Institut für Lebensmittel- und Ressourcenökonomik der
Rheinischen Friedrich-Wilhelms-Universität zu Bonn

Farm Animal Welfare: Measurement and Compliance

I n a u g u r a l - D i s s e r t a t i o n
zur
Erlangung des Grades

Doktor-Ingenieur
(Dr.-Ing.)

der
Hohen Landwirtschaftlichen Fakultät
der
Rheinischen Friedrich-Wilhelms-Universität
zu Bonn

vorgelegt am 23. Januar 2012

von

Dominic Norbert Annen

aus

Saarlouis

Referent:	Prof. Dr. Thomas Heckelei
Koreferenten:	Prof. Dr. Benno Kunz
	Prof. Dr. Wolfgang Büscher
Tag der mündlichen Prüfung:	15. Juni 2012
Erscheinungsjahr:	2012

Danksagung

Ich danke Herrn Prof. Dr. Thomas Heckelei herzlich für die Ermöglichung und Begleitung der vorliegenden Arbeit. Sein in mich gesetztes Vertrauen hat mich in meiner Arbeit bestärkt. Mein Dank gilt ebenfalls Herrn Prof. Dr. Benno Kunz und Herrn Prof. Dr. Wolfgang Büscher für die freundliche und bereitwillige Übernahme des Koreferats.

Ein besonderer Dank gilt Frau Dr. Christine Wieck für ihre Betreuung während meiner Promotionstätigkeit und die sehr gute fachliche Zusammenarbeit. Ihre Ratschläge haben mich stets sehr motiviert. Herrn Markus Kempen danke ich für seine Unterstützung und stets hilfreichen Anregungen im Projektteam. Ich danke auch Frau Dr. Bettina Rudloff für das in mich gesetzte Vertrauen und die gute Zusammenarbeit zu Beginn meiner Promotionstätigkeit.

Bei Frau Dr. Elfriede Ofner-Schröck, Herrn Mag. med. vet. Ewald Schröck und Herrn Bernd Lengers möchte ich mich herzlich für ihre Unterstützung bei der Durchführung der wissenschaftlichen Erhebungen bedanken. Ein Quell der Inspiration war ebenfalls die Arbeit im Forschungsprojekt *„Cross Compliance Assessment Tool“ (CCAT),* welches von der Europäischen Kommission finanziert wurde. In diesem Zusammenhang möchte ich Frau Dr. Berien Elbersen, sämtlichen Teammitgliedern und Verantwortlichen danken.

Ich möchte allen ehemaligen Kollegen am *Institut für Lebensmittel- und Ressourcenökonomik* für ein freundliches Miteinander und einen regen Gedankenaustausch danken.

Von ganzem Herzen danke ich meiner Mutter Irmtraud, meinem Stiefvater Ivo und meiner Lebensgefährtin Barbara. Sie unterstützten mich in allen meinen Vorhaben und gaben mir Rückhalt und Kraft.

Kurzfassung

Tiergerechtheit landwirtschaftlicher Betriebe: Messung und Einhaltung

Die vorliegende Arbeit umfasst zwei Hauptteile. Gegenstand des *ersten* Hauptteils ist es, Konzeption und Einhaltung gesetzlicher sowie freiwilliger Tierhaltungsstandards auf Österreichischen und Deutschen Schweinemast- und Rinderbetrieben hinsichtlich ihrer Relevanz für den Tierschutz vergleichend zu beurteilen. Im Rahmen des *zweiten* Hauptteils wird ermittelt, inwieweit sich theoretische Annahmen bezüglich der Entscheidung von Landwirten zur Teilnahme an Zertifizierungsstandards und/oder der gemeinschaftlichen Betriebsprämienregelung („Cross Compliance“ (CC)) auf Grundlage von Verhaltensmodellen und Befragungsergebnissen verifizieren lassen.

Im Rahmen des *ersten* Hauptteils werden geltende Europäische und nationale Gesetzesvorgaben sowie Auflagenkataloge privater Zertifizierungsstandards gesammelt und mithilfe des Österreichischen „Tiergerechtheitsindex“ (TGI), einem praxiserprobten Rahmenwerk zur Beurteilung des betrieblichen Tierschutzes, gemäß ihrer Auflagenstrenge gruppiert, bewertet und mit Vor-Ort gemessenen TGI-Profilen verglichen. Zur Abschätzung regulierter Mindesttierschutzniveaus von Schweinemastbetrieben werden die TGI-Profile anhand von Teilnahmezahlen an Zerifizierungsstandards auf die Gesamtheit der Betriebe bzw. Tierbestände im jeweiligen Land zu aggregierten TGI-Werten für konventionelle und biologische Haltungssysteme hochgerechnet. Für Rinderhaltende Betriebe werden sowohl errechnete als auch Vor-Ort gemessene TGI-Profile mit Wichtungsprofilen überlappender Tierschutzbewertungssysteme verglichen. So werden Rückschlüsse darüber gezogen, inwieweit wissenschaftlich relevante Tierschutzbedingungen Vor-Ort eingehalten und in Auflagenkatalogen gesetzlicher sowie privater Standards einbezogen werden. Die Untersuchungsresultate zeigen, dass die Auflagen gesetzlicher und privater Standards in Österreich und Deutschland je nach Nutztierart auf ähnlich hohem Tierschutzniveau angesiedelt sind. Dies lässt sich zumeist auf EU-weit einheitliche Mindestauflagen für konventionelle und biologische Betriebsarten zurückführen. Bei genauerer Betrachtung zeigen Österreichische Schweinehaltungsstandards eine größere Auffächerung in den errechneten Tierschutzprofilen als entsprechende Deutsche Standards, die sich stärker an den gesetzlichen Auflagen orientieren. Obwohl Vor-Ort erhobene als auch auf Basis von Mindestauflagen errechnete Tierschutzprofile meist parallel verlaufen, weisen die Vor-Ort erhobenen Resultate in fast allen TGI-Kriterien höhere Tierschutzniveaus aus. Besonders Auflagen bezüglich Herdenstruktur und Betreuung werden freiwillig übertroffen. Die Beachtung von Tierschutzaspekten der Bodenbeschaffenheit, des Stallklimas und Bewegungsfreiraums orientiert sich indes stärker an den Mindestauflagen der Standards. Für die Rinderhaltung wichten wissenschaftliche Beurteilungssysteme Aspekte der Bodenbeschaffenheit, des technischen Stallzustands, Bewegungsfreiraums und Auslaufs besonders stark.

Zur Umsetzung des *zweiten* Hauptteils werden mathematische Verhaltensmodelle erarbeitet, welche die Handlungsoptionen des Landwirtes in der Entscheidungssituation wiedergeben. Aus den Modellen werden Determinanten der Systemteilnahme und Hypothesen bezüglich der Entscheidungsfindung und des Systemeinhaltungsgrades abgeleitet. Zur Beurteilung der Relevanz der Determinanten werden Befragungsresultate Österreichischer Landwirte aus-

gewertet. Darüberhinaus wird die formale Beziehung zwischen Teilnahmebereitschaft und Determinanten anhand eines Probitmodells untersucht. Die Befragungsresultate dienen zusammen mit den Ergebnissen des Probitmodells zur Verifizierung oder Ablehnung der Hypothesen. Es erweist sich, dass eine rationale, von der Höhe der Betriebsprämie und den Einhaltungskosten abhängige Entscheidung zur Teilnahme an CC und Zertifizierungsstandards bestätigt werden kann. Die Resultate legen nahe, dass die Teilnahmeentscheidung unabhängig von der erwarteten Sanktionierung und Aufdeckungswahrscheinlichkeit von Verstößen ist. In Bezug auf den Einhaltungsgrad können jedoch Abhängigkeiten von der erwarteten Sanktionierung und Aufdeckungswahrscheinlichkeit von Verstößen festgestellt werden. Produktionsstandards auf Höhe gesetzlicher Mindestauflagen scheinen den Landwirt zur Teilnahme an CC oder Zertifizierungsstandards zu bewegen. Es ist anzunehmen, dass persönliche Motive die Auflageneinhaltung merklich beeinflussen.

Abstract

Farm Animal Welfare: Measurement and Compliance

The present study is divided into two main parts. The *first* main part aims at evaluating the conception of and compliance with legal and voluntary husbandry standards on Austrian and German pig fattening and cattle farms with respect to their relevance for animal welfare. The *second* main part is focussed on testing hypotheses concerning the joint decision situation of farmers choosing to participate in certification standards and/or the European Single Payment Scheme ("cross compliance" (CC)) on the basis of behavioural models and survey data.

In the course of the *first* main part, an inventory of applicable legal and farm certification standards is done. The standards are clustered into groups with identical minimum provisions. By means of the Austrian "Animal Needs Index" (ANI), a field-proven assessment framework for farm animal welfare, for each group an ANI profile is *calculated*. The latter are then compared with *on-farm measured* ANI profiles of similar farm types. For pig fattening farms, the calculated ANI profiles are extrapolated to estimate the minimum animal welfare level in the full farm or herd size population of conventional and organic farm types in Austria and Germany. This is done by weighting the ANI scores of standards in accordance to their national participation rate. For cattle farms, both calculated and on-farm measured ANI profiles are compared with weightings of animal welfare aspects provided by overlapping overall animal welfare and risk assessment systems. In this way, conclusions are drawn to what extent animal welfare conditions considered by science to be more or less relevant are imposed by standards and reflected by on-farm compliance. The results of the study show that obligations given by legal and farm certification standards in Austria and Germany are on a similar animal welfare level, depending on the livestock species. This can be largely ascribed to already harmonised European law for conventional as well as organic farm types. A closer look reveals that Austrian pig fattening standards indicate more diversification in animal welfare levels than those identified for Germany, where the labels show a greater overlap with legal standards sets. Although both calculated and on-farm measured ANI profiles show similar value patterns, the on-farm measured results disclose in nearly all ANI assessment criteria higher animal welfare levels. Especially for requirements concerning herd structure and stockman care substantial voluntary compliance is measured. However, the adherence to animal welfare aspects with regard to floor conditions, stable climate and space allowance is mainly based on the prescribed minimum obligations. Overall animal welfare and risk assessment systems for cattle farming strongly emphasise space allowance, floor, free range and technical conditions provided by the housing system.

In the course of the *second* main part, behavioural models are developed reflecting the farmer's options in the joint decision situation. The models are used to derive, on the one hand, determinants of participation in CC and/or farm certification standards and, on the other hand, hypotheses with regard to the farmer's participation choice and compliance behaviour. In order to assess the importance of the determinants, the outcomes of Austrian farm interviews are analysed. Furthermore, a formal relation between willingness to participate and the derived determinants is investigated using a probit model. The analysis of the survey together

with the results of the probit model serves as a basis for verifying or rejecting the formulated hypotheses. The research findings show that for the farmer's choice to participate in CC and farm certification standards, an underlying rational decision dependent on the amount of premia and the costs of compliance can be confirmed. The results suggest that the decision to participate is independent of the expected sanctioning and detection probability of breaches. For the degree of compliance, however, dependencies on the expected sanctions and detection probabilities of breaches can be attested. Production standards close to the legal minimum seem to prevail on the farmer to participate in CC or farm certification schemes. It can be assumed that personal motives have an appreciable influence on the compliance with requirements.

Abbreviations

AES	Agri-Environmental schemes
ALD	Assessment scheme for littered Loose housing systems of Dairy cows
AMANI	Average Minimum Animal Needs Index
ANI	Animal Needs Index
BDI	Behavioural Deprivation Index
BKA	Bundeskanzleramt
BMELF	Bundesministerium für Ernährung, Landwirtschaft und Forsten
BMELV	Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz
BMG	Bundesministerium für Gesundheit
BMGF	Bundesministerium für Gesundheit und Frauen
BMGFJ	Bundesministerium für Gesundheit, Familie und Jugend
BMVEL	Bundesministerium für Verbraucher-schutz, Ernährung und Landwirtschaft
BWAP	Bristol Welfare Assurance Programme
CAP	Common Agricultural Policy
CC	Cross Compliance
CCAT	Cross Compliance Assessment Tool
DG RTD	Directorate General Research and Technological Development
DSS	Decision Support System
DWI	Dierenwelzijnsindex
EC	European Community
EFSA	European Food Safety Authority
EU	European Union
FAS	Farm Advisory System
FAWC	Farm Animal Welfare Council
FCP	Free Choice Profiling
FCS	Farm Certification Scheme
GAEC	Good Agricultural and Environmental Condition
HPA	Hypothalamic Pituitary Adrenal
IFOAM	International Federation of Organic Farming Movements
kg	Kilogram
RSPCA	Royal Society for the Prevention of Cruelty to Animals

SFP	Single Farm Payment
SMR	Statutory Management Requirement
SPS	Single Payment Scheme
TFEU	Treaty on the Functioning of the European Union
TGI	Tiergerechtheitsindex
UK	United Kingdom
WHO	World Health Organization
WTP	Willingness to participate

Table of contents

Chapter 1 Introduction

1. Problem statement

During the last decade, the animal production sector witnessed a widespread emergence of voluntary farm certification schemes (FCS) prescribing a broad range of requirements for various livestock types and different husbandry systems (see e.g. Fraser 2006). Recent studies have shown that specific animal welfare provisions are increasingly integrated as part of FCS (Roe and Buller 2008). As these provisions may meet or exceed already existing mandatory standards imposed by national and European law, scientific literature[1] distinguishes so far basic and top level general FCS, specific animal welfare schemes as well as organic schemes. However, this classification may only serve as a rough guide for determining animal welfare, as it does not provide information concerning the relative importance of specific welfare aspects and their level of consideration in legal as well as voluntary standards. Science delivers various index systems enabling a weighting and integrated evaluation of a wide variety of farm animal welfare conditions. But to date, these concepts were only applied to assess the animal welfare status of individual farms or animal herds, not farm standards.

Weightings of animal welfare aspects form not only the basis of respective legislative standards and FCS. They can also be considered as intrinsic components (e.g. due to experiences or education) determining the farmers' husbandry actions (Simonsen 1996, p. 92). These actions may also encompass the farmers' compliance behaviour. This is of particular importance if the farmers' decisions concerning the participation in the "Single Payment Scheme" (SPS) and the related "cross compliance" (CC) system and/or FCS are observed. Scientific literature provides with the approach of Bartolini *et al.* (2008) only one attempt modelling this joint decision situation.[2] The latter describes the farmers' decision concerning participation in the SPS and voluntary schemes as an entirely rational process aiming at achieving the best economic results. As this consideration rules out the involvement of other influencing factors in the decision-making process such as asymmetric information, personal beliefs and experiences, this thesis seeks to substantiate theoretical models by empirical findings of a farm survey.

2. Research objectives and methods

This thesis addresses both problems by pursuing two main goals. *Firstly*, it focuses on comparing the relevance of animal welfare aspects for pig fattening and cattle farming as prescribed by legal and voluntary standards in Austria and Germany and determined by the farmers' on-farm compliance (Chapters 2 and 3). Based on this comparison information about the relative importance of welfare conditions as assigned by farm standards and on-farm compli-

[1] Given e.g. by Bock and van Leeuwen (2005, p. 149) and European Commission (2009*b*, p. 6f.).
[2] See also Section 1 of Chapter 4 of this thesis.

ance is retrieved. By means of the Austrian "Animal Needs Index" (ANI), a field-proven overall animal welfare assessment framework, inventoried minimum compliance levels imposed by farm certification schemes and national or European law are evaluated and compared with the farmers' on-farm compliance. In order to do so, the husbandry standards are condensed to groups[3] prescribing identical animal welfare obligations. Full compliance with the groups' minimum requirements is aligned with attribute levels of the ANI point scales. The resulting ANI profiles are compared with on-farm measured ANI results derived from an Austrian field study. Overlap between the "calculated" ANI profiles and measured on-farm compliance is analysed and interpreted. In the case of pig fattening farms, the ANI profiles are extrapolated, enabling an estimation of the minimum animal welfare level in the full farm or herd size population in Austria and Germany (Chapter 2). This is achieved by weighting their ANI scores with respective shares of farms and herd sizes joining a specific standard. In the case of cattle farms, the ANI profiles are additionally compared to weightings of animal welfare aspects[4] provided by overall welfare and risk assessment systems given in scientific literature (Chapter 3). By this means, conclusions are drawn to what extent aspects, considered by science to have a high or low relevance for animal welfare, are reflected by requirements of legislative and certification standards and the farmers' actual on-farm compliance.

Secondly, the doctoral thesis aims at deriving and validating hypotheses concerning the joint decision situation of farmers choosing to join the European SPS and observe related CC obligations and/or to participate in voluntary FCS[5] (Chapter 4). In this regard, the joint decision situation is described by means of mathematical models. The latter are used to derive determinants for participation and non-participation in the SPS and/or FCS as well as hypotheses concerning the farmers' compliance behaviour. In order to evaluate the significance of the identified determinants, results of an Austrian farm survey are investigated by means of a probit model. Finally, the outcomes of this procedure are interpreted to verify or reject the formulated hypotheses.

3. Definitions

This Section 3 provides definitions of terms relevant for the understanding of this introductory chapter. They may partly overlap with explanations given in subsequent chapters.

3.1. Animal welfare

Scientific literature provides a wide variety of definitions of the term "animal welfare" deriving from different disciplines and perspectives[6]. However, an important milestone in defining animal welfare is set by Rushen and de Passillé (1992), Mason and Mendl (1993) and Fraser

[3] As all standards of each group reach the same ANI score, the groups are in the following chapters referred to as *ANI groups*.
[4] These weightings are in the following called (*welfare) risk weightings*.
[5] The investigation addresses additionally the case of non-participation in the SPS and FCS.
[6] A short overview of relevant definitions is given under Section 1 of Chapter 2 of this thesis.

(1995) considering it as a "multidimensional concept". This multidimensionality presupposes the identification of factors relevant for defining animal welfare. The manifold animal welfare assessment procedures given in scientific literature distinguish a broad range of parameters measuring different aspects of welfare. Together they do not only serve as a means for evaluation, but also provide an integrated understanding of animal welfare[7]. The "Five Freedoms" formulated by the Farm Animal Welfare Council (FAWC) (1993) gained so far widespread acceptance as precepts of good animal welfare and form the conceptual basis of several farm animal welfare assessment methods. Based on the approach of Dawkins (1993), they identify the determinants of the animals' own awareness of their welfare state and specify conditions to preserve it (Webster 2001, p. 233). They can be distinguished as follows:

"(1) *Freedom from thirst, hunger and malnutrition* - by ready access to fresh water and a diet to maintain full health and vigour; (2) *freedom from discomfort* - by providing a suitable environment including shelter and a comfortable resting area; (3) *freedom from pain, injury and disease* - by prevention or rapid diagnosis and treatment; (4) *freedom to express normal behaviour* - by providing sufficient space, proper facilities and company of the animal's own kind; (5) *freedom from fear and distress* - by ensuring conditions which avoid mental suffering." (Webster 2001, p. 233)

Bartussek (1999) uses these Five Freedoms as the definitorial basis of farm animal welfare for developing a framework to evaluate existing livestock housing and management systems. As the application of the resulting ANI 35L plays a crucial role for the following assessments, the Five Freedoms consequently serve as definition of farm animal welfare for this dissertation.

3.2. Welfare risk weighting

If we assume that the adherence to increased animal welfare obligations generally results in a positive animal welfare effect, in turn, non-compliance with the same requirements would cause the adverse negative animal welfare effect (see also European Food Safety Authority (EFSA) 2009, p. 8f.). According to the food risk assessment terminology given by the "Codex Alimentarius" (World Health Organization (WHO) 1999), a hazard is "a biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect". Analogous to this risk assessment terminology of the Codex Alimentarius, the EFSA (2009, p. 7) defines a hazard in animal welfare risk assessment as "a design criterion with a potential to cause a negative animal welfare effect". In index systems for overall animal welfare evaluation these design criteria are represented by weighted assessment scales awarding point values. Hence, the awarded score corresponds to the severity of the adverse animal welfare effect if the respective assessment criteria are not met and consequently quantify the risk for animal welfare (see also EFSA 2009, p. 8f.). In order to simplify further explanations, we speak in the following chapters of *(welfare) risk weightings*.

[7] In this regard, Section 6 gives an overview of integrated farm animal welfare evaluation approaches.

According to this definition, welfare risk weightings also form the basis for determining legislative standards, farm certification requirements and the farmers' individual degree of on-farm compliance reflecting his willingness to implement animal welfare measures. But unlike index systems for overall animal welfare evaluation that already specify risk weightings by means of point scales, obligations of production standards and measured on-farm compliance are subject to intrinsic risk weightings pre-defined by legislation, farm certification schemes and the farmer's individual risk behaviour.

3.3. Minimum ANI

Following the procedure described in Chapter 2 and 3 of this thesis, the ANI 35L framework is used to evaluate livestock production standards for fattening pigs and cattle given by legislation and farm certification schemes. Due to its substantial overlap with indicators applied for official farm monitoring in Austria and Germany[8], it enables an assessment of production obligations. Livestock farming standards, either specified by European and national law or formulated in codes of practice of farm certification schemes, are set up in terms of minimum requirements. An evaluation of the standards' minimum requirements by means of the ANI 35L framework results in measure-specific ANI scores that can be summarised to a standard-specific overall ANI score. As these ANI scores represent the *minimum* animal welfare levels evaluated for compliant farms, they are in the following chapters considered as *minimum ANIs*.

3.4. AMANI score

To project the calculated minimum ANIs onto the full conventional and organic farm population, so-called "average minimum ANI scores" (AMANI scores) are calculated. These are the result of multiplying each minimum ANI of relevant conventional or organic standards with its "participation rate". The latter represents an aggregation weight indicating either the number of animals[9] or farms[10] covered by each legislative or certification standard. The extrapolation procedure applied to calculate AMANI scores is illustrated in Table 4.2 of Chapter 2 of this thesis. Relevant data on herd sizes and farms is provided by certification schemes and local monitoring bodies.

Following this definition, the calculated AMANI scores provide an overview of the minimum animal welfare level across a high number of farms associated to conventional and organic livestock production. Due to the definition of minimum ANIs, the AMANI calculations are based on the assumption that all farms comply with compulsory minimum requirements imposed by the legal standard and, in the case of certified farms, additional voluntary obligations prescribed by farm certification schemes.

[8] This is illustrated by Tables 2.2 of Chapter 2 and 3 of this doctoral thesis.
[9] Herd sizes of animals are relevant for the evaluation of Austrian standards.
[10] The number of farms is relevant for the evaluation of German standards.

4. Legislative standards to ensure animal welfare for pigs and cattle

Compulsory standards for farm animal welfare are prescribed by European as well as national legislation. In this regard, national law must at least comply with European rules and regulations[11]. However, it may also exceed European law by imposing more stringent obligations (see e.g. Veissier *et al.* 2008, p. 283; Elbersen *et al.* 2010, p. 72). This applies in particular to the member states United Kingdom (UK), Sweden and Norway demanding, for example, group housing for non-suckling sows in all buildings (Bock and van Huik 2007, p. 82f.) or the Netherlands prescribing stricter requirements concerning the space allowance of fattening pigs[12]. But also for Austria more stringent obligations for cattle farming are detected (see Chapter 3 of this thesis).

Following the aims of this doctoral thesis the Chapters 2 and 3 provide ANI-based evaluations of legal farm animal welfare standards for fattening pigs and cattle existent in Austria and Germany. In this regard, Section 4 of this introduction provides an overview of the considered legal acts given by the European CC system and national legislation in Austria and Germany.

Depending on the individual farm type or situation, the Austrian as well as the German animal welfare legislation provide for transitional periods for certain requirements. The baseline year of the ANI-based evaluations for fattening pigs and cattle is set at 2009, consequently reflecting the compulsory animal welfare conditions to be applied by all farmers by the end of 2009. Requirements relevant for the ANI-evaluations but assigned with transitional periods expiring at a later date are not considered in the assessments.

4.1. European cross compliance standards[13]

With the June 2003 agreement[14] a fundamental reform the common agricultural policy (CAP) of the European Union (EU) has been adopted. As core element, the full receipt of "decoupled" direct payments has been linked to the adherence of specific "cross compliance" (CC) conditions. The latter represent two sets of minimum standards. One set features standards of Good Agricultural and Environmental Condition (GAECs) outlining obligations with respect

[11] The European Commission is accountable for ensuring that EU law is properly applied in the Member States. This is given by article 258 of the "Treaty on the Functioning of the EU" (TFEU) and article 141 of the "Euratom Treaty". (see TFEU 2008; Treaty Establishing the European Atomic Energy Community 2010; Veissier *et al.* 2008, p. 282f.; European Commission 2011)

[12] Higher space allowance for stables "built before 1 November 1998 and that have not been rebuilt or altered since 1 November 1998 the minimum requirements for old stables apply. Stables or floors that have been built or rebuilt after 1 November 1998 have to adhere to the minimum space requirements for new stables" (Veissier *et al.* 2008, p. 291).

[13] The explanations of this section are extracted from "Council Regulation (EC) No 73/2009 laying down general rules for the establishment of the European Cross Compliance system" (amended by Commission Regulation (EU) No 360/2010) as well as from "Commission Regulation (EC) No 1122/2009 formulating particular provisions for the enforcement of Council Regulation (EC) No 73/2009" (amended by Commission Regulation (EU) No 146/2010) (European Council 2009; European Commission 2009*a*; European Commission 2010*a*; European Commission 2010*b*).

[14] Given by Council Regulation (EC) No 1782/2003 (European Council 2003). Council Regulation (EC) No 1782/2003 is already replaced by Council Regulation (EC) No 73/2009 (European Council 2009).

to soil conservation, minimum maintenance of agricultural land and the preservation of landscape elements that are to be defined by Member States. The other set specifies 18 Statutory Management Requirements (SMRs) relating to obligations already formulated in 19 pre-existing EU Directives and Regulations in the areas of public, animal and plant health, environment and animal welfare. These SMRs have been introduced in stages at the beginning of the years 2005, 2006 and 2007. Table 4.1 gives an overview of the CC SMRs relevant for farm animal welfare applicable from the beginning of 2007. Short descriptions of the SMRs can be found in the Tables 2.2 of the Chapters 2 and 3 of this thesis.

Table 4.1: CC SMRs in the field of farm animal welfare

CC relevant legal acts	Topic	Relevant articles
Council Directive 91/629/EEC[1]	Protection of calves	Articles 3 and 4
Council Directive 91/630/EEC[2]	Protection of pigs	Articles 3 and 4(1)
Council Directive 98/58/EC	Protection of animals kept for farming purposes	Article 4

Legend: CC: Cross compliance; EC: European Community; EEC: European Economic Community.
[1]: Codified by Council Directive 2008/119/EC (European Council 2008*a*).
[2]: Codified by Council Directive 2008/120/EC (European Council 2008*b*).
Source: Own representation based on Council Regulation (EC) No 1782/2003 (European Council 2003) and Council Regulation (EC) No 73/2009 (European Council 2009).

To ensure compliance with these obligations, a regular farm monitoring is necessary. Concerning this matter, the supervision is the responsibility of the competent authorities of the Member States. According to the EU framework, at least 1% of the farmers receiving direct payments have to be controlled systematically by the competent control body on the basis of an annual updated risk analysis and to some extent randomly (see also Kuhn *et al.* 2008). To reduce monitoring efforts, systematic on-the-spot checks can be integrated to control compliance with various EU laws and provisions (see also Wagner 2010, p. 5). As Nitsch and Osterburg (2008, p. 6) point out, as part of other kinds of checks any detected infringements of relevant standards may entail sanctioning pursuant to the CC framework. These so-called "cross checks" involve controls initiated due to cases of suspicion or complaint (see also Breitschuh *et al.* 2006, p. 10; Nitsch and Osterburg 2007, p. 13).

To support farmers in their adherence to CC relevant standards, Member States were obliged to maintain a national "Farm Advisory System" (FAS) covering at least the SMRs and GAECs. These FAS can be represented by one or more appointed authority or private body. To organise the advisory services, Member States may define priority classes of farms requesting for information. Apart from FAS, also the voluntary participation in farm certification schemes can reduce the risk of non-compliance with mandatory standards. Therefore, the participation in farm certification schemes can be considered within the risk analysis of the competent control authorities yielding lower control frequencies of the respective farms.

In case of non-compliance with SMRs or GAECs, the farmer's total amount of direct payments to be approved in the calendar year in which the non-compliance takes place is diminished or withdrawn. In this regard, premia reductions only apply if the non-adherence to CC obligations is directly attributable to the farmer concerned, his agricultural activity or the agricultural area of his holding (see also European Commission 2010*c*). Furthermore, compe-

tent authorities or bodies have to evaluate breaches based on the criteria severity, extent, permanence and repetition. The outcomes of this procedure are used for the determination of reduction rates.

The reduction rates are further determined based on non-compliance due to negligence or intentionality (see also Wagner 2010, p. 8). In case of first and negligent non-compliance, light breaches result in a reduction rate of 1% whereas violations on a medium scale lead to a 3% shortening of direct payments. Severe infringements of the same kind induce a premia reduction of 5%. Several first-time breaches detected within one field[15] and a one year period are treated as one violation (see also Breitschuh *et al.* 2006, p. 10; Wagner 2010, p. 9)[16]. Are negligent breaches detected within different fields, the total reduction rate is limited to 5% (see also Breitschuh *et al.* 2006, p. 10).

"Repeated" non-compliance occurs if the same violation reappears within a three year period. Is this the case, the reduction rate of the current year[17] is multiplied by a factor of 3. If the same violation is detected several times within the time frame, the premia reduction is limited to a maximum of 15%. Is this maximum reduction rate imposed, the competent authority informs the farmer concerned that any further non-compliance with the same obligation will be regarded as an intentional act (see also Wagner 2010, p. 10). As a result, the reduction rates may exceed 15% and a complete cancellation of direct payments is possible (see also Breitschuh *et al.* 2006, p. 10).

In cases of minor violations in terms of severity, extent and permanence a de minimis arrangement is applied allowing all Member States to decide whether a reduction of premia is to impose[18]. Concerning this matter, breaches posing an immediate threat to public or animal health must not be classified as minor. (see also Wagner 2010, p. 8)

4.2. National standards in Germany

In September 2005, the Court of Justice of the EU sentenced the Federal Republic of Germany for failing to timely implement minimum requirements for pig farming[19] within its legal system (Court of Justice of the EU 2005). As a consequence, the "Tierschutz-Nutztierhaltungsverordnung" has been recast by the Federal Ministry of Agriculture (Bundesministerium für Ernährung, Landwirtschaft und Verbrauscherschutz (BMELV)), passed the legislative process and finally came into force in August 2006 (BMELV 2006*a*).

[15] The CC framework allocates obligations to the following fields: (1) "public, animal and plant health", (2) "environment", (3) "animal welfare" and (4) GAECs (see European Council 2009).

[16] If infringements assigned to different reduction rates are registered within one field, the paying agency may adjust the reduction rate in accordance to the outcomes of the risk analysis of the competent control authority (see European Commission 2009*a*). In the case of the German "Bundesländer", the highest allocated reduction rate is imposed (e.g. Breitschuh *et al.* 2006, p. 10ff.; Wagner 2010, p. 9).

[17] In the case of more than two breaches against the same obligation within a three year period, the reduction rate of the previous year is applied (see European Commission 2009*a*).

[18] The punishment of breaches resulting in a premia reduction of not more than 100 Euro per farmer and calendar year lies within the discretion of the Member States (European Council 2009).

[19] Given by "Council Directive 2001/88/EC and Commission Directive 2001/93/EC amending Directive 91/630/EEC laying down minimum standards for the protection of pigs" (European Commission 2001; European Council 2001).

Under additional consideration of its amendments and general obligations given by the German "Tierschutzgesetz" of 2006 (BMELV 2006*b*), it represents the applicable animal welfare law for livestock farming in Germany based on minimum requirements formulated in relevant EU Directives. It involves specific as well as general provisions for the housing conditions and keeping of calves, laying hens and pigs. For adult cattle only general obligations are formulated covering the more horizontal "Animal Protection Directive"[20] applying to all livestock types.

However, if we refer to the definition of animal welfare given in Section 3.1 of this Chapter, animal transport and hygiene issues must also be considered, as these may have impacts on the animals' freedom from discomfort, pain, injury or disease. The relevant national law is provided by the "Schweinehaltungshygieneverordnung"[21] for pigs and the "Tierschutztransport-Verordnung"[22] applying to all livestock types. Whereas general guidelines concerning the execution of official farm monitoring are given by the "Tierschutzgesetz", competent state authorities are responsible for the application of risk assessment and specific control procedures.

4.3. National standards in Austria

In order to achieve conformity with EU rules, the September 1993 agreement of the "Bundesländer" concerning the protection of animals in agricultural production[23] has been reached, establishing a common minimum standard for farm animal welfare in Austria. However, regionally different implementations prevented a complete and nation-wide harmonisation of requirements (Blaas 2007). Moreover, the agreement did not provide for penalty provisions and could be terminated by the federal governments (Kallab *et al.* 2005 as cited by Ottensamer 2006, p. 5f.; Landesregierung Tirol 2005; Landesregierung Salzburg 2006).

After years of intensive negotiation[24], the increased need for nationally harmonised animal welfare legislation finally led to the unanimous resolution of the nationwide applicable "Bundestierschutzgesetz"[25] by the Austrian National Council in May 2004. As legal basis for animal welfare in Austria, the latter aggregates general as well as specific rules for the keeping of animals for farming and other purposes covering relevant EU provisions. It is enforced by several implementing regulations formulating minimum requirements such as the "1. Tier-

[20] "Council Directive 98/58/EC concerning the protection of animals kept for farming purposes" (European Council 1998).
[21] "Regulation of 7 June 1999 concerning hygienic provisions for the keeping of pigs" in its current wording (Bundesministerium für Ernährung, Landwirtschaft und Forsten (BMELF) (1999) as amended by BMELF (2000), Bundesministerium für Verbraucherschutz, Ernährung und Landwirtschaft (BMVEL) (2002), BMELV (2007) and BMELV (2009*a*)).
[22] "Regulation of 11 February 2009 concerning the protection of animals during transport" implementing Council Regulation (EC) No 1/2005 of 22 December 2004 (BMELV 2009*b*).
[23] Agreement of 13 September 1993 pursuant to article 15a Bundes-Verfassungsgesetz concerning the protection of animals in agricultural production (see e.g. Landesregierung Vorarlberg 1995).
[24] Described in more detail by Weber (2004).
[25] "Federal Act on the Protection of Animals (Animal Protection Act)" in its current wording (Bundeskanzleramt (BKA) 2004; Bundesministerium für Gesundheit, Familie und Jugend (BMGFJ) (2007) as amended by BKA (2008), BMGFJ (2008*a*) and Bundesministerium für Gesundheit (BMG) (2010*a*)).

haltungsverordnung"[26] that specifies all animal welfare obligations for the keeping of farm animals. The remaining influence fields of farm animal welfare are regulated by the "Tierschutz-Schlachtverordnung"[27] legislating minimum requirements for slaughter operations and the "Tierschutz-Kontrollverordnung"[28] defining obligations for official farm monitoring. Rules concerning the transportation of animals are imposed by the national "Tiertransportgesetz"[29] of 2007 replacing divergent regulations on state level.

By publishing manuals editing legal texts as well as checklists for on-farm monitoring in 2006, the Austrian Ministry of Agriculture set the stage for the self-evaluation of farm housing conditions[30]. As the self-evaluation checklists and manuals aggregate all relevant farm animal welfare obligations for fattening pigs and cattle, they were used for the ANI-based evaluations given in further chapters of this thesis.

5. Consideration of animal welfare in farm certification schemes

An integrated evaluation of animal welfare prescriptions requires not only the consideration of legal standards but also the involvement of voluntary provisions. The latter are part of various types of FCS described and classified in the following Section 5.1. A more detailed characterization of organic FCS is given under Section 5.2.

5.1. Classification of farm certification schemes

During the last decade, the European agrifood sector witnessed an increasing implementation of certification schemes[31] covering the entire supply chain from agricultural production to retailing (see Hatanaka *et al.* 2005, p. 365; Fraser 2006, p. 93; Theuvsen *et al.* 2007, p. 563; European Commission 2009*b*, p. 4). Due to a recent study[32], 386 certification schemes could be identified in the European agrifood sector (see also European Commission 2009*b*, p. 4).

Like legislative standards, farm certification schemes define minimum requirements for the farmer to meet, provide monitoring systems to control adherence to these requirements and allow for sanctions if non-compliance occurs (Farmer *et al.* 2007, p. 18ff.). Bredahl *et al.* (2001, p. 100) and Farmer *et al.* (2007, p. 17) stress that although the membership in farm

[26] "Regulation of the Federal Minister for Health and Women of 17 December 2004 concerning minimum requirements for the keeping of horses and equine, pigs, cattle, sheep, hoofed game, lamas, rabbits, domestic poultry, ostriches and domestic fish" in its current wording (Bundesministerium für Gesundheit und Frauen (BMGF) (2004*a*) as amended by BMGF (2006*a*), BMGF (2006*b*) and BMG (2010*b*)).
[27] "Regulation of the Federal Minister for Health and Women of 17 December 2004 concerning the protection of animals on slaughter or killing" in its current wording (BMGF (2004*b*) as amended by BMGF (2006*c*)).
[28] "Regulation of the Federal Minister for Health and Women of 17 December 2004 concerning the monitoring of the compliance with animal protection provisions" in its current wording (BMGF (2004*c*) as amended by BMGF (2006*d*), BMGFJ (2008*b*) and BMG (2010*c*)).
[29] "Federal Act of 31 July 2007 concerning the transport of animals and related operations" (BMGFJ 2007).
[30] The manuals and checklists were developed for the self-evaluation of housing conditions for pigs, cattle, goats, sheep and poultry (see Ofner *et al.* 2007).
[31] Also referred to as "farm assurance schemes/programmes" or "labelling schemes".
[32] Provided by the "Food Quality Assurance and Certification Schemes Managed within an Integrated Supply Chain" research project (European Commission 2006).

certification schemes is per se voluntary, it can in some cases be considered as a precondition for market access and/or claiming additional charges[33]. In this context, this so-called "quasi-voluntary" certification (Bredahl *et al.* 2001) is differentiated by, e.g., the livestock sector, the certification grade and/or the geographical localisation of the farm concerned.

According to Meuwissen *et al.* (2003, p. 172), one main goal of certification is to demonstrate an achieved quality or performance standard to stakeholders such as consumers, clients, governments or banks. "Eurobarometer" surveys[34] conducted in 2005 and 2006 indicate that farm animal welfare is highly relevant to European citizens and influences increasingly the consumer's choice of food (see also Evans and Miele 2007). Furthermore, the results of a recent EU-funded research project[35] indicate that particular animal welfare provisions are increasingly implemented in farm certification schemes (Roe and Buller 2008). But an increased implementation of animal welfare requirements does not necessarily mean that the requirements exceed existing legislative standards. As stand-alone animal welfare labelling is not very common in the EU, it can be merely assumed that animal welfare is to some extent considered as a quality feature whose integration in farm certification schemes is becoming a precondition for market access (Bock and van Leeuwen 2005, p. 143; Roe and Buller 2008; Passantino *et al.* 2008, p. 396). Moreover, in order to obtain marketing advantages the implementation of animal welfare obligations in farm certification schemes may also respond to the wishes of particular customer groups or adress to societal concerns (Manning *et al.* 2006, p. 92f., Farmer *et al.* 2007, p. 17).

Generally, the integration of animal welfare provisions in farm certification schemes ranges from a clear focus on animal welfare conditions to emphasising other topics, for example, food safety or environmental issues that may improve animal welfare (Wood *et al.* 1998, p. 198; Bock and van Leeuwen 2005, p. 125f.; European Commission 2009*b*, p. 6f.). However, as pointed out by a recent study launched by the European Commission (2009*b*, p. 4f.), all of these farm certification schemes show basic similarities: On the one hand, they are directed towards the end-consumer by ensuring adherence to differentiated animal welfare obligations above legal minimum requirements while, on the other hand, focusing on production processes on farm level. Furthermore, they are in most cases privately operated, may be supported by a small number of animal welfare organisations and have traditionally a national coverage[36] (European Commission 2009*b*, p. 5).

But farm certification schemes can differ considerably with respect to the type of imposed animal welfare obligations. In this regard, Main *et al.* (2001, p. 108f.) stresses that relevant animal welfare criteria considered by farm certification schemes may address conditions

[33] This applies, for instance, to the conventional pig farming sector in Germany.
[34] Special Eurobarometer 229 "Attitudes of consumers towards the welfare of farmed animals" (Eurobarometer 2005, p. 72) and Special Eurobarometer 270 "Attitudes of EU citizens towards Animal Welfare" (Eurobarometer 2007, p. 49). The outcomes of the surveys are to some extent confirmed by results of the Welfare Quality® project focussed on research in seven European countries (Hungary, Italy, France, the United Kingdom, the Netherlands, Norway and Sweden) (Kjærnes and Lavik 2007, p. 6f.).
[35] The "Welfare Quality®" research project.
[36] Some farm certification schemes provide cross-border programmes for mutual recognition of other labels in the context of cooperation.

concerning farm resources (e.g. the condition of flooring), management (e.g. the regular inspections of animals), the keeping of farm records (e.g. concerning the administration of drugs) as well as the animal's welfare status (e.g. the condition of claws).

According to Fraser (2006, p. 98f.), these animal welfare requirements can be distinguished into four broad categories: The first category is represented by requirements created to sustain basic health and body functions, expecting to show a low occurrence of disease and good preconditions for survival, growth and reproduction. Examples for this category of requirements are obligations concerning space allowance (e.g. 0.65 m² for pigs with a weight up to 110 kg), restrictions on the ammonia content in the air of the stables and the assurance of iron supply in veal calf fattening. The second category is represented by requirements addressing to "affective states" of the animals, aiming at reducing e.g. starvation, pain and suffering. They cover obligations, for example, concerning the use of local anesthesia during the dehorning of cattle or the application of electric cow trainers. Whereas a third category of requirements is targeted on the assurance to express natural behaviour, for example, the possibility to turn around in the stable, the last category of requirements aims at the availability of natural influences in the animals' environment prescribing obligations concerning e.g. the access to pasture or the minimum level of daylight in the stables. (Fraser 2006, p. 98f.)

In view of this classification, Fraser (2006, p. 98) states that the different types of requirements can be found in different livestock farming standards: Whilst requirements of the first and third category are mainly used in legislative standards[37], requirements of the fourth category are often found in codes of practice of organic farm certification schemes. However, requirements of the second category are used to some extent in various types of livestock farming standards. (Fraser 2006, p. 98)

5.2. Organic farm certification schemes

With the standards of the International Federation of Organic Farming Movements (IFOAM), an alternative agricultural production philosophy aiming at ethical principles with regard to environmental, human, animal and plant health, food quality and safety issues, gained worldwide acceptance. The current IFOAM standards[38] form the basis of what is known as "organic farming". Organic livestock farming differs in many ways from comparable conventional production (see e.g. Kijlstra and Eijck 2006, p. 78).

With respect to animal welfare on pig and cattle farms, the EU Eco-Regulation[39] imposes substantially stricter conditions compared to the legislative farming standard prescribed for conventional farms: First of all, it prescribes considerably higher space allowance requirements in the stables, permanent outdoor access[40] and the application of loose housing sys-

[37] These requirements are particularly used in initial EU Directives concerning animal welfare (Fraser 2006, p. 98).
[38] The current version of the basic IFOAM standards is given by IFOAM (2006).
[39] Given by "Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91" (European Council (2007) as amended by European Council (2008*c*)).
[40] Pursuant to article 14(1) of Council Regulation (EC) No 834/2007, the livestock "shall have permanent access to open air areas, preferably pasture, whenever weather conditions and the state of the ground allow this unless restrictions and obliga-

tems[41] (cattle). The animals have to be kept on straw bedding and fed with organic feedstuffs[42] as well as dietary fiber (sows). Whereas the usage of antibiotics is subject to restrictions, the waiting times after the administration of veterinary drugs are extended. Surgery such as teeth, beak and tail clipping and castration is generally forbidden. For pigs, the weaning periods are prolonged. (Kijlstra and Eijck 2006, p. 78)

Although the IFOAM organic standard has been criticized for a rather implicit consideration of animal welfare issues and poor scientific justification of its ethical principles (Alrøe *et al.* 2001, p. 281; FAWC 2001, p. 25; Hovi *et al.* 2003, p. 47; Lund 2006, p. 76), most of its measures are considered by science to have a positive impact on overall farm animal welfare (Hörning 2000; Sundrum 2001, p. 210f.; Hovi *et al.* 2002, p. 354; Annen *et al.* 2011, p. 51). However, other measures may also entail negative impacts on farm animal welfare. In case of pig farming, for example, there is evidence that the parasitic load is considerably higher when pigs have access to outdoors (see e.g. Baumgartner *et al.* 2003; Eijck and Borgsteede 2005). For organic calves, Höglund et al. (2001) detected an increased occurrence of lungworm infections in Swedish herds that is assumed to be correlated with the ban on the prophylactic use of antihelminthics for organic farms. Another important aspect that may influence the welfare of organic cattle is pointed out by von Borell and Sørensen (2004, p. 6). According to current EU legislation[43], the dehorning of organic cattle requires approval of the competent authority and therefore is not widespread among organic farms. But horned cattle can cause serious injuries, especially when they are kept indoors (von Borell and Sørensen 2004, p. 6).

