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Willingness of Dutch broiler and pig farmers to convert to production systems with improved welfare

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Abstract

The present study investigated 15 broiler and 13 fattening pig farmers' willingness-to-convert to alternative production systems with higher animal welfare standards compared to conventional production systems in The Netherlands, and explored the main barriers to the adoption of these alternative systems. Alternative production systems were categorised, according to whether farmers were required to make reversible or irreversible changes to the current farm. Two out of the four pig systems in the study were considered as reversible, whereas the other two as irreversible. One out of the four broiler systems presented was considered as reversible, whereas the other three as irreversible. Results show that to convert to a system requiring irreversible changes 83 and 85% (figures for each of the two irreversible systems) of the surveyed fattening pig farmers required a 30% or higher increase in their family income, while to convert to a system requiring reversible changes 8 and 23% of the pig farmers required a similar level of increase. Also, for each of the three irreversible systems, 62, 64 and 87% of the surveyed broiler farmers required a 30% or higher increase in their family income to a system requiring irreversible changes, while to convert to a system requiring reversible changes, 20% of the broiler farmers required a similar level of increase. Thirty-eight and 62% of the fattening pig farmers and 40% of the broiler farmers were willing to convert to the specific systems that allowed reversible changes if they knew they could earn the same income as they did in their current system. This study highlights a number of reasons for farmers' reluctance to switch to alternative systems: perceived uncertainty about price premiums, lack of space on the farm, scarcity of land nearby the farm, risk of disease spread, the existing farm set-up, prohibition of tail docking, allowing for castration, and views that proposed alternatives were 'farmer-unfriendly' or impractical.

Keywords: *animal welfare, barriers to adoption, broiler production, contingent valuation, farmers' decision-making, pig production*

Introduction

Dutch broiler and pig farmers in The Netherlands can choose voluntarily from a range of production systems, which comply with animal welfare (AW) standards that exceed the legislative minimum standards (Immink *et al* 2013; Vanhonacker & Verbeke 2014). A farmer's decision to adopt a new production system is affected by the farmer's intrinsic motivation to produce according to higher AW standards and by the choice set that is determined by external factors and certain farm-specific factors. Gocsik (2014) found that farmers did not have a strong intrinsic motivation to convert to a production system with higher AW standards. This study also suggested that farmers' intrinsic motivation was constrained by external factors that were beyond the farmers' control and by farm-specific factors such as farm size and farm set-up. Hence, the farmers' default choice is often a conventional production system. Nevertheless, it is likely that farmers would be willing to adopt higher AW standards if external and farm-specific factors are favourable for the adoption (Gocsik 2014).

The literature on farmers' decisions to adopt new production systems and other investments also shows that the choice of production system is influenced by external factors that are out with the farmers' control, such as the legislative environment and market forces, and by farm-specific factors such as farm set-up and farm size (Greiner & Gregg 2011). De Lauwere *et al* (2012) suggest that external factors, such as credit availability and permit procedures, are possible bottlenecks in changing to group housing for pregnant sows. Uncertainty about future legislation may also influence farmers' decisions about production practices (Tuyttens *et al* 2008; De Lauwere *et al* 2012). Furthermore, Gocsik (2014) found that land availability and price premiums also affect farmers' decisions to adopt production systems that improve AW. Previous studies also identified socio-economic and demographic factors associated with farms and farmers as relevant to the adoption decision (De Buck *et al* 2001; Oude Lansink *et al* 2003; Gocsik *et al* 2014). However, these factors are of less importance when designing market initiatives, as socio-economic and demographic factors are relatively fixed and difficult to influence. In contrast, external factors, such as market conditions are more flexible to changes. Therefore, exploring

how external factors influence farmers' participation in market initiatives may provide insights that are useful for designing viable production systems with higher levels of AW.

The objective of this study was two-fold. Firstly, to explore the conditions in which farmers would be willing to convert to an alternative system, with a particular focus on the trade-off between preferences and farmers' family income. Secondly, to identify the main barriers that prevent farmers from adopting alternative production systems.

Materials and methods

Questionnaire

The survey was administered using a paper and pencil questionnaire. The questionnaire was pre-tested, face-to-face, with a broiler farmer prior to actual data collection, and the questionnaire was revised based on comments received. The resulting questionnaire consisted of three parts. The first part contained questions regarding demographic and socio-economic characteristics. The second contained questions about the respondents' perception of external factors, which might constrain the adoption of a new production system and the third included questions about the change in family income that the respondent would require in order to be willing to convert to an alternative system.

