keep pigs disproportionately often. These farmers also tend to be male and are slightly older than the members of the other clusters (no significant differences).

Nearly all the sociodemographic and farm characteristics of cluster B (the undecided) lie between clusters A and C. Furthermore, the distribution of the mixed farms is relatively equal among the three clusters. Thus, there is no clear trend that mixed farms tend to be more present in one of the named clusters.

In order to investigate the possible effects of enhanced animal welfare standards for the financial situation of the farmers, Table 5 shows the perceived economic farm situation as well as the perceived effects of higher animal welfare standards from the farmers' point of view.

Overall, the farmers are rather satisfied with their general economic situation (0.86 [\pm 0.82]), as they are able to generate equity (0.59 [\pm 1.14]) and somewhat agree that their long-term solvency is secured (0.91 [\pm 0.92]). Nearly 50% somewhat agree or agree that they intend to enlarge their own farm in the years to come (0.36 [\pm 1.21]). But when it comes to the effects of enhanced animal welfare standards, the farmers' opinions are diverse (0.10 [\pm 1.14]). Nearly 34% agree or somewhat agree that additional national

animal welfare requirements could threaten the existence of their farms. Nearly 30% of the farmers do not agree that additional animal welfare requirements could threaten the existence of their farm. Additionally, the economic effects of participating in an AWP are rated quite diversely (-0.05 [\pm 1.10]). Nearly 28% of the farmers consider participation not to be profitable, while nearly 33% are convinced that participation in an AWP is profitable for them.

Comparing the three clusters clearly shows that perception of the financial situation and the effects of enhanced animal welfare standards differ significantly among the clusters. The economic situation of clusters A and C is similar. Both groups are quite satisfied with their economic situation, but participants in cluster B rate their own situation as slightly inferior. However, when it comes to additional animal welfare standards, the 'market conscious animal welfare friends' rate their own situation much more positively than the other clusters, as they are slightly optimistic that enhanced animal welfare requirements would not place their farms in an economic situation that could threaten their existence. In comparison, farmers in cluster A, the 'sceptical animal welfare opponents', tend to believe that additional national animal welfare requirements represent a serious risk to their farms' existence. Furthermore, the monetary effects of participation in an AWP are evaluated rather diversely. While members of cluster A somewhat agree that joining an AWP would not be profitable, the members of cluster C are slightly optimistic that participation could generate profit. Again, participants in cluster B tend to be undecided when it comes to the financial effects of participating in an AWP.

Table 5 Farmers' satisfaction with the farm situation.

Statements	Cluster A (n = 204)	Cluster B (n = 229)	Cluster C (n = 224)	Total (n = 657)
I am satisfied with the general economic situation of my farm ^{***†}	1.01 ^a	0.56 ^b	1.04 ^a	0.86
I would like to enlarge my farm in the coming years ^{*†}	0.53 ^a	0.21 ^b	0.37 ^{ab}	0.36
The long-term solvency of my farm is secured ^{*†}	0.94 ^{ab}	0.79 ^a	1.02 ^b	0.91
My farm is running so well that I am able to generate equity ^{**†}	0.70 ^a	0.40 ^b	0.69 ^a	0.59
Enhanced national animal welfare requirements might place my farm in an economic situation that could threaten its existence ^{***†}	0.56 ^a	0.04 ^b	-0.27 ^c	0.10
Participating in an animal welfare programme would not be profitable for me ^{***†}	0.35 ^a	-0.12 ^b	-0.36 ^c	-0.05

* $P \leq 0.05$; ** $P \leq 0.01$; *** $P \leq 0.001$; ^{ns} $P \geq 0.05$ (not significant).

^{ab} Mean values with no common superscript differ significantly (Tamhane's T2 *post hoc* test for $P \leq 0.05$);

[†] Scale from +2 = 'totally agree' to -2 = 'totally disagree'; n = 657.

Discussion

In this study, 657 farmers from Germany were questioned about their attitudes towards FAW and AWP via an online survey. Three clusters (farmer groups) were identified and, based on these clusters, various target groups were determined for participation in AWP. Cluster A (the 'sceptical animal welfare opponents') is characterised by strong opposition to AWP and higher welfare standards in livestock husbandry. Farmers in this cluster will probably not take part in AWP, especially because they do not consider AWP profitable. Cluster B (the 'undecided') have diverse attitudes towards AWP. As they do not reject the enhancement of animal welfare standards, these farmers may someday become willing to participate in AWP. Cluster C (the 'market-conscious animal welfare friends') have the most positive attitudes towards AWP. Overall, they constitute the most important potential target group for AWP as they indicate the highest willingness to take part in these programmes. Thus, this study supports the assumption of Coleman *et al* (1998), Breuer *et al* (2000) and Gocsik *et al* (2015), who found that a positive attitude towards FAW leads to a higher willingness to participate in quality programmes or AWP.