Given that in several EU member states consumers consider products of organic livestock farming to be more "animal friendly" than comparable conventional products, animal welfare has become an important quality feature of organic products (Harper and Makatouni 2002, p. 297; Lund and Algers 2003, p. 56). Consequently, organic labels convert perceived animal welfare benefits of organic production into purchase incentives (e.g. Hovi *et al.* 2003, p. 47).

6. Methodological background: Integrated farm animal welfare evaluation methods

Both legal and voluntary husbandry standards impose a large number of animal welfare provisions. Following the aims of this doctoral thesis, the latter are evaluated by means of a multidimensional assessment approach based on the Austrian ANI framework. But the ANI is only one approach among a variety of other frameworks assessing overall farm animal wel-

tions related to the protection of human and animal health are imposed on the basis of Community legislation". Further exceptions apply for farms with a small number (defined on national level) of cattle kept in tie stalls. In this case, transitional periods have to be observed. (European Council 2007)

[41] The transitional period for older organic cattle farms fitted with tie-stalls ends by the end of 2013 (European Commission 2008*a*). For farms with a small number (defined on national level) of cattle kept in tie stalls, this transitional period may be extended by the respective EU member state (European Council 2007).

[42] Pursuant to article 43 of Commission Regulation (EC) No 889/2008 "the use of a limited proportion of non-organic feed of plant and animal origin is allowed where farmers are unable to obtain feed exclusively from organic production" (European Commission (2008*a*) as amended by European Commission (2008*b*) and European Commission (2009*c*)).

[43] Given by article 18(1) of "Commission Regulation (EC) No 889/2008 of 5 September 2008 laying down detailed rules for the implementation of Council Regulation (EC) No 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control" (European Commission (2008*a*) as amended by European Commission (2008*b*) and European Commission (2009*c*)).

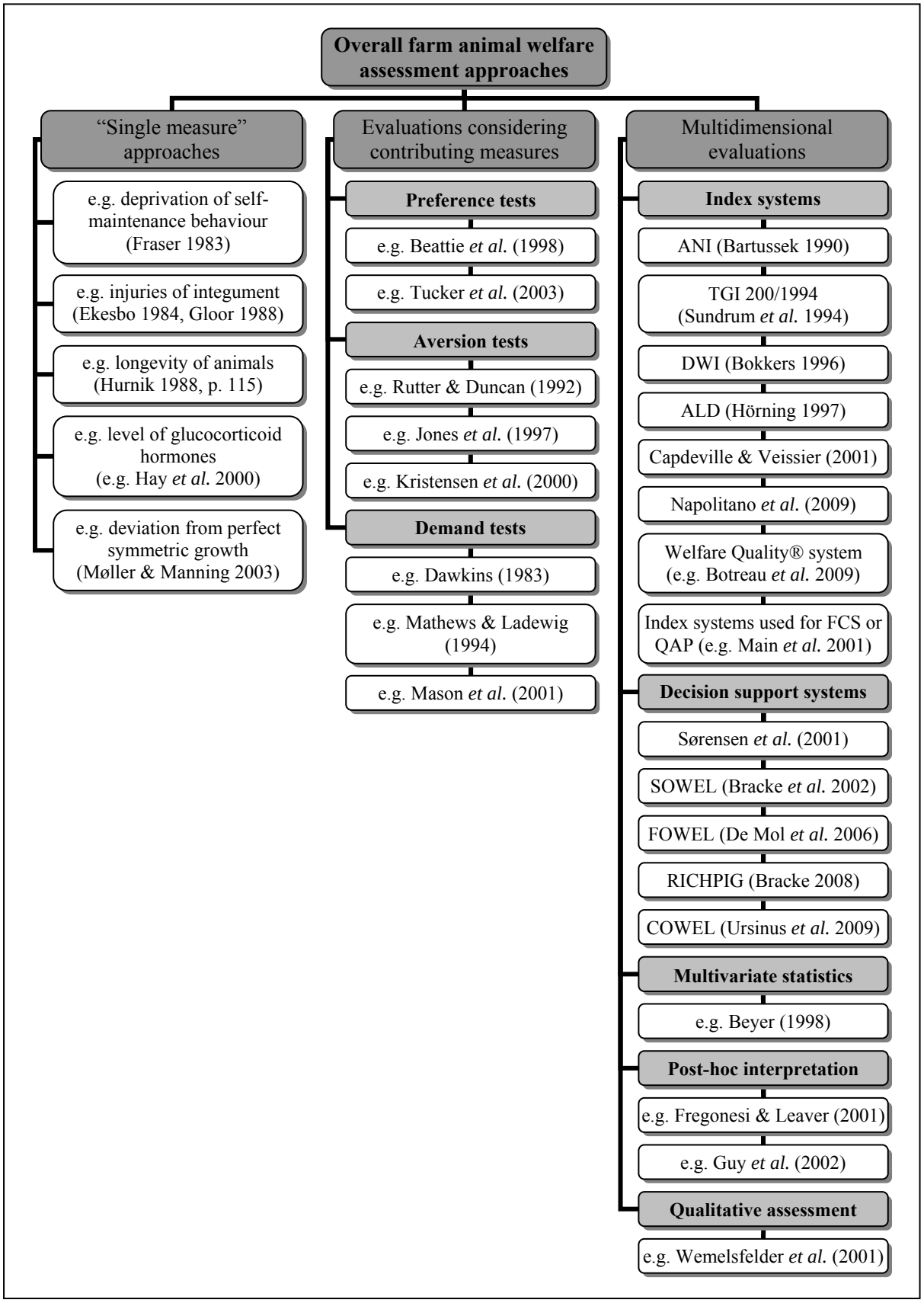
fare at herd level. In order to integrate the ANI into the research context, the Sections 6.1 to 6.4 give an overview of the existing evaluation approaches and provide a short description of their conceptual differences and the way measurements are done. It is followed by Section 6.5 outlining the general limitation of multidimensional evaluation methods.

6.1. Categories of welfare parameters and evaluation approaches

In the scientific literature a broad range of indicators for assessing on-farm animal welfare can be found. According to Johnsen *et al.* (2001, p. 27), the latter can be distinguished into animal-based and environment-based parameters: Animal-based parameters aim at capturing the animals' direct response to their housing conditions. They record the animals' state with respect to physiological, behavioural and health aspects by addressing, for example, the condition of integument or claws, fertility, milk yield (cattle) or signs of abnormal behaviour. But particularly for behavioural and physiological issues, the evaluation of animal-based parameters is complex, time and cost intensive and requires substantial effort with respect to assessment expertise, measurement setup and the interpretation of the results (see also Hörning 2001, p. 42; Winckler *et al.* 2003, p. 620; Whay *et al.* 2003*b*, p. 611). Environment-based parameters, however, focus on the description of housing conditions allowing conclusions on the animals' welfare state. They specify attributes of the animals' surroundings and stockmanship as given by the condition of flooring in the stables, the availability of drinking facilities or conditions concerning space allowance and outdoor access. In comparison to animal-based parameters enabling direct evaluations of the animals' welfare state, environment-based parameters are limited to indirect assessments of environmental factors relevant for animal welfare. Generally, the survey of environment-based parameters is rather uncomplicated, as their evaluation is simple, less time and cost intensive and in most cases reliable (see also Alban *et al.* 2001, p. 100; Waiblinger *et al.* 2001, p. 74; Spoolder *et al.* 2003, p. 530). (Johnsen *et al.* 2001, p. 27)

Both animal-based and environment-based indicators are used for overall animal welfare assessment. Overall animal welfare assessment concepts aim at evaluating the on-farm animal welfare status of livestock and/or housing systems. Fraser (1995) distinguishes three broad categories of overall animal welfare assessment approaches: The first one seeks to evaluate overall farm animal welfare by means of a single characteristic. A second approach aims at assessing animal welfare based on a single, not directly measurable characteristic that can only be evaluated by considering several contributing characteristics. And finally the third, more common scientific approach considers animal welfare as a "multidimensional concept" assuming that single characteristics can not cover all dimensions of welfare (see also Rushen and de Passillé 1992; Fraser 1995; Rousing *et al.* 2001, p. 54f.; Botreau *et al.* 2007*b*, p. 1179; Botreau *et al.* 2009, p. 363). It provides the integration of several welfare measures into an overall welfare assessment system that may have an animal-based and/or environment-based focus (see also Blockhuis *et al.* 2003, p. 446f.; Smulders *et al.* 2006, p. 439). An overview of overall farm animal welfare approaches is given by Figure 4.1.

Figure 4.1: Overview of integrated farm animal welfare assessment approaches



Legend: ALD: Assessment scheme for Littered loose housing systems of Dairy cows; ANI: Animal Needs Index; DWI: Dierenwelzijnsindex; e.g.: for example; FCS: Farm certification schemes; QAP: Quality assurance programmes; TGI: Tiergerechtheitsindex.
Source: Own compilation using a combination of Fraser (1995) and update of Spoolder *et al.* (2003).

6.2. "Single" measure approaches

Most of the "single" measure approaches found in the scientific literature refer to physiological and pathological aspects. One exception is the method of Fraser (1983), known as the "Behavioural Deprivation Index" (BDI), allowing to draw conclusions on the overall animal welfare status of housing conditions based on behavioural observations. Starting from the assumption that the animals' successful self-maintenance behaviour is the basis of animal health, Fraser (1983) developed species-specific[44] ethograms outlining natural behavioural patterns determined from extensive studies. These ethograms are distinguished into eight generic systems addressing the animals' reactivity, ingestion, exploration, kinesis, social contact, body care, territorialism and rest. In order to calculate the BDI score, the behavioural patterns of the ethograms are compared with on-farm observations. The number of the behavioural patterns (as described in the ethograms) not performed by the animal is divided by the total number of behavioural patterns given in the ethograms. In this regard, a high BDI score indicates the existence of multiple anomalous behaviour that can to some extent be ascribed to husbandry systems affecting or hampering the animals' behavioural interaction with its environment (Fraser 1983, p. 16). (Fraser 1983)

Concerning the field of pathology, another example of a "single" measure approach is given by Ekesbo (1984) proposing the condition of integument as indicator to draw conclusions on the animals' welfare state in specific housing systems. In order to do so, influences of the livestock housing facilities given by, for example, uneven or rough floors, high parasitic loads, sharp edges or corners, low space allowance or abnormal behaviour resulting in various kinds of skin lesions are interpreted on the basis of clinical and epidemiological surveys (Gloor 1988; Troxler 1998). Another single measure approach is proposed by Hurnik (1988, p. 115), stating that longevity of animals corresponds to the level of satisfaction of all of their needs and therefore could be used as an overall indicator for animal welfare. But also physiological measures of stress are proposed to evaluate overall farm animal welfare. In this regard, the standard procedure to evaluate the animals' response to stressors is to measure the hypothalamic-pituitary-adrenal (HPA) axis activity by means of blood plasma tests or saliva, urine and faecal samples (Hay *et al.* 2000; Manteuffel 2002; Mormède *et al.* 2007, p. 317). Increases in the levels of secreted glucocorticoid hormones[45] were observed when animals get into contact with a stressful stimulus such as noise, exposure to a novel environment or social or spatial restriction (Dantzer *et al.* 1983; Ladewig and Smidt 1989; Cook *et al.* 1998; Otten *et al.* 2004; Orihuela and Hernández 2007). As these stimuli imply adverse animal welfare conditions on farm, consequently, the measured level of glucocorticoid hormones is used as overall indicator of farm animal welfare.

[44] Different ethograms were developed for cattle, sheep and pigs (see Fraser 1983).

[45] Glucocorticoid hormones are generated in the fascicular zone of the animals' adrenal cortex. These include cortisol (main active hormone in pigs, cattle and sheep) and corticosterone (main active hormone in birds). (e.g. Mormède *et al.* 2007, p. 319)

A last example of the first category of welfare assessment approaches addresses to morphological aspects of farm animals. As the maintenance of an organism's symmetric growth is limited by genetic and environmental conditions, a farm animal's "randomly directed deviation" from flawless symmetric growth (also known as "fluctuating asymmetry") can to some extent be related to adverse animal welfare conditions (Tuyttens 2003, p. 535; Knierim *et al.* 2007, p. 399). In view of this aspect, Møller and Manning (2003) propose the animals' fluctuating asymmetry as an indicator for overall farm animal welfare. Standard measurement procedures for cattle compare, for example, the length and width of ears, the width of the hock joint and the distance between the medial corner of the eye and the nostril (Møller and Manning 2003, p. 21).

6.3. Evaluations considering contributing measures

Animal welfare assessment approaches of the second category can be found in the field of ethology. Examples are given by *preference tests*, allowing the animal itself to choose its preferred housing conditions or system (Fraser 1995, p. 109; Duncan 2005, p. 486). Depending on the respective livestock type, scientific literature provides a wide variety of preference tests addressing to multiple farming conditions. Beattie *et al.* (1998), for example, examined the preferences of growing pigs for substrates by letting them select between two substrates per experiment. In this way, a total of seven substrates could be ranked according to the pigs' preferences. Another example of a preference test is given by Tucker *et al.* (2003) investigating the preferences of Holstein cows with regard to the type of free stall surface. As the conduction of on-farm preference tests is complex, much effort has to be put in the experimental design in order to obtain meaningful results (Emmert 2001, p. 30; Dawkins 2004, p. 5). However, as Sherwin (2007, p. 3) points out, "preference tests tell us only about relative preferences and not absolute need" (see also von Borell 1999, p. 475; Duncan 2005, p. 486f.). The same applies for *aversion tests*, based on the assumption that unpleasant feelings evolved as a mechanism for ensuring survival (Archer 1979; Cabanac 1979, p. 1; Dawkins 1990, p. 2; Dawkins 1998, p. 308). Animals suffering from pain, discomfort or fear normally try to eliminate the source of those feelings by avoiding or escaping the situation (Widowski 2009, p. 296). In case of repeated experience of a negative affective state, the animal will develop avoidance patterns to escape the place or situation that is considered to be the cause of distress (Rushen 1986; Yue *et al.* 2004, p. 344, Widowski 2009, p. 296). This opens up the possibility to determine the relative aversiveness of different husbandry or handling procedures. In this regard, Jones *et al.* (1998) and Kristensen *et al.* (2000) conducted tests concerning the willingness of pigs and laying hens to avoid exposure to different concentrations of ammonia gas in the stables. Another example of aversion tests is given by Rutter and Duncan (1992) measuring the avoidance behaviour of domestic fowl in frightening situations. But preference and aversion tests do not allow conclusions on the strength of the animals' motivation to choose or avoid certain housing conditions (e.g. Duncan 2005, p. 486f.). The latter can be measured by means of *demand tests* derived from economical techniques valuing trade goods. In economic science the price of commodities is determined by their supply and demand. Making a

parallel to this concept, demand tests applied in the field of ethology measure the animals' behavioural priorities or demand to predefined resources (Widowski 2009, p. 296f.). By placing an "increasing cost on the opportunity to perform certain behaviours", behavioural observations are used to value the relevance of the behaviours or related resources for the animals' welfare (Jensen *et al.* 2004, p. 27). A first attempt in applying demand tests to animals is given by Dawkins (1983) measuring the strength of motivation of battery hens to access litter. Other examples of demand tests are provided by Mathews and Ladewig (1994) identifying environmental requirements of pigs by means of elasticity measures of behavioural demand functions and Mason *et al.* (2001) investigating the strength of motivation to carry out natural behaviour in fur-farmed mink.

6.4. Multidimensional evaluations

Overall animal welfare assessment approaches of the third category integrating several welfare measures, however, seek to cover all aspects of animal welfare. According to Spoolder *et al.* (2003) they can be classified into (1) index systems[46], (2) decision support systems, (3) approaches conceptualized on the basis of multivariate statistics to assign relative weights, (4) more common approaches focusing on a post-hoc interpretation of the findings and (5) qualitative assessment approaches of behavioural expression. Although all of these approaches involve a broad range of evaluation parameters, they show substantial conceptual differences.

To draw conclusions on the overall animal welfare status of housing conditions or livestock, *index systems* integrate assessment parameters selected on the basis of expert judgements and scientific evidence. As the parameters are evaluated by means of scores, they are assigned to weighting factors reflecting their individual relevance for evaluating animal welfare compared to each other. According to Bracke *et al.* (2001, p. 19) these weighting factors can be determined by means of collected information (e.g. farm surveys), on the basis of speculations or personal beliefs. A final calibration and validation of proposed weighting factors is then ensured by on-farm measures (Spoolder *et al.* 2003, p. 531). To enable a differentiated evaluation, each parameter features a number of different attribute levels[47] of whom one has to be chosen in accordance with the actual on-farm situation. Each attribute level is assigned to a score. The latter are summarised or aggregated by means of mathematical models to an overall welfare score representing the integrated animal welfare status of the respective farm or livestock. Due to their easily comprehensible conceptual design, index systems have already proved themselves in practice and show a high repeatability (see e.g. Schatz *et al.* 1996; Hörning 2001, p. 46; Amon *et al.* 2001; Spoolder *et al.* 2003, p. 531; Ofner *et al.* 2003; Mollenhorst *et al.* 2005, p. 289). Moreover, they allow a compensation of a poor welfare rating in one parameter by a better result in another one (e.g. Bartussek 2001*a*, p. 35; Johnsen *et al.* 2001, p. 27).

[46] Also referred to as "scoring systems" (see e.g. Spoolder *et al.* 2003, p. 531).
[47] If we assume the evaluation parameter "available floor area in the stable", suitable attribute levels would, for example, specify different numbers of square meters.

In the scientific literature a broad range of index systems can be found, addressing various aspects of the animals' environment and health. Although preliminary stages of welfare indexing were already outlined by Irps (1985) and Zeeb (1985)[48], the first applicable index system developed to evaluate overall animal welfare was given by the Austrian "Animal Needs Index" (ANI)[49] (see Bartussek 1988, 1990, 1995, 1999; Bartussek *et al.* 2000; Bartussek 2001*b*). Since the beginning of its development in 1985, the ANI has been continuously refined to its final version ANI 35L (Bartussek 1999). With the TGI 200/1994, Sundrum *et al.* (1994) published a German index system on the basis of a previous version of the ANI 35L (Hörning 2001, p. 43). As both index systems are subject to investigations done in this thesis, a more detailed description of the systems is given in the Chapters 2 and 3.

Once in Austria and Germany index systems for the assessment of farm animal welfare have been established, in the Netherlands a similar system was designed. Based on the concept of the German TGI 200/1994, Bokkers (1996) developed the "Dierenwelzijnsindex" (DWI)[50] applicable for the keeping laying hens, breeding sows or dairy cows (see also Bokkers 1995*a*, 1995*b*; Moraal 2005, p. 25f.). Like the TGI 200/1994 the DWI considers the assessment categories (1) locomotion, (2) feeding, (3) social behaviour, (4) resting, (5) comfort, (6) hygiene and (7) stockman care.[51] Significant overlap of DWI and TGI 200/1994 can also be found with regard to the selection of assessment parameters, attribute levels and their assigned point weightings. But contrary to the other index systems, aiming at evaluating the animal welfare status of housing conditions on individual farms, the DWI is focused on assessing the animal welfare level of husbandry systems in general. Its calculation requires only a general description of the applied husbandry system. On-farm observations of livestock are not necessary. Therefore, parameters, not suitable for measures on husbandry system level due to their degree of specification or subjectivity (e.g. the condition of litter or the smell in the stables), are not involved in the DWI assessments. Like the TGI 200/1994, the DWI is focused on environment-based evaluations. (Moraal 2005, p. 25f.)

With the "Assessment scheme for Littered loose housing systems of Dairy cows" (ALD), Hörning (1997) developed another index system to assess overall farm animal welfare. The ALD is strongly influenced by the ANI 35L and the TGI 200/1994 but seeks to achieve more differentiated results by avoiding multiple assessments of similar parameters[52], increasing the number of involved housing parameters and reducing the number of animal-based and subjective parameters (Hörning 2001, p. 43f.). Although the ALD uses the same calculation procedure as the two other frameworks, it provides a maximum sum of 120 points allocated to parameters addressing to conditions of the animals' lying, feed and walking area. Contrary to

[48] In the following, Bock (1990) investigates the relevance of assessment parameters defined by Zeeb (1985) on the housing conditions of dairy cattle kept in loose housings by adding point weightings to the parameters' attribute levels.
[49] The German expression is "Tiergerechtheitsindex" (see e.g. Bartussek 1995).
[50] It can be translated as "Animal Needs Index".
[51] For the keeping of breeding sows both frameworks involve an assessment of the excretory behaviour (see Moraal 2005).
[52] The ANI 35L and the TGI 200/1994 provide for multiple assessments of similar parameters assigned to various assessment categories (see also Hörning 1997, p. 95; 2001, p. 43). The ANI 35L assessment forms for adult cattle, for example, refer to the number of outdoor exercise days per year in three out of five assessment categories (see Bartussek *et al.* 2000, p. 19).

the index systems ANI 35L and TGI 200/1994, which already found broad application in farm animal welfare assessment, the ALD was only used on a small number[53] of farms.

Capdeville and Veissier (2001) proposed another method for assessing the dairy cows' welfare at farm level. On the basis of the "Five Freedoms" of the FAWC (FAWC 1993) (given in Section 3 of this introduction), they defined 16 basic animal needs referring to the animals' resting behaviour, health status, cleanliness, moving patterns, social interaction, housing conditions and the occurrence of fearsome events[54]. These basic needs are linked to a total of 49 assessment parameters derived from scientific literature and expert judgements. The latter are divided into attribute levels each assigned, on the one hand, to an intrinsic value reflecting their impacts on the satisfaction of the animals' needs[55] and, on the other hand, an observation value describing the share of animals in the respective herd that can be allocated by the observer to a specific attribute level. Both values are measured on a scale ranging from A (expressing the highest level of animal welfare) to D (expressing the lowest level of animal welfare). Based on the outcomes of the animal observations, specified rules for combining the two values are applied to calculate welfare scores of the parameters, basic animal needs and in the end for every single freedom defined by the FAWC. (Capdeville and Veissier 2001)

A similar methodological approach to those proposed by Capdeville and Veissier (2001) is presented by the European Welfare Quality® assessment scheme (see e.g. Botreau *et al.* 2007*a*, *b*, *c*, 2009; Welfare Quality® 2009*a*, *b*, *c*) suitable for the welfare evaluation of pigs, cattle and poultry. But unlike the concept of Capdeville and Veissier (2001) providing for evaluations on three hierarchical levels given by parameters, basic needs and superordinate principles, the Welfare Quality® framework enables the additional calculation of an overall animal welfare score. The three-stage assessment process starts with an on-farm survey of approximately 30 parameters[56] addressing to various attributes of the animals' environment, handling and health status. The outcomes of the survey are integrated into 12 welfare criteria which are, in turn, condensed to four basic welfare principles described as "good feeding", "good housing", "good health" and "appropriate behaviour". Finally, the assessment results are bundled to an overall score expressing the animal welfare status of a specific farm or slaughter plant. The aggregation procedure is realised by mathematical models and pre-set profiles allowing a limited compensation between components of the three assessment stages. (Botreau *et al.* 2007*c*, p. 1195; Veissier 2009)

Another recent approach in evaluating overall farm animal welfare by means of an index system is given by Napolitano *et al.* (2009). By modifying the ANI 35L, the authors developed an index system enabling an integrated animal welfare assessment of sheep. Although most environment-based parameters are derived from the ANI 35L, the authors included an additional selection of animal-based parameters suitable for capturing the welfare of sheep (Napolitano *et al.* 2009, p. 50f.). Whereas there are no conceptual differences between the two

[53] According to Hörning (2001, p. 43), the ALD was surveyed on 65 cattle farms.
[54] For example, the incidence of sudden noise (Capdeville and Veissier 2001, p. 65).
[55] The absence of injuries, for example, receives the highest animal welfare rating (Capdeville and Veissier 2001, p. 64).
[56] The number of surveyed parameters varies in dependence on observed farm animal species (Veissier 2009).

frameworks, strong deviations can be detected with regard to the selection of attribute levels, their point weightings and the range of the total score.

As already outlined in Section 5.1 of this introduction, the monitoring of legal and voluntary farm standards requires the application of control procedures on farm level. Official and private monitoring bodies use checklists to control on-farm compliance with standards. Although checklists are considered as an appropriate means to detect the farmers' adherence to pre-defined requirements, they only have a limited scope for direct and integrated evaluations of farm animal welfare (Botreau *et al.* 2007*b*, p. 1185). As a consequence, some private labels started to consider the outcomes of on-farm index assessments within their monitoring systems. The Austrian organic label "Bio-Austria", for example, prescribes an ANI 35L score of at least 24 points as precondition for the certification of cattle farms fitted with tie-stalls and keeping less than 35 livestock units[57] (Ofner-Schröck 2009, p. 16). Another example is given by the British "Freedom Food" scheme operated by the "Royal Society for the Prevention of Cruelty to Animals" (RSPCA). In order to assess the impacts of its scheme on overall farm animal welfare, the RSPCA invited the University of Bristol (UK) to carry out an independent investigation (Main *et al.* 2001, p. 110). The result was the development of the "Bristol Welfare Assurance Programme" (BWAP) (see e.g. Main *et al.* 2001, 2003), an assessment tool providing welfare recording protocols for animal-based evaluations of cattle, laying hens and pigs. Parameters assessing the animals' health, performance and behaviour were selected by means of an iterative investigation of expert judgements and implemented into a monitoring scheme based on observations and records of animal welfare (Whay *et al.* 2003*a*, p. 206ff.; *b*, p. 612f.; *c*, p. 197; Main and Whay 2004, p. 219). As the BWAP ensures an integrated recording of farm animal welfare conditions, it can be used to evaluate the prescribed welfare level of animals kept on certified and noncertified farms (see e.g. Main *et al.* 2004, Main *et al.* 2007, p. 233). But the ANI 35L and the BWAP are not the only index systems applied by labels or quality assurance programmes. The "A-Index" developed by Munsterhjelm *et al.* (2006) is used in the context of a meat quality programme for sows and cattle in the Finnish meat processing industry[58] (Munsterhjelm and Herva 2003 as cited by Herva *et al.* 2009, p. 418). Whereas it represents a modified version of the ANI 35L awarding points in the evaluation fields "locomotion", "social interaction", "floor quality", "stable climate" and "health and stockmanship", it considers an additional assessment category "feeding" derived from the TGI 200/1994 (Munsterhjelm *et al.* 2006, p. 495f.). But contrary to its predecessors, its application is mainly focussed on northern Scandinavian housing systems that offer only a very limited access to outdoors (Munsterhjelm *et al.* 2006, p. 494f.). Findings of Herva *et al.* (2009, p. 423f.) prove a quite good sensitivity, construct validity and overall reliability of this assessment approach.

Contrary to index systems enabling a direct assessment of on-farm conditions, *decision support systems (DSS)* focus on identifying the known connections between parameters and

[57] This provision applies since 1 January 2011 (Ofner-Schröck 2009, p. 16).
[58] The company "Atria Ltd." applies the A-Index (Munsterhjelm and Herva 2003 as cited by Herva *et al.* 2009, p. 418).

make them accessible for welfare evaluation (Spoolder *et al*. 2003, p. 532). To provide decision support for the farmers, Sørensen *et al.* (2001) developed a welfare assessment system using an "ethical account" on livestock farming. The latter combines two basic procedures relevant for ensuring farm animal welfare: On the one hand, it records the effects of farming activities on all parties concerned involving the livestock, the farmer himself, the consumer and subsequent generations while, on the other hand, causing the farmer to formulate his ethical views towards current farming methods and future goals (Sørensen *et al.* 2001, p. 12f.). To obtain the relevant information, Sørensen *et al.* (2001) defined a set of parameters capturing the animals' management and housing conditions, behaviour as well as health status. The parameters are surveyed several times per year and their outcomes are outlined in an annual welfare report handed out to the farmers (Johnsen *et al.* 2001, p. 29). Finally, this annual report serves as a means for the farmer to adjust his husbandry system pursuant to his ethical convictions with regard to welfare (Sørensen *et al.* 2001, p. 12).

The concept of Sørensen *et al.* (2001) marks a starting point for the design of more complex and computer-based DSS. A first attempt in developing a computer-based DSS for animal welfare assessment is given by the model "SOWEL"[59] (see Bracke *et al.* 2001, 2002*a*, 2002*b*). It concerns the welfare of pregnant sows and was followed by similar models designed for welfare evaluations e.g. of laying hens ("FOWEL"[60], from De Mol *et al.* 2006), fattening pigs ("RICHPIG"[61], from Bracke *et al.* 2007; Bracke 2007, 2008) and dairy cattle ("COWEL"[62], from Ursinus *et al.* 2009). Principally all of these computer-based DSS show a similar conceptual structure: Based on a definition of animal welfare, DSS derive basic animal needs from scientific literature. The latter are linked to specific environment-based features of the animals' housing system and management, called "attributes"[63]. The attributes are divided into two (e.g. in case of a yes/no decision) or more (in case of measurable attributes) "attribute levels". Each attribute level is assigned to an "attribute score" and several "weighting scores". Whereas the attribute scores express the attribute's degree of implementation, the "weighting scores" are derived from an inventory of scientific statements reflecting the attribute level's impact on the animals' welfare compared to other attribute levels. Both values are used to calculate an overall welfare score of a production system. Finally, DSS can be validated by comparing their results with surveyed expert judgements (see also Bracke *et al.* 2002*b*; Bracke *et al.* 2007). (Bracke *et al.* 1999*b*; Bracke *et al.* 2002*a*; Spoolder *et al.* 2003, p. 532; De Mol *et al.* 2006; Bracke 2008; Ursinus *et al.* 2009)

An inventory of scientific knowledge plays not only a crucial role for DSS, but also for *animal welfare assessment systems conceptualized on the basis of multivariate statistics*. An example of such an assessment system is given by the concept of Beyer (1998) aiming at the overall assessment of different housing systems for horses. By combining current knowledge concerning test and husbandry procedures, Beyer (1998) developed evaluation forms covering

[59] Derived from SOw WELfare (Bracke *et al.* 2002*a*, p. 1819).
[60] Derived from FOwl WELfare (De Mol *et al.* 2006, p. 158).
[61] Derived from enRICHment materials for PIGs (Bracke 2008, p. 289).
[62] Derived from COw WELfare (Ursinus *et al.* 2009, p. 546).
[63] Every attribute is linked to one or more needs (see e.g. Ursinus *et al.* 2009).

45 mainly environment-based assessment parameters ensuring an evaluation of the animals' housing system, care and access to an exercise yard. Each parameter is measured by means of a five point scale ranging from zero to four points, with four points expressing the optimal welfare conditions. The point weightings of each evaluation field are aggregated and linked to corresponding average values measured on a sample group of horse farms. By means of multivariate statistical methods, this procedure enables to verify the relevance of each evaluation parameter involved (see also Spoolder *et al.* 2003, p. 532, Ofner 2003, p. 17). Therefore, the assessment approach is not suitable for direct comparisons between different housing systems, but indicates the animal welfare level of each farm relative to an average welfare situation (see also Johnsen *et al.* 2001, p. 30). (Beyer 1998)

However, as Spoolder *et al.* (2003, p. 533) point out, the assessment of farm animal welfare does not necessarily require the aggregation of parameters to an overall assessment system, but may alternatively focus on a *post-hoc interpretation* of the measured outcomes. First of all, this method provides for a selection and on-farm measurement of relevant assessment parameters. In a second step, the outcomes of the measurements are used by the author to draw conclusions on the overall animal welfare status of a farm or animal population. Examples of this procedure are given by Fregonesi and Leaver (2001) measuring welfare indicators of dairy cows and Guy *et al.* (2002) collecting data on pig farms. (Spoolder *et al.* 2003, p. 533)

The application of integrated animal welfare assessment procedures calls for a determination of evaluation parameters. Evaluation parameters are usually predefined in the conceptual design of each evaluation approach. An exception is given by the "free choice profiling" (FCP) approach developed by Wemelsfelder *et al.* (2000) leaving the determination and scaling of animal welfare parameters to a group of untrained observers. The resulting scales are applied to evaluate the welfare of comparable animal populations based on behavioural observations. Starting from the assumption that subjective observations of the animals' behavioural expressions can serve as integrative welfare evaluation tool, the authors designed a framework enabling a *qualitative* and integrated assessment of animal welfare. In order to prove the practicability of the chosen approach, Wemelsfelder *et al.* (2000, 2001), Wemelsfelder and Lawrence (2001) and Napolitano *et al.* (2007) already analysed the inter- and intraobserver reliability of subjective measurements of behavioural expression. In this regard, observers were invited to conduct several on-farm and/or video-based evaluations of pig welfare by using their own set of descriptive parameters and rating scales. The outcomes of the on-farm observations were examined by means of multivariate statistical procedures indicating substantial agreement among the assessors. (Wemelsfelder *et al.* 2000, 2001; Wemelsfelder and Lawrence 2001)

6.5. General limitation of multidimensional animal welfare assessments

In recent years, there has been a broad consensus among scientists that farm animal welfare should be regarded as a "multidimensional concept" (e.g. Rushen and de Passillé 1992; Fraser 1995; Sørensen and Sandøe 2001, p. 3; Blockhuis *et al.* 2003, p. 446; Smulders *et al.* 2006, p.

439; Botreau *et al.* 2009, p. 363). As a consequence, the evaluation of overall farm animal welfare should involve a wide range of animal-based and/or environment-based parameters to achieve the most valid results (Waiblinger *et al.* 2001, p. 74). But despite the fact that numerous animal welfare parameters[64] are considered by science to have great relevance for animal welfare measurement, none of the proposed multidimensional evaluation approaches gained so far broad scientific acceptance (Scott *et al.* 2001, p. 6; Waiblinger *et al.* 2001, p. 73; Spoolder *et al.* 2003, p. 529; Smulders *et al.* 2006, p. 439). This leads to the assumption that the major difficulties of developing a universally accepted method can be rather ascribed to the integration of parameters than to their appropriateness or availability.

As outlined in the previous section of this thesis, multidimensional systems like the ANI 35L condense the outcomes of various on-farm measures to an overall animal welfare score. In this regard, each of the involved assessment parameters receives a point weighting in accordance to its relevance for farm animal welfare. In view of this aspect, Sandøe *et al.* (1996, p. 113f.), Bracke *et al.* (1999*a*, p. 286ff.; 2001, p. 17), Alban *et al.* (2001, p. 100) and Scott *et al.* (2001, p. 7f.) point out a "weighting problem" arising from the subjective nature of balancing procedures: As animal welfare parameters are often considered to have different impacts on overall farm animal welfare, their point weightings have to be balanced in order to reflect their relative importance compared to each other. Concerning this matter, Bracke *et al.* (2001, p. 19) and Rushen (2003, p. 205) stress that the weighting procedure is hampered by the involvement of measures focussing on opposing welfare aspects. An example for such "contradictory measures" is already mentioned under Section 5.2 of this thesis: The ANI 35L framework for pigs and cattle involves evaluation scales measuring the animal's outdoor access and condition of skin with special regard to the presence of ectoparasites (see Bartussek 1995; Bartussek *et al.* 2000). However, several studies have shown that animals gaining access to outdoors are subject to higher loads of parasites (e.g. Roderick and Hovi 1999, p. 39f.; Leeb and Baumgartner 2000).

Nevertheless, some of the multidimensional assessment approaches described in Section 6.4 already provide some modifications to guard against the weighting problem. Whereas the computer-based DSS developed by Bracke *et al.* (2001), De Mol *et al.* (2006), Bracke (2008) and Ursinus *et al.* (2009) focus on objectifying parameter weightings by linking them to expert judgements given in scientific literature, the approach of Beyer (1998) ensures to some extent an objective determination of relative weights by using multivariate statistical methods (Spoolder *et al.* 2003, p. 532; Aerts *et al.* 2006, p. 68). The FCP approach of Wemelsfelder *et al.* (2000) seeks to solve the weighting problem by leaving the determination and scaling of assessment criteria to a group of laymen addressing to the "whole animal" by means of direct observations (Aerts *et al.* 2006, p. 68f.). But also index systems that are in particular subject to the weighting problem due to their fixed point ratings, attempt to counteract it by allowing the compensation of poor point results in one evaluation category by better ones in another

[64] For instance, evaluation parameters concerning the animals' freedom of movement are widely regarded by science to have a high importance for animal welfare (see e.g. Gonyou 1996).

field (see e.g. Bartussek 2001*a*, p. 35; Aerts *et al.* 2006, p. 68; Botreau *et al.* 2007*c*, p. 1195). However, as pointed out by Fraser (1995, p. 113) science is not capable of assembling various animal welfare measures into an absolute objective overall welfare determination framework.

7. Outline of the thesis

The doctoral thesis proceeds as follows: *Chapter 2* is based on a paper published together with Dr. Christine Wieck and Markus Kempen in the journal "Acta Agriculturae Scandinavica A: Animal Science".[65] It deals with the estimation of the minimum animal welfare levels on Austrian and German pig fattening farm types as prescribed by FCS as well as European and national law. It starts with an outline of different scientific interpretations of animal welfare, the consideration of animal welfare requirements in legal as well as voluntary standards and a classification of animal welfare parameters. Section 2 provides an overview of different farm animal welfare evaluation approaches and a detailed description of the chosen ANI 35L assessment framework. It is followed by the Sections 3.1 and 3.2 specifying the applied methodology in surveying, clustering, evaluating and extrapolating animal welfare levels of husbandry standards by means of the ANI 35L. The outcomes of this procedure are presented in the Sections 4.1 to 4.3 pointing out overlaps of identified animal welfare levels and providing an estimation of the prescribed animal welfare level in the full farm or herd size population in Austria and Germany. Finally, Section 5 summarises the results of the chosen evaluation approach and outlines its limitations.

Chapter 3 is based on an earlier version of a paper submitted together with Dr. Christine Wieck and Markus Kempen to the journal "Animal Welfare".[66] It delivers a framework for comparing the weightings of animal welfare aspects for cattle farming in Austria and Germany, as they are prescribed by FCS and European or national law, and determined by the farmers' on-farm compliance and as they are attributed by scientific animal welfare and risk assessment systems. This is achieved by refining and adapting the ANI evaluation approach presented in Chapter 2 for the assessment of cattle standards. The introduction of Chapter 3 outlines the conceptual synergies between the European CC system and FCS, provides an overview of integrated farm animal welfare evaluation systems and points out general limitations of overall welfare assessment. It is followed by Section 2 delivering a detailed description of the considered scientific animal welfare and risk assessment systems given by the ANI 35L, the TGI 200/1994 and a risk evaluation framework of the European Food Safety Authority (EFSA)[67]. The procedure of gathering, bundling and comparing prescribed and actual on-farm compliance levels with welfare risk weightings provided by scientific opinion is presented in the Sections 3.1 and 3.2. The following Sections 4.1 and 4.2 describe the results of the chosen evaluation approach, broken down by calves and adult cattle kept in Austria and Germany. Finally, in Section 5 conclusions are drawn on the outcomes of the investigation.

[65] Dominic Norbert Annen is the first author of this paper.
[66] Dominic Norbert Annen is the first author of this paper.
[67] Given by the "Scientific Opinion of the Panel on Animal Health and Animal Welfare" (EFSA 2009).

Chapter 4 of this doctoral thesis is based on a yet unpublished working paper written together with Dr. Christine Wieck.[68] It seeks to test hypotheses regarding the farmers' decision whether to participate in the European SPS and adhere to related CC requirements and/or to join voluntary FCS. This is achieved by developing behavioural models and using farm survey results. Chapter 4 begins with a short comparison of the European CC system and FCS and a review of existing methods in modelling the farmers' compliance behaviour. The Sections 2.1 to 2.4 provide a more detailed overview of the relationship between standards defined by CC, national law and FCS. It is followed by Section 3.1 outlining the derivation of behavioural models describing the farmers' constellations of compliance with the CC system and FCS. The models serve to derive determinants of scheme participation and hypotheses on compliance behaviour. The relations of determinants and hypotheses are highlighted in Section 3.2. The Sections 4.1 to 4.3 outline results from the Austrian farm survey and the probit model that are used to disclose the importance of the stated determinants. In the Sections 5.1 and 5.2 the investigation results are discussed with regard to the validity of the hypotheses. Section 6 summarises the outcomes of the study and draws conclusions on the farmers' compliance behaviour.

Finally, the Annex delivers the farm questionnaire applied for the investigations of Chapter 4.

References

Aerts, S., Lips, D., Spencer, S., Decuypere, E. and De Tavernier, J. 2006. A new framework for the assessment of animal welfare: Integrating existing knowledge from a practical ethics perspective. *Journal of Agricultural and Environmental Ethics* 19, 67-76.

Alban, L., Ersbøll, A. K., Bennedsgaard, T. W. and Johnsen, P. F. 2001. Validation of welfare assessment at herd level: An example. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 99-102.

Alrøe, H. F., Vaarst, M. and Kristensen, E. S. 2001. Does organic farming face distinctive livestock welfare issues? – A conceptual analysis. *Journal of Agricultural and Environmental Ethics* 14, 275-299.

Amon, T., Amon, E., Ofner, E. and Boxberger, J. 2001. Precision of assessment of animal welfare by the "TGI 35 L" Austrian needs index. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 114-117.

Annen, D. N., Wieck, C. and Kempen, M. 2011. Evaluation of minimum animal welfare conditions in national standards and farm certification schemes for pig fattening. *Acta Agriculturae Scandinavica Section A: Animal Science* 61, 40-54.

Archer, J. 1979. Behavioural aspects of fear. In: Sluckin, W. (ed.) *Fear in animals and man.* Van Nostrand Reinhold, New York, pp. 164-198.

[68] Dr. Christine Wieck is the first author of this paper. Dominic Norbert Annen contributed significantly to Section 1, Section 2 and the descriptive part of Section 4. The data used in Chapter 4 was sampled by Dominic Norbert Annen.

Bartolini, F., Gallerani, V., Raggi, M. and Viaggi, D. 2008. Linking cross compliance and agri-environmental schemes: A case study in Emilia Romana. *Paper prepared for the 109th EAAE Seminar "The CAP after the Fischler Reform: National Implementations, Impact Assessment and the Agenda for Future Reforms"*. 20-21 November 2008, Viterbo, Italy.

Bartussek, H. 1988. Das Gesamtbudget. In: Haiger, A., Storhas, R. and Bartussek, H. (Hrsg.) *Naturgemäße Viehwirtschaft* [The total budget. In: Haiger, A., Storhas, R. and Bartussek, H. (eds.) *Environmental livestock husbandry*]. Verlag Eugen Ulmer, Stuttgart, Germany, pp. 157-161. (In German)

Bartussek, H. 1990. Der Tiergerechtheitsindex. In: Bartussek, H., Eisenhut, M., Haiger, A. and Storhas, R. (Hrsg.) *Naturnähe in der Veredelungswirtschaft – Ein Definitionskonzept*. Bericht über die 8. IGN-Tagung vom 22. bis 24. Februar 1990 an der LFS Schlierbach [The Animal Needs Index. In: Bartussek, H., Eisenhut M., Haiger, A. and Storhas, R. (eds.) *Naturalness in the Processing Industry - A Concept for Definition*. Report on the 8th IGN Conference of 22-24 February 1990 at the LFS Schlierbach], Federal Research Institute for Agriculture in Alpine Regions BAL Gumpenstein, Irdning, Austria, pp. 34-46. (In German)

Bartussek, H. 1995. *Tiergerechtheitsindex für Mastschweine – TGI 35L/1995 Mastschweine* [*Animal Needs Index for fattening pigs – ANI 35L/1995 fattening pigs*]. Federal Research Institute for Agriculture in Alpine Regions BAL Gumpenstein, Irdning, Austria. http://www.bartussek.at/pdf/tgischweine.pdf, accessed 27 April 2011. (In German)

Bartussek, H. 1999. A review of the Animal Needs Index (ANI) for the assessment of animal's well-being in the housing systems for Austrian proprietary products and legislation. *Livestock Production Science* 61, 179-192.

Bartussek, H. 2001*a*. A historical account of the development of the Animal Needs Index ANI-35L as part of the attempt to promote and regulate farm animal welfare in Austria: An example of the interaction between animal welfare science and society. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 34-41.

Bartussek, H. 2001*b*. *Animal Needs Index for laying hens – ANI 35L/2001 – laying hens*. Federal Research Institute for Agriculture in Alpine Regions BAL Gumpenstein, Irdning, Austria. http://www.bartussek.at/pdf/anilayinghens.pdf, accessed 23 February 2011.

Bartussek, H., Leeb, C. and Held, S. 2000. *Animal Needs Index for cattle – ANI 35L/2000 – cattle*. Federal Research Institute for Agriculture in Alpine Regions BAL Gumpenstein, Irdning, Austria. http://www.bartussek.at/pdf/anicattle.pdf, accessed 27 April 2011.

Baumgartner, J., Leeb, T., Gruber, T. and Tiefenbacher, R. 2003. Husbandry and animal health on organic pig farms in Austria. *Animal Welfare* 12, 631-635.

Beattie, V. E., Walker, N. and Sneddon, I. A. 1998. Preference testing of substrates by growing pigs. *Animal Welfare* 7, 27-34.