Data collection

A survey was carried out with 22 broiler farmers and 15 pig farmers in the province of Noord-Brabant in The Netherlands from October to December 2013 among six pre-existing study groups. These study groups assemble farmers from the area of Noord-Brabant and Limburg and they serve as a forum for farmers to regularly discuss their experiences and new developments in the sector among other farm-related issues. The respondents represented approximately 12% of the broiler farmers and 1% of the fattening pig farmers in Noord-Brabant. The farmers participating in the study were the owners of their farms and the main decision-maker at their farm. During the study group meetings, participants were presented with an introduction to the survey and explanation of the tasks was included. More specifically, farmers were asked to make their decision, taking into account the current external (eg, market, institutional, etc) circumstances. Further, it was explained that it was a voluntary choice to convert to an alternative production system. The farmers were, in general, familiar with recent market developments, however they may not have been familiar with all the details of alternative production systems. Therefore, the different aspects of the production systems, such as stocking density and provision of enrichment, were presented.

Members of two of the three participating broiler study groups completed the questionnaire individually at her/his own speed during the meeting. However, in the case of the third broiler study group and all the fattening pig study groups, filling in the questionnaire during the meeting was not feasible due to time constraints. Hence, after the introduction and explanation of the tasks, participants were asked to fill in the questionnaire at home and return it, completed, within a week.

Sample

The responses of 15 broiler farmers (out of 22) and 13 fattening pig farmers (out of 15) were useable for the analysis of willingness-to-convert (Mitchell & Carson 1989). The demographic and socio-economic characteristics of the respondents included in the analysis are described briefly here. The details of the whole sample are provided in Gocsik (2014).

Regarding broiler farmers, the mean (± SD) age of respondents was 46 (± 8.1) years (Table 1). The majority of respondents were male and had a medium- (ie a farm with 60,000–90,000 animals) or large-scale (ie a farm with > 90,000 animal places) farm with a conventional production system, which meets the minimum legal requirements. The respondents had been working, self-employed, for 17 (± 11.9) years on their farm. With regard to fattening pig farmers, the mean (± SD) age of the respondents was also 46 (± 8.5) years. They were all male, with 23 (± 11.4) years of experience in farming. They all had a medium- (ie a farm with 2,000–4,000 animal places) or large-scale (ie a farm with > 4,000 animal places) farm with a conventional production system. For the majority of respondents in both surveys, the main source of family income, which is a measure of the combined income of all the family members living in the farm, was farming. Fourteen broiler farmers and nine pig farmers indicated that they had expanded their farms in the past. On average, the respondents had expanded their farm less than ten years previously. No significant differences at a 95% confidence level were found between the broiler and fattening pig farmers in terms of their demographic and socio-economic characteristics. Differences between broiler and fattening pig farmers were not tested for the variables that depend on farm type. These variables were: study group, number of animal places (ie the number of animals that can be kept in the farm at a time), and number of animal places built during the expansion.

Perception of external factors

Farmers were asked to evaluate the broader external environment in terms of five selected external factors, which represent possible constraints for the adoption of production systems with higher AW standards (Gocsik *et al* 2014). The farmers' views were measured on a seven-point scale for each of the following external factors: land availability for farm expansion; length of time for land acquisition; certainty about price premiums; level of price premiums (whether or not they cover extra costs); and level of transition costs. Land availability for farm expansion referred to the land area nearby the farm that is potentially available for agricultural production. Respondents could indicate their answer on a scale ranging from 'very low' to 'very high'. Length of time for land acquisition referred to the time necessary for purchasing the land, acquiring permits, and similar administrative procedures related to the acquisition. This variable was evaluated on a scale ranging from 'very short' to 'very long'. With regard to price premiums, two

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Table 1 Demographic and socio-economic characteristics of broiler and fattening pig farmers in the sample.

	Broiler farmers				Fattening pig farmers		
Variable	**N**	**N(%)**	**Mean (± SD)**	**Variable**	**N**	**N (%)**	**Mean (± SD)**
Study group	15			*Study group*	12		
Study group 1 and 2		60		Study group 1		33	
Study group 3		40		Study group 2		33	
				Study group 3		34	
Age	15		46 (± 8.1)	Age	13		46 (± 8.5)
Gender	15			*Gender*	13		
Male		93		Male		100	
Female		7					
Years in farming as self-employed	10		17 (± 11.9)	Years in farming as self-employed	12		23 (± 11.4)
Sources of family income	14			*Sources of family income*	13		
Circa 100% from farm activities		65		*Circa* 100% from farm activities		62	
Circa 80% from farm activities		21		*Circa* 80% from farm activities		38	
Circa 50% from farm activities		7		*Circa* 50% from farm activities			
Circa 20% from farm activities		7		*Circa* 20% from farm activities			
Production system	15			*Production system*	13		
Conventional		93		Conventional		100	
Alternative		7		Alternative			
Number of animal places	15			*Number of animal places*	13		
< 30,000		13		< 250			
30,001–60,000				251–1,000			
60,001–90,000		13		1,001–2,000		46	
> 90,000		74		2,001–4,000		31	
				> 4,000		24	
Latest expansion of the farm	14			*Latest expansion of the farm*	13		
< 5 years ago		65		< 5 years ago		54	
5–10 years ago		1		5–10 years ago		23	
11–20 years ago		23		11–20 years ago		15	
> 20 years ago				> 20 years ago		8	
Not applicable		1		Not applicable			
Number of extra animal places built during the expansion	13		44,600 (± 33,200)	Number of extra animal places built during the expansion	11		2,300 (± 2,600)
Market	15			*Market*	13		
Domestic		20		Domestic		69	
International		7		International			
Domestic and international		73		Domestic and international		31	