Respondents' overall positive attitudes towards AWP clearly highlight the huge potential for the implementation of AWP. However, for a successful long-term implementation, it is of prime importance to convince the crucial stakeholders in the food supply chain to take part in AWP (Golan *et al* 2000; Gulbransen 2006; Franz *et al* 2010).

To benefit from farmers' generally positive attitude towards AWP and to transfer it into corresponding behaviour, it is particularly important to establish well-adapted concepts. In this regard, this study shows that the basic population of farmers cannot be understood as one homogenous group; it is possible to differentiate between three groups of farmers that differ significantly according to their FAW attitudes, their willingness to participate in AWP and their sociodemographic and farm characteristics as well as their perception of their own financial situations. A similar trichotomy was also found in earlier studies on, for instance, farmers' perceptions

and acceptance of 'minimum requirements' certification schemes (Jahn *et al* 2003). This observation thus has interesting managerial implications for the design of AWP.

Two of the clusters identified (the 'undecided' and the 'market-conscious animal welfare friends') have a generally positive attitude towards AWP and, therefore, constitute potential initial target groups for AWP. Due to the — on average — more positive attitudes towards these programmes compared to cluster A, it can be expected that further financial incentives will be less relevant for these groups. Even the 'sceptical animal welfare opponents' could prospectively become a potential target group, as they do not refuse to enhance their animal welfare level if given reasonable remuneration. However, preferences and attitudes are said to be relatively stable and durable cognitive orientations (Weber *et al* 2005). Therefore, it is very likely that there are mobility barriers between the individual clusters so that farmers will probably remain in one group for the long-term.

However, previous studies have clearly shown that monetary incentives constitute one of the most important motives for participation in a quality programme or a specialised AWP (Hubbard *et al* 2007; Kjærnes *et al* 2007; Skarstad *et al* 2007; Franz *et al* 2012; Hubbard 2012; Swinton *et al* 2015). The current study clearly shows that, so far, farmers are not convinced that participation in an AWP will provide an opportunity to gain additional profit. Furthermore, the market for products from particularly animal-friendly production is viewed rather critically by all farmers. Even the 'market-conscious animal welfare friends' who have, in principle, a high willingness to participate in an AWP, tend to evaluate the market for animal welfare products pessimistically. These results show that farmers' willingness to participate in AWP is not just a question of attitude. The decision is strongly limited by monetary factors that are closely linked to the market in which the farmers operate. This finding is in line with Bock and van Huik (2007) and with major parts of agricultural economics research, which assume intentional, rational behaviour on the part of farmers when

making business decisions (Mußhoff *et al* 2011) and is clearly at odds with the findings from consumer studies that show a strong emotional element in the debate on FAW (Deimel *et al* 2011; Franz *et al* 2012).

In this investigation, farmers with larger farms (in hectares) were more often in cluster C (the ‘market-conscious animal welfare friends’) than those with smaller farms and, therefore, indicate a higher willingness to participate in AWP. The number of animals kept (in livestock units) did not significantly differ between the clusters. This indicates that farmers with a high availability of land might more easily be able to implement higher animal welfare standards, as many AWP require outdoor access for the animals while the size of the barns does not play an important role. However, our findings contradict previous studies, which have found that farmers with small farms are more willing to participate in AWP (Bock & van Huik 2007). Furthermore, our findings contrast with the current perception of many consumers, who often associate a high level of FAW with small-scale family farming (Busch *et al* 2013).

Our study confirms previous results showing that farmers who perceive innate animal behaviour and appropriate structural-technical systems in barns as essential for animal welfare indicate a higher willingness to participate in AWP (Bock & van Huik 2007; Franz *et al* 2012).

In Germany and in many other countries, especially in north-western Europe, consumers are greatly concerned about FAW (Miele & Parisi 2001). The poultry sector, in particular, attracts heavy criticism in the media and is therefore increasingly threatened with loss of consumer acceptance (Deimel *et al* 2010). This study shows that poultry farmers are more likely than other farmers to belong to the ‘market conscious animal welfare friends’, who show a greater willingness to take part in an AWP. But, in many European countries, these farmers are often bound by contract to the downstream production stages, namely the slaughterhouses, which act as ‘supply chain captains’ (Goldsmith *et al* 2003) in the vertically integrated poultry industry. In the poultry sector, it is thus necessary to convince the slaughtering and processing industry to become involved in the development of AWP to give farmers the opportunity to produce under higher animal welfare standards. As compliance with higher animal welfare requirements is directly linked with long-term capital investments for farmers, the downstream industry has to provide financial guarantees to the producers. Thus, farmers could use the opportunity to produce high quality products and escape from the pressure of farm enlargement by making more profit per animal (Bock & van Huik 2007). At the same time, the slaughtering industry could use this circumstance to improve its poor reputation among the wider public (Albersmeier & Spiller 2010). Recent developments in the German meat industry have shown that, indeed, chain integrators from the poultry industry have taken the lead in implementing AWP and promoting animal-friendly meat products in the market.