Beyer, S. 1998. Konstruktion und Überprüfung eines Bewertungskonzeptes für Pferdehaltende Betriebe unter dem Aspekt der Tiergerechtheit [Development and review of an evaluation concept for horse farms concerning the aspect of animal welfare]. *PhD Thesis*. University of Gießen, Faculty of Veterinary Medicine, Gießen, Germany. (In German)

Blaas, K. 2007. Nutztierschutz in Österreich im Vergleich mit der EU. *Jubiläumssymposium mit Festakt – 5 Jahre Tiergesundheitsdienst* [Farm animal welfare in Austria compared to the EU. *Jubilee symposium with ceremony – 5 years Tiergesundheitsdienst*]. 26-27 April 2007, University of Veterinary Medicine Vienna, Vienna. (In German)

Blockhuis, H. J., Jones, R. B., Geers, R., Miele, M. and Veissier, I. 2003. Measuring and monitoring animal welfare: Transparency in the food product quality chain. *Animal Welfare* 12, 445-455.

Bock, C. 1990. Zur Beurteilung tiergerechter Laufställe für Milchvieh. In: Kuratorium für Technik und Bauwesen in der Landwirtschaft (KTBL) (Hrsg.) *KTBL-Schrift 339* [In order to assess animal-friendly stables for dairy cattle. In: Board of trustees for technology and building industry in Agriculture (KTBL) (ed.) *KTBL-Schrift 339*]. Darmstadt. (In German)

Bock, B. B. and van Huik, M. 2007. Pig farmers and animal welfare: A study of beliefs, attitudes and behaviour of pig producers across Europe. In: Kjaernes, U., Miele, M. and Roex, J. (eds.) *Attitudes of consumers, retailers and producers to farm animal welfare*. Welfare Quality® Report No. 2. Cardiff University, Cardiff, pp. 73-124.

Bock, B. B. and van Leeuwen, F. 2005. Review of socio-political and market developments of animal welfare schemes. In: Roex, J. and Miele, M. (eds.) *Farm animal welfare concerns – Consumers, retailers and producers*. Welfare Quality® Report No. 1. Cardiff University, Cardiff, pp. 115-167.

Bokkers, E. A. M. 1995*a*. "The Animal Welfare Index for sow farming". *Report 95-5*. Dutch Society for the Protection of Animals, Den Haag. (In Dutch)

Bokkers, E. A. M. 1995*b*. "Scientific substantiation of the I.C.S. rules for floor rearing". *Report 1995-2*. Dutch Society for the Protection of Animals, Den Haag. (In Dutch)

Bokkers, E. A. M. 1996. De Dierenwelzijnsindex: Een aanzet tot het kwantificeren van het niveau vam dierenwelzijn in Nederlandse veehouderijsystemen [*The Animal Welfare Index: A push for quantifying the level of animal husbandry systems in the Netherlands*]. Dutch Society for the Protection of Animals, Den Haag, the Netherlands. (In Dutch)

Botreau, R., Veissier, I., Butterworth, A., Bracke, M. B. M. and Keeling L. J. 2007*a*. Definition of criteria for overall assessment of animal welfare. *Animal Welfare* 16, 225-228.

Botreau, R., Bonde, M., Butterworth, A., Perny, P., Bracke, M. B. M., Capdeville, J. and Veissier, I. 2007*b*. Aggregation of measures to produce an overall assessment of animal welfare. Part 1: A review of existing methods. *Animal* 1(8), 1179-1187.

Botreau, R., Bracke, M. B. M., Perny, P., Butterworth, A., Capdeville, J., van Reenen, C. G. and Veissier, I. 2007*c*. Aggregation of measures to produce an overall assessment of animal welfare. Part 2: Analysis of constraints. *Animal* 1(8), 1188-1197.

Botreau, R., Veissier, I. and Perny, P. 2009. Overall assessment of animal welfare: Strategy adopted in Welfare Quality®. *Animal Welfare* 18, 363-370.

Bracke, M. B. M., Spruijt, B. M. and Metz, J. H. M. 1999*a*. Overall animal welfare assessment reviewed. Part 1: Is it possible? *Netherlands Journal of Agricultural Science* 47, 279-291.

Bracke, M. B. M., Metz, J. H. M. and Spruijt, B. M. 1999*b*. Overall animal welfare reviewed. Part 2: Assessment tables and schemes. *Netherlands Journal of Agricultural Science* 47, 293-305.

Bracke, M. B. M., Metz, J. H. M. and Spruijt, B. M. 2001. Development of a decision support system to assess farm animal welfare. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 17-20.

Bracke, M. B. M., Spruijt, B. M., Metz, J. H. M. and Schouten, W. G. P. 2002*a*. Decision support system for overall welfare assessment in pregnant sows A: Model structure and weighting procedure. *Journal of Animal Science* 80, 1819-1834.

Bracke, M. B. M., Metz, J. H. M., Spruijt, B. M. and Schouten, W. G. P. 2002*b*. Decision support system for overall welfare assessment in pregnant sows B: Validation by expert opinion. *Journal of Animal Science* 80, 1835-1845.

Bracke, M. B. M., Zonderland, J. J. and Bleumer, E. J. B. 2007. Expert judgement on enrichment materials for pigs validates preliminary RICHPIG model. *Applied Animal Behaviour Science* 104, 1-13.

Bracke, M. B. M. 2007. Multifactorial testing of enrichment criteria: Pigs "demand" hygiene and destructibility more than sound. *Applied Animal Behaviour Science* 107, 218-232.

Bracke, M. B. M. 2008. RICHPIG: A semantic model to assess enrichment materials for pigs. *Animal Welfare* 17, 289-304.

Bredahl, M. E., Northen, J. R., Boecker, A. and Normile, M. A. 2001. Consumer demand sparks the growth of quality assurance schemes in the European food sector. In: Regmi, A. (ed.) *Changing structures of global food consumption and trade*. Economic Research Service/USDA, Washington DC, 90-102. Agricultural and Trade Report no. WRS-01-1.

Breitschuh, G., Schwabe, M. and Eckert, H. 2006. Nationale Umsetzung von Cross Compliance (CC) in Deutschland [National implementation of cross compliance (CC) in Germany]. *Acta Agriculturae Slovenica* 87, 3-16. (In German)

Bundeskanzleramt 2004. Bundesgesetz mit dem ein Tierschutzgesetz erlassen sowie das Bundes-Verfassungsgesetz, die Gewerbeordnung 1994 und das Bundesministeriengesetz 1986 geändert werden [Federal law issueing an Animal Welfare Act and amending the Federal Constitutional Law, the Industrial Code 1994 and the Federal Ministries Act]. *Bundesgesetzblatt für die Republik Österreich* I, Nr. 118. (In German)

Bundeskanzleramt 2008. Bundesverfassungsgesetz, mit dem das Bundes-Verfassungsgesetz geändert und ein Erstes Bundesverfassungsrechtsbereinigungsgesetz erlassen wird [Federal Constitutional Law amending the Federal Constitutional Law and issueing a first act to adjust the Federal Constitutional Law]. *Bundesgesetzblatt für die Republik Österreich* I, Nr. 2. (In German)

Bundesministerium für Verbraucherschutz, Ernährung und Landwirtschaft 2002. Zweite Verordnung zur Änderung der Viehverkehrsordnung und anderer tierseuchenrechtlicher Vorschriften [Second Regulation amending the Livestock Movement Order and other animal health provisions]. *Bundesgesetzblatt* I, 4532. (In German)

Bundesministerium für Ernährung, Landwirtschaft und Forsten 1999. Verordnung über hygienische Anforderungen beim Halten von Schweinen (Schweinehaltungshygieneverord-

nung) [Regulation on hygienic requirements concering the keeping of pigs]. *Bundesgesetzblatt* I, 1252. (In German)

Bundesministerium für Ernährung, Landwirtschaft und Forsten 2000. Verordnung zur Änderung der Viehverkehrsverordnung und anderer tierseuchenrechtlicher Vorschriften [Regulation amending the Livestock Movement Order and other animal health provisions]. *Bundesgesetzblatt* I, 531. (In German)

Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz 2006*a*. Verordnung zum Schutz landwirtschaftlicher Nutztiere und anderer zur Erzeugung tierischer Produkte gehaltener Tiere bei ihrer Haltung (Tierschutz-Nutztierhaltungsverordnung) [Regulation on the protection of farmed animals and animals kept for the purpose of producing animal products]. *Bundesgesetzblatt* I, 2043. (In German)

Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz 2006*b*. Tierschutzgesetz in der Fassung der Bekanntmachung vom 18. Mai 2006, das zuletzt durch Artikel 20 des Gesetzes vom 9. Dezember 2010 geändert worden ist [Animal Welfare Act in the wording of its notification on 18 May 2006, last amended by article 20 of the law of 9 December 2010]. *Bundesgesetzblatt* I, 1206. (In German)

Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz 2007. Verordnung zur Änderung von Verordnungen zur Anpassung and das Tierische-Nebenprodukte-Beseitigungsrecht [Regulation amending regulations adjusting the act concerning the removal of animal by-products]. *Bundesgesetzblatt* I, 2461. (In German)

Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz 2009*a*. Verordnung zur Änderung der Tuberkulose-Verordnung und sonstiger tierseuchenrechtlicher Verordnungen [Regulation amending the Tuberculosis-Regulation and other animal health regulations]. *Bundesgesetzblatt* I, 1337. (In German)

Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz 2009*b*. Verordnung zum Schutz von Tieren beim Transport und zur Durchführung der Verordnung (EG) Nr. 1/2005 des Rates (Tierschutztransportverordnung) [Regulation on the protection of animals during transport and for the implementation of Council Regulation (EC) No 1/2005]. *Bundesgesetzblatt* I, 375. (In German)

Bundesministerium für Gesundheit 2010*a*. Bundesgesetz, mit dem das Tierschutzgesetz geändert wird [Federal act amending the Animal Welfare Act]. *Bundesgesetzblatt für die Republik Österreich* I, Nr. 80. (In German)

Bundesministerium für Gesundheit 2010*b*. Verordnung des Bundesministers für Gesundheit zur Änderung der 1. Tierhaltungsverordnung (Änderung der 1. Tierhaltungsverordnung) [Regulation of the Federal Minister for Health amending the first regulation on animal husbandry]. *Bundesgesetzblatt für die Republik Österreich* II, Nr. 219. (In German)

Bundesministerium für Gesundheit 2010*c*. Verordnung des Bundesministers für Gesundheit, mit der die Tierschutz-Kontrollverordnung geändert wird [Regulation of the Federal Minister for Health amending the Regulation on the monitoring of animal welfare provisions]. *Bundesgesetzblatt für die Republik Österreich* II, Nr. 220. (In German)

Bundesministerium für Gesundheit, Familie und Jugend 2007. Bundesgesetz, mit dem ein Tiertransportgesetz, und das Tierschutzgesetz und das Tierseuchengesetz geändert wer-

den [Federal act amending the Animal Transport Act, the Animal Welfare Act and the Animal Health Act]. *Bundesgesetzblatt für die Republik Österreich* I, Nr. 54. (In German)

Bundesministerium für Gesundheit, Familie und Jugend 2008*a*. Bundesgesetz, mit dem das Tierschutzgesetz geändert wird [Federal act amending the Animal Welfare Act]. *Bundesgesetzblatt für die Republik Österreich* I, Nr. 35. (In German)

Bundesministerium für Gesundheit, Familie und Jugend 2008*b*. Verordnung der Bundesministerin für Gesundheit, Familie und Jugend, mit der die Tierschutz-Kontrollverordnung geändert wird [Regulation of the Federal Minister for Health, Family and Youth amending the regulation on the monitoring of animal welfare provisions]. *Bundesgesetzblatt für die Republik Österreich* II, Nr. 5. (In German)

Bundesministerium für Gesundheit und Frauen 2004*a*. Verordnung der Bundesministerin für Gesundheit und Frauen über die Mindestanforderungen für die Haltung von Pferden und Pferdeartigen, Schweinen, Rindern, Schafen, Ziegen, Schalenwild, Lamas, Kaninchen, Hausgeflügel, Straußen und Nutzfischen (1. Tierhaltungsverordnung) [Regulation of the Federal Minister for Health and Women on minimum requirements for the keeping of horses and equine, pigs, cattle, sheep, goats, hoofed game, lamas, rabbits, domestic poultry, ostriches and domestic fish]. *Bundesgesetzblatt für die Republik Österreich* II, Nr. 485. (In German)

Bundesministerium für Gesundheit und Frauen 2004*b*. Verordnung der Bundesministerin für Gesundheit und Frauen über den Schutz von Tieren bei der Schlachtung oder Tötung (Tierschutz-Schlachtverordnung) [Regulation of the Federal Minister for Health and Women on the protection of animals during slaughter]. *Bundesgesetzblatt für die Republik Österreich* II, Nr. 488. (In German)

Bundesministerium für Gesundheit und Frauen 2004*c*. Verordnung der Bundesministerin für Gesundheit, Familie und Jugend über die Kontrolle der Einhaltung von Tierschutzbestimmungen (Tierschutz-Kontrollverordnung) [Regulation of the Federal Minister for Health, Family and Youth on the compliance with animal welfare provisions]. *Bundesgesetzblatt für die Republik Österreich* II, Nr. 492. (In German)

Bundesministerium für Gesundheit und Frauen 2006*a*. Verordnung der Bundesministerin für Gesundheit und Frauen, mit der die 1. Tierhaltungsverordnung geändert wird [Regulation of the Federal Minister for Health and Women amending the first regulation on animal husbandry]. *Bundesgesetzblatt für die Republik Österreich* II, Nr. 25. (In German)

Bundesministerium für Gesundheit und Frauen 2006*b*. Verordnung der Bundesministerin für Gesundheit und Frauen, mit der die 1. Tierhaltungsverordnung geändert wird [Regulation of the Federal Minister for Health and Women amending the first regulation on animal husbandry]. *Bundesgesetzblatt für die Republik Österreich* II, Nr. 530. (In German)

Bundesministerium für Gesundheit und Frauen 2006*c*. Verordnung der Bundesministerin für Gesundheit und Frauen, mit der die Tierschutz-Schlachtverordnung geändert wird [Regulation of the Federal Minister for Health and Women amending the regulation on the protection of animals during slaughter]. *Bundesgesetzblatt für die Republik Österreich* II, Nr. 31. (In German)

Bundesministerium für Gesundheit und Frauen 2006*d*. Verordnung der Bundesministerin für Gesundheit und Frauen, mit der die Tierschutz-Kontrollverordnung geändert wird [Regulation of the Federal Minister for Health and Women amending the regulation on the monitoring of animal welfare provisions] . *Bundesgesetzblatt für die Republik Österreich* II, Nr. 28. (In German)

Cabanac, M. 1979. Sensory pleasure. *The Quarterly Review of Biology* 54(1), 1-29.

Capdeville, J. and Veissier, I. 2001. A method of assessing welfare in loose housed dairy cows at farm level, focusing on animal observations. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 62-68.

Cook, N. J., Chang, J., Borg, R., Robertson, W. and Schaefer, A. L. 1998. The effects of natural light on measures of meat quality and adrenal responses to husbandry stressors in swine. *Canadian Journal of Animal Science* 78, 293-300.

Court of Justice of the European Union 2005. Judgement of the Court of 8 September 2005 in Case C-278/04: Commission of the European Communities v Federal Republic of Germany. *Official Journal of the European Union* C 271, 8-9.

Dantzer, R., Mormède, P., Bluthé, R. M. and Soissons, J. 1983. The effect of different housing conditions on behavioural and adrenocortical reactions in veal calves. *Reproduction Nutrition Development* 23(3), 501-508.

Dawkins, M. S. 1983. Battery Hens Name their Price: Consumer demand theory and the measurement of ethological "needs". *Animal Behaviour* 31, 1195-1205.

Dawkins, M. S. 1990. From an animal's point of view: Motivation, fitness, and animal welfare. *Behavioral and Brain Sciences* 13, 1-61.

Dawkins, M. S. 1993. *Through our eyes only? The search for animal consciousness*. Freeman, Oxford.

Dawkins, M. S. 1998. Evolution and animal welfare. *The Quarterly Review of Biology* 73(3), 305-328.

Dawkins, M. S. 2004. Using behaviour to assess animal welfare. *Animal Welfare* 13, 3-7.

De Mol, R. M., Schouten, W. G. P., Evers, E., Drost, H., Houwers, H. W. J. and Smits, A. C. 2006. A computer model for welfare assessment of poultry production systems for laying hens. *NJAS Wageningen Journal of Life Sciences* 54(2), 157-168.

Duncan, I. J. H. 2005. Science-based assessment of animal welfare: Farm animals. *Scientific and Technical Review of the Office International des Epizooties* 24(2), 483-492.

Eijck, I. A. J. M. and Borgsteede, F. H. M. 2005. A survey of gastrointestinal pig parasites on free-range, organic and conventional pig farms in the Netherlands. *Veterinary Research Communications* 29, 407-414.

Ekesbo, I. 1984. Methoden der Beurteilung von Umwelteinflüssen auf Nutztiere unter besonderer Berücksichtigung der Tiergesundheit und des Tierschutzes [Methods in evaluating environmental influences on farmed animals with special regard to animal health and animal protection]. *Wiener tierärztliche Monatsschrift* 71(6/7), 186-190. (In German)

Elbersen, B., Jongeneel, R., Kempen, M., Roos-Klein Lankhorst, J., De Vries, W., Lesschen, J. P., Oñate, J. J., Martinez Alonso, P., Kasperczyk, N., Schramek, J., Mikk, M., Peepson, A., Annen, D. N., Bouma, F., Staritsky, I. and Kros, H. 2010. *Final report of CCAT pro-*

ject results. Deliverable 2.8, CCAT project, EU 6th Framework Programme, Priority 8.1, European Commission. http://www.ccat.wur.nl/NR/rdonlyres/14A64131-DD4E-46FD-953E-986DDDB2AEC1/113043/D2_8_Final_report_V5_compr.pdf, accessed 27 April 2011.

Emmert, D. 2001. Die Rinderhaltung im Ökologischen Landbau – Eine tiergerechte und umweltverträgliche Alternative? [Cattle farming in organic agriculture – An animal-friendly and sustainable alternative?] *PhD Thesis*. University of Munich, Faculty of Veterinary Medicine, Munich, Germany. (In German)

Eurobarometer 2005. *Attitudes of consumers towards the welfare of farmed animals*. Special Eurobarometer 229, Brussels.

Eurobarometer 2007. *Attitudes of EU citizens towards Animal Welfare*. Special Eurobarometer 270, Brussels.

European Commission 2001. Commission Directive 2001/93/EC of 9 November 2001 amending Directive 91/630/EEC laying down minimum standards for the protection of pigs. *Official Journal of the European Communities* L 316, 36-38.

European Commission 2006. *Structured inventory of existing food quality assurance schemes within the EU-25*. Study prepared by the Directorate-General Joint research Centre (DG JRC) and the Institute for Prospective Technological Studies (IPTS). http://foodqualityschemes.jrc.ec.europa.eu/en/documents/Cover_report_inventory.pdf, accessed 27 April 2011.

European Commission 2008*a*. Commission Regulation (EC) No 889/2008 of 5 September 2008 laying down detailed rules for the implementation of Council Regulation (EC) No 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control. *Official Journal of the European Union* L 250, 1-84.

European Commission 2008*b*. Commission Regulation (EC) No 1254/2008 of 15 December 2008 amending Regulation (EC) No 889/2008 laying down detailed rules for implementation of Council Regulation (EC) No 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control. *Official Journal of the European Union* L 337, 80-82.

European Commission 2009*a*. Commission Regulation (EC) No 1122/2009 of 30 November 2009 laying down detailed rules for the implementation of Council Regulation (EC) No 73/2009 as regards cross-compliance, modulation and the integrated administration and control system, under the direct support schemes for farmers provided for that Regulation, as well as for the implementation of Council Regulation (EC) No 1234/2007 as regards cross-compliance under the support scheme provided for the wine sector. *Official Journal of the European Union* L 316, 65-112.

European Commission 2009*b*. *Feasibility study on animal welfare labeling and establishing a Community Reference Centre for animal protection and welfare – Part 1: Animal welfare labelling*. Study prepared by the Food Chain Evaluation Consortium (FCEC). http://ec.europa.eu/food/animal/welfare/farm/aw_labelling_report_part1.pdf, accessed 27 April 2011.

European Commission 2009*c*. Commission Regulation (EC) No 710/2009 of 5 August 2009 amending Regulation (EC) No 889/2008 laying down detailed rules for the implementation of Council Regulation (EC) No 834/2007, as regards laying down detailed rules on organic aquaculture animal and seaweed production. *Official Journal of the European Union* L 204, 15-34.

European Commission 2010*a*. Commission Regulation (EU) No 146/2010 of 23 February 2010 amending Regulation (EC) No 1122/2009 laying down detailed rules for the implementation of Council Regulation (EC) No 73/2009 as regards cross-compliance, modulation and the integrated administration and control system, under the direct support schemes for farmers provided for in that Regulation, as well as for the implementation of Council Regulation (EC) No 1234/2007 as regards cross-compliance under the support scheme provided for the wine sector. *Official Journal of the European Union* L 47, 1-3.

European Commission 2010*b*. Commission Regulation (EU) No 360/2010 of 27 April 2010 amending Annex IV and Annex VIII to Council Regulation (EC) No 73/2009 establishing common rules for direct support schemes for farmers under the common agricultural policy. *Official Journal of the European Union* L 106, 1-4.

European Commission 2010*c*. *Cross Compliance*. Joint Research Centre, Institute for Environment and Sustainability, Monitoring Agricultural Resources Unit. http://marswiki.jrc.ec.europa.eu/wikicap/index.php/Cross_Compliance, accessed 27 April 2011.

European Commission 2011. *Infringements of EU law*. http://ec.europa.eu/eu_law-/infringements/infringements_en.htm, accessed 9 December 2011.

European Council 1998. Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes. *Official Journal of the European Communities* L 221, 23-27.

European Council 2001. Council Directive 2001/88/EC of 23 October 2001 amending Directive 91/630/EEC laying down minimum standards for the protection of pigs. *Official Journal of the European Communities* L 316, 1-4.

European Council 2003. Council Regulation (EC) No 1782/2003 of 29 September 2003 establishing common rule for direct support schemes under the common agricultural policy and establishing certain support schemes for farmers and amending Regulations (EEC) No 2019/93, (EC) No 1452/2001, (EC) No 1453/2001, (EC) No 1454/2001, (EC) 1868/94, (EC) No 1251/1999, (EC) No 1254/1999, (EC) No 1673/2000, (EEC) No 2358/71 and (EC) No 2529/2001. *Official Journal of the European Union* L 270, 1-69.

European Council 2007. Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91. *Official Journal of the European Union* L 189, 1-23.

European Council 2008*a*. Council Directive 2008/119/EC of 18 December 2008 laying down minimum standards for the protection of calves (codified version). *Official Journal of the European Union* L 10, 7-13.

European Council 2008*b*. Council Directive 2008/120/EC of 18 December 2008 laying down minimum standards for the protection of pigs (codified version). *Official Journal of the European Union* L 47, 5-13.

European Council 2008*c*. Council Regulation (EC) No 967/2008 of 29 September 2008 amending Regulation (EC) No 834/2007 on organic production and labelling of organic products. *Official Journal of the European Union* L 264, 1-2.

European Council 2009. Council Regulation (EC) No 73/2009 of 19 January 2009 establishing common rules for direct support schemes for farmers under the common agricultural policy and establishing certain support schemes for farmers, amending Regulations (EC) No 1290/2005, (EC) No 247/2006, (EC) No 378/2007 and repealing Regulation (EC) No 1782/2003. *Official Journal of the European Union* L 30, 16-99.

European Food Safety Authority 2009. Scientific Opinion of the Panel on Animal Health and Welfare on a request from the Commission on the risk assessment of the impact of housing, nutrition and feeding, management and genetic selection on behaviour, fear and pain problems in dairy cows. *The EFSA Journal* 1139, 1-68.

Evans, A. and Miele, M. 2007. Why European consumers do not buy more animal friendly foods. *Electronic newsletter of the Welfare Quality® project FOOD-CT-2004-506508* http://www.welfarequality.net/ezine.m?id=38701#6, accessed 27 April 2011.

Farm Animal Welfare Council 1993. *Second report on priorities for research and development in farm animal welfare*. Ministry of Agriculture, Fisheries and Food, London, UK.

Farm Animal Welfare Council 2001. *Interim Report on the Animal Welfare Implications of Farm Assurance Schemes*. Farm Animal Welfare Council, UK.

Farmer, M., Swales, V., Jongeneel, R., Karaczun, Z., Müssner, R., Leipprand, A., Schlegel, S., Poux, X., Ramain, B., De Roest, K., Varela Ortega, C., and Simó, A. 2007. Exploring the synergies between cross compliance and certification schemes. *Deliverable 8: Synthesis report of certification schemes in 7 EU countries and 3 non-EU countries*. Paper prepared for SSPE-CT-2005-006489 Facilitating the CAP reform: Compliance and competitiveness of European agriculture. http://library.wur.nl/way/bestanden/clc/1860311.pdf, accessed 27 April 2011.

Fraser, D. 1993. Assessing animal well-being: Common sense, uncommon science. In: USDA and Purdue University Office of Agricultural Research Programs (ed.) *Proceedings of the food animal well-being conference proceedings and deliberations*. West Lafayette, Indiana, USA, pp. 37-54.

Fraser, A. F. 1983. The behaviour of maintenance and the intensive husbandry of cattle, sheep and pigs. *Agriculture, Ecosystems and Environment* 9, 1-23.

Fraser, D. 1995. Science, values and animal welfare: Exploring the "inextricable connection". *Animal Welfare* 4, 103-117.

Fraser, D. 2006. Animal welfare assurance programs in food production: a framework for assessing the options. *Animal Welfare* 15, 93-104.

Fregonesi, J. A. and Leaver, J. D. 2001. Behaviour, performance and health indicators of welfare for dairy cows housed in strawyard or cubicle systems. *Livestock Production Science* 68, 205-216.

Gloor, P. 1998. Die Beurteilung der Brustgurtanbindung für leere und tragende Sauen auf ihre Tiergerechtheit unter Verwendung der „Methode Ekesbo“ sowie ethologischer Parameter. In: Eidgenössische Forschungsanstalt für Betriebswirtschaft und Landtechnik (FAT) (Hrsg.) *Schriftenreihe FAT: Schrift 32* [Animal welfare evaluation of the tethering of pregnant and non-pregnant sows, using the „Method Ekesbo” and ethological parameter. In: Swiss Research Institute for Business Administration and Agricultural Engineering (FAT) (ed.) *Schriftenreihe FAT: Schrift 32*]. Tänikon, Switzerland. (In German)

Gonyou, H. W. 1996. Design criteria: Should freedom of movement be retained? *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 27, 36-39.

Guy, J. H., Rowlinson, P., Chadwick, J. P. and Ellis, M. 2002. Health conditions of two genotypes of growing-finishing pig in three different housing systems: Implications for welfare. *Livestock Production Science* 75, 233-243.

Harper, G. C. and Makatouni, A. 2002. Consumer perception of organic food production and farm animal welfare. *British Food Journal* 104 (3/4/5), 287-299.

Hatanaka M., Bain C. and Busch, L. 2005. Third-party certification in the global agrifood system. *Food policy* 30, 354-369.

Hay, M., Meunier-Salaun, M. C., Brulaud, F., Monnier, M. and Mormède, P. 2000. Assessment of hypothalamic-pituitary-adrenal axis and sympathetic nervous system activity in pregnant sows through the measurement of glucocorticoids and catecholamines in urine. *Journal of Animal Science* 78, 420-428.

Herva, T., Peltoniemi, O. and Virtala, A.-M. 2009. Validation of an animal needs index for cattle using test theory. *Animal Welfare* 18, 417-425.

Höglund, J., Svensson, C. and Hessle, A. 2001. A field survey on the status of internal parasites in calves on organic dairy farms in southwestern Sweden. *Veterinary Parasitology* 99, 113-128.

Hörning, B. 1997. Tiergerechtheit und Verfahrenstechnik eingestreuter Milchviehlaufställe in der Praxis [Animal welfare and process technology in littered loose housings for dairy cattle in practice]. *PhD Thesis*. University of Kassel, Faculty of Agriculture, Witzenhausen, Germany. (In German)

Hörning, B. 2000. Comparison of animal welfare on conventional and organic dairy farms. 13th International IFOAM Conference, Basel, 28-31 August 2000. In: Alfödi, T., Lockeretz, W. and Niggli, U. (eds.) *Proceedings of the 13th International IFOAM Conference*. VDF Hochschulverlag, Zürich, p. 335.

Hörning, B. 2001. The assessment of housing conditions of dairy cows in littered loose housing systems using three scoring methods. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 42-47.

Hovi, M., Kossaibati, M., Bennett, R., Edwards, S. A., Robertson, J. and Roderick S. 2002. The impact of organic livestock standards on animal welfare – A questionnaire survey of advisors, inspectors and veterinarians. UK Organic Research 2002 Conference, Aberystwyth, 26-28 March 2002. In: Powell, J. et al. (eds.) *Proceedings of the UK Organic Research 2002 Conference*. Organic Centre Wales, Institute of Rural Studies, University of Wales Aberystwyth, pp. 351-354.

Hovi, M., Sundrum, A. and Thamsborg, S. M. 2003. Animal health and welfare in organic livestock production in Europe: Current state and future challenges. *Livestock Production Science* 80, 41-53.

Hurnik, J. F. 1988. Welfare of farm animals. *Applied Animal Behaviour Science* 20, 105-117.

International Federation of Organic Agriculture Movements 2006. *The IFOAM Basic Standards for Organic Production and Processing*. http://www.ifoam.org/about_ifoam-/standards/norms/norm_documents_library/IBS_V3_20070817.pdf, accessed 27 February 2011.

Irps, H. 1985. Liegeflächenqualität und Raumstruktur in Laufställen [Quality of the lying area and spatial structure in loose housings]. *Landbauforschung Völkenrode* 75, 104-127. (In German)

Jensen, M. B., Pedersen, L. J. and Ladewig, J. 2004. The use of demand functions to assess behavioural priorities in farm animals. *Animal Welfare* 13 Suppl. 1, 27-32.

Johnsen, P. F., Johannesson, T. and Sandøe, P. 2001. Assessment of farm animal welfare at herd level: Many goals, many methods. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 26-33.

Jones, J. B., Wathes, C. M. and Webster, A. J. F. 1998. Operant responses of pigs to atmospheric ammonia. *Applied Animal Behaviour Science* 58, 35-47.

Kallab, A. Kallab, T. and Noll, A. J. 2005. *Bundestierschutzgesetz Band 2* [*Animal Welfare Act Volume 2*]. Verlag Österreich, Vienna.

Kijlstra, A. and Eijck, I. A. J. M. 2006. Animal health in organic livestock production systems: A review. *NJAS Wageningen Journal of Life Sciences* 54(1), 77-94.

Kjærnes, U. and Lavik, R. 2007. Farm animal welfare and food consumption practices: Results from surveys in seven countries. In: Kjaernes, U., Miele, M. and Roex, J. (eds.) *Attitudes of consumers, retailers and producers to farm animal welfare*. Welfare Quality® Report No. 2. Cardiff University, Cardiff, pp. 1-30.

Knierim, U., van Dongen, S., Forkman, B., Tuyttens, F. A. M., Špinka, M., Campo, J. L. and Weissengruber, G. E. 2007. Fluctuating asymmetry as an animal welfare indicator –A review of methology and validity. *Physiology and Behavior* 92, 398-421.

Kristensen, H. H., Burgess, L. R., Demmers, T. G. H. and Wathes, C. M. 2000. The preferences of laying hens for different concentrations of atmospheric ammonia. *Applied Animal Behaviour Science* 68, 307-318.

Kuhn, G., Pyczak, T., Sievert, H. and Häring, G. 2008. Umsetzung von Cross Compliance im Bereich Tierschutz [Implementation of cross-compliance related to animal welfare]. *Deutsche Tierärztliche Wochenschrift* 115, 89-96.

Ladewig, J. and Smidt, D. 1989. Behavior, episodic secretion of cortisol, and adrenocortical reactivity in bulls subjected to tethering. *Hormones and Behavior* 23, 344-360.

Landesregierung Salzburg 2006. Kundmachung der Landeshauptfrau von Salzburg vom 14. Juni 2006 über die Kündigung zweier Tierschutz-Vereinbarungen gemäß Art 15a B-VG [Announcement of the Govenor of Salzburg of 14 June 2006 concerning the termination of two animal welfare agreements according to article 15a B-VG]. *Landesgesetzblatt für das Land Salzburg* 56, 261.

Landesregierung Tirol 2005. Kundmachung des Landeshauptmannes vom 25. November 2005 betreffend die Kündigung der Vereinbarung über den Schutz von Nutztieren in der Landwirtschaft [Announcement of the Govenor of 25 November 2005 concerning the termination of the agreement on the protection of farmed animals in agriculture]. *Landesgesetzblatt für Tirol* 32(81), 320.

Landesregierung Vorarlberg 1995. 34. Kundmachung des Landeshauptmannes über die staatsrechtliche Vereinbarung über den Schutz von Nutztieren in der Landwirtschaft [34th announcement of the Govenor concerning the constitutional agreement on the protection of farmed animals in agriculture]. *Vorarlberger Landesgesetzblatt* 14(34), 119-131.

Leeb, T. and Baumgartner, J. 2000. Husbandry and health of sows and piglets on organic farms in Austria. Animal health and welfare aspects of organic pig production. In: *Proceedings of the 13th International IFOAM Scientific Conference*, 28-31 August, Basel, Switzerland, p. 361.

Lund, V. and Agers, B. 2003. Research on animal health and welfare in organic farming – A literature review. *Livestock Production Science* 80, 55-68.

Lund, V. 2006. Natural living – A precondition for animal welfare in organic farming. *Livestock Science* 100, 71-83.

Main, D. C. J., Webster, A. J. F. and Green, L. E. 2001. Animal welfare assessment in farm assurance schemes. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 108-113.

Main, D. C. J., Whay, H. R., Green, L. E. and Webster, A. J. F. 2003. Effect of the RSPCA Freedom Food scheme on the welfare of dairy cattle. *Veterinary Record* 153, 227-231.

Main, D. C. J. and Whay, H. R. 2004. Is UK farm assurance delivering good welfare? In: Weeks, C. A. and Butterworth, A. (eds.) *Measuring and auditing broiler welfare*. CABI Publishing, Wallingford, Oxfordshire, UK, pp. 215-223.

Main, D. C. J., Leeb, C., Whay, H. R., Hovi, M. and Webster J. 2004. *Bristol Welfare Assurance Programme: Animal based assessment tool for farm animal welfare certification*. http://www.vetschool.bris.ac.uk/animalwelfare/images/BWAPweboverview.pdf, accessed 27 April 2011.

Main, D. C. J., Whay, H. R., Leeb, C. and Webster, A. J. F. 2007. Formal animal-based welfare assessment in UK certification schemes. *Animal Welfare* 16, 233-236.

Manning, L., Baines R. N. and Chadd, S. A. 2006. Quality assurance models in the food supply chain. *British Food Journal* 108, 91-104.

Manteuffel, G. 2002. Central nervous regulation of the hypothalamic-pituitary-adrenal axis and its impact on fertility, immunity, metabolism and animal welfare – A review. *Archiv Tierzucht Dummersdorf* 45(6), 575-595.

Mason, G. and Mendl, M. 1993. Why is there no simple way of measuring animal welfare? *Animal Welfare* 2, 302-319.

Mason, G. J., Cooper, J. and Clarebrough, C. 2001. Frustrations of fur-farmed mink. *Nature* 410, 35-36.

Mathews, L. R. and Ladewig, J. 1994. Environmental requirements of pigs measured by behavioural demand functions. *Animal Behaviour* 47, 713-719.

Meuwissen, M. P. M., Velthuis, A.G. J., Hogeveen, H. and Huirne, R. B. M. 2003. Traceability and certification in meat supply chains. *Journal of Agribusiness* 21(2), 167-181.

Møller, A. P. and Manning, J. 2003. Growth and developmental instability. *The Veterinary Journal* 166, 19-27.

Mollenhorst, H. Rodenburg, T. B., Bokkers, E. A. M., Koene, P. and de Boer, I. J. M. 2005. On-farm assessment of laying hen welfare: A comparison of one environment-based and two animal-based methods. *Applied Animal Behaviour Science* 90, 277-291.

Moraal, M. 2005. Welzijn en het geode leven van dieren – Analyse, vergelijking en toepasbaarheid van welzijnsindices in de varkenshouderij [*Welfare and the good life of animals – Analysis, comparison and application of welfare indexes for pigs*]. University of Utrecht, Wetenschapswinkel Biologie, Utrecht, the Netherlands. (In Dutch)

Mormède, P., Andanson, S., Aupérin, B., Beerda, B., Guémené, D., Malmkvist, J., Manteca, X., Manteuffel, G., Prunet, P., van Reenen, C. G., Richard, S. and Veissier, I. 2007. Exploration of the hypothalamic-pituitary-adrenal function as a tool to evaluate animal welfare. *Physiology and Behavior* 92, 317-339.

Munsterhjelm, C., Valros, A., Heinonen, M., Hälli, O. and Peltoniemi, O. A. T. 2006. Welfare index and reproductive performance in the sow. *Reproduction in Domestic Animals* 41, 494-500.

Napolitano, F., De Rosa, G., Caporale, G., Carlucci, A., Grasso, F. and Monteleone, E. 2007. Bridging consumer perception and on-farm assessment of animal welfare. *Animal Welfare* 16, 249-253.

Napolitano, F., De Rosa, G., Ferrante, V., Grasso, F. and Braghieri, A. 2009. Monitoring the welfare of sheep in organic and conventional farms using an ANI 35 L derived method. *Small Ruminant Research* 83, 49-57.

Nitsch, H. and Osterburg, B. 2007. Efficiency of cross compliance controls – Public administrative costs and targeting. *Deliverable 18 of the CC Network Project*, SSPE-CT-2005-022727. http://literatur.vti.bund.de/digbib_extern/dk039546.pdf, accessed 27 April 2011.

Nitsch, H. and Osterburg, B. 2008. Criteria for an efficient enforcement of standards in relation to cross compliance. In: Mathijs E. and Verbeke W. (eds.) *12th Congress of the European Association of Agricultural Economists (EAAE) "People, food and environments: Global trends and European strategies"*. 26-29 August 2008, Ghent, Belgium.

Ofner, E. 2003. Eine umfassende Analyse der Beurteilungsqualität des Tiergerechtheitsindex TGI 35L/1996 für Rinder [A comprehensive analysis of the assessment quality of the Animal Needs Index TGI 35L/1996 for cattle]. *PhD Thesis*. University of Agricultural Sciences Vienna (BOKU), Institute for Agricultural, Environmental and Electrical Engineering, Vienna, Austria. (In German)

Ofner, E., Amon, T., Lins, M. and Amon, B. 2003. Correlations between the results of animal welfare assessments by the TGI 35 L Austrian Animal Needs Index and health and behavioural parameters of cattle. *Animal Welfare* 12, 571-578.

Ofner, E., Schmid, E., Schröck, E., Troxler, J. and Hausleitner, A. 2007. Self-evaluation of animal welfare by the farmer: A report of application on Austrian cattle farms. *Animal Welfare* 16, 245-248.

Ofner-Schröck, E. 2009. TGI-Punkte sammeln [Collecting ANI points]. *Bio Austria Fachzeitschrift für Landwirtschaft und Ökologie* 1/2009, 16-17. (In German)

Orihuela, A. and Hernández, C. 2007. Cortisol response of restricted suckling or artificially milk-feeding to a short term emotional stressor in dairy calves and their dams. *Animal Welfare* 16, 49-52.

Otten, W., Kanitz, E., Puppe, B., Tuchscherer, M., Brüssow, K. P., Nürnberg, G. and Stabenow, B. 2004. Acute and long term effects of chronic intermittent noise stress on hypothalamic-pituitary-adrenocortical and sympatho-adrenomedullary axis in pigs. *Animal Science* 78, 271-283.

Ottensamer, E. 2006. Ausgewählte Aspekte des Österreichischen Tierschutzgesetzes [Selected aspects of the Austrian Animal Welfare Act]. *PhD Thesis*. University of Vienna, Faculty of law, Vienna, Austria. (In German)

Passantino A. Conte, F. and Russo, M. 2008. Animal welfare labelling and the approach of the European Union: An overview on the current situation. *Journal of Consumer Protection and Food Safety* 3, 396-399.

Roderick, S. and Hovi, M. 1999. Animal health and welfare in organic livestock systems: Identification of constraints and priorities. *A report to the Ministry of Agriculture, Fisheries and Food (MAFF)*. University of Reading, Department of Agriculture, Veterinary Epidemiology and Economics Research Unit, Reading, UK. http://www.organicvet.co.uk/Cattleweb/health/MAFFOrgHealth.pdf, accessed 13 January 2012.

Roe, E. and Buller, H. 2008. Marketing farm animal welfare. *Welfare Quality® report*. http://www.welfarequality.net/downloadattachment/41858/19515/fact%20sheet%20marketi ng%20farm%20animal%20welfare%20final.pdf, accessed 27 April 2011.

Rousing, T., Bonde, M. and Sørensen, J. T. 2001. Aggregating welfare indicators into an operational welfare assessment system: A bottom-up approach. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 53-57.

Rushen, J. 1986. Aversion of sheep to electro-immobilization and physical restraint. *Applied Animal Behaviour Science* 15, 315-324.

Rushen, J. 2003. Changing concepts of farm animal welfare: Bridging the gap between applied and basic research. *Applied Animal Behaviour Science* 81, 199-214.

Rushen, J. and De Passillé, A. M. B. 1992. The scientific assessment of the impact of housing on animal welfare: A critical review. *Canadian Journal of Animal Science* 72, 721-743.

Rutter, S, M. and Duncan, I. J. H. 1992. Measuring aversion in domestic fowl using passive avoidance. *Applied Animal Behaviour Science* 33, 53-61.

Sandøe, P., Giersing, M. H. and Jeppesen, L. L. 1996. Concluding remarks and perspectives. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 27, 109-115.

Schatz, P., Boxberger, J. and Amon, T. 1996. Eine vergleichende Analyse des TGI 200/94 und des TGI 35L/1995 zur Beurteilung der Tiergerechtheit von Milchviehhaltungssystemen. *3. Internationale Tagung „Bau, Technik und Umwelt in der landwirtschaftlichen Nutztierhaltung“* [A comparative analysis of the TGI 200/94 and the ANI 35L/1995 for the assessment of animal welfare of housing systems for dairy cows. *3rd International*

Conference "Construction, technology and environment in livestock farming"]. 11-12 March 1997, Kiel, Germany. (In German)

Scott, E. M., Nolan, A. M. and Fitzpatrick, J. L. 2001. Conceptual and methodological issues related to welfare assessment: A framework for measurement. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 5-10.

Sherwin, C. M. 2007. Validating refinements to laboratory housing: Asking the animals. *NC3Rs* 12, 1-13. http://www.nc3rs.org.uk/news.asp?id=759, accessed 27 April 2011.

Simonsen, H. B. 1996. Assessment of animal welfare by a holistic approach: Behaviour, health, and measured opinion. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 27, 91-96.

Smulders, D., Verbeke, G., Mormède, P. and Geers, R. 2006. Validation of a behavioural observation tool to assess pig welfare. *Physiology and Behavior* 89, 438-447.

Sørensen, J. T. and Sandøe, P. 2001. Preface. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 3-4.

Sørensen, J. T., Sandøe, P. and Halberg, N. 2001. Animal welfare as one among several values to be considered at farm level: The idea of an Ethical Account for livestock farming. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 11-16.

Spoolder, H., De Rosa, G., Hörning, B., Waiblinger, S. and Wemelsfelder, F. 2003. Integrating parameters to assess on-farm welfare. *Animal Welfare* 12, 529-534.

Sundrum, A., Andersson, R. and Postler, G. (eds.) 1994. *Tiergerechtheitsindex 200/1994 – Ein Leitfaden zur Beurteilung von Haltungssystemen* [*Animal needs index 200/1994 – A manual for the assessment of housing systems*]. Köllen Druck und Verlag GmbH, Bonn. (In German)

Sundrum, A. 2001. Organic livestock farming – A critical review. *Livestock Production Science* 67, 207-215.

Theuvsen, L. Plumeyer, C.-H. and Gawron, J.-C. 2007. Certification systems in the meat industry: Overview and consequences for chain-wide communication. *Polish Journal of Food and Nutrition Sciences* 57, 563-569.

Treaty Establishing the European Atomic Energy Community 2010. Consolidated version of the treaty establishing the European Atomic Energy Community. *Official Journal of the European Union* C 84, 1-112.

Treaty on the Functioning of the European Union 2008. Consolidated version of the treaty on the functioning of the European Union. *Official Journal of the European Union* C 115, 47-199.

Troxler, J. 1998. Angewandte Prüfungsmethoden. In: Kuratorium für Technik und Bauwesen in der Landwirtschaft (KTBL) (Hrsg.) *Beurteilung der Tiergerechtheit von Haltungssystemen* [Applied examination methods. In: Board of trustees for technology and building industry in Agriculture (KTBL) (ed.) *The assessment of animal welfare of housing systems*]. Darmstadt, Germany, pp. 51-54. (In German)

Tucker, C. B., Weary, D. M. and Fraser, D. 2003. Effects of three types of free-stall surfaces on preferences and stall usage by dairy cows. *Journal of Dairy Science* 86, 521-529.

Tuyttens, F. A. M. 2003. Measures of developmental instability as integrated, a posteriori indicators of farm animal welfare: A review. *Animal Welfare* 12, 2003.

Ursinus, W. W., Schepers, F., De Mol, R. M., Bracke, M. B. M., Metz, J. H. M. and Groot Koerkamp, P. W. G. 2009. COWEL: A decision support system to assess welfare of husbandry systems for dairy cattle. *Animal Welfare* 18, 545-552.