Figure 1

Conventional broiler system
42 kg per m^2 stocking density
No free-range, no daylight in the barn
40–42 days
No enrichment
Min 4 h uninterrupted darkness per day

Profile 1: 'Improved conventional' ***(reversible)***	**Profile 2: 'Outdoor free-range'** ***(irreversible)***
38 kg per m^2 stocking density	27.5 kg per m^2 stocking density
No free-range, no daylight in the barn	Outdoor access 1 m^2 per chicken
45 days	63 days
Whole grains and bales of straw	Whole grains and bales of straw
Min 6 h uninterrupted darkness per day	Min 8 h uninterrupted darkness per day
Profile 3: 'Indoor free-range 1' ***(irreversible)***	**Profile 4: 'Indoor free-range 2'** ***(irreversible)***
27.5 kg per m^2 stocking density	31 kg per m^2 stocking density
Covered veranda 12 × 12 cm per chicken	Covered veranda 12 × 12 cm per chicken
63 days	56 days
Whole grains and bales of straw	Whole grains and bales of straw
Min 8 h uninterrupted darkness per day	Min 4 h uninterrupted darkness per day

Description of the conventional broiler system and alternative systems included in the study.

aspects were subject to evaluation: the certainty about price premiums and the level of price premiums. More specifically, the certainty about price premiums was evaluated on a scale ranging from 'very uncertain' to 'very certain'. Also, farmers were asked to indicate the extent to which they agreed with the statement that the level of price premiums would cover the extra costs they may incur to convert to a system with higher AW standards, on a scale ranging from 'strongly disagree' to 'strongly agree'. Lastly, the level of transition costs were evaluated on a scale ranging from 'very low' to 'very high'.

Contingent valuation

The contingent valuation method was used to reveal the farmers' monetary trade-off for alternative production systems (Bennett & Larson 1996; Bennett 1997). Broiler and pig farmers were asked to indicate their willingness-to-convert from a conventional system to an alternative system, with consequences for family income. Before respondents started with the task, it was necessary to ensure that respondents all had the same reference system. Although the majority of the respondents had a conventional system, small differences might occur across farms. Respondents were, therefore, presented with a description of a specific conventional system and asked to consider this as the reference system for the questions regarding the monetary trade-offs (Figures 1 and 2). Next, respondents were presented with four tasks; each task compared the conventional reference system with an alternative system. Four alternative systems were considered. These systems were either in current use, or hypothetical but technically feasible. The description of each of these four systems is referred to as a profile. The broiler profiles were described on the basis of five attributes: stocking density; provision of free-range area; length of growth period; provision of enrichment; and period of darkness per day. With regard to the fattening pig profiles, seven attributes were defined: indoor space; provision of free-range; bedding; group size; enrichment materials; castration; and tail docking. With respect to castration, when designing the profiles, it was considered that in recent years the Dutch farmers and the market have reacted to the intense public concerns regarding the issue of castration. As a result, currently in The Netherlands, 75% of boars are not castrated (LEI 2014). Therefore, to reflect current developments in the sector, the practice of castration was not allowed in the majority of profiles. Improvements to animal welfare, such as increased space allowance per animal, provision of free-range access, and provision of enrichment materials, in most cases increase production costs on the farm (Spoolder *et al* 2011; Gocsik *et al* 2013). The profiles were designed in such a way that they varied in terms of the reversibility of the changes required to adopt a given system. In the analysis, two categories of reversibility were distinguished: reversible in the short to medium term and irreversible. The former concerned changes that do not require large investments and construction, and where it would be possible to return to the

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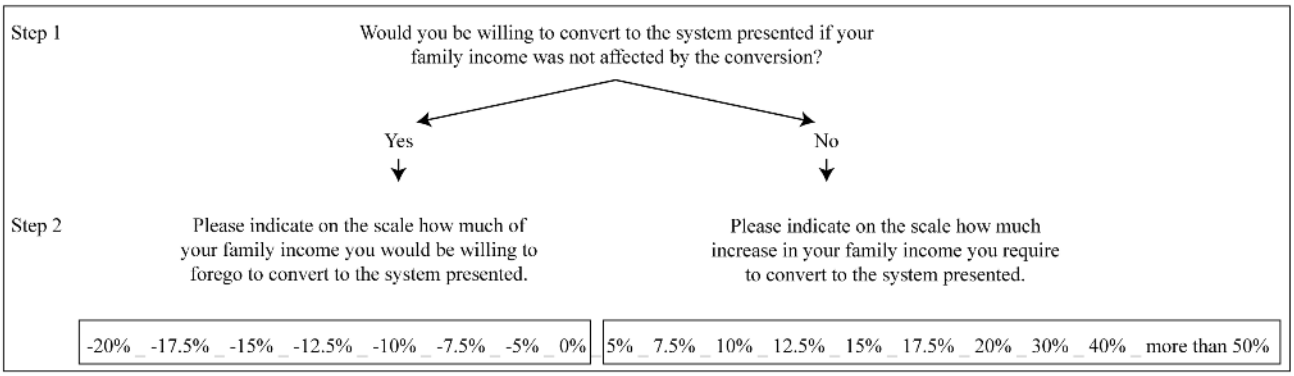
Figure 2