Dairy farmers currently face major challenges due to the abolition of export subsidies and the milk quota system and subsequent low milk prices. Our results confirm that dairy farmers rate their own financial situation as less satisfying than do poultry and pig farmers. Both dairies and dairy farmers have therefore started to search for ways to gain competitive advantages and to fulfil stakeholders’ requirements in order to stay in the market. Participating in AWP could create an appropriate opportunity to escape from the pressure to produce at the level of world market prices and, instead, to serve a market niche which is accepted and financially rewarded by society. The current study clearly shows that many dairy farmers indicate a high willingness to take part in these programmes. But, so far, most of the existing AWP (in the form of voluntary labels or as an industry solution) concentrate on higher animal welfare requirements for poultry and pig production. There is currently no dedicated AWP for dairy farmers in Germany. But there are already programmes that successfully market pasture-raised milk. Hellberg-Bahr *et al* (2012) showed that there is a high willingness to pay a price premium for pasture-raised milk among German consumers, as they associate pasturing with higher animal welfare standards and more sustainable milk production (Hellberg-Bahr *et al* 2012; Heerwagen *et al* 2013). Dairies could use this fact to offer their farmers the opportunity to take part in pasture-raised milk programmes or start to develop their own AWP with a price premium for their farmers. The critical situation of dairy farmers could also lead to an industry-wide solution comparable to the solutions for poultry and pig farmers. Furthermore, several dairies are currently working on implementing a sustainability standard for milk producers. Higher animal welfare requirements could be part of this standard.

Most pig farmers currently belong to the ‘sceptical animal welfare opponents’. Pork production in Germany is characterised by high export rates. Germany is the largest producer of pork in the EU and exported 2.6 million tons in 2013 (German Meat 2015). This could explain why the members of cluster A perceive enhanced national animal welfare requirements as a considerable threat to their existence and are predominantly unwilling to participate in AWP. But, within Germany, industrialised pork production is viewed increasingly critically by the public. To meet the expectations of critical stakeholders concerning more animal-friendly production, participation in an AWP could constitute an appropriate solution. For farmers who would like to move away from mass production, participation in such programmes could be an opportunity to switch to a differentiation strategy (Wissenschaftlicher Beirat Agrarpolitik BMEL 2015).

Farmers in clusters A and C perceive their own economic situation more positively than ‘undecided’ farmers. This suggests that the determination of a clear competitive strategy (cost leadership vs differentiation) can lead to better financial results than a strategy that is non-committal (Porter 1980). The ‘undecided’ might therefore be able to improve their

financial situation through commitment to a stringent competitive strategy. The members of cluster B attach great importance to reasonable remuneration of AWP and have an overall rather positive attitude towards AWP. Therefore, financial incentives could probably convince these farmers to convert their production to higher animal welfare standards and choose differentiation as their competitive strategy.

Even though Schulze *et al* (2008) found that 20 to 30% of German consumers are willing to pay a price premium for products from more animal-friendly production, farmers rate consumers' willingness to pay more for these products somewhat negatively and expect products from particularly animal-friendly production to remain a niche market. In the retail sector, meat is quite often part of aggressive special offers and sold at very cheap prices. Many consumers still use these special offers and might therefore fuel farmers' impression that price is the most important decision factor when purchasing meat or meat products. However, several studies show that the number of consumers who prefer meat from more animal-friendly production systems has continually increased over the past several years (Blandford & Fulponi 1999; EC 2007; Schulze *et al* 2008; Burda Community Network 2009; Lusk & Norwood 2012).

It was the goal of the present paper to evaluate farmers' attitudes towards FAW and AWP and find potential target groups for participation in AWP among German conventional farmers. This goal was achieved by grouping the farmers into three clusters according to their attitudes and indicated willingness to participate.

Like most non-experimental research, this study has some limitations that need to be taken into account when interpreting the results. Firstly, the study is not fully representative as the sample composition differs compared to the basic population of German farmers. Farmers in this survey have farms averaging 219.61 hectares, which is well above the national average for the basic German farming population. Secondly, there is probably further selection bias since farmers interested in FAW are represented disproportionately. Thirdly, social desirability bias may have led some farmers to indicate a more positive attitude and willingness to participate in AWP than they really have. All of these aspects might result in an overestimation of farmers' positive attitudes and their indicated willingness to participate in AWP.