Veissier, I. 2009. The overall on-farm animal welfare score. *Fact sheet*. Welfare Quality® project. http://www.welfarequality.net/everyone/41858/5/0/22, accessed 19 September 2011.

Veissier, I., Butterworth, A., Bock, B. and Roe, E. 2008. European approaches to ensure good animal welfare. *Applied Animal Behaviour Science* 113, 279-297.

von Borell, E. 1999. Ist Wohlbefinden ein Produktionsfaktor? [Is well-being a production factor?] *Züchtungskunde* 71, 473-481. (In German)

von Borell, E. and Sørensen, J. T. 2004. Organic livestock production in Europe: Aims, rules and trends with special emphasis on animal health and welfare. *Livestock Production Science* 90, 3-9.

Wagner, A. 2010. CC-Regelungen in der Praxis – Folgen von Regelverstößen und Möglichkeiten zur Vermeidung von Sanktionen. *Vortrag im Rahmen der Winterschulung beim Sächsischen Landesamt für Umwelt, Landwirtschaft und Geologie* [CC rules in practice – Consequences of violations and possibilities for avoiding sanctions. *Presentation in the course of the winter education in the Saxon State Office for Environment, Agriculture and Geology*]. 21 January 2010, Rötha, Germany. (In German)

Waiblinger, S. Knierim, U. and Winckler, C. 2001. The development of an epidemiologically based on-farm welfare assessment system for use with dairy cows. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 73-77.

Weber, C. 2004. Entstehung und Hintergründe – Der Weg zum modernsten Tierschutzgesetz Europas. *3. Gumpensteiner Nutztierschutztagung* [Development and background – The road to the most modern Animal Welfare Act in Europe. *3rd Animal Welfare Conference in Gumpenstein*]. 30 November 2004, Federal Research Institute for Agriculture in Alpine Regions BAL Gumpenstein, Irdning, Austria. (In German)

Webster, A. J. F. 2001. Farm animal welfare: The Five Freedoms and the free market. *The Veterinary Journal* 161, 229-237.

Welfare Quality® 2009*a*. *Welfare Quality® assessment protocol for cattle*. Welfare Quality® Consortium: Lelystad, Netherlands.

Welfare Quality® 2009*b*. *Welfare Quality® assessment protocol for pigs*. Welfare Quality® Consortium: Lelystad, Netherlands.

Welfare Quality® 2009*c*. *Welfare Quality® assessment protocol for poultry*. Welfare Quality® Consortium: Lelystad, Netherlands.

Wemelsfelder, F., Hunter, E. A., Mendl, M. T. and Lawrence, A. B. 2000. The spontaneous qualitative assessment of behavioural expressions in pigs: First explorations of a novel methodology for integrative animal welfare measurement. *Applied Animal Behaviour Science* 67, 193-215.

Wemelsfelder, F., Hunter, T. E. A., Mendl, M. T. and Lawrence, A. B. 2001. Assessing the "whole animal": A free choice profiling approach. *Animal Behaviour* 62, 209-220.

Wemelsfelder, F. and Lawrence, A. B. 2001. Qualitative assessment of animal behaviour as an on-farm welfare-monitoring tool. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 21-25.

Whay, H. R., Main, D. C. J., Green, L. E. and Webster, A. J. F. 2003*a*. Animal-based measures for the assessment of welfare state of dairy cattle, pigs and laying hens: Consensus of expert opinion. *Animal Welfare* 12, 205-217.

Whay, H. R., Main, D. C. J., Green, L. E. and Webster, A. J. F. 2003*b*. An animal-based welfare assessment of group-housed calves on UK dairy farms. *Animal Welfare* 12, 611-617.

Whay, H. R., Main D. C. J., Green L. E. and Webster A. J. F. 2003*c*. Assessment of the welfare of dairy cattle using animal-based measurements: Direct observations and investigation of farm records. *Veterinary Record* 153, 197-202.

Widowski, T. 2009. Why are behavioral needs important? In: Grandin, T. (ed.) *Improving animal welfare: A practical approach*. CABI Publishing, Wallingford, Oxfordshire, UK, pp. 290-307.

Winckler, C., Capdeville, J., Gebresenbet, G., Hörning, B., Roiha, U., Tosi, M. and Waiblinger, S. 2003. Selection of parameters for on-farm welfare-assessment protocols in cattle and buffalo. *Animal Welfare* 12, 619-624.

Wood, J. D., Holder, J. S. and Main, D. C. J. 1998. Quality assurance schemes. *Meat Science* 49 (Suppl. 1), 191-203.

World Health Organization 1999. *Principles and Guidelines for the conduct of microbiological risk assessment*. Codex Alimentarius Commission (CAC/GL-30). http://www.who.int/foodsafety/publications/micro/cac1999/en/, accessed 27 April 2011.

Yue, S., Moccia, R. D. and Duncan, I. J. H. 2004. Investigating fear in domestic rainbow trout, oncorhynchus mykiss, using an avoidance learning task. *Applied Animal Behaviour Science* 87, 343-354.

Zeeb, K. 1985. Zur Beurteilung von Haltungssystemen für Rinder aus ethologischer Sicht [The assessment of housing systems for cattle from an ethological point of view]. *Tierärztliche Umschau* 40, 752-758. (In German)

Chapter 2 Evaluation of minimum animal welfare conditions in national standards and farm certification schemes for pig fattening[69]

Abstract

This chapter aims at assessing the status of animal welfare in Austria and Germany as it is regulated by private, national and European animal welfare legislation. In order to achieve this, an inventory of existing private and state-driven animal welfare certification schemes that are relevant for fattening pigs in Austria and Germany is done, and the overlap between legislative and private certification requirements for animal welfare analysed. The chapter's methodological contribution lies in the development of an assessment approach based on the Austrian "Animal Needs Index" that allows the evaluation of minimum farm animal welfare standards without expensive and time-consuming on-farm measures. The comparison of legislative and private certification scheme pig standards indicate slight differences between the minimum animal welfare obligations of certification schemes existent in Austria and Germany whereas the reviewed Austrian scheme obligations show in general more diversification from the evaluated legislative standards.

1. Introduction

The importance of animal welfare conditions on European farms increased over the last years not only at the national level but also in the European context (Veissier *et al.* 2008). With the Common Agricultural Policy (CAP) reform of 2003, compliance with minimum production conditions ("cross compliance" (CC)) related to environmental, food safety and animal welfare standards became relevant for all farms receiving subsidies from the European Union. The national animal welfare law may go beyond European requirements, but a first step toward a common European set of minimum legislative levels has been made. At the same time, the private sector also moves ahead with the implementation and communication of animal welfare standards. These are increasingly part of quality certification schemes used by farmers, marketing associations, transporters and slaughterhouses (Roe and Buller, 2008). One problem common to these approaches and initiatives is that definition, implementation and assessment of animal welfare are still inconsistent, heterogeneous and costly to control (Böcker *et al.* 2006; Trevisi *et al.* 2006).

In the literature the term "animal welfare" is approached from different perspectives. The animal-based standpoint by Broom (1996) defines it as the "animal's state as regards its attempts to cope with its environment", whereas McInerney (1994) explores the meaning of

[69] This Chapter is based on a paper published together with Dr. C. Wieck and M. Kempen in the journal "Acta Agriculturae Scandinavica Section A: Animal Science" (Volume 61, pp. 40-54). The present study is part of the research project "CCAT", EU 6th Framework Programme, Priority 8.1 (European Commission, DG RTD, contract no. 44423-CCAT). Its content does not represent the official position of the European Commission and is entirely under the responsibility of the authors. The authors acknowledge the support of Dr. E. Ofner-Schröck and Mag. med. vet. E. Schröck in conducting the on-farm survey.

farm animal welfare as "a subset of man's perception of his own welfare". A consumer's perspective is at the forefront of the Boogaard *et al.* (2006) and Te Velde *et al.* (2002) definition. A more production-based[70] approach is taken by Knierim (2002) who considers animal welfare as a criterion that measures to what extent housing conditions within the agricultural production system contribute to the animal's well-being. The approach taken in this study combines the animal- and production-based standpoint.

The multiple definitions of animal welfare come along with even more animal welfare assessment approaches derived from different disciplines. According to Sundrum (1998), the applied indicator sets can be divided into animal-referenced parameters and those aiming at the assessment of the animal's housing conditions. Although the animal-referenced evaluation approaches with focus on ethological, physiological, pathological and performance indicators enable a direct assessment of the animal's wellbeing, they require, apart from a time-consuming on-site examination of the respective animals, in most cases expert knowledge or techniques. In contrast to this, the livestock husbandry obligations given by legislative standards and certification schemes open up the possibility to conduct evaluations of the effective minimum animal welfare standard without on-farm visits. The existence of these minimum standards established by private or public certification schemes and the European CC system enables a differentiated assessment of the minimum animal welfare standards for compliant farms and a comparison with existing CC legislation.

Based on the existence of these minimum standards, the objective of this study is to assess the status of animal welfare as it is legislated by private, national and European CC legislation. In order to achieve this, an inventory of existing private and state-driven animal welfare certification schemes that are relevant for fattening pigs in Austria and Germany is done and overlap between legislative and certification requirements for animal welfare analysed and compared. The certification scheme's minimum animal welfare obligations are calculated using the "Animal Needs Index", a specific indicator framework developed by Bartussek (1990), and compared across labels with respect to relevant assessment categories and across countries.

The approach of this study proposes a framework to define and assess animal welfare that has been proven to work in practice and shows how it can be linked to minimum legislative animal welfare standards for evaluation. The results show that, in particular in Germany, there exists significant overlap of quality certification schemes with existing national standards and, thus, no higher level of animal welfare is achieved by these private schemes. Contrary to that, some conventional schemes but the vast majority of organic schemes in both countries ensure higher animal welfare standards.

The chapter proceeds as follows: In Section 2, the animal welfare evaluation framework will be described with Section 3 explaining material and methods, followed by a presentation of the results in Section 4. The last section presents the discussion and conclusions of the chapter.

[70] Also referred to as "environment-based" (see Section 6.1 of Chapter 1 of this thesis).

2. A framework to evaluate animal welfare

The measurement of animal welfare is complex and depends on the chosen approach. In an animal-based approach, animal-referenced parameters[71] may be the preferred indicators. An approach that aims at assessing not only animal-related parameters but also housing conditions may ask for a more complex indicator or index system. Unlike the multiple assessment concepts developed by e.g. Barnett *et al.* (1984), Bock (1990), Sandøe *et al.* (1997), Manteuffel *et al.* (2004), Scott *et al.* (2006), Smulders *et al.* (2006), Boissy *et al.* (2007), Mormède *et al.* (2007) and von Borell *et al.* (2007) that develop or combine indicator groups, index systems as e.g. developed by Fraser (1983), Bartussek (1990, 1999), Scott *et al.* (2001), Bracke *et al.* (2002) and Müller-Lindenlauf *et al.* (2010) are able to ensure an integrated assessment of animal welfare involving a higher number of relevant parameters (Botreau *et al.* 2007).

With the Austrian "Animal Needs Index" (ANI) the first index system to measure livestock housing conditions with regard to farm animal welfare was developed by Bartussek (1990). The following other index systems were designed or published by Plank (1991), Sundrum *et al.* (1994), Bokkers (1996), Capdeville and Veissier (2001), Main *et al.* (2001) and Hörning (2003) using similar methodological approaches. Napolitano *et al.* (2009) developed an animal welfare index system for sheep on conventional and organic farms by modifying and fitting the latest version of the ANI for cattle (ANI 35L 2000; Bartussek *et al.* 2000) to the assessment of sheep. The most recent approach in developing integrated assessment systems for different farm animal types is given by the evaluated monitoring schemes of the "Welfare Quality®" research project in 2009 (De Rosa *et al.* 2009; Forkman and Keeling 2009; Keeling 2009).

The ANI principally considers five welfare aspects of farm animals that are given by its assessment categories:

1. The possibility of mobility (locomotion)
2. Social interaction
3. Condition of flooring for lying, standing and walking
4. Climatization (light, air, noise)
5. The intensity or quality of human care (stockmanship).

The ANI categories are divided into a number of assessment scales assigning point values to defined livestock housing conditions. The worse the animal welfare status of the offered farming conditions, the lower are the awarded point values. The latter are added up to an overall ANI score. The ANI allows a compensation of a poor welfare status within one field by a better one within another area. Different ANIs were developed for calves, adult cattle, laying hens, fattening pigs and sows (Bartussek 2000). The latest version of this indicator framework

[71] Animal-referenced parameters refer e.g. to the animal's body condition, behaviour, and so on (see e.g. Johnsen *et al.* 2001).

is the "ANI 35L" (Bartussek 1995*a*, *b*; 2000; 2001)[72]. Table 2.1 provides an overview of the ANI assessment categories and point scales for fattening pigs. (Bartussek 1999, 2001)

Table 2.1: ANI 35L/1995 assessment categories and point scales for fattening pigs

ANI categories	ANI assessment scales							Point intervals
	a	b	c	d	e	f	g	
I. Locomotion	Floor area	Material for behav. needs	Rubbing	Size of the free range	Outdoor exercise days/year	Pasture days/year		
Point interval	[-0.5–3]	[-0.5–2]	[0.5–1]	[0–1]	[0–1.5]	[0–1]		**[-1–9.5]**
II. Social interaction	Floor area	Available facilities	Delivery of young animals	Bounds of farrow. crate	Herd structure	Outdoor exercise days/year	Drove alleyway	
Point interval	[-0.5–2]	[-0.5–2]	[0–1]	[-0.5–1]	[-0.5–1.5]	[0–1.5]	[0–1]	**[-2–10]**
III. Condition of flooring	No. of different floors	Softness of lying area	Cleanliness of lying area	Slipperiness of lying area	Activity areas	Condition of free range	Wallow	
Point interval	[0–1]	[-0.5–2]	[-0.5–1]	[0.5–1]	[-0.5–1.5]	[-0.5–1.5]	[0.5–1]	**[-2.5–9]**
IV. Light, air and noise	Light intensity	Air quality	Draught	Showers	Noise intensity	Outdoor exercise hours/day	Providers of shade, wallow	
Point interval	[-0.5–1.5]	[-0.5–1.5]	[-0.5–1]	[0.5–1]	[-0.5–1]	[0.5–1.5]	[-0.5–1.5]	**[-2.5–9]**
V. Stockmanship	Cleanliness of stables	Condition of equipment	Loss of animals	Condition of skin	Condition of claws and joints	Record keeping	Animal health	
Point interval	[-0.5–1]	[-0.5–1]	[-0.5–1.5]	[-0.5–1.5]	[-0.5–1.5]	[0–1]	[-0.5–1.5]	**[-3–9]**
							Minimum point sum	**-11**
							Maximum point sum	**46,5**

Legend: ANI: Animal Needs Index; behav.: behavioural; farrow.: farrowing; No.: Number.
Source: Modified from Bartussek (1995).

The ANI has been long tested in practice[73] and allows a high repeatability of the overall ANI scores in case of multiple assessments by different investigators (Schatz *et al.* 1996; Amon *et al.* 2001, p. 114; Capdeville and Veissier 2001, p. 62f.; Napolitano *et al.* 2009). But - as it was initially developed for the assessment of animal welfare conditions on organic farms - free-range and pasture conditions receive a strong reward in the assessment scale that may lead to a bias in the ANI framework. If only minimum legislative requirements are observed, it will automatically rank organic farming systems higher than conventional ones. Otherwise, regardless of the respective farm type, free-range and pasture conditions are largely considered by the science to be of relevance for farm animal welfare (e.g. Gonyou 1996). Bartussek (1999, p. 186) states that all farm species need adequate space and exercise to express natural behaviour (see also Müller 1987; Jensen and Toates 1993). With this aspect in mind, Bartussek (1999, p. 186) refers to a broad consensus among scientists that the lack of exercise weakens the immune system and contributes to an atrophy of the skeleton and muscles (see also Pilaski 1970; Schole 1982; Ferket and Hacker 1985; Wokac 1989; Marchant and Broom 1996). However, Gonyou (1996, p. 39) states that housing systems ensuring enough space allowance may entail other welfare risks. In the case of fattening pigs for example, the para-

[72] From now on, the term ANI always refers to the most recent version of the indicator framework, i.e. the ANI 35L.
[73] Since 1995, the ANI is used as the official evaluation system for the assessment of housing conditions of organic cattle farms in Austria (see Bartussek 2001).

sitic load is assumed to be substantially higher when pigs gain outdoor access (Borgsteede and Jongbloed 2001; Baumgartner *et al.* 2003; Kijlstra *et al.* 2004; Eijck and Borgsteede 2005; Kijlstra and Eijck 2006). To face this problem, the ANI involves a 5-point assessment scale[74] addressing the health status of the skin and the presence of ectoparasites weighted in accordance to the share of affected animals in the total herd size and their level of injury (Bartussek 1995*a*, p. 18). Considering these aspects, several studies have proven the ANI to be suitable for the assessment of housing conditions of organic and conventional farm types (see e.g. Hörning 1997; 2000; 2001).

Table 2.2: Overlap between the ANI indicator set and official CC indicators for animal welfare

Pigs Directive			Animal Protection Directive [a]		
Short description of relevant obligations	**Number of overlapping ANI assessment scales**	**Share of points in final ANI [%]**	**Short description of relevant obligations**	**Number of overlapping ANI assessment scales**	**Share of points in final ANI [%]**
Minimum space for group and individual housing	7	25.8	Freedom of movement / sufficient space	7	25.8
Requirements for mixing groups of pigs	1 [b]	2.2 [b]	Accommodation for sick or injured animals	0	0.0
Innocuous accommodation material and construction	4	15.1	Innocuous accommodation material and construction	4	15.1
Means to minimise aggression	1	4.3	Keeping of animals for farming purposes	0	0.0
Air circulation, temp., etc.	2	7.5	Air circulation, temp., etc.	2	7.5
Suitable lightning	2	7.5	Suitable lightning	2	7.5
Condition of flooring	6	22.6	Record keeping	1	2.2
Requirements for noise control	1	3.2	Inspections of automated and mechanical equipment	1	3.2
Requirements for weaning	0	0.0	Qualified / sufficient staff	0	0.0
Qualified and sufficient staff	0	0.0	Inspections of animals	3	10.8
Restrictions for tethering	4	23.7	Prohibition to administer harmful substances	1	4.3
Diet and feeding intervals	1	5.4	Diet and feeding intervals	1	5.4
Feed and water access	2	8.6	Feed and water access	2	8.6
Adequate conditions of farrowing	1	4.3	Animal care in case of illness and injury	4	17.2
Suitable bedding / material for behavioural needs	5	18.3	Protection for animals not kept in buildings	1	4.3
Sufficient space to suckle and means to protect piglets	0	0.0	Requirements for breeding procedures	0	0.0
Conditions of mutilation and interventions	0	0.0	Conditions of mutilation and interventions	0	0.0

Note: Note that the ANI indicators, which are allocated to the specific legislative standards, partly overlap among themselves.
[a]: By means of the ANI of fattening pigs.
[b]: In case of breeding sows.
Legend: ANI: Animal Needs Index; temp.: temperature.
Source: Own compilation.

But also private and state-driven farm certification schemes as well as national monitoring authorities apply index systems and checklists to assess the animal welfare status (Farmer *et al.* 2007, p. 20; Veissier *et al.* 2008, p. 283). Given the increased importance of animal welfare obligations and their correct measurement over time, these certification specific index systems converged with respect to its measurement categories in recent years (Botreau *et al.* 2007, p. 1179). Exemplary for this development, Table 2.2 describes the detected overlap

[74] The ANI assessment scale T5d (category 5 assessment scale d) refers to the condition of skin and the presence of ectoparasites.

between the ANI indicator scales and the respective CC indicator sets for animal welfare. The relevant CC legislation for animal welfare can be found in the "Pigs directive"[75] and the more horizontal "Animal Protection Directive"[76] relevant for all farm animals. Within Table 2.2, the relevant obligations dealt with in the directive are captured and the number of indicator scales that assess the obligation as well the percentage weight that this obligation receives in the final ANI score is shown.

The calculations show that there already exists significant overlap of the ANI framework with the official CC farm monitoring system. Given that most certification schemes follow in their codes of practice official guidelines or regulations, it seems acceptable to assume that this ANI indicator framework is also suitable to assess the animal welfare obligations of farm certification schemes.

Since the ANIs first widespread use in the year 1995, animal welfare science has developed greatly. In this regard one could argue that the recently developed "Welfare Quality®" evaluation system rather matches the current state of science, as it involves more animal-based measures unfolding the "direct" outcomes of the interaction between the animal and its environment (see e.g. Johnsen *et al.* 2001, p. 27; Keeling 2009, p. 2f.; Welfare Quality® 2009). But concerning the objective of this study this approach involves several difficulties. Generally, the conduction of animal-based measures requires expensive and time-consuming on-farm assessments as well as assessment expertise. As this chapter aims at developing a new approach to evaluate animal welfare standards of compliant farms without the conduction of farm visits, the assessments have to be focused on environmental and management-based measures used to control legislative and certification requirements. Among all existing integrated welfare evaluation systems, the ANI framework shows the strongest overlap with official monitoring indicators. Under additional consideration of its already mentioned high practicability and assessment quality, hence, the decision is made to use the ANI framework for our evaluation.

3. Methodology and data of the study

3.1. Methodology

In order to achieve the assessment and comparison of animal welfare standards for pig production farms following different regulations regarding animal welfare, the study proceeds in five steps.

In the first step, an inventory of certification schemes that are applied in Austria and Germany and contain specific animal welfare requirements was carried out. Schemes that

[75] "Council Directive 91/630/EEC of 19 November 1991 laying down minimum standards for the protection of pigs" (European Council 1991).
[76] "Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes" (European Council 1998).

include relevant animal welfare obligations but focus also on other topics as, for example, food safety were also included in this inventory.

In a second step, under the assumption of full compliance with requirements of the respective standards, we calculate *minimum ANIs* based on the specific production obligations given by the CC relevant Council Directives[77], the EU organic standard[78], or the respective farm certification scheme. Many certification schemes only refer to national or European regulations without including them in their own set of standards. For this reason, where necessary, the legislative requirements had to be transferred into the respective certification codes. The ANI was evaluated for fattening pigs with a weight of 60-110 kg. In the case of not specified outdoor yards for the animals, protection against weathering was not considered.

As described under the second section of this chapter, the vast majority of ANI assessment scales are covered by requirements specified in codes of practice of certification schemes and national or European law. But for few assessment scales e.g. the availability of showers in the stable[79] or the number of available floor types[80], the relevant information is not provided by the standards. In cases where these assessment scales did not directly correlate with ratings of other scales (e.g. the scale "condition of claws"[81] shows a direct correlation to the scales covered by the ANI category "condition of flooring"), they were awarded with zero ANI points. If direct correlation to other scales could be assumed, their ratings were consequently adjusted according to the judgments made for the correlating scales.

The ANI assessments for fattening pigs with resulting points per indicator scale and category were summarised to the final ANI scores, which represent the minimum animal welfare level of the livestock housing conditions on a specific farm that complies with a set of specific standards. According to the ANI indicator framework, ratings of the livestock housing conditions are classified as shown in Table 3.1.

Table 3.1: Rating of animal welfare levels according to the ANI framework

Sum of ANI points	Naming of categories with respect to welfare	Expressed in percentage of ANI points
< 11	Not suitable	0 – 15
11 - < 16	Scarcely suitable	16 – 30
16 - < 21	Somewhat suitable	31 – 50
21 – 24	Fairly suitable	51 – 60
>24 – 28	Suitable	61 – 75
> 28	Very suitable	> 75

Legend: ANI: Animal Needs Index.
Source: Own representation based on Bartussek (1999).

In the third step, the respective standards were compared by means of the calculated ANI scores and *aggregated to groups* with identical minimum ANIs.

[77] "Council Directive 91/630/EEC of 19 November 1991 laying down minimum standards for the protection of pigs" and "Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes".
[78] Imposed by "EU Commission Regulation (EC) No. 889/2008 of 5 September 2008 laying down detailed rules for the implementation of Council Regulation (EC) No. 834/2007 on organic production and labelling of organic products with regard to organic production, labelling, and control".
[79] The ANI assessment scale T4d (category 4 assessment scale d) refers to the availability of showers.
[80] The ANI assessment scale T3a (category 3 assessment scale a) refers to the number of available floor types.
[81] The ANI assessment scale T5e (category 5 assessment scale e) refers to the condition of claws.

In a fourth step, these groups of labels were compared regarding their animal welfare requirements and in relation to the legislative standards. This allows for *assessing the overlap* between standards.

In the last step, an *extrapolation* of the calculated minimum ANI levels to the full farm or herd size population in Austria and Germany was performed. This enables drawing conclusions on the minimum animal welfare level in the full farm population. For this, the calculated minimum ANI levels were weighted with its respective number of farms and herd sizes participating in a specific certification scheme.

For the comparison of Austrian certification schemes and national legislation, we were able to perform an *additional step* given that recent results from an on-farm assessment of animal welfare using the ANI framework exist (Annen 2009). Here, the minimum ANI values that are calculated on the assumption of full farm compliance were adjusted with the arithmetic average of respective Austrian on-farm ANI results. This allows comparison of the "full compliance" minimal ANI scores with "on-farm" assessed real ANIs that reveal the actual degree of compliance of farms.

3.2. Data

3.2.1. Farm certification schemes

The great variety of animal welfare referenced labels and farm certification schemes existent in Austria and Germany entail a large variety of trademarks, logos of conventional or organic farm associations, certifications of origin, as well as labels only indicating farm control of certain monitoring bodies. In order to identify the private and state-driven farm certification schemes relevant for this study, the following selection criteria were considered:

- Focus on all relevant housing conditions
- Minimum standards set up in codes of practice handed out to the farmers
- Regular controls of the compliance with standards
- Enforcement of sanctions if the minimum requirements are not achieved.

3.2.2. Data on farm numbers and herd sizes

To draw conclusions from the minimum ANI scores to the national coverage of labels, information about certification participation rates, herd sizes and so on are essential. To achieve this goal, responsible bodies of the involved conventional and organic certification schemes as well as public authorities were contacted in the time period from June to August 2009. They provided information about participation rates and number of animals covered by the respective labels. In cases where appropriate data could not be delivered, the data gaps had to be filled with estimations or assumptions based on other data sources available. This holds for the missing information about herd sizes of organic fattening pigs in Austria. Here information about herd sizes of all organic pigs in Austria and the average share of fattening pigs to all pigs on organic farms in Germany was used (Statistisches Bundesamt 2007; Austrian Ministry of Agriculture 2008).

3.2.3. On-farm assessments

From February to March 2009, ANI assessments were conducted on Austrian pig fattening farms. The 25 pig farms that were selected for the on-farm assessments are distributed over Austria and are associated to various certification grades. The adherence to CC obligations was controlled by means of official monitoring forms.

4. Results and discussion

4.1. Inventory of standards and clustering to ANI groups

The number of standards that are found to have animal welfare reference in their label description is illustrated in Table 4.1. This account includes farm certification, marketing schemes and quality meat programmes that emphasise the animal welfare aspect in their label description. At the request of several certification schemes, the names of these schemes can not be disclosed and all results are anonymised. For the above chosen standards and schemes, specific ANI scores based on the scheme's codes of practice, the given ANI indicator scales, and the assumption that farms fully comply with the codes of practice were calculated.

In order to analyse the overlap between legislative and private animal welfare relevant schemes, schemes with similar requirements that lead to identical ANI scores are clustered into ANI groups and, subsequently, in the next section compared with regard to their individual minimum obligation values according to the ANI categories. The numbers of resulting ANI groups for fattening pigs are given in the respective columns of Table 4.1.

Table 4.1: Clustering of schemes according to their ANI assessment results

Type of legislation	Public legislation:				Private standards:			
	EU/national (conventional non-certified)		EU organic standard		Conventional labels		Organic labels	
Reviewed /grouping	Reviewed	ANI groups	Reviewed	ANI groups	Reviewed	ANI groups	Reviewed	ANI groups
Austria	1	1	1	1	6	1	25 [b]	2
Germany	1	1	1	1	9	2	17	1
Sum of reviewed standards / resulting ANI groups	**2**	**2**	**1** [a]	**1** [a]	**15**	**3**	**41** [b]	**3**

Legend: ANI: Animal Needs Index.
Source: Own compilation.
[a]: Due to same or partly same standards in Austria and Germany.
[b]: Including one label that combines conventional and organic products at the marketing point.

In total, 59 programmes/labels/standards were found that reference animal welfare for fattening pigs. The national standard relates to the legislative minimum standard resulting from EU CC legislation and national law and is the relevant legislation for all farms that are not certified under some private or organic programme. There exists one national standard in each country; hence, this standard defines one ANI group, respectively. The EU organic standard refers to the EU legislation relevant for organic farms and is the same for all EU member states, consequently forming one ANI group as well. For the private labels, the situation is

more complex. In Austria, we found six different private conventional standards; however, they do not differ with respect to the animal welfare requirements as categorized by the ANI framework. Hence, we clustered them into one group in order to ease the comparison across animal welfare levels. Contrary to Austria, in Germany exists a larger heterogeneity in private conventional schemes and, out of the nine existing conventional standards, two groups of standards with differing animal welfare requirements could be formed. Private organic labels are abound in both countries, nevertheless, the labels could be aggregated to two groups for Austria and one group for Germany according to the animal welfare requirements in each country.

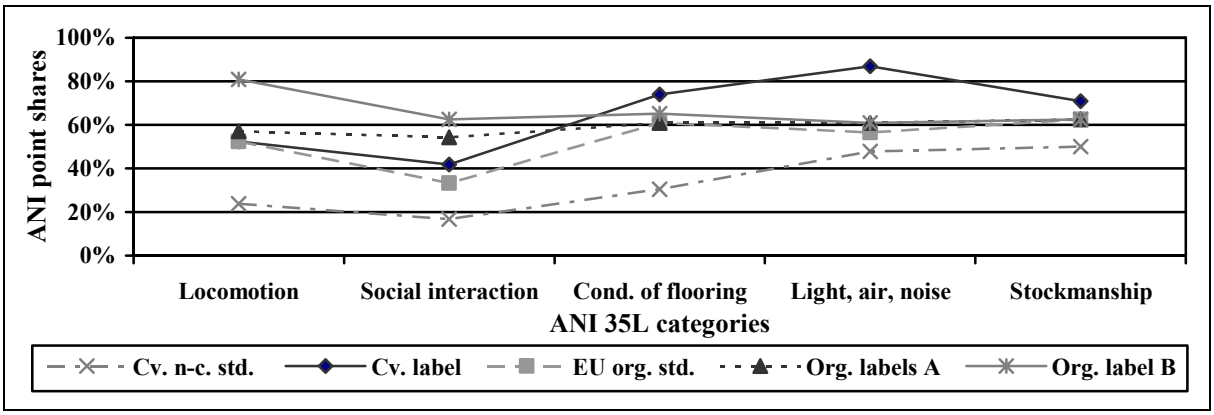
4.2. Overlap between legislative level and farm certification standards

In this section, we compare the animal welfare requirements of the different groups identified in the section before and as assessed by the ANI. To illustrate the detected overlap of the identified ANI groups of standards, their shares of achieved ANI points are plotted for the respective ANI categories "locomotion", "social interaction", "condition of flooring", "light, air, noise", as well as "stockmanship".

4.2.1. Austria

As can be seen from Table 4.1, five different clusters of labels with identical ANI requirements could be identified. The two groups of labels distinguished in the area of private organic schemes are marked with the capitals A and B in Figure 4.1.

Figure 4.1: Shares of achieved ANI points of the ANI groups in Austria



Legend: ANI: Animal Needs Index; Cond.: Condition; Cv.: Conventional; EU: European Union; n-c.: non-certified; Org.: organic; std.: standard.
Source: Own compilation.

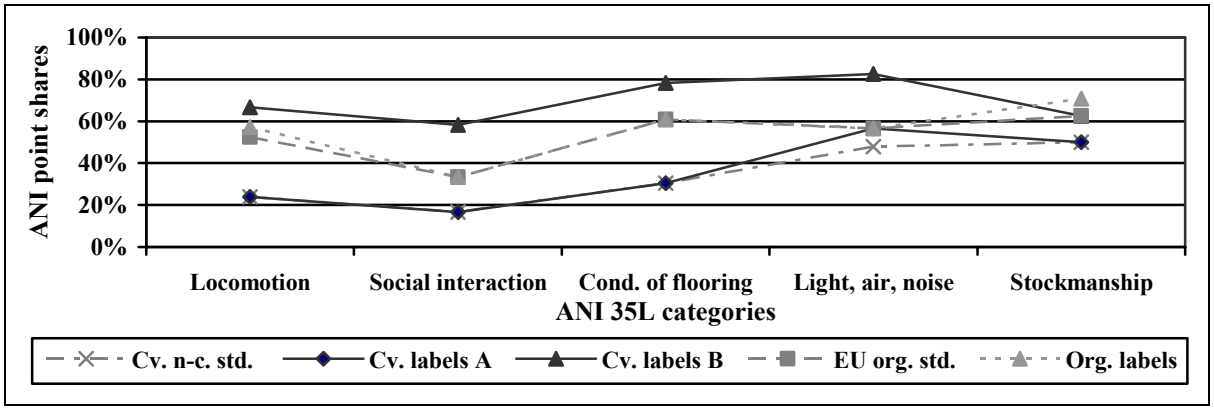
As expected the lowest minimum level of farm animal welfare in Austria is defined by the national conventional standard. The results of the other ANI groups indicate that they have to comply with considerably higher minimum requirements instated by the respective certification schemes. Although the ANI point shares of the ANI groups allocated to organic schemes vary especially with respect to the categories "locomotion" and "social interaction", their curves run to a large extent parallel to the curve representing the EU organic standard, while

the curve assigned to a conventional label shows substantial deviation especially in reference to the ANI category "light, air, noise". The strong variations in the ANI point shares with respect to the categories "locomotion" and "social interaction" reflect substantial differences concerning the minimum space allowance, free-range and pasture obligations of the respective standard sets. The absence of strong variations in the ANI point shares of the remaining categories "condition of flooring", "light, air, noise" and "stockmanship" can to some extent be traced back to the already high ANI point share of the conventional noncertified standard and the consideration of rather vague formulated requirements that underlie margins of interpretation. In particular concerning the category "stockmanship" only little differences in the respective obligations were found.

4.2.2. Germany

According to Table 4.1, the ANI clusters identified for German pig fattening standards distinguish one ANI group for private organic and two groups containing private conventional schemes. The latter are indicated with the capitals A and B. In accordance to the procedure applied in Figure 4.1, their ANI point shares are plotted against the ANI categories and illustrated in Figure 4.2.

Figure 4.2: Shares of achieved ANI points of the ANI groups in Germany



Legend: ANI: Animal Needs Index; Cond.: Condition; Cv.: Conventional; EU: European Union; n-c.: non-certified; Org.: organic; std.: standard.
Source: Own compilation.

In general, it can be observed that the curves representing the ANI point shares for German ANI groups show a very similar development as those detected for Austria as compliance with obligations imposed by the European CC system and the EU organic standard are the same in all member states of the EU.

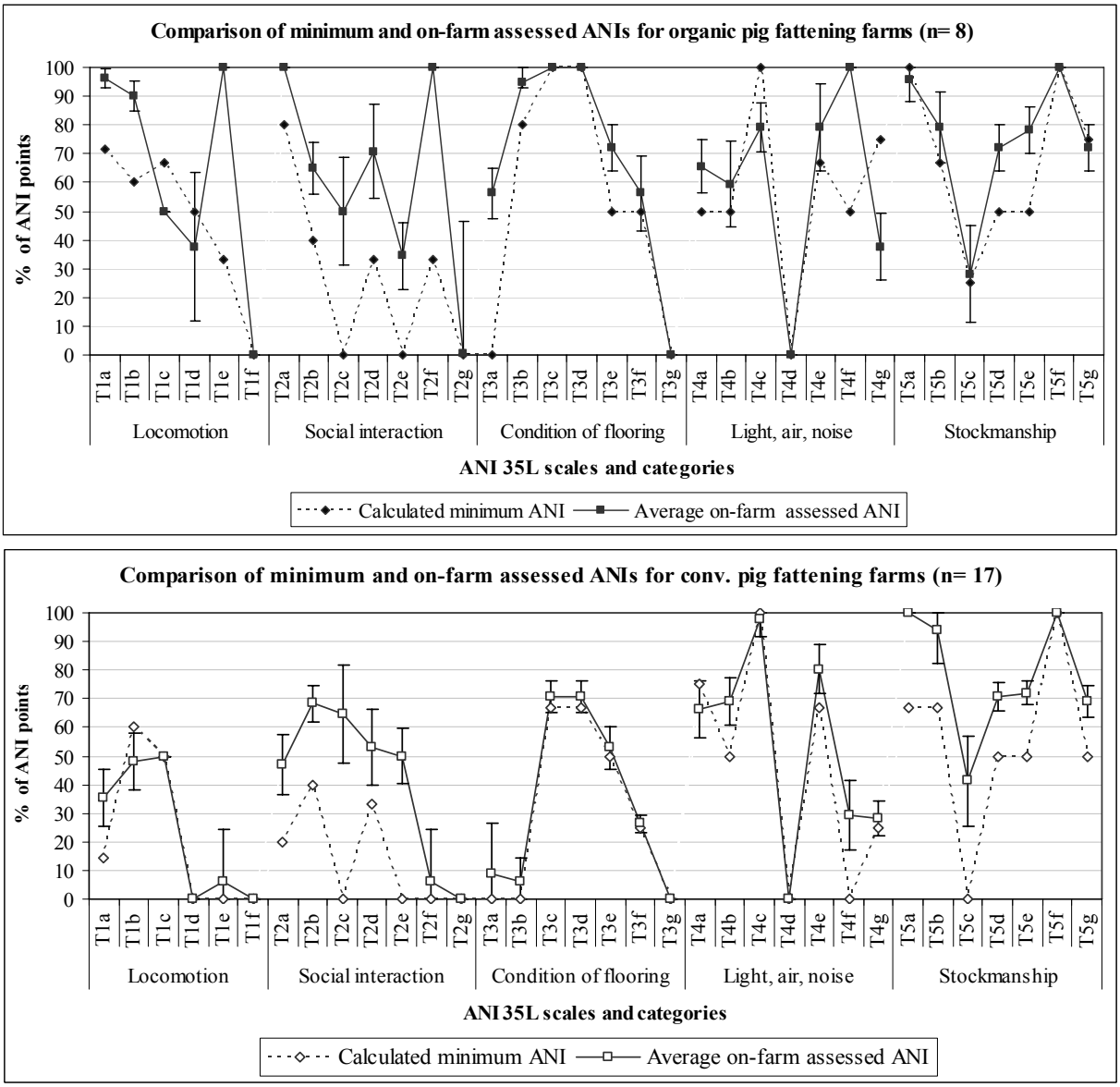
Nevertheless, in contrast to the wider variation of Austrian values, the ANI results of the groups in Germany show more overlap with the respective legislative standard. This holds for both conventional and organic schemes. The positive exception is one conventional label that is characterized by very high minimum requirements in four ANI categories and thus also shows substantial deviation from the respective conventional legislative standard. The negative exception is the other group of conventional labels that only deviate in the category "light, air, noise" from the instated national minimum requirements. For private organic la-

bels, only a slight variation from the EU organic standard can be observed for the categories "locomotion" and "stockmanship".

4.2.3. Comparisons of calculated minimum ANIs with on-farm assessments in Austria

As explained in the third section, there exist recent results from an on-farm assessment of animal welfare using the ANI framework for Austria. Thus, in Figure 4.3 the calculated ANI scores based on full compliance with Austrian legislative and certification requirements are plotted against the averages of on-farm measured ANI values. For each on-farm assessed ANI scale, the standard deviation is specified. Given that the on-farm assessment of animal welfare is focused on conventional noncertified farms and organic farms, comparison of calculated minimum ANIs and real ANIs is possible only for these two groups.

Figure 4.3: Comparison of minimum calculated ANIs with on-farm ANI measures



Note: Long text of subcategory codes can be found in Table 2.1.
Legend: ANI: Animal Needs Index; conv.: conventional; n: sample size.
Source: Own compilation.

The diagrams of Figure 4.3 show that the on-farm ANI measures deviate from the calculated minimum ANI scores that were based on the legislative/label requirements. Generally it can be observed that the curves representing the on-farm assessments show higher ANI point shares and run to a large extent parallel to those related to the calculated minimum obligations. In three indicator scales of the ANI categories "light, air, noise" (T4a, T4b and T4c) and "stockmanship" (T5a, T5b and T5c) the on-farm measurements on conventional noncertified farms reach even higher ANI shares than those conducted on farms associated to the organic labels. In reference to the ANI categories "social interaction" and "stockmanship", the ANI point shares related to the on-farm assessment of conventional noncertified and organic farms show partially strong deviation from the calculated minimum shares. This can be to a large extent ascribed to the fact that these ANI categories involve several indicator scales that are not covered by requirements given by European or national legislation.

When doing on-farm assessments of animal welfare obligations, violations with the respective codes can be found also. For organic labels, medium violations were detected concerning the ANI category "light, air, noise", whereas on conventional noncertified farms small violations were detected with respect to the ANI categories "condition of flooring" and "locomotion". This is reflected in the low observed ANI shares achieved in these categories for conventional noncertified and organic farms. They nearly approach the calculated minimum standard.

Concerning most ANI scales, the standard deviation detected for the on-farm assessments of conventional farms reaches lower values than those of organic farms. This applies in particular to the scales allocated to the category "social interaction". The higher standard deviation of evaluations on organic farms can be, to some extent, ascribed to the higher number of organic labels involved in the assessments that show, in accordance with the findings of Figure 4.1, diverging minimum requirements assigned to different animal welfare levels.

4.3. Extrapolation of calculated animal welfare levels into the full farm population

In this section, we attempt to provide a picture about the relevance of these calculated minimum ANIs for the full population of pigs housed on conventional and organic farms in Austria and Germany. In order to do so, averages of the calculated minimum ANIs as presented in Figures 4.1 and 4.2 are calculated where each minimum ANI is multiplied with its "participation rate". The resulting number is called the average minimum ANI (AMANI) score. The "participation rate" represents the number of animals that are covered by each specific certification scheme (aggregation weight). If this knowledge is not available, the number of farms participating in a specific label may be used (relevant for Germany). The data section describes in detail how these numbers were obtained. The AMANI calculations conducted for Austria and Germany can be illustrated in Table 4.2.

Table 4.2: AMANI calculations for pig fattening farms in Austria and Germany

Country	Farming type	ANI cluster	Miminum ANI score	Aggregation weight[1]	Resulting AMANI score
Austria	Conventional	Non-certified	8.5	0.997	8.55
		Label	26.5	0.003	
	Organic	EU organic std.	19.5	0.417	21.62
		Label A	23	0.563	
		Label B	27	0.021	
Germany	Conventional	Non-certified	8.5	0.543	8,98
		Label A	9.5	0.455	
		Label B	29	0.001	
	Organic	EU organic std.	19.5	0.863	19.70
		Labels	21	0.137	

Legend: AMANI: Average Minimum Animal Needs Index; ANI: Animal Needs Index.
Source: Own compilation.
[1]: For Austria: According to number of fattening pigs kept on the respective farm types. For Germany: Pursuant to number of farms of the respective farm types.

Doing these kind of extrapolations from calculated minimum ANI levels based on codes of practice and the assumption of full compliance to the full farm population is very useful since it provides a cost-efficient and transparent way of providing a picture on the status of animal welfare across many farms.

4.3.1. Conventional farms

For the conventional standards and schemes of both countries, similar AMANI scores were calculated: Austria reaches an AMANI score of 8.55, Germany an AMANI score of 8.98. Some farms will achieve higher scores given that we identified conventional certification schemes requiring substantially higher animal welfare obligations. But these certification schemes are characterized by considerably lower participation rates in terms of farm numbers and livestock sizes and thus do not impact strongly on these kinds of extrapolations. Given that most pigs are still in conventional husbandry systems, these rather low scores describe the minimum animal welfare conditions on most farms as they are required by national law and EU CC legislation given that the conventional legislative standards existent in Austria and Germany completely overlap with the CC requirements imposed by the "Pigs Directive" and the "Animal Protection Directive". But one also has to keep in mind that these are only *minimum* animal welfare conditions given the respective codes of practice and that the actual implementation may differ to the better (or worse if non-compliance occurs). This fact was already demonstrated in the previous section where the on-farm assessment was compared with the calculated minimum ANIs and the on-farm assessment revealed that, in particular, conventional farms scored above the minimum levels in some ANI categories.

4.3.2. Organic farms

With AMANI scores of 21.62 (Austria) and 19.7 (Germany), the standards of organic farms located in Austria and Germany reach substantially higher animal welfare levels than their conventional counterparts according to the applied ANI assessment system. Within the ANI indicator framework, the adherence to defined free-range and pasture conditions play a very important role in the final ANI scores. For fattening pigs, a share of approximately 25% of the

maximum sum of reachable points can be ascribed to the compliance with free-range and pasture obligations. In contrast to the animal welfare standard of conventional farms, the organic standard defined by the EU emphasises considerably higher free-range requirements and leads, therefore, to higher ANI scores.