Conventional fattening pig system
0.8 m² per animal indoor space
No free-range, no daylight in the barn
Concrete floor with small amount of litter
8–20 animals per group
Metal chain with ball
Castration allowed
Tail docking allowed

Profile 1: 'Improved conventional, small groups' *(reversible)*	**Profile 2: 'Improved conventional, large groups'** *(reversible)*
1.0 m² per animal indoor space	1.0 m² per animal indoor space
No free-range, no daylight in the barn	No free-range, daylight in the barn
Concrete floor with small amount of litter	Concrete floor with small amount of litter
8–20 animals per group	> 40 animals per group
Wood, sturdy rope, straw	Wood, sturdy rope, straw
Castration not allowed	Castration not allowed
Tail docking allowed	Tail docking allowed
Profile 3: 'Free-range 1' *(irreversible)*	**Profile 4: 'Free-range 2'** *(irreversible)*
0.7 m² per animal indoor space	0.9 m² per animal indoor space
0.7 m² per animal free-range	1.0 m² per animal free-range
Straw/sawdust bedding (5–10 cm)	Straw/sawdust bedding (5–10 cm)
8–30 animals per group	> 40 animals per group
Straw, roughage	Wood, sturdy rope, straw
Castration allowed	Castration not allowed
Tail docking not allowed	Tail docking not allowed

Description of the conventional fattening pig system and alternative systems included in the study.

Figure 3

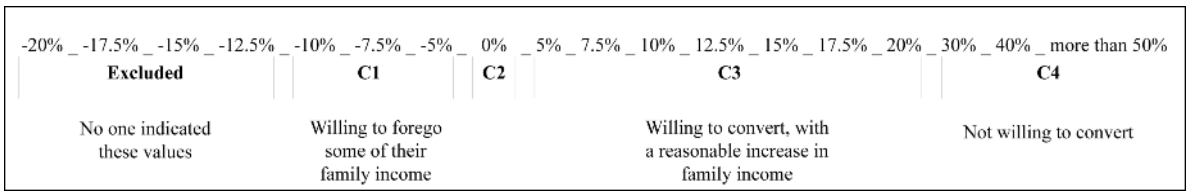


Structure of the contingent valuation tasks.

conventional situation in the short to medium term. The latter concerned large investments, such as building a covered veranda or acquiring land. However, the distinction between reversible and irreversible was not indicated in the description of the tasks. Figures 1 and 2 present the conventional and alternative systems for broiler and pig farmers, respectively.

In each task, a dichotomous choice question was presented in which respondents had to decide whether they would switch from the conventional to the alternative system, given that this switch would not affect their family income (Figure 3). If their answer was 'Yes', they had to indicate on a pre-defined scale, ranging from 0 to

Figure 4



Scale used for the willingness-to-convert to an alternative production system and associated categories of willingness-to-convert.

Table 2 Perception of external factors by broiler and fattening pig farmers.

External factor	Scale of measurement	Broiler farmers			Fattening pig farmers		
		n	Mean (± SD)	Median	n	Mean (± SD)	Median
Availability of land	Very low (1)–Very high (7)	15	2.87 (± 1.73)	3.00	13	4.00 (± 2.27)	4.00
Length of land acquisition	Very short (1)–Very long (7)	15	5.67 (± 1.68)	6.00	13	5.16 (± 1.91)	5.00
Certainty about price premium	Very uncertain (1)–Very certain (7)	15	2.73 (± 1.87)	2.00	13	2.46 (± 1.56)	2.00
Price premium covers extra costs	Strongly disagree (1)–Strongly agree (7)	15	3.13 (± 2.13)	3.00	13	2.54 (± 1.90)	2.00
Level of transition costs	Very low (1)–Very high (7)	15	5.87 (± 1.19)	6.00	12	5.33 (± 1.78)	6.00

20%, how much of their family income (including income obtained from farming activities and from other off-farm activities) they would be willing to give up. If they answered 'No', they were asked to indicate the increase in family income they would require to switch to the system concerned (on a scale ranging from 5 to more than 50%). When farmers indicated that they would require an increase of more than 50% in their family income, they were asked to indicate the main reason for this.