Another weak point of the study is that farmers' indicated willingness to join an AWP cannot be directly interpreted as actual behaviour. To establish a broad market segment of animal welfare products, it is important to transfer farmers' positive attitudes and the indicated willingness to participate in AWP into corresponding behaviour. From consumer studies, we already know that there are several barriers, which prevent consumers from buying animal welfare products. These barriers often lead to considerable attitude-behaviour discrepancies, also known as 'consumer-citizen gap' (Coff *et al* 2008; Vanhonacker *et al* 2010; Harvey & Hubbard 2013). A similar pattern could exist among farmers, which might prevent them from actually taking part in AWP. However, the theory of planned behaviour

(Ajzen 1991) and similar decision theories clearly show that a positive attitude can be considered a foundation for a decision to participate. To reduce discrepancies between farmers' attitudes and their behaviour, existing barriers to participation in AWP need to be prospectively decreased. These barriers include the financial (un-)attractiveness of AWP, the reservations of other stakeholders along the food supply chain (Buller & Cesar 2007) and the lack of available land for outdoor access by the animals (for instance, for pasture-raised milk programmes).

Nevertheless, this study provides interesting results for various stakeholders in the agricultural and food sectors. Furthermore, the study can contribute to the development of AWP that meet the needs of certain target groups.

To acquire an even broader consensus concerning AWP among farmers, it is particularly important to convince even more stakeholders along the food supply chain to take part in AWP. Furthermore, it is essential to create further financial incentives to encourage even larger numbers of farmers to take part in these programmes. Recent scientific research has suggested redirecting EU payments from the first to the second pillar and using these financial resources to reward farmers who implement higher animal welfare standards (Wissenschaftlicher Beirat Agrarpolitik BMEL 2015). Other initiatives rely on joint actions by leading retailers, which pay a fixed amount per kg of meat sold into a central budget, which is then used to finance higher animal welfare standards (Initiative Tierwohl 2016), initiating an interesting competition for the best idea for promoting higher animal welfare standards. Moreover, farmers should have the opportunity to choose between several AWP requiring differing levels of animal welfare standards. Thus, farmers who are unable to provide outdoor access due to a lack of available land or who are only willing to implement small changes on their farm could also take part in AWP. The Initiative Tierwohl, which is an industry solution recently established in Germany, clearly shows that large segments of conventional farmers are willing to implement higher animal welfare standards that are easy to adapt to current production systems (TopAgrar 2015). In this way, concepts such as the Initiative Tierwohl can constitute an important starting point for the broad enhancement of farm animal welfare standards in conventional livestock farming.

Even some political implications can be drawn from this study. Currently, farmers fear that additional national standards could lead to competitive disadvantages and threaten the existence of their farms. Politicians should consider this concern when deciding on new legal animal welfare requirements. New national legislation is obviously not useful for inspiring farmers to adapt a higher level of FAW. Voluntary animal welfare labels or industry solutions that are financially supported by the government through such means as second pillar payments under the Common Agricultural Policy could result in a higher willingness among farmers to support this development. This leads to the opportunity to meet the requirements of considerable segments of society and reduce the dissent between the broad public and the agricultural and food sectors.

It was the aim of the present study to identify various farmer groups that differ in their attitudes towards FAW and AWP and to derive target groups for the participation in AWP. This goal was achieved by grouping the farmers into three clusters according to their attitudes. These clusters also differ with regard to their sociodemographics and farm characteristics and their satisfaction with the own financial farm situation. Based on our results, we derived specific management and political implications. These implications can help develop a broader market segment for animal welfare products, the overall level of animal welfare in livestock production can be enhanced and the demands of large segments of society can be met. However, the long-term success of animal welfare concepts is not determined only by farmers' attitudes and behaviour but also by the financial attractiveness of these concepts.

Future research studies could investigate in greater depth the financial effects of participating in AWP on the economic success of a farm. At the moment, many farmers fear that participation does not pay off. But, so far, no scientific study has examined whether this assumption is true. The financial effects could be analysed by using Propensity Score Matching, which allows researchers to control for differences between AWP participants and non-participants (for instance, regarding farm size in hectares or animal species kept) and thus makes participants in AWP statistically comparable to other conventional farmers who do not participate in AWP. As there are considerable differences regarding attitudes and willingness to participate in AWP between poultry, pig and cattle farmers, it would also be interesting to carry out a cluster analysis separately per animal species kept and try to find different potential target groups for AWP participation within these sub-samples. These results could provide even more detailed information than that acquired in the present study and would therefore yield very interesting managerial and political implications.

Animal welfare implications

Our study has provided insight into farmers' attitudes towards FAW and AWP and has also shown their reservations and concerns regarding AWP. In this way, our study represents an important starting point for transferring farmers' indicated willingness to participate in AWP into corresponding behaviour. Thus, a broader market segment for products with higher animal welfare standards can be established, enabling a large number of farm animals to live under improved conditions.

Acknowledgements

This study is part of the project Animal Welfare in Intensive Livestock Production Systems. Financial support from the Lower Saxony Ministry of Science and Culture is gratefully acknowledged.