Although the calculated AMANI scores of organic pig fattening in Austria and Germany are similar, nearly all Austrian labels relevant for this study slightly specify or extend the sometimes rather general formulated animal welfare obligations given by the European organic standard that leads to an increase of their individual ANI scores and the overall AMANI score for organic pig fattening. Compared to this, the organic labels identified in Germany focus more on the compliance with legislative requirements, which results in a slightly lower AMANI score for organic farms.

5. Conclusions

Generally, the ANI-based comparison of legislative and private certification scheme pig standards reveals very similar animal welfare levels of label clusters identified in Austria and Germany as compliance with obligations imposed by the European CC system and the EU organic standard are the same in all member states of the EU. But in detail, we find that the reviewed Austrian scheme obligations show more diversification in animal welfare levels than those identified for Germany where the labels indicate a greater overlap with the respective legislative standards sets.

According to the ANI framework, the vast majority of the identified organic schemes prescribes a substantially higher animal welfare level than comparable conventional schemes or legislative standards. Although this can be to some extent ascribed to the strong reward of free-range and pasture conditions existent on organic farms by the ANI, there were some conventional labels identified in Austria and Germany that clearly exceed the animal welfare requirements of organic schemes. This reveals not only an increasing relevance of free-range and pasture requirements for animal welfare on conventional farm types but underlines the practicability of the chosen ANI-based approach for organic and conventional farm types.

For Austria, we were able to compare the "full compliance" minimal ANI scores with "on-farm" assessed real ANIs that reveal the actual degree of compliance of farms. Although both ANIs show similar value patterns, the on-farm measured ANIs of conventional noncertified and organic farms largely exceed the calculated minimum ANIs. These results indicate that farmers may have an incentive to comply not only with the minimum requirements laid out in the legislation but improve the housing conditions in order to achieve the best economic results.

In addition, extrapolations from calculated minimum ANI levels based on codes of practice and the assumption of full compliance to the full farm population has been done for conventional and organic farms in Austria and Germany. This kind of extrapolation of the results is very useful since it provides a cost-efficient and transparent way of providing a picture on the status of animal welfare in a country and across many farms. But the outcomes of Section 4 underline that the accuracy of the chosen evaluation approach depends on the farmer's de-

gree of compliance with legislative and certification requirements. Although for Austria, a considerably strong adherence to the obligations was detected, the underlying assumption of full compliance with standards is expected to be actually reflected by only a share of farms. Whereas for these farms the ANI assessments of this chapter can be considered as an estimation of the minimum animal welfare standard of housing conditions, for partly and noncompliant farms, the evaluation approach is not suitable as it does not refer to the actual on-farm situation.

To conclude, this study was successful in evaluating animal welfare as it is fostered by national legislation and farm certification schemes using an indicator framework. The detected overlap between the ANI indicator set and official monitoring and certification indicators emphasise the practicability of the developed ANI evaluation approach, which enables an estimation of the minimum animal welfare standard of animal housing conditions of compliant farms without the conduction of expensive and time-consuming farm visits. But like all integrated animal welfare assessment systems, the ANI is based on current scientific knowledge in the field of animal science. It represents merely an estimate of farm animal welfare that is moreover influenced by societal believes and trends. Hence, the ANI used for the applied evaluation approach needs to be continuously refined and scrutinized in accordance to the development of science and knowledge on the needs of farm animals.

References

Amon, T., Amon, B., Ofner, E. and Boxberger, J. 2001. Precision of assessment of animal welfare by the "TGI 35 L" Austrian needs index. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 114-117.

Annen, D. N. 2009. *Report describing the operationalisation of the second selection of indicators into impacts of Cross Compliance and the implementation in the final analytical tool.* Deliverable 2.6/2.7, CCAT project, EU 6th Framework Programme, Priority 8.1, European Commission. http://www.ccat.wur.nl/NR/rdonlyres/14A64131-DD4E-46FD-953E-986DDDB2AEC1/120807/D2_6_2_7_Operationalisation_indicators_FIN1.pdf, accessed 27 April 2011.

Austrian Ministry of Agriculture 2008. *49. Grüner Bericht gemäß § 9 des Landwirtschaftsgesetzes BGBl. Nr. 375/1992* [49th Green Report according to § 9 of the Agricultural Act BGBl. No. 375/1992]. http://www.bsbz.at/bwlunterlagen2010/gb2008.pdf, accessed 27 April 2011. (In German)

Barnett, J. L., Cronin, G. M., Winfield, C. G. and Dewar, A. M. 1984. The welfare of adult pigs: The effects of five housing treatments on behaviour, plasma corticosteroids and injuries. *Applied Animal Behaviour Science* 12, 209-232.

Bartussek, H. 1990. Der Tiergerechtheitsindex. In: Bartussek, H., Eisenhut, M., Haiger, A. and Storhas, R. (Hrsg.) *Naturnähe in der Veredelungswirtschaft – Ein Definitionskonzept*. Bericht über die 8. IGN-Tagung vom 22. bis 24. Februar 1990 an der LFS Schlierbach [The Animal Needs Index. In: Bartussek, H., Eisenhut M., Haiger, A. and Storhas, R. (eds.) *Naturalness in the Processing Industry - A Concept for Definition*. Report on the

8th IGN Conference of 22-24 February 1990 at the LFS Schlierbach], Federal Research Institute for Agriculture in Alpine Regions BAL Gumpenstein, Irdning, Austria, pp. 34-46. (In German)

Bartussek, H. 1995*a*. *Tiergerechtheitsindex für Mastschweine – TGI 35L/1995 Mastschweine* [*Animal Needs Index for fattening pigs – ANI 35L/1995 fattening pigs*]. Federal Research Institute for Agriculture in Alpine Regions BAL Gumpenstein, Irdning, Austria. http://www.bartussek.at/pdf/tgischweine.pdf, accessed 27 April 2011. (In German)

Bartussek, H. 1995*b*. *Tiergerechtheitsindex für Legehennen – TGI 35L/1995 Legehennen* [*Animal Needs Index for laying hens – ANI 35L/1995 laying hens*]. Federal Research Institute for Agriculture in Alpine Regions BAL Gumpenstein, Irdning, Austria. http://www.bartussek.at/pdf/tgilegehennen.pdf, accessed 27 April 2011. (In German)

Bartussek, H. 1999. A review of the Animal Needs Index (ANI) for the assessment of animal's well-being in the housing systems for Austrian proprietary products and legislation. *Livestock Production Science* 61, 179-192.

Bartussek, H. 2000. How to measure animal welfare. In: Hovi, M. and Trujillo, G. R. (eds.) Proceedings of the Second NAHWOA Workshop, 8-11 January 2000, Cordoba, Spain, pp. 135-142.

Bartussek, H. 2001. A historical account of the development of the Animal Needs Index ANI-35L as part of the attempt to promote and regulate farm animal welfare in Austria: An example of the interaction between animal welfare science and society. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 34-41.

Bartussek, H., Leeb, C. and Held, S. 2000. *Animal Needs Index for cattle – ANI 35L/2000 – cattle*. Federal Research Institute for Agriculture in Alpine Regions BAL Gumpenstein, Irdning, Austria. http://www.bartussek.at/pdf/anicattle.pdf, accessed 27 April 2011.

Baumgartner, J., Leeb, T., Gruber, T. and Tiefenbacher, R. 2003. Husbandry and animal health on organic pig farms in Austria. *Animal Welfare* 12, 631-635.

Bock, C. 1990. Zur Beurteilung tiergerechter Laufställe für Milchvieh. In: Kuratorium für Technik und Bauwesen in der Landwirtschaft (KTBL) (Hrsg.) *KTBL-Schrift 339* [In order to assess animal-friendly stables for dairy cattle. In: Board of trustees for technology and building industry in Agriculture (KTBL) (ed.) *KTBL-Schrift 339*]. Darmstadt. (In German)

Böcker, A., Nocella, G. and Scarpa, R. 2006. Do consumers want public bodies to monitor animal friendly production and marketing schemes? And does trust matter? *Paper prepared for presentation at the 99th EAAE Seminar "Trust and Risk in Business Networks"*, 8-10 February 2006, Bonn, Germany.

Boissy, A., Manteuffel, G., Bak Jensen, M., Opperman Moe, R., Spruijt, B., Keeling, L. J., Winckler, C., Forkman, B., Dimitrov, I., Langbein, J., Bakken, M., Veissier, I. and Aubert, A. 2007. Assessment of positive emotions in animals to improve their welfare. *Physiology and Behaviour* 92, 375-397.

Bokkers, E. A. M. 1996. De Dierenwelzijnsindex: Een aanzet tot het kwantificeren van het niveau vam dierenwelzijn in Nederlandse veehouderijsystemen [*The Animal Welfare In-*

dex: A push for quantifying the level of animal husbandry systems in the Netherlands]. Dutch Society for the Protection of Animals, Den Haag, the Netherlands. (In Dutch)

Boogaard, B. K., Oosting, S. J. and Bock, B. B. 2006. Elements of societal perception of farm animal welfare: A quantitative study in the Netherlands. *Livestock Science* 104, 13-22.

Borgsteede, F. H. M. and Jongbloed, A. W. 2001. Organic pig farming: What about parasitic infections? *Tijdschrift voor Diergeneeskunde* 126, 39-42. (In Dutch)

Botreau, R., Bonde, M., Butterworth, A., Perny, P., Bracke, M. B. M., Capdeville, J. and Veissier, I. 2007. Aggregation of measures to produce an overall assessment of animal welfare. Part 1: A review of existing methods. *Animal* 1(8), 1179-1187.

Bracke, M. B. M., Spruijt, B. M., Metz, J. H. M. and Schouten, W. G. P. 2002. Decision support system for overall welfare assessment in pregnant sows A: Model structure and weighting procedure. *Journal of Animal Science* 80, 1819-1834.

Broom, D. M. 1996. Animal welfare defined in terms of attempts to cope with the environment. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 27, 22-28.

Capdeville, J. and Veissier, I. 2001. A method of assessing welfare in loose housed dairy cows at farm level, focusing on animal observations. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 62-68.

De Rosa, G., Grasso, F., Pacelli, C., Napolitano, F. and Winckler, C. 2009. The welfare of dairy buffalo. *Italian Journal of Animal Science* 8 Suppl. 1, 103-116.

Eijck, I. A. J. M. and Borgsteede, F. H. M. 2005. A survey of gastrointestinal pig parasites on free-range, organic and conventional pig farms in the Netherlands. *Veterinary Research Communications* 29, 407-414.

European Commission 2008. Commission Regulation (EC) No 889/2008 of 5 September 2008 laying down detailed rules for the implementation of Council Regulation (EC) No 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control. *Official Journal of the European Union* L 250, 1-84.

European Council 1991. Council Directive 91/630/EEC of 19 November 1991 laying down minimum standards for the protection of pigs. *Official Journal of the European Union* L 340, 33-38.

European Council 1998. Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes. *Official Journal of the European Communities* L 221, 23-27.

Farmer, M., Swales, V., Jongeneel, R., Karaczun, Z., Müssner, R., Leipprand, A., Schlegel, S., Poux, X., Ramain, B., De Roest, K., Varela Ortega, C., and Simó, A. 2007. Exploring the synergies between cross compliance and certification schemes. *Deliverable 8: Synthesis report of certification schemes in 7 EU countries and 3 non-EU countries*. Paper prepared for SSPE-CT-2005-006489 Facilitating the CAP reform: Compliance and competitiveness of European agriculture. http://library.wur.nl/way/bestanden/clc/1860311.pdf, accessed 27 April 2011.

Ferket, S. L. and Hacker, R. R. 1985. Effect of forced exercise during gestation on reproductive performance of sows. *Canadian Journal of Animal Science* 65, 851-859.

Forkman, B. and Keeling, L. 2009 (eds.). Assessment of animal welfare measures for sows, piglets and fattening pigs. *Welfare Quality® Reports No. 10*. http://www.welfarequality.net/everyone/43218/7/0/22, accessed 27 April 2011.

Fraser, A. F. 1983. The behaviour of maintenance and the intensive husbandry of cattle, sheep and pigs. *Agriculture, Ecosystems and Environment* 9, 1-23.

Gonyou, H. W. 1996. Design criteria: Should freedom of movement be retained? *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 27, 36-39.

Hörning, B. 1997. Tiergerechtheit und Verfahrenstechnik eingestreuter Milchviehlaufställe in der Praxis [Animal welfare and process technology in littered loose housings for dairy cattle in practice]. *PhD Thesis*. University of Kassel, Faculty of Agriculture, Witzenhausen, Germany. (In German)

Hörning, B. 2000. Vergleich der Tiergerechtheit von Milchviehlaufställen auf konventionellen und ökologischen Betrieben [Comparison of animal welfare of loose housings on conventional and organic dairy farms]. *Lebendige Erde* 6, 38-39. (In German)

Hörning, B. 2001. The assessment of housing conditions of dairy cows in littered loose housing systems using three scoring methods. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 42-47.

Hörning, B. 2003. Attempts to integrate different parameters into an overall picture of animal welfare using investigations in dairy loose houses as an example. *Animal Welfare* 12, 557-564.

Jensen, P. and Toates, F. M. 1993. Who needs "behavioural needs"? Motivational aspects of the needs of animals. *Applied Animal Behaviour Science* 37, 161-181.

Johnsen, P. F., Johannesson, T. and Sandøe, P. 2001. Assessment of farm animal welfare at herd level: Many goals, many methods. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 26-33.

Keeling, L. 2009. An overview of the Welfare Quality® project assessment systems. *Welfare Quality® Reports No. 12*. http://www.welfarequality.net/everyone/43220/7/0/22, accessed 27 April 2011.

Kijlstra, A. and Eijck, I. A. J. M. 2006. Animal health in organic livestock production systems: A review. *NJAS Wageningen Journal of Life Sciences* 54(1), 77-94.

Kijlstra, A., Eissen, O. A., Cornelissen, J., Munniksma, K., Eijck, I. and Kortbeek, T. 2004. Toxoplasma gondii infection in animal-friendly pig production systems. *Investigative Ophthalmology and Visual Science* 45, 3165-3169.

Knierim, U. 2002. Basic ethological considerations concerning the assessment of husbandry conditions with regard to animal welfare. *Deutsche Tierärztliche Wochenschrift* 109, 261-266. (In German)

Main, D. C. J., Webster, A. J. F. and Green, L. E. 2001. Animal welfare assessment in farm assurance schemes. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 108-113.

Manteuffel, G., Puppe, B. and Schön, P. C. 2004. Vocalization of farm animals as a measure of welfare. *Applied Animal Behaviour Science* 88, 163-182.

Marchant, J. N. and Broom, D. M. 1996. Effects of dry sow housing conditions on muscle weight and bone strength. *Animal Science* 62, 105-113.

McInerney, J. P. 1994. Animal welfare: An economic perspective. In: Bennett, R. M. (ed.) *Valuing farm animal welfare*, *Occasional paper No. 3*. University of Reading, Department of Agricultural Economics and Management, Reading, United Kingdom, pp. 9-25.

Mormède, P., Andanson, S., Aupérin, B., Beerda, B., Guémené, D., Malmkvist, J., Manteca, X., Manteuffel, G., Prunet, P., van Reenen, C. G., Richard, S. and Veissier, I. 2007. Exploration of the hypothalamic-pituitary-adrenal function as a tool to evaluate animal welfare. *Physiology and Behavior* 92, 317-339.

Müller 1987. Animal protection regulations for pig management. In: Fölsch, D. W. (ed.) *Ethical, ethological and legal aspects of intensive farm animal management*. Birkhauser Verlag, Basel, pp. 83-148.

Müller-Lindenlauf, M., Deittert, C. and Köpke, U. 2010. Assessment of environmental effects, animal welfare and milk quality among organic dairy farms. *Livestock Science* 128, 140-148.

Napolitano, F., De Rosa, G., Ferrante, V., Grasso, F. and Braghieri, A. 2009. Monitoring the welfare of sheep in organic and conventional farms using an ANI 35 L derived method. *Small Ruminant Research* 83, 49-57.

Pilaski, J. 1970. Untersuchungen über den Einfluss einer künstlichen Immobilisierung auf den Mineralstoffgehalt des Blutes und auf den Knochenaufbau der Legehenne. *Archiv für Geflügelkunde* 2, 94-108. (In German)

Plank, A. R. (1991). HK-Wert. KT-Nutztierhaltungs-Klassifizierungssystem. Verlag Kritische Tiermedizin (ed.), Freiland Verlag, Wien. (In German)

Roe, E. and Buller, H. 2008. Marketing farm animal welfare. *Welfare Quality® report*. http://www.welfarequality.net/downloadattachment/41858/19515/fact%20sheet%20marketi ng%20farm%20animal%20welfare%20final.pdf, accessed 27 April 2011.

Sandøe, P., Munksgaard, L., Bådsgård, N. P. and Jensen, K. H. 1997. How to manage the management factor – Assessing animal welfare at the farm level. In: Sorensen, J. T. (ed.) *Livestock farming systems – More than food production. Proceedings of the fourth international symposium on livestock farming systems, 22-23 August 1996, Foulum, Denmark*. EAAP Publication No. 89, pp. 221-230.

Schatz, P., Boxberger, J. and Amon, T. 1996. Eine vergleichende Analyse des TGI 200/94 und des TGI 35L/1995 zur Beurteilung der Tiergerechtheit von Milchviehhaltungssystemen. *3. Internationale Tagung „Bau, Technik und Umwelt in der landwirtschaftlichen Nutztierhaltung“* [A comparative analysis of the TGI 200/94 and the ANI 35L/1995 for the assessment of animal welfare of housing systems for dairy cows. *3rd International Conference “Construction, technology and environment in livestock farming”*]. 11-12 March 1997, Kiel, Germany. (In German)

Schole, J. 1982. Physiologische Grundlagen der nichterreger- und nichtantigenspezifischen Abwehr [Physiological basics of the non-agent and non-antigenspecific immune defence]. *Der praktische Tierarzt* 63, 345-354. (In German)

Scott, E. M., Nolan, A. M. and Fitzpatrick, J. L. 2001. Conceptual and methodological issues related to welfare assessment: A framework for measurement. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 5-10.

Scott, K., Chennells, D. J., Campbell, F. M., Hunt, B., Armstrong, D., Taylor, L., Gill, B. P. and Edwards, S. A. 2006. The welfare of finishing pigs in two contrasting housing systems: Fully-slatted versus straw-bedded accommodation. *Livestock Science* 103, 104-115.

Smulders, D., Verbeke, G., Mormède, P. and Geers, R. 2006. Validation of a behavioural observation tool to assess pig welfare. *Physiology and Behavior* 89, 438-447.

Sundrum, A. 1998. Zur Beurteilung der Tiergerechtheit von Haltungsbedingungen landwirtschaftlicher Nutztiere. *Deutsche Tierärztliche Wochenschrift* 105, 65-72. (In German)

Sundrum, A., Andersson, R. and Postler, G. (eds.) 1994. *Tiergerechtheitsindex 200/1994 – Ein Leitfaden zur Beurteilung von Haltungssystemen* [*Animal needs index 200/1994 – A manual for the assessment of housing systems*]. Köllen Druck und Verlag GmbH, Bonn. (In German)

Statistisches Bundesamt 2007. Betriebe mit ökologischem Landbau. *Agrarstrukturerhebung*. Fachserie 3, Reihe 2.2.1. (In German)

Te Velde, H., Aarts, N. and van Woerkum, C. 2002. Dealing with ambivalence: Farmers' and consumers' perceptions of animal welfare in livestock breeding. *Journal of Agricultural and Environmental Ethics* 15, 203-219.

Trevisi, E., Bionaz, M., Piccioli-Cappelli, F. and Bertoni, G. 2006. The management of intensive dairy farms can be improved for better welfare and milk yield. *Livestock Science* 103, 231-236.

Veissier, I., Butterworth, A., Bock, B. and Roe, E. 2008. European approaches to ensure good animal welfare. *Applied Animal Behaviour Science* 113, 279-297.

von Borell, E., Langbein, J., Després, G., Hansen, S., Leterrier, C., Marchant-Forde, J., Marchant-Forde, R., Minero, M., Mohr, E., Prunier, A., Valance, D. and Veissier, I. 2007. Heart rate variability as a measure of automatic regulation of cardiac activity for assessing stress and welfare in farm animals – A review. *Physiology and Behavior* 92, 293-316.

Welfare Quality® 2009. *Welfare Quality® assessment protocol for pigs*. Welfare Quality® Consortium: Lelystad, Netherlands.

Wokac, R. M. 1989. Ökomorphologie von Hochleistungshennen – Eine Untersuchung an Skeletten aus Batterie- und Bodenhaltung. In: Martin, G. and Fölsch, D. W. (Hrsg.) *Artgemäße Nutztierhaltung und ökologisch orientierte Landwirtschaft. Tierhaltung Band 19* [Ecomorphology of high performance hens – An investigation of skeletons from battery and deep litter hens. In: Martin, G. and Fölsch, D. W. (eds.) *Species-appropriate livestock farming and ecologically oriented agriculture. Livestock husbandry Volume 19*], Birkhäuser, Basel, Boston, Berlin, pp. 91-99. (In German)

Chapter 3 Animal welfare on the farm: Legislation, certification standards and assessment frameworks[82]

Abstract

This chapter aims at comparing weighting factors of animal welfare aspects for cattle kept in Austria and Germany as they are regulated by private, national and European legislation, as they are determined by on-farm compliance and as they are assigned by animal welfare and risk evaluation systems. To achieve this goal, the methodological approach of Annen *et al.* (2011) based on the Austrian "Animal Needs Index 35L" framework, enabling the assessment of pig fattening standards without cost-intensive on-farm measures, is refined and adapted for the evaluation of cattle standards. The comparison of legislative and private certification scheme standards for calves indicates only slight differences between the minimum animal welfare obligations existent in Austria and Germany. For adult cattle kept on German conventional non-certified farms considerably lower minimum requirements are detected than on comparable Austrian farms. Whereas on-farm measured results indicate substantial voluntary compliance with requirements concerning the animals' social interaction, access to free range and the quality of stockman care, for those relating to floor and space allowance conditions in the stable an increased risk of non-compliance is detected. However, the review of welfare evaluation frameworks shows that obligations regulating conditions of flooring and equipment, space allowance in the stables and the access to outdoors reach the highest point-referenced rewards.

1. Introduction

With the fundamental reform of the Common Agricultural Policy (CAP) of June 26th 2003, the EU set the stage for the decoupling of direct support and its modulation and linkage to the adherence of "cross compliance" (CC) obligations related to environmental, food safety and animal welfare standards. One main objective of the CC system is to establish minimum EU production standards on farm level that are controlled by monitoring agencies of the respective EU member states (Farmer and Swales 2007, p. 5). Compliance with private and state-driven farm certification schemes plays also an increasingly important role for agricultural producers. During the last decade the organic farming sector has benefitted from a growing share of participants (Eurostat 2011).

A comparison of 31 private and state-driven farm certification schemes in seven EU member states, drawn by a recent EU-funded research project[83], shows synergy effects with

[82] This Chapter is based on an earlier version of a paper submitted together with Dr. C. Wieck and M. Kempen to the journal "Animal Welfare". The present study is part of the research project "CCAT", EU 6th Framework Programme, Priority 8.1 (European Commission, DG RTD, contract no. 44423-CCAT). Its content does not represent the official position of the European Commission and is entirely under the responsibility of the authors. The authors acknowledge the support of Dr. E. Ofner-Schröck and Mag. med. vet. E. Schröck in conducting the on-farm survey.

the European CC system. Whereas there is often additional overlap in the respective sets of standards, both approaches impose minimum requirements, apply checklists to control compliance and provide for penalties if these requirements are not fulfilled. Depending on the type of animal production, the spectrum of obligations ranges from requirements of food safety and quality to animal welfare standards. (Farmer *et al.* 2007, p. 18f.)

With respect to particular animal welfare conditions, another recent EU-funded research project[84] shows that these standards are increasingly part of certification schemes applied by retailers, hauliers, slaughterhouses and farms (Horgan and Gavinelli 2006, p. 304; Roe and Buller 2008; Veissier *et al.* 2008, p. 284f.). An increased implementation of animal welfare obligations in private farm certification schemes does not necessarily lead to a higher level of farm animal welfare, if they simply overlap with regulations of European and national legislation.

Monitoring checklists of private and state-driven farm certification schemes used to control compliance with legislative and/or scheme-specific obligations only allow a very limited range of judgements in terms of welfare. Although some schemes[85] show a grading into major, minor and facultative requirements, their standardized measurements lead to yes/no answers that do not reflect differentiated on-farm conditions and forbid comparisons among farms (Botreau *et al.* 2007, p. 1185). In contrast to the various elaborations and combinations of specific farm animal welfare indicators deriving from a broad spectrum of different disciplines[86], assessment systems as, for example, developed or published by Bartussek (1990; 1995*a*, *b*; 2000), Sundrum *et al.* (1994), Bokkers (1996), Capdeville and Veissier (2001), Hörning (2001), Scott *et al.* (2001) and Bracke *et al.* (2002*a*, *b*) ensure an integrated evaluation of the on-farm welfare conditions involving a higher number of relevant parameters (Botreau *et al.* 2007, p. 1180). A recent approach in developing overall animal welfare assessment systems for different livestock types is given by the evaluated monitoring schemes of the "Welfare Quality®" project in 2009 (Botreau *et al.* 2009; Canali and Keeling 2009; De Rosa *et al.* 2009; Forkman and Keeling 2009; Keeling 2009).

A general issue of the integrated assessment systems arises in practice. Although most systems lack to some extent animal-based parameters in order to achieve a better practicability (Willen 2004, p. 13), on-farm assessments require apart from a time consuming on-site examination of the housing conditions and animals, in most cases expert knowledge and/or techniques. In this regard, livestock husbandry obligations given by legislative standards and farm certification schemes open up the possibility to conduct evaluations of the mandatory minimum animal welfare status of farms without expensive and time-consuming on-farm visits. Preconditions for this procedure are the assumption of full compliance with legislative and/or certification standards and as well as the use of an integrated farm animal welfare as-

[83] "Facilitating the CAP reform: Compliance and competitiveness of European agriculture" research project, EU 6th Framework Programme, Priority 8.1 (European Commission, DG RTD contract no. SSPE-CT-2005-006489).
[84] "Welfare Quality®" research project, EU 6th Framework Programme, Priority 5 ("Food Quality and Safety"), project no. FOOD-CT-2004-506508.
[85] The "GLOBALG.A.P. scheme" (formerly known as "EUREPG.A.P. scheme"), for example, shows a grading into major, minor and facultative requirements (Botreau *et al.* 2007, p. 1182).
[86] Farm animal welfare indicators derive e.g. from the disciplines ethology, physiology, pathology, economy, sociology, etc. (see Section 6 of Chapter 1 of this thesis).

sessment that shows a significant overlap with official monitoring and certification indicators sets.

Apart from their individual strengths and weaknesses all of the approaches to assess overall farm animal welfare face difficulties arising from the multifactorial character of animal welfare as well as the problem of determining the relative importance of its aspects (Pedersen 1996, p. 76; Fraser 1995, p. 113f.; Sandøe *et al.* 1996, p. 113f.; Bracke *et al.* 2001, p. 17; Waiblinger *et al.* 2001, p. 73; Wemelsfelder and Lawrence 2001, p. 21f.; Rushen 2003, p. 205). Applying the food risk assessment terminology given by the Codex Alimentarius (World Health Organization (WHO) 1999) to the field of animal welfare assessment, aspects considered by risk and overall animal welfare evaluation systems can be regarded as "design criteria with a potential to cause a negative animal welfare effect" (European Food Safety Authority (EFSA) 2009, p. 7). They are linked to weighting factors determined on the basis of empirical findings or expert opinion (Bracke *et al.* 2001, p. 19). In index systems these factors are represented by assessment scales awarding point values. Concerning this matter, the assigned point values express the severity of the adverse animal welfare effect quantifying the risk for animal welfare in case of non-compliance with the respective criteria (see also EFSA 2009, p. 8f.). Consequently, we speak in the following of *(welfare) risk weightings*.

But risk weightings of animal welfare aspects can not only be found in animal welfare evaluation systems. Legislative standards and farm certification schemes prescribe obligations associated to various animal welfare levels. The latter can also be assumed for on-farm conditions reflecting the individual farmer's willingness to implement animal welfare measures. Contrary to the integrated animal welfare evaluation systems that already provide measure-specific risk weightings, for example in terms of point scales, requirements of production standards as well as on-farm compliance underlie intrinsic risk weightings determined by legislation, certification schemes and the farmer's individual risk behaviour.

The objective of this study is to compare risk weightings of farm animal welfare aspects for cattle kept in Austria and Germany as formulated by minimum requirements of certification schemes and legislation, as measured on-farm and as assigned by overall animal welfare and risk assessment systems.

To achieve this goal, the status of animal welfare on Austrian and German cattle farms as it is legislated by private, national and European CC requirements is evaluated. In a first step, an inventory of legislative and certification standards applied in Austria and Germany is done. In a second step, standards with identical minimum animal welfare requirements are clustered into groups. In a third step, full compliance with the requirements of the groups is matched with attribute levels of point scales given by the "Animal Needs Index 35L" (ANI 35L)[87], an index system ensuring the assessment of overall farm animal welfare. This procedure enables not only the exploration of overlaps in the requirements catalogue of the standard clusters and their comparison across labels and countries, but also an assessment of the animal welfare level of the specific obligations. In a last step, we were able to compare these "calculated"

[87] The ANI 35L was developed by Bartussek (2000).

animal welfare levels, on the one hand, with on-farm assessments on Austrian farms using the ANI 35L framework and, on the other hand, with risk weightings of overlapping animal welfare and risk evaluation systems. Based on this comparison, conclusions are drawn to what extent farm requirements considered by science to have a high or low relevance for animal welfare are reflected in the codes of practice of certification schemes, in national and European legislation and in the farmers' on-farm compliance.

The chapter proceeds as follows: In Section 2 of this chapter, the applied animal welfare evaluation and reference frameworks will be described in more detail with Section 3 examining material and methods. While Section 4 presents the results, the last section outlines the discussion and conclusions of the chapter.

2. Reference frameworks to evaluate overall animal welfare

Generally, the methods for evaluating overall farm animal welfare vary in their shares of involved environmental-based and animal-based assessment parameters. Whereas environmental-based parameters focus on the evaluation of the animal's housing conditions and the farm management[88], animal-based parameters assess the animal's responses to environmental influences affecting health, physiology and behaviour (Johnsen *et al.* 2001, p. 27). As the use of environmental-based parameters offers a less complicated, repeatable and relatively objective evaluation of minimum housing conditions given by legislative and certification standards (Alban *et al.* 2001, p. 100; Waiblinger *et al.* 2001, p. 74; Spoolder *et al.* 2003, p. 530), they are primarily involved in the overall animal welfare systems considered for this study.

The Austrian "Animal Needs Index" (ANI) developed by Bartussek (1990) represents the first index system to measure overall farm animal welfare at herd level. Different ANI assessment frameworks for calves, adult cattle, laying hens, fattening pigs and breeding sows were continuously refined into their latest version, the ANI 35L[89] (Bartussek 1995*a*, *b*; 1999; 2001; Bartussek *et al.* 2000).

All ANIs principally regard five welfare aspects of farm animals, represented by the evaluation categories "locomotion" (freedom of movement), "social interaction", "condition of flooring", "light, air and noise" (climatisation in the stables) and "stockmanship" (quality of stockman care) (see e.g. Bartussek 1995*a*). Each ANI category contains several assessment scales awarding points to different characteristics of the observed livestock housing system. The better the animal welfare level of housing conditions, the higher is the assigned point value. As all points are summarised to an overall ANI score, the ANI framework enables a compensation of a poor welfare status in one field by a better one within another area. An overview of the ANI assessment scales and categories for cattle is given in the Table 2.1. (Bartussek 1999, p. 180; 2001, p. 35; Bartussek *et al.* 2000, p. 3)

[88] Environmental-based parameters are e.g. space allowance, air quality, herd structure, etc. (see e.g. Johnsen *et al.* 2001).
[89] From now on, the term "ANI" always refers to the most recent version of the indicator framework, i.e. the ANI 35L.

Table 2.1: ANI 35L/2000 assessment categories and scales for adult cattle

ANI category	ANI assessment scales							Point interval
	a	**b**	**c**	**d**	**e**	**f**	**g**	
I. Locomotion	Loose housing		Tie-stalls		Outdoor exercise days/year	Pasture days/year		
	Floor area	Lying down, rising	Cubicle/ stall size	Move-ment of tether				
Point interval	[0–3]	[0–3]	[0–1]	[0–1]	[1–3]	[0.5–1.5]		**[0–10.5]**
II. Social inter-action	Floor area	Herd structure	Breeding	Outdoor exercise days/year	Pasture days/year			
Point interval	[0–3]	[-0.5–2]	[-0.5–1]	[0.5–2.5]	[0.5–1.5]			**[-1–10]**
III. Condition of flooring	Lying area			Activity areas	Outdoor yard	Pasture		
	Softness	Cleanli-ness	Slipperi-ness					
Point interval	[-0.5–2.5]	[-0.5–1]	[-0.5–1]	[-0.5–1]	[-0.5–1.5]	[0.5–1]		**[-2.5–8]**
IV. Light, air and noise	Light intensity	Air qual-ity	Draught	Noise intensity	Outdoor exercise days/year	Outdoor exercise hours/day		
Point interval	[-0.5–2]	[-0.5–1.5]	[-0.5–1]	[-0.5–1]	[0.5–2]	[0.5–2]		**[-2–9.5]**
V. Stockmanship	Clean-liness of stables	Condition of equip-ment	Condition of inte-gument	Cleanli-ness of animals	Condition of hooves	Techno-pathies	Animal health	
Point interval	[-0.5–1]	[-0.5–1]	[-0.5–1]	[-0.5–0.5]	[-0.5–1.5]	[-0.5–1.5]	[-0.5–1.5]	**[-3–8]**
							Minimum point sum	**-8.5**
							Maximum point sum	**46**

Legend: ANI: Animal Needs Index.
Source: Modified from Bartussek *et al.* (2000).

The ANI has already proven its practicability and repeatability (Schatz *et al.* 1996; Amon *et al.* 2001; Capdeville and Veissier 2001, p. 62; Napolitano *et al.* 2009, Popescu *et al.* 2009). But it was primarily developed for the evaluation of housing conditions on organic farms (see Bartussek 2001). Generally, organic standards prescribe stricter free range and pasture requirements than comparable conventional standards. This results in a strong reward of respective ANI assessment scales which may lead to a bias in the ANI framework. On the other hand, free range and pasture conditions are largely considered by science to be important determinants for farm animal welfare (Gonyou 1996). As Bartussek (1999, p. 186) points out, all species used in livestock husbandry show a broad range of behavioural patterns and ethological functions whose expression demands appropriate space allowance and possibilities of movement (see also Müller 1987; Jensen and Toates 1993). In this context, Bartussek (1999, p. 186) refers to evidence stating that the absence of exercise weakens the immune system, and contributes to the atrophy of muscles and bones (see Schole 1982; Ferket and Hacker 1985; Marchant and Broom 1996). In view of these aspects, several studies have proven the ANI to be an adequate framework for the evaluation of housing conditions of organic and conventional farm types (see e.g. Hörning 1997, 2000, 2001).

Moreover, its assessment scales show a substantial overlap[90] with official CC monitoring parameters for cattle, based on the "Calves Directive"[91] and the more horizontal "Animal Pro-

[90] Among all comparable assessment systems, the ANI shows the strongest overlap with official CC monitoring indicators.
[91] Represented by "Council Directive 91/629/EEC of 19 November 1991 laying down minimum standards for the protection of calves" (European Council 1991).

tection Directive"[92], that is relevant for all farm animals. This is illustrated in the Table 2.2. Its grey highlighted rows indicate the number of ANI assessment scales that assess the respective obligation as well as the percentage weight that this obligation receives in the final ANI score. In this regard, obligations concerning floor conditions given by the "Calves Directive" are addressed by five ANI scales accounting for 21.3 % of reachable ANI points.

Table 2.2: Overlap between the ANI indicator set and official CC indicators for animal welfare

Calves Directive			Animal Protection Directive [a]		
Short description of relevant obligations	**No. of overlapping ANI assessment scales**	**Share of points in final ANI [%]**	**Short description of relevant obligations**	**No. of overlapping ANI assessment scales**	**Share of points in final ANI [%]**
Minimum space for group and individual housing	8	36.0	Freedom of movement / sufficient space	7	25.8
Perforated walls to allow visual and physical contact	1	5.6	Accommodation for sick or injured animals	0	0.0
Innocuous accommodation materials and construction	3	11.2	Innocuous accommodation material and construction	4	15.1
Adequate electrical circuits and equipment	1	3.4	Keeping of animals for farming purposes	0	0.0
Air circulation, temp. etc.	2	7.9	Air circulation, temp., etc.	2	7.5
Suitable lightning	2	9.0	Suitable lightning	2	7.5
Condition of flooring	5	21.3	Record keeping	1	2.2
Inspections of automated and mechanical equipment	1	3.4	Inspections of automated and mechanical equipment	1	3.2
Sanitary standards	2	6.7	Qualified and sufficient staff	0	0.0
Inspections of calves	3	10.1	Inspections of animals	3	10.8
Restrictions for tethering, chains, muzzles, etc.	3	22.5	Prohibition to administer harmful substances	1	4.3
Diet and feeding intervals	0	0.0	Diet and feeding intervals	1	5.4
Feed and water access	1	3.4	Feed and water access	2	8.6
Animal care in case of illness and injury	3	12.4	Animal care in case of illness and injury	4	17.2
Appropriate bedding	3	13.5	Protection for animals not kept in buildings	1	4.3
Provision of cow colostrums after birth	0	0.0	Requirements for breeding procedures	0	0.0
-	-	-	Conditions of mutilation	0	0.0

Legend: ANI: Animal Needs Index; temp.: temperature.
Note: Note that the ANI indicators, which are allocated to the specific legislative standards, partly overlap among themselves.
[a]: By means of the ANI of adult cattle.
Source: Own compilation.

As most farm certification schemes follow in their guidelines legislative standards, it can be assumed that the ANI is also an appropriate instrument to evaluate animal welfare requirements of farm certification schemes. But one could argue that it does not match the current state of science, as its development process started about 20 years ago. In this regard, the recently developed "Welfare Quality®" assessment system might be the better choice, as it considers more animal-based measures revealing the "direct" outcomes of the interaction between the animal and its environment (see e.g. Johnsen *et al.* 2001, p. 27; Keeling 2009, p. 2f.; Welfare Quality® 2009). However, this approach is not suitable to achieve the goals of this

[92] Represented by "Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes" (European Council 1998).

study. Generally, animal-based measures have to be conducted on-farm and require assessment expertise. In contrast, this chapter follows a new approach of evaluating animal welfare standards of compliant farms independent of time-consuming on-farm assessments. Therefore, the evaluations involve only environmental and management measures specified by certification schemes and legislation. Taking also into account the ANIs already mentioned high practicability, assessment quality and overlap with official monitoring indicators, it proves to be an appropriate evaluation system for this study.

Another environmental-based index system to assess overall farm animal welfare is given by the TGI 200/1994[93] published by Sundrum *et al.* (1994). It represents a reworked German version of the ANI[94]. Although both systems share the same evaluation procedure and focus to a large extent on overlapping evaluation criteria, the TGI 200 shows a higher number of assessment scales and maximum number of points. The latter depends on the applied housing system. The fewer restrictions are imposed on the animal, the higher is the overall score achievable in the evaluation - in the case of loose housing systems with access to outside run and pasture an overall score of 200 points can be attained (Johnsen *et al.* 2001, p. 29). The TGI 200 distinguishes seven welfare aspects of livestock: (1) "locomotion", (2) "feeding behaviour", (3) "social behaviour", (4) "resting behaviour", (5) "comfort behaviour", (6) "hygiene" and (7) "stockman care" (Sundrum *et al.* 1994, Johnsen *et al.* 2001). Due to a modification of the ANI assessment scales, the animal welfare criteria addressed by the TGI 200 receive a point weighting between 1 and 7 (Sundrum *et al.* 1994). The TGI 200 scales do not award minus points, if requirements are not met. The TGI 200 is also field-proven and repeatable (van den Weghe 1998; Alban *et al.* 2001; Capdeville and Veissier 2001, p. 62f.). It is suitable for assessments on organic and conventional farm types (Hörning 2001).

The last reference framework for farm animal welfare considered in this study is the "Scientific Opinion of the Panel on Animal Health and Animal Welfare" (EFSA 2009). Contrary to the index systems ANI and TGI 200, which enable an integrated evaluation of animal welfare conditions for cattle, this approach only provides a scientific judgement to what extent recent husbandry practices adhere to the welfare needs of dairy cows in terms of pathology, physiology, behaviour and zootechnology. To achieve this goal, it delivers measure-specific risk weightings for non-compliance with the respective animal welfare conditions, given by its "severity scores". These were determined by a scientific panel investigating the impacts of different husbandry practices on the welfare of dairy cows, using a point scale ranging from zero points ("negligible" effects) to four points ("very severe" effects). The EFSA approach involves four scientific opinions focussing on different impacts of poor welfare: (1) "metabolic and reproductive disorders", (2) "udder disorders", (3) "leg and locomotion problems" and (4) "behaviour, fear and pain". Each opinion distinguishes four aspects of hazards for animal welfare: (1) "housing", (2) "nutrition and feeding", (3) "management" and (4) "genetics". As the exposure to a particular hazard varies depending on the applied housing

[93] From now on, the term "TGI 200" always refers to the most recent version of the framework, i.e. the TGI 200/1994.
[94] The TGI 200 was designed on the basis of a former version of the ANI 35L (Bartussek 2001, p. 36f.; Hörning 2001, p. 43).

system, it allocates different risk weightings to cubicle houses, tie stalls, straw yards and the keeping of animals at pasture. (EFSA 2009)

Compared to the other welfare judgements provided by the EFSA panel, the scientific opinion concerning "behaviour, fear and pain"[95] shows substantial overlap with the ANI and TGI 200. Apart from their conceptual differences, the three frameworks share a similar understanding of animal welfare and its goals. This is most clearly reflected in the overlap of their assessment criteria. Given that all three frameworks additionally refer to tie-stalls and loose housing systems, their risk weightings can be systematically compared across schemes.

3. Methodology and data of the study

In order to achieve the objective of this investigation, an inventory of mandatory and voluntary animal welfare standards applied in Austria and Germany is done. The animal welfare standards are clustered into groups imposing identical minimum requirements. Full compliance with the groups' obligations is aligned with attribute levels of the ANI point scales. By this means, overlap between legislative and certification requirements is detected, analysed and compared across schemes and countries. This procedure delivers also an evaluation of the animal welfare level prescribed by minimum requirements in specific and husbandry standards in general. Its outcomes are compared with the results of ANI on-farm assessments and risk weightings of animal welfare aspects provided by the frameworks presented in Section 2 of this chapter. In this way, conclusions are drawn to what extent scientifically relevant animal welfare aspects are implemented in standards sets and reflected by on-farm compliance.

3.1. Methodology of the animal welfare assessment

Annen *et al.* (2011) described the development of a new assessment approach based on the ANI framework that allows the assessment of farm animal welfare standards[96] for fattening pigs without expensive and time-consuming on-farm measures. The procedure of this assessment approach is applied for the evaluation of farm animal welfare standards for cattle in Austria and Germany. In this regard, the ANI is evaluated for horned adult cattle with at least 500 kg of weight and calves (under the age of 6 months) weighting between 150 and 180 kg. If access to an outside run is not prescribed, shelter against adverse weather conditions is not considered. Because the assessment of different housing systems for cattle leads to substantially diverging overall ANI scores, farms are distinguished into farms fitted with tie-stalls, farms fitted with loose housing systems, suckler cow farms and dairy farms. The ANI assessment forms for calves are updated and aligned to the present European legislation[97].

[95] From now on, the term "EFSA framework" is used for this scientific opinion.
[96] Involving legislative and voluntary farm certification standards.
[97] Given by "Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes" as well as "Council Directive 91/629/EEC of 19 November 1991 laying down minimum standards for the protection of calves" (European Council 1991; 1998).

As specified in Section 2 of this chapter, nearly all ANI assessment scales overlap with obligations formulated in codes of practice of farm certification schemes and national or European law. But in cases where the relevant information is not delivered by the standards (e.g. the cleanliness of animals[98]), and direct correlations to ratings of other assessment scales can be eliminated (e.g. the scale "condition of claws"[99] indicates a correlation to the scales of the ANI category "condition of flooring"), the respective ANI scales are awarded with zero points. If scales show a direct correlation to other scales, their ratings are consequently adjusted pursuant to those of the correlating scales. The "calculated" ANI scores for adult cattle and calves represent the minimum animal welfare level of livestock housing conditions on a specific farm that complies with a set of specific standards. In order to simplify further explanations, they are in the following referred to as *minimum ANIs*.

Generally, legislative standards prescribe the lowest animal welfare requirements and accordingly achieve the lowest minimum ANIs. But in some EU member states European law is exceeded by national regulations which results in a higher minimum ANI of the legislative standard and potentially higher minimum ANI of private certification schemes. As this is the case for Austrian cattle farming, the decision is made to involve German standards in the investigation that do not exceed the European guidelines. As for other livestock types, ANI ratings of housing conditions for cattle are classified in the following way (Table 3.1).