It is often claimed that contingent valuation methods do not provide reliable estimates, because of the starting point bias, ie respondents have a tendency to say yes at first (Mitchell & Carson 1989). In order to reduce the possibility of bias, the order of the tasks was varied. Half of the respondents received the tasks in the order of Profile 1, Profile 2, Profile 3, and Profile 4, while the other half of the respondents were presented with the tasks in the order of Profile 2, Profile 1, Profile 4, and Profile 3.

Data analysis

Contingent valuation

To facilitate the interpretation of results, the values on the scale were grouped into four categories. Figure 4 presents the scale, which respondents used to indicate their willingness-to-convert to the alternative systems and the categories which were defined to facilitate interpretation.

The first category (C1) included values ranging from –10 to –5%; respondents in this category were described as willing to forego some of their income to convert to the given system. Respondents in the second category (C2) were described as willing to accept the alternative system, if the family income remained at the same level. Respondents in the third category (C3) were described as willing to accept the alternative system, given a realistic increase in their family income (values from 5 to 20%). An increase of 5 to 20% was considered realistic in the sense that it can probably be achieved under current market circumstances. However, an increase in family income of 30% or more was considered unrealistically high, because it is likely that it cannot be achieved given the current market conditions. Hence, respondents indicating an increase of 30% or more were considered as farmers that were unwilling to convert (C4). No respondents indicated values from –12.5 to –20%, so no category was created for these values.

Check on the generalisability of the results

To check the extent to which the results could be generalised, an expert workshop was organised. A panel of seven experts (ie farm advisors and veterinarians) participated in the workshop; three experts specialised in poultry production and four in pig production. Experts were presented with a series of statements describing a typical broiler and fattening pig farmer, in terms of their perception of external factors and their willingness-to-convert, consistent with the findings of the survey. They were asked to indicate the percentage of farmers to which these statements applied, at both the regional (in particular the study area of Noord-Brabant and Limburg) and country level. Based on the results of the survey, 95% confidence intervals were established for each statement about the perception of external factors and willingness-to-convert. The results of the survey were deemed generalisable if the answers from the experts were within these confidence intervals (Witte & Witte 2010).

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Table 3 Number of broiler farmers in each category of willingness-to-convert for the different profiles (alternative production systems).

	Profile 1 'Improved conventional' (reversible; n = 15)		Profile 2 'Outdoor free-range' (irreversible; n = 15)		Profile 3 'Indoor free-range 1' (irreversible; n = 13)		Profile 4 'Indoor free-range 2' (irreversible; n = 14)	
Willingness-to-convert	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
C1: Yes, and willing to forego some of their family income	1	7	0	0	0	0	2	14
–10%	1		0		0		2	
C2: Yes, given the same level of family income	6	40	0	0	2	15	0	0
0%	6		0		2		0	
C3: Yes, given a reasonable increase in family income	5	33	2	13	3	23	3	22
+5%	0		1		0		0	
+10%	3		1		0		1	
+15%	1		0		1		0	
+20%	1		0		2		2	
C4: No	3	20	13	87	8	62	9	64
+30%	1		1		1		1	
+40%	1		2		2		3	
More than 50%	1		10		5		5	

Results

Perception of external factors

Table 2 shows that for broiler farmers, the average score for the availability of land was 2.87, indicating that land availability was perceived as rather low. The average score for the length of acquiring land was 5.67, indicating that for the majority of respondents the procedure of land acquisition would take longer than reasonable when adopting new animal welfare production systems. Regarding the certainty about the price premium and the extent to which the price premium covers extra costs, respondents scored, on average, 2.73 and 3.13, respectively. That is, the majority of respondents were rather uncertain about earning a price premium on products with higher AW standards and they perceived that the level of price premium was not sufficient to cover the extra costs incurred due to the alternative production system. The level of transition costs to convert to an alternative system with higher AW standards (the production system was not specified in this question) was, on average, perceived as high (5.87 [± 1.19]).

The results for the pig farmers were similar to those for the broiler farmers. The availability of land was, on average, perceived as neither low nor high (4.00 [± 2.27]), while the length of land acquisition was perceived as rather long (5.16 [± 1.91]). The average scores for the certainty about the price premium and the extent to which this price premium covers extra costs were 2.46 and 2.54, respectively. These scores indicate that the majority of respondents perceived that there was uncertainty about the price premium and that the level of price premium was insufficient to cover extra costs. Similarly, the level of transition costs was, on average, perceived as high (5.33 [± 1.78]). No significant differences at a 95% confidence level were found between the perceptions of broiler farmers and fattening pig farmers.

Contingent valuation

Table 3 shows that broiler farmers were more willing to adopt systems requiring reversible as opposed to irreversible changes. With regard to the 'Improved conventional' system, which entails predominantly reversible changes, one respondent was willing to give up some of his income (10% of family income) and change to this system. Eleven respondents were willing to convert to the 'Improved conventional' system given the same level of or a realistic increase in family income. In contrast, in the case of the other three presented systems, defined as irreversible systems, the majority of respondents were not willing to change at all.