References

- Ajzen I** 1991 The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes* 90(2): 179-211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Albersmeier F and Spiller A** 2010 The reputation of the German meat sector: a structural equation model. *German Journal of Agricultural Economics* 59(4): 258-270
- Bacher J, Pöge A and Wenzig K** 2010 *Clusteranalyse. Anwendungsorientierte Einführung in Klassifikationsverfahren, Third Edition*. Oldenbourg Wissenschaftsverlag: Munich, Germany. <https://doi.org/10.1524/9783486710236>. [Title translation: Cluster analysis. An application orientated introduction].
- Backhaus K, Erichson E, Plinke W and Weiber R** 2011 *Multivariate Analysemethoden- Eine anwenderorientierte Einführung*. Springer: Berlin/Heidelberg, Germany. <https://doi.org/10.1007/978-3-642-16491-0>
- Bahlmann J and Spiller A** 2008 Wer koordiniert die Wertschöpfungskette? *Fleischwirtschaft* 8(88): 23-29. [Title translation: Who co-ordinated the supply chain?]
- Blandford D and Fulponi L** 1999 Emerging public concerns in agriculture: domestic policies and international trade commitments. *European Review of Agricultural Economics* 26(3): 409-424. <https://doi.org/10.1093/erae/26.3.409>
- BMEL** 2011 *Milcherzeugung in den EU-Mitgliedstaaten Milch nur von Milchkühen*. <http://berichte.bmelv-statistik.de/SBT-0302010-2009.pdf>. [Title translation: Milk production in EU-member. Milk only from dairy cows]
- BMEL** 2015 *Bruttoeigenerzeugung an Fleisch*. <http://berichte.bmelv-statistik.de/SJT-8032400-0000.pdf>. [Title translation: Gross indigenous production]
- Bock BB and Van Huik MM** 2007 Animal welfare: the attitudes and behavior of European farmers. *British Food Journal* 109(11): 931-944. <https://doi.org/10.1108/00070700710835732>
- Bracke MBM** 2007 Animal-based parameters are no panacea for on-farm monitoring of animal welfare. *Animal Welfare* 16(2): 229-231
- Breuer K, Hemsworth PH, Barnett JL, Matthews LR and Coleman GJ** 2000 Behavioural response to humans and the productivity of commercial dairy cows. *Applied Animal Behavior Science* 66: 273-288. [https://doi.org/10.1016/S0168-1591\(99\)00097-0](https://doi.org/10.1016/S0168-1591(99)00097-0)
- Brosius F** 2011 *SPSS 19*. Mitp: Heidelberg/Munich, Germany
- Bühl A** 2010 *SPSS 18 Einführung in die moderne Datenanalyse*. Pearson: Munich, Germany. [Title translation: Introduction to modern data analysis]
- Buller H and Cesar C** 2007 Eating well, eating fare: farm animal welfare in France. *International Journal of Sociology of Food and Agriculture* 15(3): 45-58
- Burda Community Network** 2009 *Typologie der Wünsche 2009: Menschen-Medien-Märkte*. Burda Community Network: Offenburg, Germany. [Title translation: Typology of wishes. People-media-markets]
- Busch G, Kaiser M and Spiller A** 2013 Factory farming from a consumer's perspective: associations and attitudes. *Jahrbuch der Österreichischen Gesellschaft für Agrarökonomie* 22(1): 61-70