Table 3.1: Rating of animal welfare levels according to the ANI framework

Sum of ANI Points	Naming of categories with respect to welfare	Expressed in percentage of range of points	Abbreviatory grading
< 11	Not suitable	0 – 15	VI
11 - < 16	Scarcely suitable	16 – 30	V
16 - < 21	Somewhat suitable	31 – 50	IV
21 - 24	Fairly suitable	51 – 60	III
> 24 - 28	Suitable	61 – 75	II
> 28	Very suitable	> 75	I

Legend: ANI: Animal Needs Index
Source: Own representation based on Bartussek (1999).

Recent results from ANI on-farm evaluations (Annen 2009) are used to explore to what extent prescribed as well as actual on-farm compliance with animal welfare requirements matches with comparable scientific recommendations. The latter are provided by the reference frameworks already presented in Section 2. As the frameworks claim to integrate all conditions determining animal welfare on cattle farms, it is assumed that the relevance of each animal welfare measure is defined by its percentage in the overall sum of the assigned point values (ANI, TGI 200) and severity scores (EFSA framework) respectively.[100] In accordance to the explanations given in Section 1, these point shares are referred to as welfare risk weightings. Given that the frameworks show substantial overlap with respect to the addressed housing condi-

[98] The ANI assessment scale T5d (category 5 assessment scale d) refers to the cleanliness of animals.
[99] The ANI assessment scale T5e (category 5 assessment scale e) refers to the condition of claws.
[100] The EFSA framework refers to some housing conditions that differ only in terms of the severeness of their adverse animal welfare effect (see EFSA 2009). In this case, the highest severity of the adverse effect is considered in the sum of assigned severity scores.

tions, their welfare risk weightings are bundled and plotted against the ANI assessment scales. By this means, the risk weightings are compared with "calculated" ANI values based on full compliance with standards, on-farm measured ANI results revealing the actual degree of compliance of farms and across frameworks. However, the welfare risk weightings of each reference framework may deviate in dependence of the applied housing system. Hence, they are additionally distinguished for cattle housed in tie stalls and those kept in loose housings.

3.2. Data

3.2.1. Farm certification schemes

For cattle farming in Austria and Germany a wide spectrum of trade marks, conventional and organic farm associations, certifications of origin as well as monitoring bodies with logos indicating animal welfare reference is offered. Selection criteria are applied to choose the private and state-driven farm certification schemes relevant for this investigation. In this regard, the schemes have to impose requirements with focus on livestock housing conditions, which have to be formulated in their codes of practice handed out to the farmers. Moreover, the schemes have to ensure regular controls and enforce sanctions if obligations are not met.

3.2.2. On-farm assessments

During the period from February to March 2009 ANI on-farm evaluations were carried out on 40 Austrian cattle farms, spread all over Austria and associated to various certification grades. Their compliance with CC requirements was examined by means of forms used by official monitoring bodies.

4. Results and discussion

4.1. Inventory of standards and clustering to ANI groups

The numbers of standards referring to animal welfare aspects in their label description are given in Table 4.1. This account involves farm certification, marketing schemes, as well as quality meat programmes. Due to the request of several certification schemes, their names can not be published and all results are anonymised. Based on the standard's codes of practice, the given ANI indicator framework and the assumption that farms fully comply with the codes of practice, standard-specific minimum ANI scores were calculated.

In order to investigate the overlap between legislative and private animal welfare relevant standards, standards with similar requirements yielding identical ANI scores are clustered into ANI groups and subsequently in the next section compared concerning their individual minimum obligation values according to the ANI categories[101].

[101] See also Annen *et al.* (2011, p. 47) describing the clustering procedure for fattening pig standards.

The numbers of clustered ANI groups for calves and adult cattle are displayed in the grey highlighted columns of Table 4.1.

Table 4.1: Results of the clustering of schemes according to their ANI assessment results

EU MS	Livestock type	Housing system	Conventional non-certified std.		EU organic std.		Conventional labels		Organic labels	
			Reviewed	ANI groups	Reviewed	ANI groups	Reviewed	ANI groups	Reviewed	ANI groups
AT	Suckler cows	LH	1	1	1	1	5	1	26	1
		TS	1	1	1	1	5	0	26	1
	Other cattle	LH	1	1	1	1	4	0	25	2
		TS	1	1	1	1	4	0	25	1
	Suckler calves	LH	1	1	1	1	5	1	26	1
	Other calves	LH	1	1	1	1	4	0	25	2
Austria Σ			**6**	**6**	**6**	**6**	**27 [a]**	**2**	**153 [a]**	**8**
DE	Suckler cows	LH	1	1	1	1	11	2	18	2
		TS	1	1	1	1	11	1	18	0
	Other cattle	LH	1	1	1	1	11	2	17	2
		TS	1	1	1	1	11	1	17	0
	Suckler calves	LH	1	1	1	1	11	2	18	3
	Other calves	LH	1	1	1	1	11	2	17	2
Germany Σ			**6**	**6**	**6**	**6**	**66 [a]**	**10**	**105 [a]**	**9**
Overall Σ			**12**	**12**	**12**	**12**	**93 [a]**	**12**	**258 [a]**	**17**

Legend: ANI: Animal Needs Index; AT: Austria; C.: Country; DE: Germany; EU: European Union; LH: Loose housing; MS: Member State; std.: standard; TS: Tie stall.
[a]: The overlapping labels involve standards that address to divergent animal types and housing systems.
Source: Own compilation.

Altogether, 258 programmes/labels/standards could be identified referencing animal welfare for cattle. In this regard it has to be mentioned that nearly all reviewed programmes/labels/standards can be distinguished into several partly overlapping sub-standards for different livestock types kept in loose housing systems and tie stalls. The conventional non-certified standard refers to the legislative minimum standard based on EU CC and national law and represents the relevant requirements for all farms not participating in conventional or organic certification schemes[102]. As there is only one conventional non-certified standard in each country, it stands for one ANI group respectively. The EU organic standard relates to the actual EU provisions for organic farming[103]. As the conventional non-certified standard, it is also considered as one ANI group. A more complex situation emerges for conventional and organic labels. From 27 reviewed private conventional labels in Austria, only one label for adult cattle and calves was found to have higher animal welfare requirements than the conventional non-certified standard according to the ANI framework. With 66 involved private conventional labels aggregated to ten ANI groups with differing animal welfare requirements, Germany shows a wider range of private conventional schemes than Austria. Although considerably more Austrian than German private organic labels were identified, eight ANI groups for Austria and nine ANI groups for Germany could be formed.

[102] There is no conventional standard for adult cattle farming defined by national law in Germany. The standard for conventional adult cattle farming is instead given by the European "Animal Protection Directive" referring to all livestock types.
[103] The EU organic standard is represented by "EU Commission Regulation (EC) No. 889/2008 of 5 September 2008 laying down detailed rules for the implementation of Council Regulation (EC) No. 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control" (EU Commission 2008).

4.2. Overlap between legislative level and farm certification standards

In this section, full compliance with the minimum animal welfare requirements of the clustered ANI groups is aligned with the attribute levels of the ANI point scales. The resulting minimum ANIs reflect not only the minimum animal welfare level of the clustered ANI groups, but may also serve as a means to explore overlaps in their requirements catalogue. To visualize these overlaps, the groups' percentages of reached ANI points are plotted against the ANI categories "locomotion", "social interaction", "condition of flooring", "light, air, noise" and "stockmanship".

4.2.1. Standards for calves

The identified ANI groups are distinguished into standards relevant for suckler and dairy calves. Due to the "Calves Directive", that forbids the keeping of calves in tie-stalls, a further classification of the ANI groups into housing systems is not necessary. The outcomes of the procedure are presented in Table 4.2 for Austrian calves standards. For each on-farm assessed ANI scale the standard deviation is specified.

Table 4.2: Shares of achieved ANI points of the ANI groups for calf standards in Austria

Animal category	Identified ANI groups	Percentages of achieved points per ANI 35L category [%]								ANI 35L grading[1]
		Loco-motion	Social interact.	Cond. of flooring	Light, air, noise	Stock-manship		total		
						A	B	A	B	
Suckler calves	**Non-cert. conv. std.**	50	43	48	45	55	62	**48**	**50**	**IV**
	EU organic std.	77	67	67	64	68	76	**68**	**70**	**II**
	Organic scheme 1	77	67	71	68	68	76	**70**	**72**	**II**
Dairy calves	**Non-cert. conv. std.**	50	24	48	45	55	62	**44**	**46**	**IV**
	Conv. scheme	77	62	76	73	64	67	**70**	**71**	**II**
	EU organic std.	77	48	67	64	68	76	**65**	**66**	**II**
	Organic scheme 1	77	48	71	68	68	76	**67**	**68**	**II**
	Organic scheme 2	100	81	71	77	73	81	**80**	**82**	**I**

Legend: ANI: Animal Needs Index; Cond.: Condition; Conv.: Conventional; EU: European Union; interact.: interaction; Non-cert.: Non-certified; std.: standard; A: Applies to cattle farms that keep more than 50 calves per year; B: Applies to cattle farms that keep maximally 50 calves per year.
[1]: As given in the right column of Table 3.1.
Source: Own compilation.

Whereas the lowest minimum level of animal welfare for Austrian calves is certainly defined by the conventional non-certified standard, the ANI point shares of all other ANI groups indicate considerably higher minimum requirements. Albeit the ANI point shares allocated to organic schemes show especially with respect to the category "social interaction" strong variation, they reach in all other categories values similar to those calculated for the EU organic standard. The ANI point shares assigned to the conventional scheme show substantial deviation from the conventional non-certified standard and take values comparable to the EU organic standard. In reference to the ANI category "light, air, noise", they even reach the highest values.

Strong variation in the ANI point shares of the ANI categories "locomotion" and "social interaction" can be observed. It can be traced back to considerable deviations of the standards'

minimum space allowance, free range and pasture obligations. The substantially lower variation of the ANI point shares of the remaining categories "condition of flooring", "light, air, noise" and "stockmanship" can to some extent be ascribed to comparably high ANI point shares of the conventional non-certified standard and the involvement of obligations that are subject to margins of interpretation. Especially with respect to the category "stockmanship" only slight discrepancies of the respective requirements are found.

The ANI groups identified for German calf standards are distinguished into the respective legislative conventional and organic standards as well as one ANI group for organic and two for conventional schemes. Following the procedure applied in Table 4.2, their ANI point shares are plotted against the ANI categories and presented in Table 4.3.

Table 4.3: Shares of achieved ANI points of the ANI groups for calf standards in Germany

Animal category	Identified ANI groups	Percentages of achieved points per ANI 35L category [%]								ANI 35L grading[1]
		Loco-motion	Social interact.	Cond. of flooring	Light, air, noise	Stock-manship		total		
						A	B	A	B	
Suckler calves	**Non-cert. conv. std.**	50	43	48	45	55	62	**48**	**50**	**IV**
	Conv. scheme 1	50	43	48	50	55	62	**49**	**51**	**A: IV; B:III**
	Conv. scheme 2	91	76	81	82	68	76	**80**	**81**	**I**
	EU organic std.	77	67	67	64	68	76	**68**	**70**	**II**
	Organic scheme 1	86	76	67	68	73	81	**74**	**76**	**A: II; B: I**
	Organic scheme 2	95	86	71	64	73	81	**78**	**79**	**I**
Dairy calves	**Non-cert. conv. std.**	50	24	48	45	55	62	**44**	**46**	**IV**
	Conv. scheme 1	50	24	48	50	55	62	**45**	**47**	**IV**
	Conv. scheme 2	91	71	81	82	68	76	**79**	**80**	**I**
	EU organic std.	77	48	67	64	68	76	**65**	**66**	**II**
	Organic scheme 1	86	57	67	68	73	81	**70**	**72**	**II**
	Organic scheme 2	95	67	71	64	73	81	**74**	**76**	**A: II; B: I**

Legend: ANI: Animal Needs Index; Cond.: Condition; Conv.: Conventional; EU: European Union; interact.: interaction; Non-cert.: Non-certified; std.: standard; A: Applies to cattle farms that keep more than 50 calves per year; B: Applies to cattle farms that keep maximally 50 calves per year.
[1]: As given in the right column of Table 3.1.
Source: Own compilation.

Generally, the ANI point shares indicated for German ANI groups show significant overlap with those detected for Austria. This can be mainly ascribed to the compliance with obligations imposed by CC relevant directives and the EU organic standard. In this regard, the similar ANI point shares allocated to conventional non-certified standards can be traced back to the overlap of imposed national obligations covering respective CC statutory management requirements (SMRs). The same applies to the obligations imposed by the EU organic standard that completely overlap with national legislation in Austria and Germany. They are exceeded by several organic schemes with slightly higher minimum requirements. Although the organic standard reaches in all categories substantially higher ANI point shares as its conventional non-certified counterpart, the highest values are reached in most categories by a conventional scheme.

As already observed for Austrian calf standards, a strong variation of the ANI point shares concerning the categories "locomotion" and "social interaction" reflects substantial divergences among the minimum space allowance, free range and pasture requirements of the standards sets. A comparable lower variation of the ANI point shares is given with respect to

the categories "condition of flooring", "light, air, noise" and "stockmanship". This can be mainly ascribed to the specific weighting of the respective ANI 35L indicator scales referring to more subjective assessment attributes that do hardly differ among the standards sets.

4.2.2. Standards for adult cattle

In dependence on the farm type and the applied housing system, the ANI 35L calculations for adult cattle lead to substantially different results. Therefore the identified ANI groups were sub-divided into suckler cow farms, dairy farms, farms fitted with loose housings and those fitted with tie-stalls. In accordance to the procedure applied for calves, the overlap of the requirements given by the identified ANI groups for adult cattle in Austria is presented in the Table 4.4.

Table 4.4: Shares of achieved ANI points of the ANI groups for adult cattle standards in Austria

Animal category	Identified ANI groups	Percentages of achieved points per ANI 35L category [%]						ANI 35L grading[1]
		Loco-motion	Social interact.	Cond. of flooring	Light, air, noise	Stock-manship	total	
Suckler cows (loose housing)	**Non-cert. conv. std.**	29	18	62	39	59	**41**	**IV**
	EU organic std.	62	50	67	52	64	**59**	**III**
	Organic scheme 1	62	50	71	57	64	**61**	**II**
	Organic scheme 2	90	82	67	83	73	**79**	**I**
Suckler cows (tie stalls)	**Non-cert. conv. std.**	10	23	57	39	59	**38**	**IV**
	EU organic std.	29	36	67	52	64	**50**	**IV**
	Organic scheme 1	29	36	71	57	64	**51**	**III**
Other adult cattle (loose housing)	**Non-cert. conv. std.**	29	0	62	39	59	**38**	**IV**
	Conv. scheme	90	68	81	70	59	**74**	**II**
	EU organic std.	62	32	67	52	64	**55**	**III**
	Organic scheme 1	62	32	71	57	64	**57**	**III**
Other adult cattle (tie stalls)	**Non-cert. conv. std.**	10	5	57	39	59	**34**	**IV**
	EU organic std.	29	18	67	52	64	**46**	**IV**
	Organic scheme 1	29	18	71	57	64	**48**	**IV**

Legend: ANI: Animal Needs Index; Cond.: condition; Conv.: Conventional; EU: European Union; interact.: interaction; Non-cert.: Non-certified; std.: standard.
[1]: As given in the right column of Table 3.1.
Source: Own compilation.

Depending on the observed standard or scheme, the lowest average ANI point shares are certainly allotted to ANI groups aggregating standards for dairy farms fitted with tie-stalls. Their counterparts fitted with loose housings already reach substantially higher ANI point shares with respect to the categories "locomotion" and "social interaction". These categories contain several indicator scales that enable a precise assessment of the animal's space allowance under consideration of the applied housing system. The same applies to ANI groups aggregating standards for suckler cow farms. Although they achieve, due to the evaluation of their characteristic herd structure in terms of the category "social interaction" considerably higher ANI point shares than those of comparable dairy farm standards, the application of tie-stalls leads to a decrease of the respective values.

In general, it can be noticed that ANI groups of organic standards and schemes reach substantially higher average ANI point shares than those associated to the conventional non-certified standard. Both legislative standards, the conventional non-certified as well as the EU

organic standard are exceeded by private certification schemes imposing higher minimum requirements. Although the highest average ANI point share is achieved by a private organic scheme, a private conventional scheme reaches the highest ANI point share in the category "condition of flooring".

The ANI point shares detected for Austrian calf standards, presented in Table 4.2, show strong overlap with those calculated for Austrian adult cattle standards given by Table 4.4. Both evaluations also show a strong variation of the values with respect to the categories "locomotion" and "social interaction". Concerning the other categories "condition of flooring", "light, air, noise" and "stockmanship", however, a much lower variation is detected. These similarities can, on the one hand, be ascribed to the basic legislative obligations given by the CC relevant directives and the EU organic standard imposing partially overlapping requirements for adult cattle and calves. On the other hand, they can be traced back to overall requirements for cattle set up by conventional and organic farm certification schemes. Certification schemes only addressing to calves or adult cattle could not be detected. Compared to the Austrian calf standards, the substantially higher variation in the ANI categories "locomotion" and "social interaction" can be traced back to the additional sub-division into loose housing systems and tie-stalls for adult cattle.

Under consideration of the applied housing systems, the ANI groups identified for German adult cattle standards are distinguished into legislative conventional and organic standards as well as ANI groups aggregating two conventional and organic schemes. Further to the procedure applied in Table 4.4, their ANI point shares are presented in the Table 4.5.

Table 4.5: Shares of achieved ANI points of the ANI groups for adult cattle standards in Germany

Animal category	Identified ANI groups	Percentages of achieved points per ANI 35L category [%]						ANI 35L grading[1]
		Loco-motion	Social interact.	Cond. of flooring	Light, air, noise	Stock-manship	total	
Suckler cows (loose housing)	**Non-cert. conv. std.**	19	18	38	39	55	**34**	**IV**
	Conv. scheme 1	19	18	48	43	59	**37**	**IV**
	Conv. scheme 2	90	77	86	74	64	**78**	**I**
	EU organic std.	62	50	67	52	64	**59**	**III**
	Organic schemes 1	71	59	67	57	73	**65**	**II**
	Organic scheme 2	71	59	67	70	73	**68**	**II**
Suckler cows (tie stalls)	**Non-cert. conv. std.**	10	23	33	39	55	**32**	**IV**
	Conv. scheme 1	10	23	43	43	59	**36**	**IV**
	EU organic std.	29	36	67	52	64	**50**	**III**
Other adult cattle (loose housing)	**Non-cert. conv. std.**	19	0	38	39	55	**30**	**IV**
	Conv. scheme 1	19	0	48	43	59	**34**	**IV**
	Conv. scheme 2	90	73	86	74	64	**77**	**I**
	EU organic std.	62	32	67	52	64	**55**	**III**
	Organic schemes 1	71	41	67	57	73	**62**	**II**
	Organic scheme 2	71	41	67	70	73	**64**	**II**
Other adult cattle (tie stalls)	**Non-cert. conv. std.**	10	5	33	39	55	**28**	**V**
	Conv. scheme 1	10	5	43	43	59	**32**	**IV**
	EU organic std.	29	18	67	52	64	**46**	**IV**

Legend: ANI: Animal Needs Index; Cond.: Condition; Conv.: Conventional; EU: European Union; interact.: interaction; Non-cert.: Non-certified; std.: standard.
[1]: As given in the right column of Table 3.1.
Source: Own compilation.

The ANI point shares of the German conventional non-certified standard for adult cattle are in nearly all ANI categories considerably lower than those calculated for comparable Austrian adult cattle standards. This can be traced back to the absence of specific national laws. In contrast to the Austrian obligations for cattle farms that partially exceed the European requirements because of their increased level of specification, the German obligations for cattle farming simply meet the European CC guidelines given by the "Animal Protection Directive" that are formulated in more general terms and apply for all livestock types.

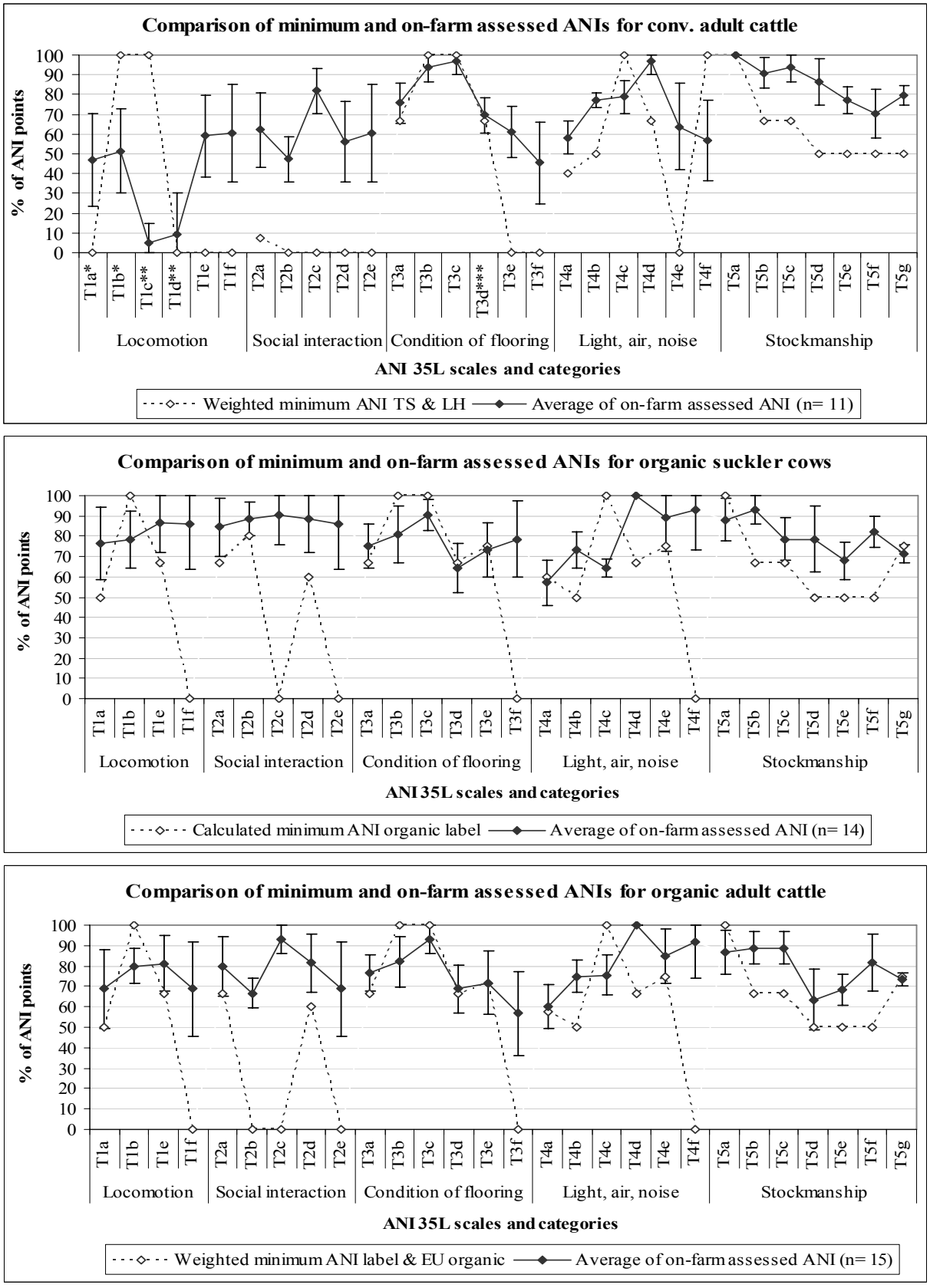
Also the ANI point shares detected for German calf standards, presented in Table 4.3, show strong overlap with those calculated for German adult cattle standards given by Table 4.5. As already mentioned with respect to values calculated for Austrian standards, the similar ANI point shares can be ascribed to partially overlapping requirements imposed by the legislative standards and certification schemes.

Compared to the other evaluations, the ANI point shares of German adult cattle standards show in nearly all ANI categories the highest variation. Especially in the categories "locomotion" and "social interaction" strong variation is detected. This can be explained, on the one hand, with the highest number of identified ANI groups and, on the other hand, with the lowest ANI point shares for conventional non-certified standard. Furthermore, the already high obligations imposed by the EU organic standard and organic certification schemes are exceeded by a conventional scheme which reaches the highest ANI point shares in four categories.

4.2.3. Comparisons of calculated minimum ANIs with on-farm assessments in Austria

As already mentioned in Section 3 of this chapter, current outcomes of on-farm ANI assessments conducted in Austria are available. Hence, in Figure 4.2 and Figure 4.3 the calculated minimum ANIs based on full compliance with Austrian law and certification obligations are plotted against the averages of on-farm measured ANI scores. In this regard, the abbreviations T1a to T5g represent the respective ANI assessment scales already described in Table 2.1. As in this on-farm assessment of animal welfare, only conventional non-certified farms and organic farms participated, only the calculated minimum ANIs with real ANIs in these two groups can be compared. In case of conventional non-certified farms, assessments were involved on farms fitted with tie-stalls and those equipped with loose housings. Therefore, the calculated minimum values are weighted in accordance to the shares of farms using these housing systems. The same procedure is applied to the calculated minimum values for organic adult cattle. As the on-farm assessments were conducted on farms certified under either a private organic label or the EU organic standard, the calculated minimum values were also weighted pursuant to the shares of farms of both certification grades. For adult cattle kept in loose housing systems associated to a private Austrian organic label, an additional differentiation into suckler cows was carried out.

Figure 4.2: Comparison of minimum calculated ANIs for adult cattle with on-farm ANI measures



Legend: ANI: Animal Needs Index; Conv.: Conventional; EU: European Union; LH: loose housing; n: sample size; TS: tie stall.
Note: For organic adult cattle the application of loose housing systems is assumed. *: The application of loose housing systems is assumed; **: The application of tie-stalls is assumed; ***: In case of the application of tie-stalls an outside run is available for the animals.
Source: Own compilation.

Generally, it can be observed that in dependence of the respective animal type, housing environment and/or certification grade, the calculated minimum ANIs are in most categories considerably lower than the averages of the on-farm measured ANI values. Whereas both curves related to adult cattle kept on conventional and organic certified farms show a moderately positive correlation[104], those referring to suckler cows housed on organic certified farms indicate a slight negative correlation[105]. Especially in the categories "social interaction", "light, air, noise" and "stockmanship" on-farm measured values exceed substantially the calculated minimum shares. But also concerning the animals' access to free range and pasture[106] substantially voluntary compliance is detected.

One of five indicator scales of the category "social interaction" addresses to requirements not covered by European or national legislation, which enlarges the point-referenced interval between the calculated and on-farm measured shares. Nevertheless, for this category a higher voluntary compliance with animal welfare obligations is detected. With respect to floor (T3a-T3d) and space allowance (T1a-T1d) conditions in the stable, the on-farm measured ANI values show a lower deviation from the calculated point shares indicating a lower voluntary compliance. In additional consideration of the relatively high level of legislative requirements in this field, for those animal welfare obligations an increased risk of non-compliance can be expected.

Although conventional farms show with respect to the ANI categories "locomotion" and "social interaction" considerably lower on-farm ANI results than organic farms, they reach in nearly all assessment scales of the category "stockmanship" even higher ANI point shares than their organic counterparts. This can be to some extent ascribed to the ANI indicator structure. Whereas the ANI assessment scales of the categories "locomotion" and "social interaction" ensure a quantitative and objective evaluation of the on-farm conditions, those allocated to the category "stockmanship" allow, due to their more subjective design, a greater margin of discretion. Nevertheless, due to an indirect correlation of several assessment scales of the category "stockmanship" with those involved in the categories "locomotion", "social interaction" and "condition of flooring", one could have assumed higher ANI point shares for organic farms.

Whereas for both farm types moderate violations against minimum requirements could be detected with respect to space allowance (T1b and T1c[107]) and the slipperiness of the lying area (T3c), slight breaches were noticed concerning animal health (T5g). This is primarily reflected by the overlap of calculated and on-farm measured ANI point shares indicating an increased risk of non-compliance with the underlying requirements.

Following the procedure applied for Figure 4.2, the calculated ANI point shares based on full compliance with certification requirements for organic calves are plotted against comparable on-farm measured ANI values. In this regard, a further differentiation into calves kept

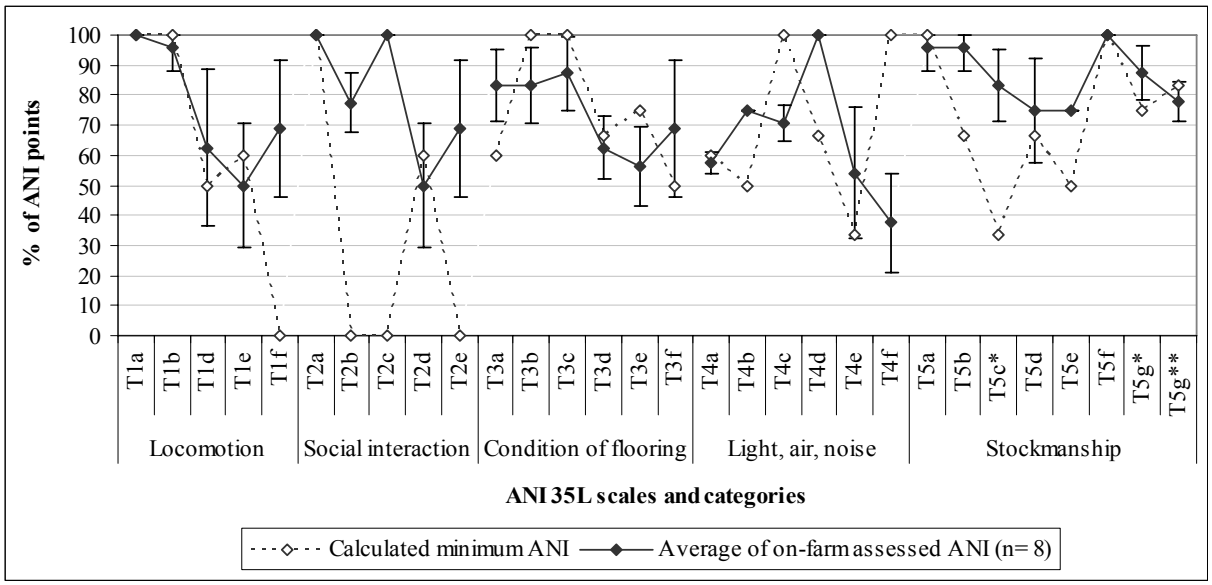
[104] The correlation coefficient for adult cattle amounts to 0.36 for conventional farms and 0.30 for organic farms.
[105] The correlation coefficient for suckler cows on organic farms amounts to -0.16.
[106] As referred to by the ANI assessment scales T1e, T1f, T2d, T2e, T4e and T4f shown in Figure 4.2 of this chapter.
[107] This assessment scale only applies to adult cattle housed in conventional tie-stalls.

on suckler cow farms and those housed on dairy cow farms was not carried out. The outcomes are illustrated in Figure 4.3.

Compared to the curves of the ANI point shares presented for organic adult cattle in Figure 4.2, those allocated to organic calves show an extensively different run. In reference to the ANI category "social interaction" a comparably high deviation from the calculated minimum shares is observed. Concerning the categories "locomotion" and "condition of flooring", however, the curves show only slight variation.

As already observed for adult cattle standards, one of five indicator scales of the ANI category "social interaction" is not covered by legislative requirements, which enlarges the point-referenced interval between calculated and on-farm measured shares. Otherwise, with respect to this assessment field a higher voluntary adherence to animal welfare measures can be assumed.

Figure 4.3: Comparison of minimum and on-farm assessed ANIs for organic calves (Austrian label)



Legend: ANI: Animal Needs Index; n: sample size.
Note: *: Applies to cattle farms that keep more than 50 calves per year; **: Applies to cattle farms that keep maximally 50 calves per year.
Source: Own compilation.

Whereas violations concerning the ANI categories "social interaction" and "stockmanship" can be neglected, breaches allocated to the category "light, air, noise" were detected on a small scale. This is pointed out by the slightly overlapping ANI point shares. Given that also ANI point shares measured with respect to the categories "locomotion" and "condition of flooring" nearly approach the calculated minimum standard, one can assume a higher risk of non-compliance with legislative requirements in these assessment fields.

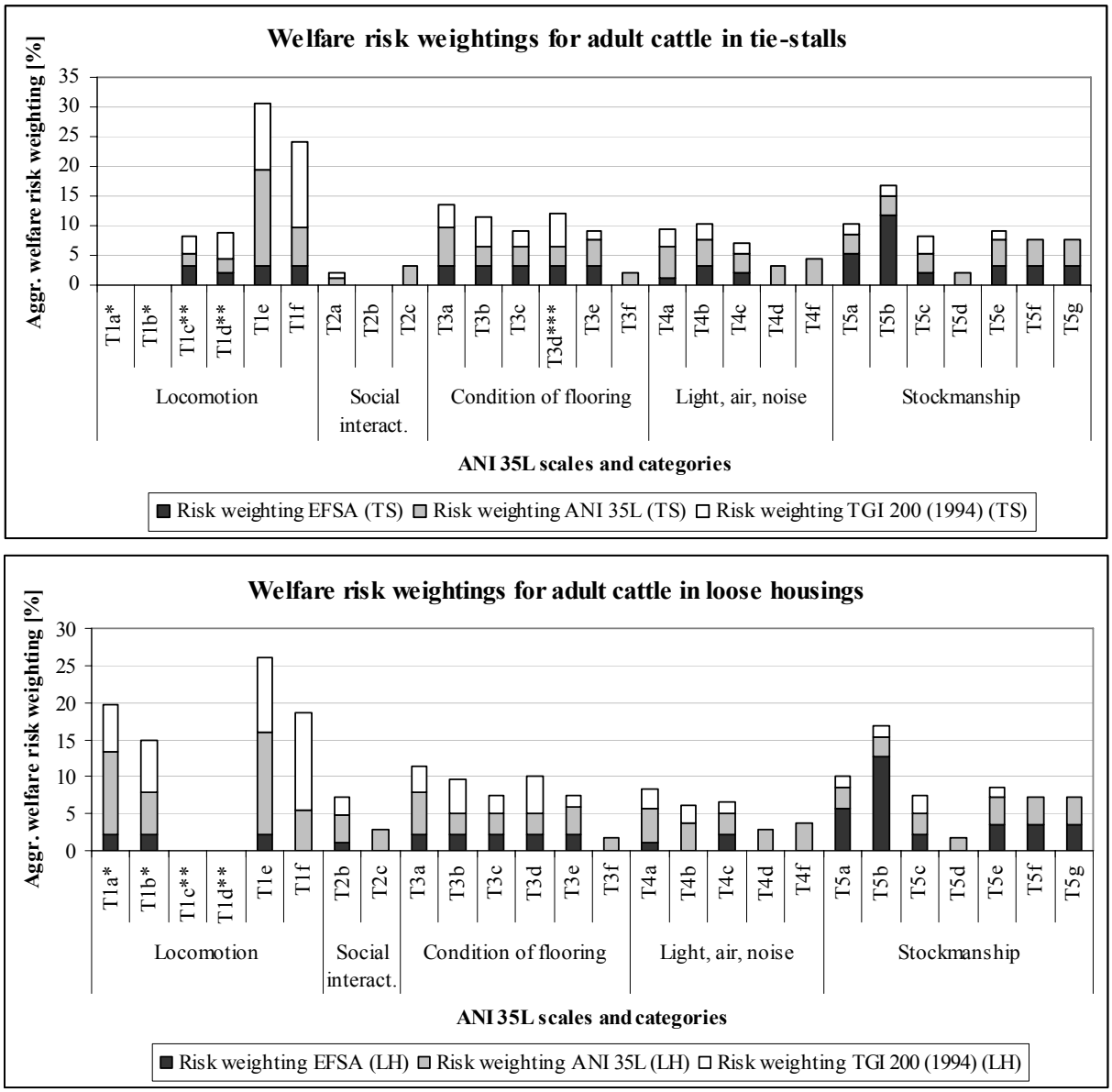
4.2.4. Review of the results in the context of reference frameworks

In this section, calculated minimum and on-farm measured values are compared with risk weightings of integrated animal welfare evaluation systems and scientific recommendations covering all or the majority of the observed ANI assessment scales. Based on this comparison, conclusions can be drawn to what extent farm requirements, considered by science to have a

high or low relevance for animal welfare, are reflected in the codes of practice of certification schemes, in national and European legislation and the on-farm compliance of the farmers.

The welfare risk weightings represent point shares in the overall point sum of the respective frameworks that are assigned to the fulfilment of specific animal welfare conditions. In Figure 4.4 the welfare risk weightings are summarised to "aggregated welfare risk weightings" and plotted against the ANI assessment scales. This procedure enables a direct comparison of allocated weighting factors on the basis of the ANI.

Figure 4.4: Welfare risk weightings of integrated risk and welfare evaluation systems



Legend: Aggr.: Aggregated; ANI: Animal Needs Index; EFSA: European Food Safety Authority; interact.: interaction; LH: loose housings; TS: tie-stalls.
Note: *: The application of loose housing systems is assumed; **: The application of tie-stalls is assumed; ***: An outside run is available for the animals.
Source: Own compilation.

As outlined in Table 2.1, the ANI framework provides for multiple evaluations of identical animal welfare conditions. To avoid double counting, risk weightings of the overlapping ANI

scales T2a, T2d, T2e and T4e are not listed separately but added to those of the overlapping scales T1a, T1e and T1f. The risk weightings may also diverge in dependence of the observed housing system. Therefore, Figure 4.4 distinguishes between adult cattle housed in tie stalls and those kept in loose housings.

It can be noticed that the highest welfare risk weightings are reached by assessment scales referring to the animals' access to free range and pasture (T1e and T1f), space allowance (T1a) as well as the condition of flooring (T3a-T3f) and equipment (T5b). Although the high relevance of these requirements in terms of farm animal welfare remains scientifically unquestioned, their increased emphasis can to some extent be ascribed to the fact that the ANI was primarily developed and used for the evaluation of organic farms. This might also apply to the TGI 200, as it is based on a former version of the ANI. Nevertheless, as already outlined in Section 2 of this chapter, several studies proved a high assessment quality and appropriateness of both evaluation frameworks for organic as well as conventional farm types.

The findings of Section 4.2.3 unfold substantial voluntary compliance with requirements regulating the animals' access to outdoors and the condition of equipment. For the same provisions, relatively high welfare risk weightings are detected, suggesting a greater overlap with measured on-farm compliance levels than with minimum requirements imposed by legislation and farm certification schemes. In contrast, Figure 4.2 reveals for floor conditions in the stable an increased risk of non-compliance. In this case, the welfare risk weightings based on scientific recommendations, measured on-farm compliance and calculated minimum values are assumed to be on a comparably high level.

Compared to the welfare risk weightings allocated to assessment scales covering floor conditions and the animals' access to outdoors, those assigned to scales of the ANI category "social interaction" reach lower values. For the latter, the comparison of on-farm measured and calculated minimum ANIs indicates for conventional and organic farms substantial voluntary compliance. This suggests the assumption that the minimum requirements of the standards fall below the risk weightings of the reference frameworks.

In the ANI category "light, air, noise" the assessment scales T4a, T4b and T4c, referring to light intensity and air quality, show substantially higher welfare risk weightings than the scale T4d focussing on noise intensity in the stables. A contrasting situation, however, is detected on-farm. As illustrated in Figure 4.2, conditions concerning noise control show higher compliance levels than those addressing to aspects of the stable climate. Calculated minimum ANIs vary in dependence of the observed farm type.

The welfare risk weightings referring to space allowance in the stables are for adult cattle kept in loose housing systems (T1a, T1b) substantially higher than for those housed in tie-stalls (T1c, T1d). This is in particular reflected by the conventional farmers' on-farm compliance with the same requirements, which proved to be higher with respect to loose housing systems. Comparable minimum values, calculated on the basis of full compliance with prescribed requirements, however, show a quite different pattern.

5. Conclusions

The outcomes indicate that an increasing integration of animal welfare requirements in farm certification schemes does not necessarily result in a higher level of farm animal welfare if they only overlap with existing national standards. According to the applied ANI framework, for calf standards and certification schemes existent in Austria and Germany only slight divergences of the minimum requirements could be detected. As a result, the minimum ANIs of Austrian and German label clusters reach very similar values. This can be largely ascribed to the obligations imposed by the European CC system and the EU organic standard that are identical for all member states of the EU.

The detected minimum animal welfare requirements for Austrian calf standards show strong overlap with those calculated for Austrian adult cattle standards. Due to the absence of national laws specifying the rather generally formulated CC guidelines given by the "Animal Protection Directive", the minimum animal welfare level for conventionally kept adult cattle in Germany is in nearly all ANI categories considerably lower than its Austrian counterpart and the comparable German calf standard.

Depending on the applied housing system, the ANI evaluations for adult cattle lead to different results. In general, cattle farms fitted with tie stalls reach significant lower animal welfare levels than those provided with loose housings. Due to their specific herd structure, suckler cow farms attain with respect to the ANI category "social interaction" a substantial higher animal welfare level than comparable dairy farms.

For Austria, recent results from a field study allowed a comparison of the calculated minimum ANIs based on full compliance with mandatory requirements, with on-farm measured ANI values disclosing the actual degree of compliance of farms. In this regard, for most of the ANI assessment scales substantially higher on-farm results are detected. This was especially the case concerning the ANI categories "social interaction" and "stockmanship", referring to the animal's herd structure and the quality of stockman care. Hence, one can assume that farmers may have an incentive to exceed the requirements prescribed by legislative standards and certification schemes in order to reach the best economic results. This conclusion is underlined by the fact that conventional and organic farms show similar on-farm results whereas the calculated minimum values of both farm types diverge significantly. For ANI scales referring to space allowance and floor conditions in the stables, only minor deviations between the calculated minimum values and measured on-farm compliance are detected. Vice versa, one can argue that for requirements covering these scales an increased risk of non-compliance can be expected.

The comparison of on-farm measured and calculated minimum ANIs illustrates that the accuracy of the applied assessment approach depends on the farmer's degree of compliance with national law and certification obligations. Notwithstanding the fact that for Austrian cattle farms a notably strong adherence to the requirements could be observed, full compliance with mandatory and/or voluntary standards can only be assumed for a share of farms. Concerning this matter, the ANI calculations given in Sections 4.2.1 and 4.2.2 represent an estimation of the minimum animal welfare standard of housing conditions existent on fully com-

pliant farms. For farms not or partly adhering to the standards, the chosen approach is not suitable as it does not address to the individual on-farm conditions.

The calculated minimum values based on full compliance with standards and the on-farm measured results are compared with welfare risk weightings of overall animal welfare evaluation systems and scientific recommendations covering all or the majority of the observed ANI assessment scales. The outcomes of this comparison indicate that requirements concerning the condition of flooring and equipment as well as the animals' space allowance in the stable and access to outdoors reach the highest point-referenced rewards, and therefore the highest scientific relevance in terms of animal welfare. Remaining obligations with focus on the animals' social interaction and the quality of stockmanship, however, achieve substantially lower weightings. Moreover, the findings of Section 4.2.3 reveal an increased risk of non-compliance with respect to space allowance and floor conditions in the stables and substantial voluntary compliance concerning the animals' social interaction and the quality of stockmanship. In this regard, the question arises whether it would make sense to raise the minimum standards for requirements showing voluntary compliance and lower those indicating increased risks of non-compliance in order to reach a higher overall level of animal welfare for adult cattle.

In conclusion, we have illustrated that the chosen ANI assessment approach is feasible to evaluate minimum animal welfare conditions on compliant cattle farms as prescribed by legislative standards and farm certification schemes. On the one hand, the detected overlap of the ANI indicators with official farm monitoring and certification indicators ensures a viable and cost-efficient evaluation of the respective minimum requirements without time-consuming on-farm measurements. On the other hand, it enables a comparison with measure-specific weighting factors given by other overall welfare and risk evaluation systems. But as an estimate of farm animal welfare the ANI is not only based on current knowledge but also affected by public opinion and trends. Therefore, it has to be continuously evolved pursuant to the chosen assessment approach.

References

Alban, L., Ersbøll, A. K., Bennedsgaard, T. W. and Johnsen, P. F. 2001. Validation of welfare assessment methods at herd level: An example. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 99-102.

Amon, T., Amon, B., Ofner, E. and Boxberger, J. 2001. Precision of assessment of animal welfare by the "TGI 35 L" Austrian needs index. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 114-117.

Annen, D. N. 2009. *Report describing the operationalisation of the second selection of indicators into impacts of Cross Compliance and the implementation in the final analytical tool.* Deliverable 2.6/2.7, CCAT project, EU 6th Framework Programme, Priority 8.1, European Commission. http://www.ccat.wur.nl/NR/rdonlyres/14A64131-DD4E-46FD-953E-986DDDB2AEC1/120807/D2_6_2_7_Operationalisation_indicators_FIN1.pdf, accessed 10 November 2011.

Annen, D. N., Wieck, C. and Kempen, M. 2011. Evaluation of minimum animal welfare conditions in national standards and farm certification schemes for pig fattening. *Acta Agriculturae Scandinavica Section A: Animal Science* 61, 40-54.