In response to the open-ended question about the reasons for requiring an increase of more than 50% in family income, respondents mentioned one or more reasons (Table 4). Disease risk or animal diseases, and extra work were indicated for all the systems. Reasons, such as the provision of outdoor access and covered veranda, and the high space requirements that make it impossible to adopt certain systems, were also given.

Table 4 Reasons given by broiler farmers for requiring an increase in family income of more than 50% (the number of respondents that mentioned each reason, if more than one, is indicated in brackets).

Profile 1 'Improved conventional' (n = 1)	Profile 2 'Outdoor free-range' (n = 10)	Profile 3 'Indoor free-range 1' (n = 5)	Profile 4 'Indoor free-range 2' (n = 5)
• Disease risk	• Avian influenza, animal diseases (4)	• Avian influenza	• Avian influenza
• Extra work	• Too high transition costs	• Covered veranda (2)	• Covered veranda
• Transition costs	• Extra work	• Enrichment	• Extra work (2)
• Lack of space on the farm and feasibility	• High space requirements, lack of space on the farm	• Extra work	• Lack of space on the farm
	• Outdoor access (4)	• Transition costs (2)	• Transition costs (3)
	• Impossible	• Existing barns do not entirely suit the alternative system	• Existing barns do not entirely suit the alternative system
		• Given the current legislation it is not feasible	• Given the current legislation it is not feasible

Table 5 Number of fattening pig farmers in each category of willingness-to-convert for the different profiles (alternative production systems).

	Profile 1 'Improved conventional' (reversible; n = 13)		Profile 2 'Improved conventional, large groups' (reversible; n = 13)		Profile 3 'Free-range 1' (irreversible; n = 13)		Profile 4 'Free-range 2' (irreversible; n = 12)	
Willingness-to-convert	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
C1: Yes, and willing to forego some of their family income	2	15	1	8	0	0	0	0
–10%	2		1		0		0	
C2: Yes, given the same level of family income	8	62	5	38	0	0	1	8
0%	8		5		0		1	
C3: Yes, given a reasonable increase in family income	2	15	4	31	2	15	1	9
+5%	0		2		0		0	
+10%	0		0		0		0	
+15%	0		2		0		0	
+20%	2		0		2		1	
C4: No	1	8	3	23	11	85	10	83
+30%	0		1		5		4	
+40%	1		1		1		1	
More than 50%	0		1		5		6	

Respondents also indicated that the existing barns were not completely suitable for some of the systems and that the current legislation made adopting these systems not feasible.

With regard to fattening pig farmers, results, similar to those of the broiler farmers, show that farmers were more willing to accept reversible than irreversible changes. Table 5 shows that 12 out of 13 respondents were willing to convert to the 'Improved conventional, small groups' system and ten out of 13 were willing to accept to the 'Improved conventional, large groups' system. In the case of the irreversible systems, the majority of respondents were unwilling to convert to the 'Free-range 1' (eleven out of 13 respondents) and 'Free-range 2' systems (ten out of 12 respondents).

As mentioned earlier, farmers were more reluctant to convert to the free-range systems than to the other two presented systems. The reasons given by fattening pig farmers for requiring an increase of more than 50% in family income are shown in Table 6. The reasons given for the 'Free-range 1' and 'Free-range 2' systems were similar; respondents indicated that these systems required large

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Table 6 Reasons given by fattening pig farmers for requiring an increase in family income of more than 50% (each reason was given by one respondent only).

Profile 2 'Improved conventional, large groups' (n = 1)	Profile 3 'Free-range 1' (n = 5)	Profile 4 'Free-range 2' (n = 6)
• Group size > 40	• Bedding material	• Farmer unfriendly system
	• Tail docking not allowed	• Free-range
	• Does not work	• High risk
	• Large investment, more risks, shorter payback period	• No room for free-range next to the barn
	• Market is questionable	• Large investment
	• Lack of space on-farm	• No tail docking leads to distress
	• Castration allowed	
	• Spacious free-range area	

investments and space, and entailed more risks. Further, farmers thought that the consumer demand was not large enough to support such a system (ie does not work, market is questionable). In addition, management issues, such as allowing for castration and prohibition of tail docking, also added to farmers' reluctance to convert.

Check on the generalisability of the results

The findings regarding the generalisability of the results are presented for broiler farmers in Table 7 and fattening pig farmers in Table 8 (see supplementary material to papers published in *Animal Welfare* on the UFAW website: www.ufaw.org.uk). In general, Tables 7 and 8 are structured as follows. The first column in both tables lists the statements describing the typical broiler and pig farmer. The second indicates the percentage of the farmers to which the statements applied. These percentages were estimated from the results of the farmer survey. The third column indicates the lower bound, whereas the fourth indicates the upper bound of the 95% confidence intervals that were established based on the results of the farmer survey. The rest of the table indicates the opinion of experts.