- Coff C, Korthals M and Barling D** 2008 Ethical traceability and informed food choice. ethical traceability and communicating food. In: Coff C, Barling D, Korthals M and Thorkild N (eds) *The International Library of Environmental, Agricultural and Food Ethics 15* pp 1-18. Springer: Dordrecht, The Netherlands
- Coleman GJ, Hemsworth PH and Hay M** 1998 Predicting stockperson behavior towards pigs from attitudinal and job-related variables and empathy. *Applied Animal Behavior Science* 58: 63-75. [https://doi.org/10.1016/S0168-1591\(96\)01168-9](https://doi.org/10.1016/S0168-1591(96)01168-9)
- Deimel I, Franz A, Frentrup M, von Meyer M, Spiller A and Theuvsen L** 2010 *Perspektiven für ein Europäisches Tierschutzlabel*. <http://download.ble.de/08HS010.pdf>. [Title translation: Perspectives for a European animal welfare label]
- Deimel I, Franz A and Spiller A** 2011 Das Animal Welfare - Verständnis deutscher Schweinemäster: Eine Analyse landwirtschaftlicher Frames. *Jahrbuch der Österreichischen Gesellschaft für Agrarökonomie* 20(2): 191-200. [Title translation: The animal welfare understanding of German pig producers: an analysis of agricultural frames]
- Destatis** 2010 *Landwirtschaftszählung 2010. Landwirtschaftliche Betriebe und landwirtschaftlich genutzte Fläche nach Größenklassen der landwirtschaftlich genutzten Fläche 2010*. https://www.destatis.de/DE/ZahlenFakten/Wirtschaftsbereiche/LandForstwirtschaftFischerei/Landwirtschaftszaehlung2010/Tabellen/1_2_LandwirtschaftlicheBetriebeGenutzteFlaeche_end.html. [Title translation: Agricultural census 2010, Farms and agricultural land in size categories]
- Destatis** 2013 *Land- und Forstwirtschaft, Fischerei. Sozialökonomische Verhältnisse Agrarstrukturerhebung*. https://www.destatis.de/DE/Publikationen/Thematisch/LandForstwirtschaft/Betriebe/SozialoekonomischeVerhaeltnisse2030215139004.pdf?__blob=publicationFile. [Title translation: Agriculture and forestry, fishing, socioeconomic condition, structural survey]
- Destatis** 2014 *Publikation - Land- und Forstwirtschaft, Fischerei. Viehhaltung der Betriebe. Agrarstrukturerhebung 2013*. https://www.destatis.de/DE/Publikationen/Thematisch/LandForstwirtschaft/ViehbestandTierischeErzeugung/Viehhaltung2030213139004.pdf?__blob=publicationFile. [Title translation: Agriculture and forestry, fishing. Livestock-keeping farms, structural survey 2013]
- Destatis** 2015a *Fleischproduktion im ersten Quartal 2015 auf Höchststand*. <https://www.destatis.de/DE/ZahlenFakten/Wirtschaftsbereiche/LandForstwirtschaftFischerei/TiereundtierischeErzeugung/AktuellSchlachtungen.html>. [Title translation: Meat production in the first quarter of 2015 at a record high]
- Destatis** 2015b *Bildungsstand. Bevölkerung nach Bildungsabschluss in Deutschland*. <https://www.destatis.de/DE/ZahlenFakten/GesellschaftStaat/BildungForschungKultur/Bildungsstand/Tabellen/Bildungsabschluss.html>. [Title translation: Level of education, population separated in education levels]
- Döring R and Wichtmann W** 2007 *Chancen einer Öko-Kennzeichnung von Erzeugnissen der Seefischerei für die deutsche Fischwirtschaft*. Final Research Project Report, University of Greifswald, Greifswald, Germany. [Title translation: Chances of eco-labelling for products of sea-fishing for the German fish industry]
- Duffy R and Fearn A** 2009 Value perceptions of farm assurance in the red meat supply chain. *British Food Journal* 111(7): 669-685. <https://doi.org/10.1108/00070700910972369>
- EC (European Commission)** 2006 *A community action plan on the protection and welfare of animals 2006-2010*. <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV:f82003>
- EC (European Commission)** 2007 Attitudes of consumers towards the welfare of farmed animals. *Special Eurobarometer 229(2)*. http://ec.europa.eu/food/animal/welfare/survey/sp_barometer_fa_en.pdf
- Everitt BS** 1998 *The Cambridge Dictionary of Statistics*. Cambridge University Press: Cambridge, UK
- Franz A, Deimel I and Spiller A** 2012 Concerns about animal welfare: a cluster analysis of German pig farmers. *British Food Journal* 114(10): 1445-1462. <https://doi.org/10.1108/00070701211263019>
- Franz A, Meyer M and Spiller A** 2010 Einführung eines Animal Welfare Labels in Deutschland: Ergebnisse einer Stakeholder Befragung. *Jahrbuch der Österreichischen Gesellschaft für Agrarökonomie* 19(1): 41-50. [Title translation: Implementation of a animal welfare label in Germany: Results of a stakeholder analysis]
- German Meat** 2015 *Fleisch aus Deutschland*. <http://www.germanmeat.org/de/fleisch-aus-deutschland/schlachtung-und-zerlegung>. [Title translation: Meat from Germany]
- Gocsik É, Saatkamp HW, De Lauwere CC and Lansink AGJM** 2014 A conceptual approach for a quantitative economic analysis of farmers' decision-making regarding animal welfare. *Journal of Agricultural and Environmental Ethics* 27(2): 287-308. <https://doi.org/10.1007/s10806-013-9464-9>
- Gocsik É, van der Lans IA, Lansink AGJM and Saatkamp HW** 2015 Willingness of dutch broiler and pig farmers to convert to production systems with improved welfare. *Animal Welfare* 24(2): 211-222. <https://doi.org/10.7120/09627286.24.2.211>
- Golan E, Kuchler E and Mitchell L** 2000 Economics of food labeling. Economic research service; USDA. *Agricultural Economic Report, No 793*. http://www.ers.usda.gov/publications/aer_793/
- Goldsmith P, Turan N and Gow H** 2003 Food safety in the meat industry: a regulatory quagmire. *International Food and Agribusiness Management Review* 6(1): 25-37
- Gulbrandsen LH** 2006 Creating markets for eco-labelling: are consumers insignificant? *International Journal of Consumer Studies* 30(5): 477-489. <https://doi.org/10.1111/j.1470-6431.2006.00534.x>
- Hair J, Black F, Babin BJ and Anderson RE** 2010 *Multivariate Data Analysis: A Global Perspective*. Pearson: Upper Saddle River, NJ, USA
- Hansson H and Lagerkvist CJ** 2012 Measuring farmers' attitudes to animal welfare and health. *British Food Journal* 114(6): 840-852. <https://doi.org/10.1108/00070701211234363>
- Hansson H and Lagerkvist CJ** 2014 Defining and measuring farmers' attitudes to farm animal welfare. *Animal Welfare* 23: 47-56. <https://doi.org/10.7120/09627286.23.1.047>
- Harper G and Henson S** 2001 *Consumer concerns about animal welfare and the impact on food choice. EU-Project EU-FAIR-CT-98-3678. Final Report*, Centre for Food Economics Research, Department of Agriculture and Food Economics, The University of Reading, UK
- Harper G and Makatouni A** 2002 Consumer perception of organic food production and farm animal welfare. *British Food Journal* 104(3/4/5): 287-299
- Harvey D and Hubbard C** 2013 Reconsidering the economy of farm animal welfare: an anatomy of market failure. *Food Policy* 38: 105-114. <https://doi.org/10.1016/j.foodpol.2012.11.006>