Bartussek, H. 1990. Der Tiergerechtheitsindex. In: Bartussek, H., Eisenhut, M., Haiger, A. and Storhas, R. (Hrsg.) *Naturnähe in der Veredelungswirtschaft – Ein Definitionskonzept*. Bericht über die 8. IGN-Tagung vom 22. bis 24. Februar 1990 an der LFS Schlierbach [The Animal Needs Index. In: Bartussek, H., Eisenhut M., Haiger, A. and Storhas, R. (eds.) *Naturalness in the Processing Industry - A Concept for Definition*. Report on the 8th IGN Conference of 22-24 February 1990 at the LFS Schlierbach], Federal Research Institute for Agriculture in Alpine Regions BAL Gumpenstein, Irdning, Austria, pp. 34-46. (In German)

Bartussek, H. 1995*a*. *Tiergerechtheitsindex für Mastschweine – TGI 35L/1995 Mastschweine* [*Animal Needs Index for fattening pigs – ANI 35L/1995 fattening pigs*]. Federal Research Institute for Agriculture in Alpine Regions BAL Gumpenstein, Irdning, Austria. http://www.bartussek.at/pdf/tgischweine.pdf, accessed 10 November 2011. (In German)

Bartussek, H. 1995*b*. *Tiergerechtheitsindex für Legehennen – TGI 35L/1995 Legehennen* [*Animal Needs Index for laying hens – ANI 35L/1995 laying hens*]. Federal Research Institute for Agriculture in Alpine Regions BAL Gumpenstein, Irdning, Austria. http://www.bartussek.at/pdf/tgilegehennen.pdf, accessed 10 November 2011. (In German)

Bartussek, H. 1999. A review of the Animal Needs Index (ANI) for the assessment of animal's well-being in the housing systems for Austrian proprietary products and legislation. *Livestock Production Science* 61, 179-192.

Bartussek, H. 2001. A historical account of the development of the Animal Needs Index ANI-35L as part of the attempt to promote and regulate farm animal welfare in Austria: An example of the interaction between animal welfare science and society. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 34-41.

Bartussek, H., Leeb, C. and Held, S. 2000. *Animal Needs Index for cattle – ANI 35L/2000 – cattle*. Federal Research Institute for Agriculture in Alpine Regions BAL Gumpenstein, Irdning, Austria. http://www.bartussek.at/pdf/anicattle.pdf, accessed 10 November 2011.

Bock, B. B. and van Leeuwen, F. 2005. Review of socio-political and market developments of animal welfare schemes. In: Roex, J. and Miele, M. (eds.) *Farm animal welfare concerns – Consumers, retailers and producers*. Welfare Quality® Report No. 1. Cardiff University, Cardiff, pp. 115-167.

Bokkers, E. A. M. 1996. De Dierenwelzijnsindex: Een aanzet tot het kwantificeren van het niveau vam dierenwelzijn in Nederlandse veehouderijsystemen [*The Animal Welfare Index: A push for quantifying the level of animal husbandry systems in the Netherlands*]. Dutch Society for the Protection of Animals, Den Haag, the Netherlands. (In Dutch)

Botreau, R., Bonde, M., Butterworth, A., Perny, P., Bracke, M. B. M., Capdeville, J. and Veissier, I. 2007. Aggregation of measures to produce an overall assessment of animal welfare. Part 1: A review of existing methods. *Animal* 1(8), 1179-1187.

Botreau, R., Veissier, I. and Perny, P. 2009. Overall assessment of animal welfare: Strategy adopted in Welfare Quality®. *Animal Welfare* 18, 363-370.

Bracke, M. B. M., Metz, J. H. M. and Spruijt, B. M. 2001. Development of a decision support system to assess farm animal welfare. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 17-20.

Bracke, M. B. M., Spruijt, B. M., Metz, J. H. M. and Schouten, W. G. P. 2002*a*. Decision support system for overall welfare assessment in pregnant sows A: Model structure and weighting procedure. *Journal of Animal Science* 80, 1819-1834.

Bracke, M. B. M., Metz, J. H. M., Spruijt, B. M. and Schouten, W. G. P. 2002*b*. Decision support system for overall welfare assessment in pregnant sows B: Validation by expert opinion. *Journal of Animal Science* 80, 1835-1845.

Canali, E. and Keeling, L. 2009. Welfare Quality project: From scientific research to on farm assessment of animal welfare. *Italian Journal of Animal Sciences* 8 Suppl. 2, 900-903.

Capdeville, J. and Veissier, I. 2001. A method of assessing welfare in loose housed dairy cows at farm level, focusing on animal observations. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 62-68.

De Rosa, G., Grasso, F., Pacelli, C., Napolitano, F. and Winckler, C. 2009. The welfare of dairy buffalo. *Italian Journal of Animal Science* 8 Suppl. 1, 103-116.

European Food Safety Authority 2009. Scientific Opinion of the Panel on Animal Health and Welfare on a request from the Commission on the risk assessment of the impact of housing, nutrition and feeding, management and genetic selection on behaviour, fear and pain problems in dairy cows. *The EFSA Journal* 1139, 1-68.

European Commission 2008. Commission Regulation (EC) No 889/2008 of 5 September 2008 laying down detailed rules for the implementation of Council Regulation (EC) No 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control. *Official Journal of the European Union* L 250, 1-84.

European Council 1991. Council Directive 91/629/EEC of 19 November 1991 laying down minimum standards for the protection of calves. *Official Journal of the European Union* L 340, 28-32.

European Council 1998. Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes. *Official Journal of the European Communities* L 221, 23-27.

Eurostat 2011. *Statistics on organic farming: Number of registered organic operators.* http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=food_act2&lang=en, accessed 10 November 2011.

Farmer, M. and Swales, V. 2007. Future Policy Options for Cross Compliance. *Background Paper for the Cross Compliance Policy Seminar*, 26 April 2007, Brussels, Deliverable D23 of the SSPE-CT-2005-022727 CC Network Project. http://www.ieeplondon.org.uk-/publications/pdfs/crosscompliance/future_policy_options_for_cc.pdf, accessed 10 November 2011.

Farmer, M., Swales, V., Jongeneel, R., Karaczun, Z., Müssner, R., Leipprand, A., Schlegel, S., Poux, X., Ramain, B., De Roest, K., Varela Ortega, C., and Simó, A. 2007. Exploring

the synergies between cross compliance and certification schemes. *Deliverable 8: Synthesis report of certification schemes in 7 EU countries and 3 non-EU countries*. Paper prepared for SSPE-CT-2005-006489 Facilitating the CAP reform: Compliance and competitiveness of European agriculture. http://library.wur.nl/way/bestanden/clc/1860311.pdf, accessed 10 November 2011.

Ferket, S. L. and Hacker, R. R. 1985. Effect of forced exercise during gestation on reproductive performance of sows. *Canadian Journal of Animal Science* 65, 851-859.

Forkman, B. and Keeling, L. 2009 (eds.). Assessment of animal welfare measures for dairy cattle, beef bulls and veal calves. *Welfare Quality® Reports No. 11*. http://www.welfarequality.net/downloadattachment/43219/20192/WQR11.pdf, accessed 10 November 2011.

Fraser, D. 1995. Science, values and animal welfare: Exploring the "inextricable connection". *Animal Welfare* 4, 103-117.

Fraser, D. 2003. Assessing animal welfare at the farm and group level: The interplay of science and values. *Animal Welfare* 12, 433-443.

Gonyou, H. W. 1996. Design criteria: Should freedom of movement be retained? *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 27, 36-39.

Horgan, R. and Gavinelli, A. 2006. The expanding role of animal welfare within EU legislation and beyond. *Livestock Science* 103, 303-307.

Hörning, B. 1997. Tiergerechtheit und Verfahrenstechnik eingestreuter Milchviehlaufställe in der Praxis [Animal welfare and process technology in littered loose housings for dairy cattle in practice]. *PhD Thesis*. University of Kassel, Faculty of Agriculture, Witzenhausen, Germany. (In German)

Hörning, B. 2000. Vergleich der Tiergerechtheit von Milchviehlaufställen auf konventionellen und ökologischen Betrieben [Comparison of animal welfare of loose housings on conventional and organic dairy farms]. *Lebendige Erde* 6, 38-39. (In German)

Hörning, B. 2001. The assessment of housing conditions of dairy cows in littered loose housing systems using three scoring methods. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 42-47.

Jensen, P. and Toates, F. M. 1993. Who needs "behavioural needs"? Motivational aspects of the needs of animals. *Applied Animal Behaviour Science* 37, 161-181.

Johnsen, P. F., Johannesson, T. and Sandøe, P. 2001. Assessment of farm animal welfare at herd level: Many goals, many methods. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 26-33.

Keeling, L. 2009 (ed.). An overview of the development of the Welfare Quality® project assessment systems. *Welfare Quality® Reports No. 12*. http://www.welfarequality.net-/downloadattachment/43220/20191/WQR12.pdf, accessed 10 November 2011.

Marchant, J. N. and Broom, D. M. 1996. Effects of dry sow housing conditions on muscle weight and bone strength. *Animal Science* 62, 105-113.

Müller 1987. Animal protection regulations for pig management. In: Fölsch, D. W. (ed.) *Ethical, ethological and legal aspects of intensive farm animal management*. Birkhauser Verlag, Basel, pp. 83-148.

Napolitano, F., De Rosa, G., Ferrante, V., Grasso, F. and Braghieri, A. 2009. Monitoring the welfare of sheep in organic and conventional farms using an ANI 35 L derived method. *Small Ruminant Research* 83, 49-57.

Pedersen, B. K. 1996. Animal welfare: A holistic approach. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 27, 76-81.

Popescu, S., Borda, C., Lazar, E.-A. and Hegedüs, C. I. 2009. Assessment of dairy cow welfare in farms from Transylvania. *Proceedings of the 44th Croatian and 4th International Symposium on Agriculture*. 16-20 February 2009, Opatija, Croatia, pp. 752-756.

Roe, E. and Buller, H. 2008. Marketing farm animal welfare. *Welfare Quality® report*. http://www.welfarequality.net/downloadattachment/41858/19515/fact%20sheet%20marketi ng%20farm%20animal%20welfare%20final.pdf, accessed 10 November 2011.

Rushen, J. 2003. Changing concepts of farm animal welfare: Bridging the gap between applied and basic research. *Applied Animal Behaviour Science* 81, 199-214.

Sandøe, P., Giersing, M. H. and Jeppesen, L. L. 1996. Concluding remarks and perspectives. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 27, 109-115.

Schatz, P., Boxberger, J. and Amon, T. 1996. Eine vergleichende Analyse des TGI 200/94 und des TGI 35L/1995 zur Beurteilung der Tiergerechtheit von Milchviehhaltungssystemen. *3. Internationale Tagung „Bau, Technik und Umwelt in der landwirtschaftlichen Nutztierhaltung“* [A comparative analysis of the TGI 200/94 and the ANI 35L/1995 for the assessment of animal welfare of housing systems for dairy cows. *3rd International Conference "Construction, technology and environment in livestock farming"*]. 11-12 March 1997, Kiel, Germany. (In German)

Schole, J. 1982. Physiologische Grundlagen der nichterreger- und nichtantigenspezifischen Abwehr [Physiological basics of the non-agent and non-antigenspecific immune defence]. *Der praktische Tierarzt* 63, 345-354. (In German)

Scott, E. M., Nolan, A. M. and Fitzpatrick, J. L. 2001. Conceptual and methodological issues related to welfare assessment: A framework for measurement. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 5-10.

Sundrum, A., Andersson, R. and Postler, G. (eds.) 1994. *Tiergerechtheitsindex 200/1994 – Ein Leitfaden zur Beurteilung von Haltungssystemen* [*Animal needs index 200/1994 – A manual for the assessment of housing systems*]. Köllen Druck und Verlag GmbH, Bonn. (In German)

van den Weghe, S. 1998. Beurteilung der Tiergerechtheitsindizes TGI 35 L und TGI 200/1994. In: Kuratorium für Technik und Bauwesen in der Landwirtschaft (KTBL) (Hrsg.) *KTBL-Schrift 377* [Assessment of the animal welfare indexes TGI 35 L and TGI 200/1994. In: Board of trustees for technology and building industry in Agriculture (KTBL) (ed.) *KTBL-Schrift 377*]. Darmstadt. (In German)

Veissier, I., Butterworth, A., Bock, B. and Roe, E. 2008. European approaches to ensure good animal welfare. *Applied Animal Behaviour Science* 113, 279-297.

Waiblinger, S. Knierim, U. and Winckler, C. 2001. The development of an epidemiologically based on-farm welfare assessment system for use with dairy cows. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 73-77.

Welfare Quality® 2009. *Welfare Quality® assessment protocol for cattle*. Welfare Quality® Consortium: Lelystad, Netherlands.

Wemelsfelder, F. and Lawrence, A. B. 2001. Qualitative assessment of animal behaviour as an on-farm welfare-monitoring tool. *Acta Agriculturae Scandinavica Section A: Animal Science* Suppl. 30, 21-25.

Willen, S. 2004. Tierbezogene Indikatoren zur Beurteilung der Tiergerechtheit in der Milchviehhaltung – Methodische Untersuchungen und Beziehungen zum Haltungssystem [Animal-based indicators for the assessment of animal welfare in dairy farming – Methodological investigations and relations to the housing system]. *PhD Thesis*. University of Veterinary Medicine Hannover, Hannover, Germany. (In German)

World Health Organization 1999. *Principles and Guidelines for the conduct of microbiological risk assessment*. Codex Alimentarius Commission (CAC/GL-30). http://www.codexalimentarius.net/download/standards/357/CXG_030e.pdf, accessed 10 November 2011.

Chapter 4 Cross compliance and private farm certification schemes: Participation, compliance and synergies at farm level[108]

Abstract

Most European farmers participate in the Single Payment Scheme and are member of a farm certification scheme. Incentives to participate may result as these requirements often at least partially overlap, or because farm structure allows rather easy compliance. Also low monitoring intensities, detection rates, or sanctions may be an incentive to "free ride" on the participation. The paper develops a theoretical model that explains the joint compliance behaviour and tests the model using individual farm survey data. Evidence from the survey on Austrian animal farms indicates that farmers weigh the relevance of compliance, control, detection and sanctions differently in the two systems but strive to comply with all rules. Hence, the expected trade-off between costs and gains of participation and compliance only partially occurs.

1. Introduction

The Single Payment Scheme (SPS) and related cross compliance (CC) as a new policy instrument has been introduced with the Luxemburg Reform of the Common Agricultural Policy reform in the year 2003. This SPS requires that all farmers receiving the single farm payment (SFP), also called direct payments, must comply with CC regulation which is defined by 18 statutory European standards in the fields of environment, food safety and animal health and welfare (EU Commission 2003). Farmers will be sanctioned for not complying with these standards through cuts in their direct payments. Controls are undertaken by the responsible administrative governmental body, but with a very low frequency (about 1% of the farms are controlled in a given year). At the same time, many farmers are members of private farm certification schemes[109] (FCS) either because they want to signal a special quality they produce on their farm (e.g. "organic", "local") or because they are "voluntarily" pushed to participate by the marketing partners since they refuse to buy their output in case of non-participation (e.g. "QS" for pig meat in Germany). Controls of these privately set standards are generally carried out by private organisations, are much more frequent than CC controls, and cover all farms that participate in a specific certification scheme. However, contrary to CC obligations, the requirements imposed by FCS center usually around those parts of the farm that are tar-

[108] This chapter is based on a yet unpublished working paper written together with Dr. C. Wieck (first author). Dominic Norbert Annen contributed significantly to Section 1, Section 2 and the descriptive part of Section 4. The data used in Chapter 4 was sampled by Dominic Norbert Annen within the research project "CCAT", EU 6th Framework Programme, Priority 8.1 (European Commission, DG RTD, contract no. 44423-CCAT). Its content does not represent the official position of the European Commission and is entirely under the responsibility of the authors. The authors acknowledge the support of Dr. E. Ofner-Schröck and Mag. med. vet. E. Schröck in organising the farm interviews used for this study.
[109] Sometimes, these schemes are also associated with the term "quality assurance schemes".

geted by the specific FCS. In case of the German "QS label" for example, their requirements may be relevant for pig production on the farm, but the arable production part of the farm is ignored. Here, CC has a much broader scope since it covers relevant standards of farming in the areas of food production, environmental issues, animal welfare and public health. Nevertheless, the two systems overlap with respect to the defined standards and their enforcement. Thus, synergies may exist that allow reducing the administrative burden of farmers and controlling costs for the respective agencies (Farmer *et al.* 2007).

Though CC is a compulsory policy instrument for all farms receiving the SFP, farms may decide to opt out of the system, i.e. forego the direct premium and CC controls. This may be the case, if for example the relation between administrative burden and financial reward is too unbalanced as it may happen on specialised horticultural farms for example. In addition, there may be commercial livestock farms that due to their production structure do not participate in the SPS and thus do not receive the SFP and consequently must not comply with the CC rules. Thus, for farmers, the decision to participate and comply with CC and FCS may differ depending on their production and marketing situation, level of the SFP and other socio-economic conditions and personal goals. Similarly, there may be incentives for farms to join a specific FCS because CC and FCS obligations overlap significantly or because past farm orientation, management and buildings allow rather easy compliance. But also low monitoring intensities, detection rates, or sanctions in CC or a FCS may be an incentive to "free ride" on the participation when the farmer can expect that non-compliance will potentially not be detected or fined.

In the literature, not many attempts have been made to model these decisions about participation in the SPS or FCS from a farmer's perspective. Bartolini *et al.* (2008) is to our knowledge the only paper, that addresses this joint decision problem but in the context of participation in voluntary agri-environmental schemes (AES). In their theoretical analysis they distinguish, based on maximisation of expected farm profit, four strategies the farmer can take in this situation: no involvement in CC or AES; compliance with CC and no participation in AES; no compliance of CC and participation in AES; and compliance with CC and participation in AES. In an application of the methodology, they simulate the compliance with a nitrate directive in a specific region in Italy assuming six different farm types where the costs of compliance differ. In addition, they parameterise the monitoring intensity of the administrative body. Their results show that all farm types are interested in receiving the direct payments related to CC and that they have an incentive to cheat regarding compliance. The similar effect is found for the participation in AES. Only when monitoring is sufficiently high, compliance with the obligations can be increased. Raggi *et al.* (2008) analyses the design of CC controls taking into account the moral hazard problem. They model the farmers' optimal level of cross-compliance assuming a specific monitoring intensity by the competent authorities. They also allow for non-compliance by the farmers but assume that this can be perfectly detected with a sufficient control effort by the authorities. Nitsch and Osterburg (2008) focus on the control effort by the authorities and develop a theoretical model based on the control theory as provided by Lippert (2002). Taking the state perspective, they argue that the three variables control rate, probability of detection and height of sanction are the relevant ones to

be optimized by the state in order to define efficient enforcement strategies for CC. From the point of view of the addressee, i.e. the farmer, they combine benefit-cost calculation of compliance with personal moral convictions and considerations of social sanctioning as the relevant variables that enter the farmer's decision process. Without empirically validating their theoretical model, they finish the paper with a discussion of the characteristics of different control systems for CC and specialised controls in the EU. In a theoretical paper, Herzfeld and Jongeneel (2012) provide a literature overview on various approaches from economics, psychology and sociology to explain compliance behaviour and put these approaches then in the asymmetric farmer-regulator setting of CC. They conclude their paper by highlighting the need for further empirical research based on models that go beyond the assumption of utility maximizing agents and include other reasons for compliant behaviour. These reasons may include intrinsic motivations, moral convictions, or social preferences apart from economic cost-benefit considerations. The synergies in standards among CC and FCS were analysed by Farmer *et al.* (2007) and Annen *et al.* (2011). Farmer *et al.* (2007) show in a broad analysis of CC and FCS across EU member states that there exist significant synergies between the two sets of standards but also points out that there are key differences: for example, most FCS do not cover the full range of standards that are governed by CC obligations. Annen *et al.* (2011) show for the case of animal welfare standards in German and Austrian FCS that there exist wide similarities between FCS standards and CC and that farms being member of a FCS do comply with the relevant CC animal welfare obligations. Not directly focusing on CC but related in terms of theory is the literature dealing with participation and compliance to AES, mostly focusing on issues related to information asymmetries (Ozanne and White (2007), moral hazard and adverse selection (Hart and Latacz-Lohmann 2005) or uncertainty (Yano and Blandford 2011).

Focusing on the explanation of the compliance behaviour of farms regarding CC and participation in FCS, our paper provides several contributions to the literature that go beyond the above presented state-of-the-art. In the first section, the paper develops a comprehensive theoretical model accounting for this joint decision on CC and FCS compliance under different monitoring and sanctions scenarios that are relevant and consider the current CC legislation. In a second step, the theoretical model is then tested using the results from a unique Austrian farm survey. The survey offers compliance control information from about 65 animal farms as well as further information sampled in the form of on-farm interviews about their behaviour facing both CC and FCS obligations, their knowledge and expectations regarding control and sanctions, but also with respect to personal beliefs, risk behaviour and past and planned investment decisions related to compliance with the obligations.

The paper proceeds in Section 2 by showing areas of overlap and divergence between CC and FCS standards followed in Section 3 by a derivation of a theoretical model and hypotheses for farm decision making when facing different systems of standards. Section 4 contains the empirical analysis providing an overview on the farm survey and the analysis of the results using descriptive and econometric methods. Section 5 discusses the hypotheses in the light of the survey results and Section 6 concludes.

2. The relationship of public and private standards

2.1. Standards as laid out by cross compliance regulations

With the Luxemburg Reform of 2003[110] the farm allocation of direct payments was linked to the farmer's adherence to CC farm standards. The obligations imposed by CC relevant directives can be distinguished into the standards of "Good Agricultural and Environmental Condition" (GAECs) and "Statutory Management Requirements" (SMRs).

Table 2.1: Overview of the CC SMRs

No.	Legal act with CC relevance	Relevant articles	Influence field	CC introduction
1	"Birds Directive": 79/409/EEC	3(1), (2)(b); 4(1), (2), (4); 5(a), (b), (d)	Environment	01.01.2005
2	"Groundwater Directive": 80/68/EEC	4; 5		
3	"Sewage Sludge Directive": 86/278/EEC	3		
4	"Nitrate Directive": 91/676/EEC	4; 5		
5	"Habitats Directive": 92/43/EEC	6; 13(1)(a)		
6	Council Directive 2008/71/EC[1]	3 - 5	Public and animal health: identification and registration of animals	
7	Regulation (EC) No 1760/2000	4; 7		
8	Council Regulation (EC) No. 21/2004[2]	3 - 5		
9	Council Directive 91/414/EEC	3	Public, animal and plant health	01.01.2006
10	Council Directive 96/22/EC	3(a), (b), (d), (e); 4; 5; 7		
11	Council Regulation (EC) No. 178/2002	14, 15, 17 (1)[3], 18 - 20		
12	Council Regulation (EC) No. 999/2001	7; 11; 12; 13; 15		
13	Council Directive 85/511/EEC	3		
14	Council Directive 92/119/EEC	3		
15	Council Directive 2000/75/EC	3		
16	"Calves Directive": 91/629/EEC	3; 4	Animal welfare	01.01.2007
17	"Pigs Directive": 91/630/EEC	3; 4 (1)		
18	"Animal Protection Directive": 98/58/EC	4		

Legend: CC: Cross compliance; EC: European Council; No.: Number.
[1]: Formerly covered by Council Directive 92/102/EEC.
[2]: Formerly covered by Regulation (EC) No 2629/97 (articles: 6 and 8).
[3]: "As implemented in particular by: Regulation (EEC) No 2377/90 (Articles 2, 4 and 5); Regulation (EC) No 852/2004 (Article 4(1) and Annex I part A (II 4 (g, h, j), 5 (f, h), 6; III 8 (a, b, d, e), 9 (a, c)); Regulation (EC) No 853/2004 (Article 3(1) and Annex III Section IX Chapter 1 (I-1 b, c, d, e; I-2 a (i, ii, iii), b (i, ii), c ; I-3; I-4; I-5; II-A 1, 2, 3, 4; II-B 1 (a, b)), Annex III Section X Chapter1 (1)); Regulation (EC) No 183/2005 (Article 5 (1) and Annex I, part A (I-4 e, g; II-2 a, b, e), Article 5(5) and Annex III (1, 2), Article 5(6) and Regulation (EC) No 396/2005 (Article 18)" (European Council 2009).
Source: Own representation based on European Council (2009).

The GAECs are defined by the member states and set requirements for farmers with respect to soils and maintenance of landscape as well as habitat features that reflect characteristic environmental conditions of the member states' countryside. In contrast, the SMRs specify mandatory rules covering parts of 18 existing and already implemented regulations or directives with focus on the environment, public, animal and plant health and animal welfare and apply currently to EU-15, Slovenia and Malta (Table 2.1). Depending on their impact fields, the SMRs were stepwise introduced in the years 2005-2007. Nitsch and Osterburg (2007) provide an overview on the implementation of CC on member state basis.

[110] Given by Council Regulation (EC) No 1782/2003 of 29 September 2003 (European Council 2003) that is already replaced by Council Regulation (EC) No 73/2009 of 19 January 2009 (European Council 2009).

Member states must provide farmers with the list of SMRs, and must establish management, control and a sanction system to ensure sufficient monitoring with a minimum of 1% of farms checked on-site each year. The selection of farms for control in a given year shall be based on some risk-related criteria where the responsible agencies have leverage to define these criteria. Criteria such as change in farm ownership, enlargement or start of new farming activities and investment in buildings or land are often mentioned as factors influencing the farm specific risk score. When the SMRs or GAECs are not met by the farmer, the payments granted under the SPS ("direct payments") in the calendar year in which the violation occurs are reduced. The applied penalty rates vary depending on intent, extent, severity and permanence of the non-compliance, ranging from 1% to 15% in the event of negligence, to at least 15% where intentional violation can be assumed. In case of repeated non-compliance, or breaches in several areas, penalties are cumulated and lead to a severe direct payment reduction. (European Commission 2011)

2.2. Relationship of CC with national law

Even if farms decide to opt out of the CC system, they still have to comply with relevant national law. In many areas, national law and CC obligations are congruent with each other: As all SMRs defined in CC, are formulated in pre-existing EU directives and regulations, they have already been incorporated into national law of the member states[111]. Thus their compliance by farms is automatic if farms adhere to all national law. The distinction between CC and national regulation lies in the fact that control frequency and sanctions are different, even though controls are executed by the same authorities, i.e. in most EU member states by the regional veterinary agencies. With respect to controls of abidance by national law, frequency of control is not exactly known by the farm and sanctions in the form of administrative fines are lower than in the CC case. The GAECs are principally "on-top" of national law. But depending on the EU member state or federal state they may be already covered by national rules, completely or to some extent. Hence, though farms not participating in CC are not obliged to comply with the GAECs they may face these GAEC regulations via national law.

2.3. Standards as defined by farm certification schemes

Many farms do also comply with voluntary standards imposed by FCS. The farmer's main benefit of a membership in FCS is the permission to use a branded label serving to enter the market, to communicate the product quality and/or to achieve higher price premium. The obligations imposed by FCS vary depending on the responsible body, respective farming sector, livestock or crop type and scope of the scheme. Although FCS requirements for conventional

[111] However, national legislation may also exceed European law. For example, UK and Sweden exceed European law by prescribing group housing for non-suckling sows in all buildings (see e.g. Bock and van Huik 2007; Veissier *et al.* 2008, p. 283).

or organic farms show in most cases strong overlap with the underlying conventional and organic legislative standards, they may respond to additional public concerns in the areas of animal welfare[112], food safety, wildlife conservation or potential dangers of genetically modified crops. They are either formulated as recommendations or have compulsory character (Farmer *et al.* 2007). Costs incur not only by the regular membership or one-off joining fees of FCS, but also by adjusting farm management practices to meet the certification requirements, by regular audits or controls, as well as by sanctions in case of non-compliance.

2.4. Conclusions on the relationship between CC and FCS standards

As displayed in Table 2.2, there are similarities with respect to the farming activities covered by both frameworks but also large differences between the two schemes. In general, the CC system defines horizontal standards in four areas that apply to all types of farming activities and participation is mandatory if the farm receives the SFP. Participation in a FCS, however, is voluntary or "quasi-" voluntary and standards set by the FCS may be specific only to some areas and farm activities or may also be more horizontal depending on the scope of the label. In general, one may state that the CC standards define the legislative minimum standards defined for a specific area. The FCS standards may go beyond this. Hence, when analysing the relation of CC and FCS standards, we have to distinguish two situations:

1. There may be a broad overlap between FCS and CC standards regulating the same areas and farming activities. With respect to the stringency of the respective standards, we have to differentiate between two cases:
    - The FCS standards are equivalent to the CC standards.
    - The FCS standards go beyond the level of the CC standards.
2. CC or FCS address areas that do not overlap. For example, a specific FCS may not address environmental issues covered by the CC framework or that the FCS provides detailed marketing standards (e.g. with respect to traceability) having no counterpart in CC.

[112] Focusing on animal welfare, Veissier *et al.* (2008) provides a very good overview on the existence and relationship of public and private standards in that area. According to our knowledge, for the other areas, no such overviews do exist.

Table 2.2: Overview on characteristics of CC and FCS

Characteristic	Farm certification schemes	Cross compliance
Responsible body	Sectoral body, retailer, interest group, local administration	EU -> member states -> delegated authorities
Farming sectors	May be relevant to all production sectors or only specific areas of a farm.	All sectors except those ineligible for single payment (e.g. horses). Applies to entire holding if farm receives SFP.
Participation status	Voluntary	Compulsory if farm receives SFP.
Scope of standards	Varies by FCS standards. May relate to single, sector-specific standards or encompass many sectors or horizontal standards. Often includes mix of compulsory standards and best practice recommendations.	Basic horizontal standards for: • Environment • Food safety • Animal and plant health • Animal welfare
Costs of participation	One-off joining fee Annual costs of certification inspection Costs of compliance: Costs for adjustment of farm management practices to meet standards if not already met.	Costs of compliance: Costs for adjustment of farm management practices to meet pre-existing legal requirements/or new standards introduced with CC if not already met.
Benefits from participation	Certification often permits the use of a branded logo that allows access to special markets/niche and higher prices.	Entitlement to SFP.
Relation to jurisprudence	Schemes respect legal requirements as minimum basis, but coverage may not be comprehensive.	SMRs are based on national legislation, as mandated by EU legislation. GAEC standards may be based on national legislation.
Inspection	Inspection protocol is responsibility of the FCS body. Frequency of control varies but each single farm is inspected.	Responsibility of the responsible control authority. Controls occur annually on a minimum of 1% of the farms claiming the SFP.
Sanctions	Warnings and time for re-establishment of compliance. Withdrawal of certification and right to use logo.	Level of penalty depends on severity of the breach, but little to no scope to avoid sanction resulting in loss of part or full SFP.

Legend: CC: Cross compliance; e.g.: for example; EU: European Union; GAEC: Good Agricultural and Environmental Condition; SFP: Single farm payment; SMR: Statutory Management Requirement.
Source: Own representation based on Farmer *et al.* (2007, p.19ff).

3. Model of farm decision making when facing cross compliance and farm certification system obligations

3.1. A model of joint participation

The SPS and related CC constitute a classical principal agent problem with asymmetric information between the participating agents and issues of moral hazard and adverse selection inherent in the design of the contractual relationship: The administrative body is the principal

and does not hold all information about the behaviour of the agent, namely the farmer. The farmer has the possibility of cheating as the administrative agency can monitor the farmer's behaviour only imperfectly, because in practice full control is difficult and costly. To a lower extent, adverse selection may occur as farmers differ with respect to their personal convictions and attitudes toward cheating. Even though farm selection for CC control occurs according to risk-based criteria, the administrative regulator has no tool to discover the farmer's individual attitude towards cheating in advance in order to individually adjust the risk-based selection criteria to the expected level of farm compliance.

The behavioural model of the farmer in this decision situation can be represented as a problem where the farmer has to choose his strategy out of four possible schemes: exposition to national law (NAT), but no involvement in any of the systems (CC, FCS); membership only in one of the systems; and as a fourth case, simultaneous participation in both systems (CC+FCS). The optimal decision is assumed to depend on the expected profit, the level of single farm payment but also on compliance costs resulting from the alignment of the production programme to the given standards, on farmer's expectations about control and detection rate of the monitoring agencies for CC or FCS and finally on expectations about the sanctions that may arise from non-compliance.

Formally, the farmers' behaviour may be stated as follows:

$$\pi_i = \max\left(\pi_i^{NAT}; \pi_i^{CC}; \pi_i^{FCS}; \pi_i^{CC+FCS}\right), \tag{1}$$

where *i* represents the individual farmer, and the farm profits π_i stand for the maximum expected profit obtained by pursuing one of the different strategies outlined above and will be discussed in detail below.

3.1.1. Case 0 – General case: Definition of optimal farm production programme when no standards exist

Assume a case where the farmer has no outside regulations to comply with but is able to define her farm optimal production programme. This leads to the following maximisation problem:

$$\max_{y_i, e_i} \left\{\pi_i^0 = py_i - C_i(y_i, e_i, w)\right\}, \tag{2}$$

where π_i^0 represents the farm profit, y_i represents a vector of farming activities and *p* a vector of corresponding output prices. e_i represents the level of one specific farm characteristic (e.g. space in animal barn) a farmer would choose when no regulation exist but which may be subjected to a standard in certain regulatory frameworks. It is assumed that $e_i > 0$. $C_i(\bullet)$ defines a well-behaved, theory consistent cost function (Chambers 1998, p. 51f.) and depends on y_i, e_i and input price vector *w*. Costs are assumed to be convex in the level of the farm characteristic considered.

The first order conditions of this farm maximisation problem represent:

$$\text{Optimal production programme: } \frac{\partial \pi_i^0}{\partial y_i} = p - \frac{\partial C_i(\bullet)}{\partial y_i} = 0, \tag{3}$$

(4) optimal level of realisation of farm characteristic: $\frac{\partial \pi_i^0}{\partial e_i} = -\frac{\partial C_i(\bullet)}{\partial e_i} = 0$,

where equation
(**4**) simply says that the level of the farm characteristic should be such that the cost of realisation is (ceteris paribus) minimal.

3.1.2. Case 1 – National law

Now, we assume that the farm is subjected to national law but does not receive the SFP premium or participates in a FCS. This leads to the following farm profit formulation:

(5) $$\max_{y_i, e_i} \left\{ \pi_i^{NAT} = py_i - C_i(y_i, e_i, w) - m_i^{NAT}(d_i^{NAT})\phi^{NAT} \right\},$$

where d_i stands for the degree of compliance a farm achieves for a specific level of a farm characteristic and is defined as:

$$d_i^{NAT} = \frac{e_i}{\bar{e}^{NAT}},$$

where $\bar{e}^{NAT}$ represents the regulatory level of the standard as defined by national law. The degree of compliance is modelled as a continuous variable with $d_i^{NAT} > 0$ and is specific to each regulatory framework. ϕ marks the fine that is imposed if non-compliance is detected.

$m(d_i)$ is the probability of detecting an infringement and is defined as the product of the probability c of the farm to be controlled in a given period and the probability h that an infringement is discovered when a control takes place: $m_i^{NAT}(d_i^{NAT}) = c_i^{NAT} \cdot h^{NAT}(d_i^{NAT})$. Similar to the degree of compliance, c_i, h_i and m_i are specific to each regulatory framework.

The probability of control is farm specific and depends on a number of (risk-based) factors defined by the respective control agencies as explained in Section 2. The probability to be caught is the same across all farms within a regulatory framework but depends on the farm-specific degree of compliance. This conditional probability to be caught decreases with higher levels of compliance,

$$\text{i.e. } \frac{\partial h^{NAT}(d_i^{NAT})}{\partial e_i} \leq 0,$$

because it is more difficult to detect breaches when a high degree of compliance is already achieved. Consequently, the unconditional detection probability also decreases with the degree of compliance,

$$\text{i.e. } \frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i} = c_i^{NAT} \cdot \frac{\partial h^{NAT}(d_i^{NAT})}{\partial e_i} < 0.$$

With respect to the relation between degree of compliance, control, discovery and detection, the following holds (Table 3.1):

Table 3.1: Relation between degree of compliance and detection probability

Degree of compliance	Resulting probability of discovery	Control probability	Resulting probability of detection
d≥1	=> h(d)=0	c=0	=> m(d)=0
		c>0	
d<1	=> h(d)>0	c=0	=> m(d)=0
		c>0	=> m(d)>0

Note: For reasons of clarity, the subscript *i* has not been added in this table.
Source: Own representation.

When full compliance is achieved, i.e. $d_i \geq 1$, probability of discovery is zero, and regardless of the control probability, the detection probability is zero (non-positive) as there is no infringement to detect. When the degree of compliance is less than one, the probability of discovery is larger zero. If the probability of control is zero, the resulting detection probability must also be zero as no control will take place, otherwise, if the control probability is larger zero, then also the probability of detection is larger zero.

The first order conditions of the farm maximisation problem in (5) are

$$\frac{\partial \pi_i^{NAT}}{\partial y_i} = p - \frac{\partial C_i(\bullet)}{\partial y_i} = 0, \tag{6}$$

$$\frac{\partial \pi_i^{NAT}}{\partial e_i} = -\frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi - \frac{\partial C_i(\bullet)}{\partial e_i} = 0 \qquad \Rightarrow \frac{\partial C_i(\bullet)}{\partial e_i} = -\frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi. \tag{7}$$

Equation (7) says that the marginal costs for an increased level of a specific farm characteristics, shall not exceed (must be equal to) the expected fine.

Costs of compliance occur when a farm has to change its production programme from its optimal state (case 0) in order to (fully) fulfil for a specific farm characteristic given legislation. This implies that additional costs of compliance to a standard only occur, if compliance involves a higher standard level than what the farm realizes "voluntarily" for that specific characteristic. Compliance with a standard may involve both, adjustments in the outputs with related changes in revenue and additional costs that occur due the regulatory requirement. So, costs of compliance are measured as the difference in profit between the "ideal" production programme and the realized one, e.g. $\pi_i^{NAT} - \pi_i^0$.

When only national law exists, two *states of compliance* can be distinguished: the farm is compliant or non-compliant (Table 3.2). In the first state, a farm is fully or even "over-compliant" when the farm characteristic meets at least the level defined by the standard, i.e. $e_i \geq \overline{e}^{NAT}$. The maximisation problem reduces to case 0. No costs of compliance occur as the maximisation problem of equation (5) lead to the same profit as in case 0. If the farm operates with a specific farm characteristic below a defined standard level, $e_i < \overline{e}^{NAT}$, the farm is considered to be non-compliant ($d_i < 1$). Further assuming $c^{NAT} > 0$, the detection probability is larger zero (compare Table 3.1), and thus equation (7) describes the decision behaviour for the realisation of the farm optimal level of e_i considering the expected fine. Compared to the "ideal" case, costs of compliance, $\pi_i^{NAT} - \pi_i^0$, occur and are negative. This finding is in line with reality, as we observe that quite a number of farms have no or only few costs of compliance for a wide range of standards as their farm-specific optimal level of compliance lies be-

yond the (minimum) requirements formulated in national law (Annen *et al.*, 2011). If the control probability is zero, then, the detection probability is equal zero (see Table 3.1) and no costs of compliance occur as equation (7) reduces to the expression in case 0.

Table 3.2: States and costs of compliance for case 1

State of compliance	Assumption about control probability	Resulting profit loss ("costs of compliance")
Compliant to standard	Not relevant	None
Non-compliant to standard	$c_i^{NAT} > 0$	Exist
	$c_i^{NAT} = 0$	None

Source: Own representation.

3.1.3. Case 2 – Participation in the Single Payment Scheme

If the farmer decides to receive the EU SFP, he is obliged to follow the CC requirements. Thus the farmer declares his willingness to accept premium reductions in case of non-compliance with these standards. At the same time, the farm has to follow national law, as explained in Section 2. As the principles of compliance, control, discovery and detection are the same for national law and CC, all definitions are according to case 1, but symbols are marked with the subscript CC. If non-compliance is detected, a sanction calculated as a function of the single farm payment is imposed, where ρ^{CC} represents the share of the payment that will be subtracted as a result of non-compliance. The farm maximisation problem may be stated as follows:

(8)
$$\max_{y_i, e_i} \left\{ \pi_i^{CC} = py_i - C_i(y_i, w, e_i) - m_i^{NAT}(d_i^{NAT})\phi + SFP_i - m_i^{CC}(d_i^{CC})\rho(d_i^{CC})SFP_i \right\}.$$

The first order conditions read:

(9)
$$\frac{\partial \pi_i^{CC}}{\partial y_i} = p - \frac{\partial C_i(\bullet)}{\partial y_i} = 0,$$

(10)
$$\frac{\partial \pi_i^{CC}}{\partial e_i} = -\frac{\partial C_i(\bullet)}{\partial e_i} - \frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi - \frac{\partial m_i^{CC}(d_i^{CC})}{\partial e_i}\rho(d_i^{CC})SFP_i = 0,$$

$$\Rightarrow \frac{\partial C_i(\bullet)}{\partial e_i} = -\frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi - \frac{\partial m_i^{CC}(d_i^{CC})}{\partial e_i}\rho(d_i^{CC})SFP_i .$$

Thus, in this case, equation (10) says that the marginal costs for an increased level of a farm characteristic, shall not exceed (must be equal to) the marginal expected sanction comprising the fine for non-compliance with national law and for the SFP.

Costs of compliance are defined as the difference in profit between the "ideal" production programme and the realized one, i.e. $\pi_i^{CC} - (\pi_i^0 + SFP_i)$. We have added now the SFP[113] also to the "ideal" case, as we assume that the farm is participating in the SPS. With respect to the *states of compliance*, the following relations of standards and farm compliance exist in the EU:

a) General case: National law is equal to CC requirement, i.e. $\overline{e}^{NAT} = \overline{e}^{CC}$.
   Thus, the farm realisation of the standard may be above the requirement, $e_i \geq \left(\overline{e}^{NAT} = \overline{e}^{CC}\right)$, i.e. the farm is compliant with the standard, or below, $e_i < \left(\overline{e}^{NAT} = \overline{e}^{CC}\right)$, meaning that the farm is non-compliant.
b) There exist exceptions to that rule in some member states (e.g. Austria): The standard according to national law is higher than the same standard according to CC, i.e. $\overline{e}^{NAT} > \overline{e}^{CC}$.

   This leads to three different options for the farm compliance behaviour:

   - The farm is compliant to both standards: $e_i \geq \overline{e}^{NAT} > \overline{e}^{CC}$.
   - The farm is compliant only to the lower standard, i.e. compliant to the CC requirement but not to the national law regulation: $\overline{e}^{NAT} > e_i \geq \overline{e}^{CC}$.
   - The farm is non-compliant to both standards: $\overline{e}^{NAT} > \overline{e}^{CC} > e_i$.

Thus, overall, we have three states: full compliance to both standards, no compliance to both standards, or compliance to CC but not to national law. The costs of compliance expressed as expected loss in profit relating to these states are represented in Table 3.3.

Table 3.3: States and costs of compliance for case 2

State of compliance	Assumption about control probability	Resulting profit loss ("costs of compliance")
Compliant to both standards	Not relevant	None
Non-compliant to both standards	$c_i^{NAT} > 0$, $c_i^{CC} > 0$	Exist, larger than in case 1.
	$c_i^{NAT} = 0$, $c_i^{CC} = 0$	None
Compliant to CC but not to national law	$c_i^{NAT} > 0$, not relevant for CC	Exist, same as in case 1.
	$c_i^{NAT} = 0$, not relevant for CC	None

Legend: CC: Cross compliance.
Source: Own representation.

It can be seen that costs of compliance only accumulate when the degree of compliance is below one for one or both of the standards and when the threat of a control exists (control probability larger zero). When non-compliance to both standards is detected, the potential sanction resulting from both systems is higher and the subsequent profit loss is larger than when only one standard is neglected or no infringement takes place. When the control threat

[113] In the mathematical formulas, the SFP is defined as being specific for each farm *i*. Nevertheless, in the text, we suppress the subscript *i*, as here, we understand the term as being generic and representing the abbreviation of "single farm payment".

is not credible, i.e. control probability zero, farms may be non-compliant without impacts on their profit. From a regulator's perspective this means an unwanted result that should be prevented by ensuring a sufficiently high control probability and control frequency.

3.1.4. Case 3 – Participation only in FCS and not in Single Payment Scheme

The next situation to be discussed relates to the farmer's decision of participation in a FCS without participating in the SPS. Here the farm has to comply with standards set by the respective FCS. The reward from participating in a specific FCS means that the farm can sell its products under the respective label and usually receives a higher price. This increase in profit due to the farmer's membership in the label is indicated by δ^{FCS} where $\delta^{FCS} > 0$. As in the case of CC, the individual farmer has the decision to which degree he wants to comply with the standards. Control of the standards take place by authorized control agencies where the monitoring procedure is clearly defined in the FCS guidelines. We assume the same principles for compliance and detection as in the previous cases and use the same symbols attached with the superscript FCS. As previously, levels of probability and frequency of controls may differ across regulatory frameworks and farms. In the FCS case, control often depends on past levels of compliance on the farm as for example the "QS" label distinguishes a one, two and three year control frequency depending on past results. The sanction in case of non-compliance to the standards of a FCS means in the most drastic case that the use of the label for marketing will be revoked and thus that the farm has to market its product in the standard conventional channel with subsequent financial consequences. Also in this case, farms have to respect national law, but FCS controls are generally independent of national controls.[114] This results in the following profit maximisation formulation:

$$\textbf{(11)} \qquad \max_{y_i, e_i} \left\{ \pi_i^{FCS} = \left(1 + \left(1 - m_i^{FCS}(d_i^{FCS})\right)\delta^{FCS}\right) py_i - C_i(y_i, e_i, w) - m_i^{NAT}(d_i^{NAT})\phi^{NAT} \right\}.$$

The first order condition reads:

$$(12) \qquad \frac{\partial \pi_i^{FCS}}{\partial y_i} = \left(1 + \left(1 - m_i^{FCS}(d_i^{FCS})\right)\delta^{FCS}\right) p - \frac{\partial C_i(\bullet)}{\partial y_i} = 0,$$

$$(13) \qquad \frac{\partial \pi_i^{FCS}}{\partial e_i} = -\frac{\partial m_i^{FCS}(d_i^{FCS})}{\partial e_i}\delta py_i - \frac{\partial C_i(\bullet)}{\partial e_i} - \frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi = 0,$$

$$\Rightarrow \frac{\partial C_i(\bullet)}{\partial e_i} = -\frac{\partial m_i^{FCS}(d_i^{FCS})}{\partial e_i}\delta py_i - \frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi.$$

Thus, marginal costs of increasing the level of the considered farm characteristic must be equal to the marginal expected sanction imposed.