In the case of broiler farmers, a large variation was observed in expert opinion with regard to the statements about availability of land and length of land acquisition. At regional level, experts indicated values ranging from 20 to 90% for availability of land and from 30 to 100% for the length of land acquisition. At country level, the ranges were even wider. The willingness-to-convert for the alternative systems was generally estimated by the experts as higher than in the results of the farmer survey, however estimates fell within the confidence interval in the case of Expert 1 and Expert 3. Experts tended to estimate a higher willingness-to-convert at the country compared to the regional level.

In the case of fattening pig farmers, a large variation was observed in expert opinion for the statement on land availability. Regarding the percentage of farmers at the regional level who perceive land availability as reasonable, Experts 1 and 2 both estimated a lower percentage (20 and 20%, respectively) than the lower bound of the confidence interval of 24%. Whereas, Expert 4 indicated a higher percentage of farmers that perceive land availability as reasonable (80%) compared to the upper bound of 76%. The expert estimates for willingness-to-convert for the alternative systems were usually within the confidence interval. The expert opinions about farmers' willingness-to-convert were similar at regional and country level.

For the expert workshop, regarding the categorisation on willingness-to-convert, the categorisation was different to what it was for farmers in the farmer survey. For the experts, changes to the specific conventional system were categorised as 'small changes', 'somewhat larger changes', and 'large changes' instead of presenting them with the entire alternative systems as it was for farmers. This difference in categorisation resulted in some overlaps between the categories. Hence, in order to compare the survey results with the expert opinion, the following considerations were made.

In the case of broiler production, the first two categories that were presented for experts (ie 'small changes' and 'somewhat larger changes') in principle comprised reversible changes. They were, thus, compared with the 'Improved conventional' system, which was considered reversible. The third category (ie 'large changes') referred to irreversible changes. Hence, this category was compared with one of the latter three alternative broiler production systems, which were all irreversible. Out of the three systems one with the highest percentage of farmers who were willing to convert to these systems was selected. Expert opinion regarding the third category (ie 'large changes') was, thus, compared to 'Indoor free-range 1' system.

In the case of pig production, the first category (ie 'small changes') largely corresponded to the 'Improved conventional, small groups' system. The second category (ie 'somewhat larger changes') was matched with the 'Improved conventional, large groups' system. Similar to the case of broiler production, the third category (ie 'large changes') referred to irreversible changes, which was, thus, compared with one of the latter two alternative pig produc-

tion systems. The system that served as basis for comparison was selected using the same criterion as in broiler production. As a result, expert opinion regarding the third category (ie 'large changes') was compared to 'Free-range 2' system.

Discussion

The objective of this study was to assess broiler and fattening pig farmers' willingness-to-convert to alternative production systems with higher levels of AW, and to explore farmers' perceptions of potential barriers to the adoption of these alternative systems. Alternative production systems were classified according to whether the changes that farmers were required to make to their current production system were reversible or irreversible. Reversible changes do not require large investments and mainly affect variable costs, therefore the conventional farming practice can be easily restored. In contrast, irreversible changes involve large investments, which limits the flexibility of farmers to revert to the conventional farm situation. In this regard, the results show that both broiler and fattening pig farmers were more willing to adopt systems requiring reversible changes compared to systems requiring irreversible changes, such as covered veranda and outdoor access.

Higher AW standards usually generate increased net costs (Spoolder *et al* 2011; Gocsik *et al* 2013). Many of the respondents were willing to convert to a system requiring reversible changes if they knew they could earn the same income as they did in the conventional production system, ie if the increased costs due to higher AW standards were compensated. However, the results also show that, on average, broiler and fattening pig farmers perceived that earning a price premium for products with higher levels of AW was quite uncertain and that the price premium would not be sufficient to cover the extra costs. Furthermore, the results suggest that in the case of irreversible investments, farmers require a higher increase in their family income to reduce the payback period of the investment and thereby reduce the income risk.

The study also highlights potential reasons for farmers' reluctance to switch to an alternative system; these reasons were related to external conditions, farm characteristics, and the production system itself, all of which are often inter-related. Firstly, the perceived uncertainty about price premiums is likely to contribute significantly to farmers' reluctance, because farmers need at least a minimum level of certainty in strategic planning. Secondly, a more practical reason that could limit the adoption of alternative systems is the lack of space on the farm for providing a free-range area and the scarcity of land nearby the farm available for agricultural production. Broiler farmers, in particular, perceived land availability as low. Both broiler and fattening pig farmers indicated lack of space on the farm as a reason for requiring more than 50% increase in their family income to convert to various alternative systems. Immink *et al* (2013) also found that outdoor space is sometimes difficult to arrange at individual farm level in The Netherlands. Thirdly, in some cases, the alternative systems, such as free-range systems, do not fit into the current farm set-up. Existing buildings and farm equipment are often unsuitable for free-range production systems. This was mentioned by broiler farmers in particular as a reason for their unwillingness to convert to alternative systems. Lastly, respondents also expressed their concerns about the higher risk of spreading diseases in free-range broiler production systems and indicated this as one of the reasons for their reluctance to switch to free-range systems. Koch and Elbers (2006) suggested that free-range poultry production is a major risk for the introduction and spread of Avian Influenza. Also, another study (Gocsik 2014), found negative attitudes towards free-range systems among broiler and fattening pig farmers.