- Heerwagen LR, Christensen T and Sandøe P** 2013 The prospect of market-driven improvements in animal welfare: lessons from the case of grass milk in Denmark. *Animals* 3: 499-512. <https://doi.org/10.3390/ani3020499>
- Hellberg-Bahr A, Steffen N and Spiller A** 2012 Marketingpotentiale für Weidemilch. *Jahrbuch der Österreichischen Gesellschaft für Agrarökonomie* 21 (1): 3-12. [Title translation: Marketing potentials for pasture-raised milk]
- Hubbard C** 2012 Do farm assurance schemes make a difference to animal welfare? *Veterinary Record* 170: 150-151. <https://doi.org/10.1136/vr.e847>
- Hubbard C, Bourlakis M and Garrod G** 2007 Pig in the middle: farmers and the delivery of farm animal welfare standards. *British Food Journal* 109(11): 919-930. <https://doi.org/10.1108/00070700710835723>
- Huijps K, Hogeveen H, Antonides G, Valeeva N, Lam T and Oude Lansink AG** 2010 Sub-optimal economic behavior with respect to mastitis management. *European Review of Agricultural Economics* 37(4): 553-568. <https://doi.org/10.1093/erae/jbq036>
- Initiative Tierwohl** 2016 *Die Initiative Tierwohl*. <http://initiative-tierwohl.de>. [Title translation: The Tierwohl Initiative]
- Jahn G, Peupert M and Spiller A** 2003 *Einstellungen deutscher Landwirte zum QS-System: Ergebnisse einer ersten Sondierungsstudie*. Working paper, Institute of Agricultural Economics, University of Goettingen, Germany. [Title translation: Attitudes of German farmers towards the OS-Systems, Results of a first exploratory study]
- Jansen J and Laatz W** 2007 *Statistische Datenanalyse mit SPSS für Windows*. Springer: Heidelberg, Germany. [Title translation: Statistical analysis with SPSS for Windows]
- Keeling L, Evans A, Forkmann B and Kjærnes U** 2013 Welfare Quality® principles and criteria. In: Blokhuis H, Miele M, Veissier I and Jones B (eds) *Improving Farm Animal Welfare: Science and Society Working Together: The Welfare Quality® Approach* pp 91-114. Wageningen Academic Publishers: Wageningen, The Netherlands. https://doi.org/10.3920/978-90-8686-770-7_5
- Keeling L and Kjærnes U** 2009 *Principles and criteria of good farm animal welfare*. Fact Sheet. <http://www.welfarequality.net/everyone/41858/5/0/22>
- Kjærnes U, Miele M and Roex J** 2007 *Attitudes of consumers, retailers and producers to farm animal welfare*. Welfare Quality® Report No 2. Cardiff University, School of City and Regional Planning: Cardiff, UK
- Leach K, Whay H, Maggs C, Barker Z, Paul E, Bell A and Main D** 2010 Working towards a reduction in cattle lameness I. Understanding barriers to lameness control on dairy farms. *Research in Veterinary Science* 89: 311-317. <https://doi.org/10.1016/j.rvsc.2010.02.014>
- Lusk JL and Norwood FB** 2012 Speciesism, altruism and the economics of animal welfare. *European Review of Agricultural Economics* 39(2): 189-212. <https://doi.org/10.1093/erae/jbr015>
- Main D and Mullan S** 2012 Economic, education, encouragement and enforcement influenced within farm assurance schemes. *Animal Welfare* 21(S1): 107-111. <https://doi.org/10.7120/096272812X13345905673881>
- Makatouni A** 2002 What motivates consumers to buy organic food in the UK? *British Food Journal* 104(3/4/5): 345-352
- Menghi A** 2007 Italian pig producers' attitude towards animal welfare. *British Food Journal* 109(11): 870-878. <https://doi.org/10.1108/00070700710835688>
- Miele M, Blokhuis H, Bennett R and Bock B** 2013 Changes in farming and in stakeholder concern for animal welfare. In: Blokhuis H, Miele M, Veissier I and Jones B (eds) *Improving Animal Welfare. Science and Society Working Together: The Welfare Quality® Approach* pp 19-48. Wageningen Academic Publishers: Wageningen, The Netherlands. https://doi.org/10.3920/978-90-8686-770-7_2
- Miele M and Parisi V** 2001 *Consumer concerns about animal welfare and the impact on food choice*. Italian Survey Report no 1, EU Project CT983678, University of Pisa, Italy
- Mußhoff O, Hirschauer N and Hengel P** 2011 Are business management games a suitable tool for analyzing the bloodedly rational behavior of economic agents? *Modern Economy* 2(4): 468-478. <https://doi.org/10.4236/me.2011.24052>
- Nocella G, Hubbard L and Scaroa R** 2010 Farm animal welfare, consumer willingness to pay, and trust: results of a cross-national survey. *Applied Economic Perspective and Policy* 32(2): 275-297. <https://doi.org/10.1093/aep/ppp009>
- Norwood FB and Lusk JL** 2009 The farm animal welfare debate. *Choices – The Magazine of Food, Farm and Resource Issues* 24(3): 1-7
- Porter E** 1980 *Competitive Strategy*. The Free Press: New York, USA
- Schulze B, Lemke D and Spiller A** 2008 Glücksschwein oder arme Sau? Die Einstellung der Verbraucher zur modernen Nutztierhaltung. In: Spiller A and Schulze B (eds): *Zukunftsperspektiven der Fleischwirtschaft – Verbraucher, Märkte, Geschäftsbeziehungen* pp 465-488. University Publishing Goettingen: Goettingen, Germany. [Title translation: Lucky pig or poor sow? Consumers' attitudes towards modern livestock production]
- Skarstad GA, Terragni L and Torjusen H** 2007 Animal welfare according to Norwegian consumers and producers: Definitions and Implications. *International Journal of Sociology of Food and Agriculture* 15(3): 74-90
- Swinton SM, Rector N, Robertson GP, Jolejole-Foreman C and Lupi F** 2015 Farmer decisions about adopting environmentally beneficial practices. In: Hamilton SK, Doll JE and Robertson GP (eds) *The Ecology of Agricultural Landscapes* pp 340-359. Oxford University Press: New York, USA
- Theuvsen L** 2011 *Tierschutzlabel: Handlungsoptionen – Wirkungen – Verantwortlichkeiten*. Akademie für tierärztliche Fortbildung Fachgruppe Tierschutz und Institut für Tierhygiene, Tierschutz und Nutztierethologie der Stiftung Tierärztliche Hochschule Hannover *Aktuelle Probleme des Tierschutzes* pp 63-71. Hannover, Germany. [Title translation: Animal welfare label: options for action – effects - responsibilities]
- TopAgrar** 2015 *Initiative Tierwohl – wie geht es weiter mit der Warteliste?* <http://www.topagrar.com/news/Schwein-News-Schwein-Initiative-Tierwohl-wie-geht-es-weiter-mit-der-Warteliste-1772899.html>. <http://www.topagrar.com/news/Schwein-News-Schwein-Initiative-Tierwohl-wie-geht-es-weiter-mit-der-Warteliste-1772899.html>. [Title translation: The Tierwohl Initiative, what is going to happen to the waiting list?]
- Valeeva NI, Lam TJGM and Hogeveen H** 2007 Motivation of dairy farmers to improve mastitis management. *Journal of Dairy Science* 90: 4466-4477. <https://doi.org/10.3168/jds.2007-0095>

Vanhonacker F, Van Poucke E, Tuyttens F and Verbeke W 2010 Citizens' views on farm animal welfare and related information provision: exploratory insights from Flanders, Belgium. *Journal of Agricultural and Environmental Ethics* 23: 551-569. <https://doi.org/10.1007/s10806-010-9235-9>

Vetouli T, Lund V and Kaufmann B 2012 Farmers' attitude towards animal welfare aspects and their practice in organic dairy calf rearing: a case study in selected Nordic farms. *Journal of Agricultural and Environmental Ethics* 25(3): 349-364. <https://doi.org/10.1007/s10806-010-9301-3>

Weber H, Rammsayer T and Bengel J 2005 *Handbuch der Persönlichkeitspsychologie*. Hogrefe: Göttingen, Germany. [Title translation: Handbook of personality psychology]

Wissenschaftlicher Beirat Agrarpolitik BMEL 2015 *Wege zu einer gesellschaftlich akzeptierten Nutztierhaltung*. http://www.bmel.de/SharedDocs/Downloads/Ministerium/Beiraete/Agrarpolitik/GutachtenNutztierhaltung.pdf?__blob=publicationFile. [Title translation: Ways to a socially accepted livestock production]