The expert validation confirmed the results of the survey for both broiler and fattening pig farmers, with the exception of a few differences. Experts tended to estimate farmers' willingness-to-convert as higher than the results of the survey suggested. For most statements, the experts had similar estimates about the percentage of farmers for whom the statement was relevant. A possible explanation for this is that the experts are likely to be regularly involved in discussions about the sectors, and therefore have a similar reference point.

Generally, there is risk for a range of biases, such as hypothetical and social desirability bias, associated with contingent valuation methods (Fisher 1993; List & Gallet 2001). These biases would tend to increase the likelihood of respondents saying they are willing to convert than they actually are. In the present study, the effect of these biases were apparently small because respondents did not choose for socially desirable systems (eg free-range systems). Besides, following Samuelson (1954), bias might occur in the opposite direction also. It is more likely that bias has occurred in the other direction. The respondents may have understated their interest in conversion because it better suited their self-interest Samuelson (1954). That is, they indicated that a higher increase in family income was required to convert to a particular system than they actually required. To prevent such biases, respondents were asked explicitly to give their own opinion.

Also, biases might have occurred due to the selected elicitation method. To elicit farmers' willingness-to-convert the payment card method was applied. That is, a range of values was listed from which respondents had to choose an amount that best represented their willingness-to-convert. This method is widely used in contingent valuation studies, however it is not without drawbacks (Carson & Mitchell 1988). Concerns have been expressed that the range of values presented to respondents might influence the respondent-indicated willingness-to-convert, ie range bias (Carson & Mitchell 1988). Furthermore, Romano (1999) suggests that some respondents will preferentially choose the first or last amount indicated on the payment scale. Although there is a possibility that these biases occur, the payment card method was suitable to address the main aim of the present study which was not to quantify farmers' willingness to convert exactly, but reveal its magnitude. Having said this, to put it into practice it was necessary to present a more detailed range for the farmers.

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The results of this study have implications for policy-making and for the design of future production systems aimed at increasing AW. To facilitate the transition to systems with higher AW standards, it is important to manage the (perceived) uncertainty of the market and price premiums. Uncertainty can be managed either by governmental policies or specific long-term agreements between supply chain parties. Van Huik and Bock (2007) also concluded that farmers' reluctance is not caused by a negative attitude towards AW as such, but by the negative consequences of switching to an alternative system, such as the need to invest in new systems and the unknown financial impact of standards. Animal welfare policies, therefore, need to offer a long-term perspective and require commitment from all stakeholders in the supply chain. It could be argued that an important first step is the further development of the middle-market segment by including production systems that only require reversible changes to the farm. In addition to providing better conditions for farm animals, a middle-market segment also offers prospects for several parties in the supply chain. At farm level, these systems could be attractive because farmers have the flexibility to revert to the conventional system if their expectations are not met. The results in this study indicated that farmers were more willing to convert to a production system that required reversible changes. Furthermore, these systems enable farmers to produce with a relatively low increase in production costs compared to, for example, free-range systems (Ellen *et al* 2012). Consequently, retailers could supply consumers with these products at a relatively small price premium.

The economic viability of AW systems depends ultimately on consumers' willingness-to-pay for products with higher AW (Harvey & Hubbard 2013). In most cases, economic viability requires that consumers are willing to pay a higher price for the same quantity of animal-friendly products as they purchased from conventional products. Studies have shown that consumer segments exist that are willing to pay a premium for products with higher AW standards (De Jonge, personal communication 2014; Kehlbacher *et al* 2012). However, many farmers perceive the market for animal-friendly products as very small and expect that it will remain so in the future (Van Huik & Bock 2007).

The results of this study suggest that the current farm set-up can limit the adoption of alternative production systems. Although differences in farm set-up may exist across farms, a large part of broiler and pork meat production in The Netherlands comes from conventional production systems on medium- and large-sized farms. Hence, these farms have a large share in the level of AW in the country as a whole. The largest increase in overall AW can, thus, probably be achieved by implementing changes in these farms. Therefore, it is important to take into account the characteristics of these farms when designing market concepts.

Farmers are willing to adopt higher AW standards that require reversible changes to the farm as long as the extra costs are covered and these changes fit their current farm set-up. However, to implement irreversible investments, farmers require more certainty. Stakeholder collaboration aimed at the harmonisation of supply and demand and the creation of favourable market conditions is essential for creating a more certain market environment that facilitates the uptake of production systems with higher levels of AW.

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