Loss in profit due to compliance, i.e. *costs of compliance*, compared to the "ideal" production programme are $\pi_i^{FCS} - \pi_i^{0,\delta}$, where we assume that the output price in the ideal pro-

[114] Private control agencies usually have notification requirement to public authorities if public and food safety is affected. Given the EU wide repercussions of the recent dioxin food safety scandal in Germany, we may observe changes in the future regarding the responsibilities of private and public control agencies.

duction programmes are now adjusted for the premium that farms receive when participating in a FCS. Costs of compliance, as before may result from adjustments in the production programme or changes in production costs. We may observe the following *states of compliance*:

a) FCS standard is equal to national law, i.e. $\overline{e}^{FCS} = \overline{e}^{NAT}$.
   Thus, the farm realisation may be above the standard, $e_i \geq \left(\overline{e}^{FCS} = \overline{e}^{NAT}\right)$, or below, $e_i < \left(\overline{e}^{FCS} = \overline{e}^{NAT}\right)$.
b) FCS standard is higher than national law: $\overline{e}^{FCS} > \overline{e}^{NAT}$.

   This leads to three different options for farm compliance:

   - The farm is compliant to both standards: $e_i \geq \overline{e}^{FCS} > \overline{e}^{NAT}$.
   - The farm is compliant only to the lower standard, i.e. national law: $\overline{e}^{FCS} > e_i \geq \overline{e}^{NAT}$.
   - The farm is non-compliant to both standards: $\overline{e}^{FCS} > \overline{e}^{NAT} > e_i$.

Thus, overall, we observe three states: full compliance to both standards, no compliance to both standards, or compliance to national law but not the FCS standard. The costs of compliance expressed as expected loss in profit are represented in Table 3.4.

Again, costs of compliance only occur when the degree of compliance is below one for one or both of the standard types and when the threat of a control exists. When non-compliance to both standards is detected, the costs of compliance are largest compared to when only one standard is neglected or no infringement takes place. When the control probability zero, farms may be non-compliant without impacts on their profit as the farm can continue to sell the products under the FCS label. With respect to overall costs of compliance in the FCS system, it is to assume that the loss of the marketing premium due to non-compliance is the lowest when the FCS standard is very similar to the national one. For FCS standards that are much higher than national ones, the marketing margin is likely high as well and thus the incentive not to lose this advantage will be indirectly reflected in the costs of compliance.

Table 3.4: States and costs of compliance for case 3

State of compliance	Assumption about control probability	Resulting profit loss ("costs of compliance")
Compliant to both standards	Not relevant	None
Non-compliant to both standards	$c_i^{NAT} > 0$, $c_i^{FCS} > 0$	Exist, larger than in case 1.
	$c_i^{NAT} = 0$, $c_i^{FCS} = 0$	None
Compliant to national law but not to FCS	$c_i^{FCS} > 0$, not relevant for NAT	Exist, but smaller than cost of compliance when non-compliant to both standards. Depends on marketing margin and difference between national and FCS standard.
	$c_i^{FCS} = 0$, not relevant for NAT	None

Legend: FCS: Farm certification scheme; NAT: National law.
Source: Own representation.

3.1.5. Case 4 – Participation in both: SPS and FCS

The final issue relates to the farmer's decision problem when participating in the SPS and thus being obliged to CC and additional participation in a FCS. Hence, the elements and assumptions from the previous cases will be brought together in order to reflect this situation. The resulting farm profit maximisation problem is given by:

$$(14) \quad \max_{y_i, e_i} \left\{ \begin{array}{l} \pi_i^{CC+FCS} = \left(1+\left(1-m_i^{FCS}(d_i^{FCS})\right)\delta^{FCS}\right) py_i - C_i(y_i, e_i, w) \\ \qquad\qquad - m_i^{NAT}(d_i^{NAT})\phi^{NAT} + SFP - m_i^{CC}(d_i^{CC})\rho(d_i^{CC})SFP_i \end{array} \right\},$$

with first order conditions:

$$(15) \quad \frac{\partial \pi_i^{FCS}}{\partial y_i} = \left(1+\left(1-m_i^{FCS}(d_i^{FCS})\right)\delta^{FCS}\right) p - \frac{\partial C_i(\bullet)}{\partial y_i} = 0,$$

(16)

$$\frac{\partial \pi_i^{FCS}}{\partial e_i} = -\frac{\partial m_i^{FCS}(d_i^{FCS})}{\partial e_i}\delta py_i - \frac{\partial C_i(\bullet)}{\partial e_i} - \frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi - \frac{\partial m_i^{CC}(d_i^{CC})}{\partial e_i}\rho(d_i^{CC})SFP_i = 0,$$

$$\Rightarrow \frac{\partial C_i(\bullet)}{\partial e_i} = -\frac{\partial m_i^{FCS}(d_i^{FCS})}{\partial e_i}\delta py_i - \frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi - \frac{\partial m_i^{CC}(d_i^{CC})}{\partial e_i}\rho(d_i^{CC})SFP_i .$$

The optimal level of compliance combines elements from cases 1-3 indicating that marginal costs of adjusting the level of the production characteristic considered are now driven by all relevant standards. *Costs of compliance* are defined according to the previous cases, i.e. $\pi_i^{CC+FCS} - (\pi_i^{0,\delta} - SFP_i)$ with the same assumptions as before. With respect to the *states of compliance*, we may observe the following:

a) Full compliance to all standards: $e_i \geq \left\{\overline{e}^{NAT}, \overline{e}^{CC}, \overline{e}^{FCS}\right\}$.

b) No compliance to any standard: $e_i < \left\{\overline{e}^{NAT}, \overline{e}^{CC}, \overline{e}^{FCS}\right\}$.

c) Partial compliance with the standards.

Table 3.5: States and costs of compliance for case 4

State of compliance	Assumption about control probability	Resulting profit loss ("costs of compliance")
Compliant to all standards	Not relevant	None
Non-compliant to all standards	$c_i^{NAT} > 0$, $c_i^{CC} > 0$, $c_i^{FCS} > 0$	Exist, larger than in all other cases.
	$c_i^{NAT} = 0$, $c_i^{CC} = 0$, $c_i^{FCS} = 0$	None
Only partial compliance	Control probability larger zero for specific case.	Exist, but size depends on marketing margin and difference between national and FCS standard.
	Control probability equal zero for specific case.	None

Legend: FCS: Farm certification scheme.
Source: Own representation.

As before, costs of compliance only occur when the degree of compliance is below one for at least one of the standard types and when the threat of a control exists and control also takes place (Table 3.5). When non-compliance to all standards is detected, the costs of compliance are largest compared to when only one standard is neglected or no infringement takes place. When the control threat is not credible, i.e. control probability is equal to zero, farms may be non-compliant without impacts on their profit.

3.2. Comparison of solutions and hypotheses

In the last section, the various cases of participation in CC and FCS and compliance with the respective standards were discussed. Tables 3.2-3.5 showed that costs of compliance only occur when farms not already comply with the standards without considering related sanctions. The derivative of the profit function with respect to the level of the farm characteristic *e* becomes relevant when a credible control threat of a respective standard exists. The following table comprises a comparison of this second first order condition across all four cases.

Table 3.6: Comparison of derivative of profit function with respect to farm characteristic *e*

		Cross compliance	
		Non-participation	**Participation**
FCS	**Non-part.**	$\frac{\partial C_i(\bullet)}{\partial e_i} = -\frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi$	$\frac{\partial C_i(\bullet)}{\partial e_i} = -\frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi - \frac{\partial m_i^{CC}(d_i^{CC})}{\partial e_i}\rho(d_i^{CC})SFP_i$
	Part.	$\frac{\partial C_i(\bullet)}{\partial e_i} = -\frac{\partial m_i^{FCS}(d_i^{FCS})}{\partial e_i}\delta py_i - \frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi$	$\frac{\partial C_i(\bullet)}{\partial e_i} = -\frac{\partial m_i^{FCS}(d_i^{FCS})}{\partial e_i}\delta py_i - \frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi - \frac{\partial m_i^{CC}(d_i^{CC})}{\partial e_i}\rho(d_i^{CC})SFP_i$

Legend: FCS: Farm certification scheme; Non-part.: Non-participation; Part.: Participation.
Source: Own representation.

The optimal levels of realisation of a specific level of the farm characteristic when participating in CC or FCS or both resemble each other in the way that they all depend on the detection probability, the degree of compliance as well as a sanction that will be imposed if the respective standard is not met. The more schemes are relevant on the farm, the more terms related to detection and sanctions have to be considered in the compliance decision.

Given these theoretical derivations reflecting the farm optimal solution to obligations resulting from CC and/or FCS, we can derive hypotheses about the farmer's behaviour regarding participation and compliance. The formulated hypotheses are divided into two blocks: Hypothesis one to three deal with the general choice to participate in cross compliance and farm certification programmes where the second block (hypothesis four to seven) focus on the decision regarding the degree of compliance.

3.2.1. Participation choice

- Hypothesis 1: Low costs of compliance to the CC and/or FCS standards determine farmers' decision to participate in the respective system(s).
- Hypothesis 2: High fines or detection probabilities lead farmers to abstain from participation in system.
- Hypothesis 3: Standards close to the national minimum requirements lead farms to participate in CC or FCS system.

3.2.2. Degree of compliance

- Hypothesis 4: Farms expecting a higher detection probability, higher fines, or both, will show a higher degree of compliance with obligations resulting from CC and/or FCS.
- Hypothesis 5: Finally, farmers may have motives to comply with the obligations as for example personal beliefs regarding authority of the government, animal welfare, risk aversion, or societal status that are not captured explicitly in the above presented approach.

4. Evidence from Austrian farm survey

In this section, results from a survey conducted in 2009 on 65 Austrian farms about their attitude and behaviour regarding issues related to CC and FCS will be reported. In Sub-section 4.1, an overview on the design of survey will be given, in Sub-section 4.2 the relevant findings of the survey are reported, and in Sub-section 4.3 a regression analysis is performed analysing the determinants of participation in more depth.

4.1. Farm survey overview

Using different avenues (agricultural research center, agricultural chamber, certification agencies and other contacts) 113 livestock farms in Austria were contacted of which 65 farms participated in the survey. Thus, the survey is not representative of the farm population in Austria, but still provides meaningful insights on compliance behaviour of farmers. Out of the 65 farms, 61 farms were able to fully answer the questionnaire, and thus entered into the result evaluation. The farms were distributed over Austria with 31 farms located in Styria, 12 farms in Lower Austria, 8 farms in Salzburg, four farms in Upper Austria and Tyrol, respectively, as well as two farms in Carinthia. Main production focus of 38 farms is beef fattening and dairy production, the remaining 23 farms generate most of the income with pig fattening. The farms all received direct payments from the EU, and hence are obligated to comply with CC regulations. In addition, 90% of the farms participated in one or more FCS, i.e. 55 farms. Out of these 55 farms, 36 farms or 65% are certified as organic.

The survey was done on farm in personal interviews that took about 1 hour each. In addition, with the support of a veterinary official, an inspection of the animal confinements was done and data collected in order to calculate an animal welfare index used by the Austrian monitoring bodies for evaluating organic farms. Hence, apart from the results of the survey, also on-farm degrees of compliance with legal veterinary requirements could be assessed. The full survey (in German) can be found in the Annex.

4.2. Farmer's attitudes and behaviour towards CC and FCS

4.2.1. Attitude and knowledge about CC and FCS

General attitude towards CC was positive within the population of the questioned farmers with about 59% considering the introduction of the *CC system* as "somewhat" or "very useful" (q22)[115]. But also about 41% of the farmers claim the CC obligations to be "somewhat useless" (26%) or "completely useless" (15%). Nevertheless, about 79% of the farmers say that their knowledge level (q18) about CC is "average" (47%) or even "good" (32%), but also 3% of the farmers claim that they have no knowledge about it[116]. This finding was confirmed in question 17 where it was asked how CC obligations relate to national law. About 42% answered that CC obligations are widely captured already by national Austrian obligations, another 33% said that they are completely covered by national law whereas only 17% said that they are not or almost not captured by national regulations with the remaining respondents said that they don't know the answer.

4.2.2. Reasons for compliance and participation in CC and FCS

When it comes to compliance with the CC obligations (q58) the following ones are listed as main reasons for compliance (in descending order): prevention of SFP reduction (listed as important or very important by 93%), overlapping with FCS obligations (62%), concerns regarding animal protection (51%), concerns regarding consumer protection (48%), prevention of financial sanctions (33%) and endorsement of CC system (8%).

Turning to the comparison of the relevance of the CC and the FCS system, 66% of the sampled certified farmers answered that the compliance with the FCS (q53) has the highest priority for them where for only 12% the priority is on the CC obligations and 22% ranked both systems as equally important. When the farmers were asked to rank both systems by their financial importance (q55), the result tendencies were the same with an even slightly stronger importance on the FCS (77%) and an average increase in income (q61) due to the participation by about 9% (standard deviation of 11). Inquiring the reasons for participation in a FCS (q59), highest importance was assigned most often to "trust in the certificate" (74%), "improved marketing of products" (72%) and "increase in revenue" (70%), whereas the least

[115] Number refers to question number in survey.
[116] Even though all farms actually receive direct payments!

importance was assigned most often to a potentially "reduced administrative control rate" (93%) and the "overlap with CC obligations" (95%). As other relevant reasons "minimum requirements in supply chain" (60%), "animal welfare considerations" (60%) and "organic/alternative way of living" (57%) were mentioned. For those 6 farms that are not certified (q64), 3 responded that they generally do not intend to enter a FCS with the most important reason listed (q65) being that the farm structure does not fit for such a standard. Other reasons mentioned were that some obligations were "counterproductive" or that investment costs were too high.

4.2.3. Decision on degree of compliance

The decision about the degree of compliance seems to be an important one from a theoretical perspective. Two questions deal with this issue, asking if farmers do comply with all regulations and if they may intentionally not comply with some obligations (q56, q57). The survey reveals that about 33% of the farmers do not comply with some of the CC obligations, but that all of these cases of non-compliance result from the use of transition periods for specific obligations or problems with the structural design of the farm buildings. Similarly, according to the question about investments and degree of compliance (q40), all farmers expect to fulfil all obligations after the termination of all investments and construction projects. The on-farm inspection of CC made in the context of this survey revealed that the degree of compliance on average was 97% with 50% of the farms fulfilling all CC obligations already at the time of the survey. Hence, in practice, given the density of regulations relevant on the farm and the link of compliance with sanctions, the decision about degree of compliance seems not to be relevant. Supporting evidence is also the observation that 75% of the farmers state that they have made very positive (10%), positive (42%), or at least neutral (23%) experiences with EU law (q83) and that about 66% of the farmers said that considerations about legal conformity with current law play a certain role in their decisions (q84). In addition, about 85% of the surveyed farmers said that animal welfare and consumer protection play a large or very large role in their decision comply with the law.

4.2.4. Costs of compliance

As the most work and cost intensive obligations (q31), "cleanliness of housing facilities", "identification and registration of pigs" and "mutilation requirements for cattle" were named, where "cleanliness of housing facilities" received by far the highest number of checks (56%). 66% of the farmers ranked the administrative burden (q43) in the FCS to be the largest, whereas 25% said that the administrative work is the same in the CC and FCS systems. With respect to investments into animal production in the last five years (q32), farmers invested on average about 25.000-50.000 Euro, and for about 61% of the farmers, 11-30% of the money was necessary to fulfil all CC obligations (q33) and for about 40% of the farmers, 10% of the investments were needed to comply with certification standards (q35). Hence, in both cases, there existed also quite a number of farmers that did not do the investments for compliance purposes but for other reasons.

4.2.5. Monitoring, detection and sanctions

On average, the sampled farmers expect a CC *control* every third year (q46)[117]. The variation in expectation was striking with some farmers expecting a control only once in 20 years and others every quarter of the year. In reality, since the introduction of the CC system, about 36% of the farms have not been monitored, another 36% were controlled once and the remaining farms two to six times (q48). On 15% of the farms, non-compliance with one or more obligations was found where requirement about "maintenance of agricultural land" was the one with the most objections.

The expected *detection* rates in the various monitoring exercises (general farm control by veterinary agency, CC control, FCS control) are on average rather close and in the area of 81%-90% (veterinary agency) and 91%-100% detection rate in the respective CC and FCS controls, even though in the case of the FCS control about 65% of the farmers expect with a detection rate of 100% that non-compliance will be detected (contrary to only 45% in the veterinary control).

A cut in direct payments is by far the most deterrent *sanction* (q71), followed by a damage of their public image and an increase in the rate of CC control. Questioned about the expected reduction in SFP payment, farmers expected the premium to be reduced (q74) by about 6% on average for a first case of non-compliance in the area of animal welfare. For a repeated case of non-compliance they expected this rate to move up to about 13% on average. The highest reduction was expected for a deliberate case of non-compliance with a CC obligation with about 87% average reduction of the SFP. For FCS control (q72), the most deterrent sanctions were the expulsion from the certification system, followed by a contract penalty (as e.g. no use of the logo for a specific period of time) and a cost intensive additional control. Regarding indirect sanctions or effects on their societal status (q75), 44% said that the image loss when non-compliance with obligations is detected play a large role in their decision, and the prohibition of animal production in the future has an even more significant threat potential for 95% of the farmers. With respect to a potential increase in the control rate due to detected non-compliance, only 9% of the farmers responded that this impact significantly their decision. When asked about the reality of CC and FCS control on the sampled farms, the results where much less drastic: When non-compliance with CC obligations were found, in 87% of the cases no sanctions were imposed. Similarly, when deviations from FCS standards were detected in 14 of 20 cases no sanctioning was undertaken (q52). In the remaining six cases, a new control was scheduled.

[117] Even though mean and median were close together, some expected a control only once in 20 years, others every quarter of a year.

4.2.6. Potential integration of the systems

Given the discussion about a potential integration of the CC and FCS system and the use of the monitoring results from one system to reduce the administrative control burden in the other system, the survey also included some questions regarding this topic. About 81% of the farmers think that a replacement of CC controls by FCS controls (q28) is "very useful" and also support in majority (81%) the idea that results from a FCS control should be used in CC monitoring (q25). Only 7% of the farmers were not willing to show results of FCS controls to the official monitoring bodies. This result strongly supports ideas to further consider the integration of existing certification schemes.

4.3. Determinants of participation in FCS

This part of the result section is devoted to an analysis of the survey findings using a limited dependent variable model. The objective is to disclose if the variables identified in the theoretical section as relevant for determining participation or non-participation are actually significant and if yes, if they are important for the decision. There are two decisions to make by the farmer: About participation in CC and about participation in a FCS. However, as the survey results reveal, also supported by simulations performed by Raggi *et al.* (2008), participation in CC is in financial terms important for farmers but for most farmers rather costless in terms of compliance. The question to ask would be then, if farmers degree of compliance depends on their risk aversion, financial abilities, moral considerations and other characteristics about the degree of compliance (as for example also assumed in Nitsch and Osterburg 2007). Nevertheless, also here, the survey revealed that after a transition period and additional investments, all farms will be 100% compliant with the regulations. This means that questions on the willingness of farmers to participate in FCS in addition to CC and the related degree of compliance are left. Given that we were not able to gather information on the degree of compliance to certification for our specific sample of farmers, only the willingness to participate (WTP) can be analysed subsequently. This WTP in FCS in addition to CC may be explained by determinants such as specialisation of the farm, investments in order to fulfil with the obligations, expectations about controls, or social factors such as age, education, risk behaviour, general believes. For this kind of discrete binary choice problem, logit or probit models are well suited (Verbeek 2000) and both generally yield very similar results in empirical work (Verbeek 2000, p. 179). Hence, for reasons of convenience and previous experience, we focus on the standard normal distribution underlying the probit model. Our approach follows closely Defrancesco *et al.* (2007) and Vanslembrouck *et al.* (2002) in their empirical approach.

Denoting the cumulative normal distribution as used in the probit model with $F(\bullet)$, the probability of participating in a FCS is defined as:

(1) $$P(y_i = 1) = F(\Theta_i) \quad and \quad P(y_i = 0) = 1 - F(\Theta_i) \quad ,$$

where $y = 1$ means that the farmer is willing to participate in a FCS, and $y = 0$ refers to the opposite, Θ is formed by the following variable based on the survey results as discussed in Section 4.2:

$$\begin{aligned}\Theta_i = \; & \beta_0 + \beta_1 Age + \beta_2 EDU + \beta_3 FType + \beta_4 LastINV + \beta_5 FutINV \\ & + \beta_6 ExpConCC + \beta_7 ExpDetecFCS + \beta_8 ExpSanImage + \beta_9 ExpSanIncCon \\ & + \beta_{10} Risk + \beta_{11} ExpeEU + \beta_{12} LegConf + \beta_{13} ANWELF \\ & + \beta_{14} CPROT + \beta_{15} LastPft + \beta_{16} DP\end{aligned} \tag{2}$$

The variable definitions follow from Table 4.1. The signs behind the variables indicate the expectations about their impact on the willingness to participate in FCS: (+/-) stands for a positive/negative impact and (~) indicates an a priori unclear effect.

Table 4.1: Variable definition

Variable name (related question in survey)	Variable type	Definition	Expect. impact
Age (q2)	Continuous	Years	~
EDU: Agricultural education (q4)	Categorical, ordered	1: Apprenticeship: 2: Certified technical farmer: 3: (Applied) University degree; 4: Other	+
FType: Farm type (q7)	Binary	Part (=0) or full time (=1)	+
LastINV: Farm investment in last 5 years (q32 with categories merged)	Categorical, ordered	1: 0€-50.000€; 2: >50.000€	+
FutINV: Investment in next 3 years (q37 with categories merged)	Categorical, ordered	1: 0€-10.000€; 2:> 10.000€-50.000€; 3: >50.000€-150.000€; 4 >150.000€	+
ExpConCC: Expected control rate CC (q46 with categories merged)	Categorical, ordered	1: >10 yrs; 2: >5-10 yrs; 3: 2-5 yrs; 4: <= 1 yrs	-
ExpDetecFCS: Expected detection rate FCS (q70 with categories merged)	Categorical, ordered	1: 91-100%; 2: 81-90%; 3: 71-80%; 4: >=70%	-
ExpSanImage: Expected indirect sanction: image loss (q75A)	Categorical, ordered	1: No relevance; 2: Small relevance; 3: Large relevance; 4: Very large relevance	-
ExpSanIncCon: Expected sanction: increased control rate (q75B)	Categorical, ordered	1: No relevance; 2: Small relevance; 3: Large relevance; 4: Very large relevance	-
Risk aversion (q76)	Categorical, ordered	1: Very averse; 2: Slightly averse; 3: Neutral; 4: Somewhat risky; 5: Very risky	~
ExpeEU: Experience with EU law (q83)	Categorical, ordered	1: Very bad; 2: Somewhat bad; 3: Neutral; 4: Somewhat good; 5: Very good	~
LegConf: Personal ethics regarding legal conformity (q84A)	Categorical, ordered	1: No relevance; 2: Small relevance; 3: Large relevance; 4: Very large relevance	~
ANWELF: Personal ethics regarding animal welfare (q84B)	Categorical, ordered	1: No relevance; 2: Small relevance; 3: Large relevance; 4: Very large relevance	+
CPROT: Personal ethics regarding consumer protection (q84C)	Categorical, ordered	1: No relevance; 2: Small relevance; 3: Large relevance; 4: Very large relevance	+
LastPft: Last profit (q89)	Categorical, ordered	1: Very bad yr; 2: Bad yr; 3: Average yr; 4: Good yr; 5: Very good yr	-
DP: Direct payments received	Continuous	Euros	-

Legend: CC: Cross compliance; EU: European Union; Expect.: Expected; FCS: Farm certification scheme; yr: year; yrs: years.
Note: Direct payments were taken from public data base on direct support (Agrarmarkt Austria, 2010).
Source: Own representation.

In total, two variations of the above equation (1) were estimated with the second variant representing a reduced version where some insignificant variables were left out. This increased

the overall fit of the equation and the significance of most of the remaining variables without inducing sign changes or large changes in the size of the coefficients. This indicates a certain stability of the identified relation between the explanatory variables and the probability to participate in FCS. Nevertheless, also in the reduced equation, only age and farm type could be identified as being significant at the 10% level and with the expected sign in the case of farm type.

Table 4.2: Estimation results

Dependent variable: Participation in farm certification scheme (equal to 1 if participating, 0 = otherwise)
Number of observations: 61
Observations with dependent variable y=1: 55

	Full equation		Reduced equation	
Variable	**Coefficient**	**Probability**	**Coefficient**	**Probability**
Intercept	-3.65	*0.39*	-4.18	*0.14*
Age	0.12	*0.05*	0.12	*0.04*
Education	0.15	*0.66*	0.25	*0.46*
Farm type	2.76	*0.12*	2.26	*0.09*
Last investment	-1.21	*0.39*	-1.10	*0.36*
Future investment	-0.28	*0.49*	-0.28	*0.48*
Expected control rate CC	-0.17	*0.80*	-	-
Exp. detection rate FCS	-0.25	*0.57*	-0.30	*0.48*
Exp. sanction: Image loss	-0.11	*0.72*	-	-
Exp. san.: incr. controls	0.85	*0.23*	0.83	*0.29*
Risk behaviour	-0.75	*0.29*	-0.61	*0.34*
Experience EU law	0.34	*0.42*	0.50	*0.15*
Ethics: legal conformity	1.12	*0.33*	1.43	*0.17*
Ethics: animal welfare	0.29	*0.87*	-	-
Ethics: consumer protec.	0.38	*0.84*	-	-
Last farm profit	-0.04	*0.93*	-	-
Direct payments	-7.55E-05	*0.31*	-6.19E-05	*0.33*
McFadden R-squared	0.52		0.50	
Log likelihood	-9.40		-9.87	
Restr. log likelihood	-19.61		-19.61	
LR statistic	20.43		19.47	
Prob(LR statistic)	0.20		0.05	
% of correct predictions	93.44%		93.44%	

Legend: Exp.: Expected; incr.: increased; protec.: protection; Restr.: Restricted; san.: sanction.
Source: Own estimation.

5. Discussion of hypotheses

5.1. Participation choice

Hypothesis 1 said that low cost of compliance drives farmer's decision to participate in CC or a FCS. Given the survey results, this hypothesis can be confirmed. Using as a proxy for costs of compliance past or planned investments, the survey results reveal that CC as a system is overwhelmingly accepted and investments were done or planned only partially to comply

with CC obligations, but compliance was still achieved. Also for participation in a FCS, only minor parts of the investments were done in order to fulfil FCS obligations but for other reasons. Financial importance of the FCS was ranked highest as well as the participation reasons "trust in the certificate", "improved marketing of products" and "increase in revenue". This means that cost of compliance were marginal compared to the financial incentives provided by participation in a FCS. Similarly, the probit model results indicate that full time farms tend to favour participation in a FCS which indicates that economic reasons underlie this decision.

Hypothesis 2 stated that expectations about high fines or detection probabilities indicate that farmers rather not participate in one or both of the systems. This hypothesis could not be confirmed. The few farmers that were not participating in a FCS, indicated as their main reason that the FCS requirements do not fit with their farm structure and specialisation.

The *third hypothesis* analyses whether standards close to the national minimum requirements lead farms to participate in CC or FCS system. In Austria in particular, for animal welfare requirements, national law is stricter than CC. This fact certainly drives participation in CC as it makes it easy for the farms to also apply for the SFP. This is confirmed by the finding that all farms in the survey participate in CC. With respect to participation in FCS, about 60% of the farmers said that they participated because these were minimum requirements in the production chain. Unfortunately, we cannot differentiate further how these minimum requirements relate to national law.

5.2. Decision about degree of compliance

Hypothesis 4 deals with the degree of compliance and its relation to expectations about controls, detection and sanctions. The survey shows that all farms aim at full compliance with all obligations even though rather different expectations about monitoring intensity exist. The additional assessment of on-farm degrees of compliance with legal veterinary requirements showed that most farms were compliant with all requirements (Annen *et al.*, 2011; Annen *et al.*, 2012). This shows that the objective to fully comply with all relevant regulation is not only an intention, but has also been achieved in practice on the farm. The survey further reveals that farmers on average expect to be controlled for CC obligations every third year. This question was not asked for FCS because the control rate is usually set in the codes of practice of the respective standards. Regarding detection rates, farmers expect rather high rates with about 80%-90% of all breaches to be found. The cut in direct payments and the expulsion from the certification system were considered as the most deterrent sanctions, even though in practice (especially in the FCS) first time cases of non-compliance did not lead to sanctions. Overall, the hypothesis can be confirmed as we observe high degrees of compliance as well as high expectations about intensity of controls and detections with little variance among the surveyed farms.

Hypothesis 5 about other motives to comply with obligations can be confirmed given the areas that were touched in the survey. This means that image loss, prohibition of animal keeping, increase in control rate, risk aversion, legal conformity, animal welfare and consumer

protection positively impact their decision to comply with the obligations even though a statistically significant impact could not be found in the econometric analysis.

6. Conclusions

Developing a theoretical model explaining compliance behaviour, this paper analyses attitudes, determinants and behaviour of compliance of Austrian farms with cross compliance and farm certification obligations. Using individual farm survey data from Austrian farms, several hypotheses derived from the theoretical model regarding farmers' expectations and behaviour regarding compliance are then tested. Theoretically, farmers have several choices when it comes to participation in CC and FCS: Participation itself is a choice where no participation means that the farm is exposed to national law only as well, membership in only one system or simultaneous participation in both systems. Apart from that, the degree of compliance is also a potential decision variable.

The formal analysis showed that the expectation about the monitoring intensity and the sanctions in relation to the benefits of the scheme (i.e. single farm payment or marketing gain from private label use) decide about the optimal level of compliance and that this decision is made independently for each scheme. Nevertheless the analysis shows that farmers do not think so strategically about compliance and costs of compliance but rather try fulfilling all obligations in order to avoid a penalty. High expectations about detection rates, personal convictions and other factors such as the image loss related to such a penalty seem to contribute to this behaviour. In addition, for a lot of standards especially on animal farms, full compliance strongly depends on the physical structures of the farm and thus on (past) investment decisions. Once, these investments have been realized, and no further changes in the standards occur, compliance is achieved. The survey revealed that farmers put more importance on compliance with FCS than CC as the FCS provides the larger financial incentives.

For farm certification schemes another issue is relevant as too strict certification controls disincentive farms from participation, but too lenient controls on the other side discredit the certification scheme. Hence, level of standards, monitoring intensity and participation influence each other indirectly, and farm certification schemes must be careful to keep the balance between popularity of a label and level of standards and control intensity. Farm certification organisations try to avoid this dilemma by assigning independent control agencies with the monitoring, but still the antagonism between high participation and strict standards exist. The analysis of Farmer *et al.* (2007, p. 66) already discussed this issue and noted that certification organisations support non-compliant farms usually by "providing time to rectify a breach before membership is withdrawn". This observation is supported also by results of our survey where out of 20 farms found with breaches only six farms had to pay for a repeated control, and no case of membership withdrawal occurred.

Finally, apart from the compliance issue, the potential further integration and synergies of CC and certification systems is an important topic that surface in public discussion from time to time. Our survey revealed that farmers are very in favor of actions that may reduce their administrative burden and that they think that the integration of CC and certification schemes

is a practical idea. Also, about 90% of the farmers were willing to facilitate sensitive information about control results between public and private administrative agencies. This indicates the importance farmers assign to this issue, but still, from a broader perspective it is not clear how it could work in practice given that not all areas of CC are covered by specific FCS. Apart from the already raised problems in Farmer *et al.* (2007), this would mean that CC controls must have knowledge about the FCS and the areas they consider in their control. At the same time problems arise when infringements of FCS rules were detected: because some FCS obligations are higher than what is expected for CC, and thus, non-compliance with FCS rules does not necessarily mean that also CC obligations are not fulfilled. Hence, if the CC administration wants to make use of certification results, data exchange about levels of standards has to be very comprehensive and result assessment would probably need to be standardized so that CC level of compliance and higher levels can easily be assessed.

Even though one has to be careful to extrapolate from a farm survey in Austria with about 65 farmers to the farm population of the EU-27, as a concluding result, it was discovered that farmers seem to strive to fully comply with CC and FCS legislation and that cheating seem not to occur to large extents. With respect to the streamlining of administrative burdens of different certification and compliance systems, there seems to be broad acceptance about such an approach but feasibility has to be proven first. Further research analysing actual compliance behaviour of farmers may be desirable, as the small survey size as well as the farm selection mechanism may lead to a positive bias overestimating the compliance behaviour of the farms.

References

Agrarmarkt Austria. 2010. *EU Agrarzahlungen.* http://www.transparenzdatenbank.at/trans-/see.through?init, accessed 6 April 2010.

Annen, D. N., Wieck, C. and Kempen M. 2011. Evaluation of minimum animal welfare conditions in national standards and farm certification schemes for pig fattening. *Acta Agriculturae Scandinavica Section A: Animal Science* 61, 40-54.

Annen, D. N., Wieck, C. und Kempen, M. 2012. Animal welfare on the farm: Legislation, certification standards and assessment frameworks. *Technical Paper No. 11.01.* University of Bonn, Institute for Food and Resource Economics, Chair of Economic and Agricultural Policy, Bonn, Germany.

Bartolini, F., Gallerani, V., Raggi, M. and Viaggi, D. 2008. Linking cross compliance and agri-environmental schemes: A case study in Emilia Romana. *Paper prepared for the 109th EAAE Seminar "The CAP after the Fischler Reform: National Implementations, Impact Assessment and the Agenda for Future Reforms"*. 20-21 November 2008, Viterbo, Italy.

Bock, B. B. and van Huik, M. 2007. Pig farmers and animal welfare: A study of beliefs, attitudes and behaviour of pig producers across Europe. In: Kjaernes, U., Miele, M. and Roex, J. (eds): *Attitudes of consumers, retailers and producers to farm animal welfare*. Welfare Quality® Report No. 2. Cardiff University, Cardiff, pp. 73-124.

Chambers, R. G. 1988. *Applied Production Analysis*. Cambridge University Press, Cambridge, United Kingdom.

Defrancesco, E., Gatto, P., Runge, F. and Trestini, S. 2008. Factors affecting farmers' participation in agri-environmental measures: A Northern Italian perspective. *Journal of Agricultural Economics* 59, 114-131.

European Commission 2003. CAP Reform Summary. *Newsletter Special Edition*, July 2003, Directorate General for Agriculture, Brussels, Belgium.

European Commission 2011. Cross-compliance. *Info sheets on the different aspects of the CAP reform – General provisions*. http://ec.europa.eu/agriculture/capreform/infosheets-/crocom_en.pdf, accessed 15 November 2011.

European Council 2003. Council Regulation (EC) No 1782/2003 of 29 September 2003 establishing common rules for direct support schemes under the common agricultural policy and establishing certain support schemes for farmers and amending Regulations (EEC) No 2019/93, (EC) No 1452/2001, (EC) No 1453/2001, (EC) No 1454/2001, (EC) 1868/94, (EC) No 1251/1999, (EC) No 1254/1999, (EC) No 1673/2000, (EEC) No 2358/71 and (EC) No 2529/2001. *Official Journal of the European Union* L 270, 1-69.

European Council 2009. Council Regulation (EC) No 73/2009 of 19 January 2009 establishing common rules for direct support schemes for farmers under the common agricultural policy and establishing certain support schemes for farmers, amending Regulations (EC) No 1290/2005, (EC) No 247/2006, (EC) No 378/2007 and repealing Regulation (EC) No 1782/2003. *Official Journal of the European Union* L 30, 16-99.

Farmer, M., Swales, V., Jongeneel, R., Karaczun, Z., Müssner, R., Leipprand, A., Schlegel, S., Poux, X., Ramain, B., De Roest, K., Varela Ortega, C., and Simó, A. 2007. Exploring the synergies between cross compliance and certification schemes. *Deliverable 8: Synthesis report of certification schemes in 7 EU countries and 3 non-EU countries*. Paper prepared for SSPE-CT-2005-006489 Facilitating the CAP reform: Compliance and competitiveness of European agriculture. http://library.wur.nl/way/bestanden/clc/1860311.pdf, accessed 15 November 2011.

Hart, R. and Latacz-Lohman, U. 2005. Combating moral hazard in agri-environmental schemes: A multiple-agent approach. *European Review of Agricultural Economics* 32, 75-91.

Herzfeld, T. and Jongeneel, R. 2012. Why do farmers behave as they do? Understanding compliance with rural, agricultural, and food attribute standards. *Land Use Policy 29: 250-260*.

Nitsch, H. and Osterburg, B. 2008. Criteria for an efficient enforcement of standards in relation to cross compliance. In: Mathijs E. and Verbeke W. (eds.) *12th Congress of the European Association of Agricultural Economists (EAAE) "People, food and environments: Global trends and European strategies"*. 26-29 August 2008, Ghent, Belgium.

Ozanne, A. and White, B. 2007. Equivalence of input quotas and input charges under asymmetric information in agri-environmental schemes. *Journal of Agricultural Economics* 58, 260-268.

Ozanne, A. and White, B. 2008. Hidden action, risk aversion and variable fines in agri-environmental schemes. *Australian Journal of Agricultural and Resource Economics* 52, 203-212.

Raggi M., Bartolini, F., Gallerani V. and Viaggi, D. 2008. Effectiveness of Cross-Compliance under asymmetric information and differentiated compliance constraints. In: Mathijs E. and Verbeke W. (eds.) *12th Congress of the European Association of Agricultural Economists (EAAE) "People, food and environments: Global trends and European strategies"*. 26-29 August 2008, Ghent, Belgium.

Vanslembrouck, I., van Huylenbroeck and Verbeke, W. 2002. Determinants of the willingness of Belgian farmers to participate in agri-environmental measures. *Journal of Agricultural Economics* 53, 489-511.

Veissier, I., Butterworth, A., Bock, B. and Roe, E. 2008. European approaches to ensure good animal welfare. *Applied Animal Behaviour Science* 113, 279-297.

Verbeek, M. 2000. *A Guide to Modern Econometrics*. John Wiley and Sons, West Sussex, UK.

Yano, Y. and Blandford, D. 2011. Agri-environmental policy and moral hazard under multiple sources of uncertainty. *European Review of Agricultural Economics* 38, 141-155.

Annex Farm questionnaire relevant for the investigations of Chapter 4

Allgemeine Angaben zur Person

1) Bitte nennen Sie Ihr Geschlecht!

[ ]a Männlich
[ ]b Weiblich

2) Wie alt sind Sie?

…… Jahre

3) Bitte nennen Sie Ihren (höchsten) Schulabschluss!

[ ]a Hauptschulabschluss
[ ]b Realschulabschluss
[ ]c Abitur
[ ]d Sonstige

4) Bitte nennen Sie Ihren (höchsten) Ausbildungsabschluss als Landwirt!

[ ]a Lehre / Ausbildung
[ ]b Meister / staatlich geprüfter Landwirt
[ ]c (Fach)-Hochschulabschluss
[ ]d Sonstiges

5) Bitte nennen Sie Ihren (höchsten) außerlandwirtschaftlichen Ausbildungsabschluss!

[ ]a Lehre / Ausbildung
[ ]b Meister
[ ]c (Fach)-Hochschulabschluss
[ ]d Sonstige

Allgemeine Angaben zum Betrieb

6) Welche Rechtsform hat Ihr Betrieb?

[ ]a Einzelunternehmen
[ ]b BGB-Gesellschaft (GbR)
[ ]c Kommanditgesellschaft (KG)
[ ]d GmbH
[ ]e GmbH & Co.KG
[ ]f Offene Gesellschaft (OG)
[ ]g Sonstige

7) Wird Ihr Betrieb im Haupt- oder Nebenerwerb bewirtschaftet? (Haupterwerb: Betrieb wird hauptberuflich bewirtschaftet wobei mehr als 50 % des Einkommens aus landwirtschaftlicher Arbeit erzielt wird)

[ ]a Haupterwerb
[ ]b Nebenerwerb

8) Welche Betriebszweige beinhaltet Ihr Landwirtschaftlicher Betrieb?

[ ]A Schweinemast
[ ]B Rindermast
[ ]C Kälbermast
[ ]D Rinderaufzucht
[ ]E Geflügelmast
[ ]F Ferkelproduktion
[ ]G Kälberproduktion

[ ]H Milchproduktion
[ ]I Eierproduktion
[ ]J Ackerbau
[ ]K Biogasproduktion
[ ]L Sonstige

9) Welcher Betriebszweig liefert den größten Einkommensbeitrag in Ihrem landwirtschaftlichen Betrieb?

Mehrfachnennungen möglich!
[ ]a Schweinemast
[ ]b Rindermast
[ ]c Rinderaufzucht
[ ]d Kälbermast
[ ]e Geflügelmast
[ ]f Ferkelproduktion
[ ]g Kälberproduktion
[ ]h Milchproduktion
[ ]i Eierproduktion
[ ]j Ackerbau
[ ]k Biogasproduktion
[ ]l Sonstige

10) Die von Ihrem Betrieb bewirtschafteten Flächen sind zum größten Teil...?

[ ]a Pachtflächen
[ ]b (Familien-) Eigentum
[ ]c Sonstige

11) Bitte geben Sie ihren Viehbestand an!

[ ]A Mutterkühe: ……
[ ]B Milchkühe: ……
[ ]C Mastrinder: ……
[ ]D Aufzuchtrinder: ……
[ ]E Kälber: ……
[ ]F Mastschweine: ……
[ ]G Zuchtsauen: ……
[ ]H Ferkel: ……
[ ]I Sonstige

12) Wie wird Ihr Betrieb im Tierhaltungsbereich bewirtschaftet?

Mehrfachnennungen bei kombinierter Tierhaltung möglich!
[ ]A Konventionell
[ ]B Konventionell mit Qualitätszertifikat
[ ]C Ökologisch / biologisch (zertifiziert)
[ ]D Sonstige

13) Welche Arbeitskräfte werden auf Ihrem Betrieb beschäftigt?

[ ]a Familien-AK
[ ]b Fremd-AK
[ ]c Beide

14) Falls Betrieb zertifiziert: Welche Zertifikate wurden durch Ihren Betrieb erworben? Wann wurde die Zertifizierung durchgeführt? Welchen Betriebsbereichen sind die Zertifikate zugeordnet?

[ ]A AMA-BIO:
[ ]B BIO-AUSTRIA:
[ ]C BIOLAND:
[ ]D DEMETER:
[ ]E NATURLAND:
[ ]F BIO-HOFMARKE:

[ ]G BK MOORBAD HARBACH:
[ ]H BL ENNSTAL:
[ ]I ORBI:
[ ]J QS:
[ ]K IKB:
[ ]L EUREPGAP:
[ ]M KT-FREILAND:
[ ]N AMA-GÜTESIEGEL:
[ ]O SCHIRNHOFER:
[ ]P Sonstige

15) Falls Betrieb zertifiziert: In welchen zeitlichen Abständen wird Ihr Betrieb auf das Zertifikat hin überprüft (auditiert)? Wie lange dauert eine Überprüfung durchschnittlich?

[ ]a Vierteljährlich: .....
[ ]b Halbjährlich: .....
[ ]c Jährlich: .....
[ ]d Alle 2 Jahre: .....
[ ]e Alle 3 Jahre: .....
[ ]f Sonstige

Allgemeine Vorstellung von "Cross Compliance"

16) Was verstehen Sie unter "Cross Compliance"?

……
……
……

17) Inwieweit werden CC-Auflagen in Österreich durch nationale Gesetze bereits abgedeckt?

[ ]a Keine Abdeckung
[ ]b Kaum Abdeckung
[ ]c Weitgehende Abdeckung
[ ]d Vollständige Abdeckung
[ ]e Weiß nicht

18) Wie würden Sie ihren Kenntnisstand bezüglich des CC-Systems beschreiben?

[ ]-2 Keine Kenntnisse
[ ]-1 Kaum Kenntnisse
[ ]0 Durchschnittlicher Kenntnisstand
[ ]1 Guter Kenntnisstand
[ ]2 Sehr guter Kenntnisstand

19) Wie gut wurden Sie von behördlicher Seite über das CC-System informiert?

[ ]-2 Keine behördlichen Information
[ ]-1 Lückenhafte behördliche Information
[ ]0 Ausreichende behördliche Information
[ ]1 Gute behördliche Information
[ ]2 Sehr gute behördliche Information

20) Wurden Sie von behördlicher Seite hinsichtlich des CC-Systems und seiner Auflagen beraten bzw. wurde Ihnen persönliche Beratung angeboten?

[ ]a Ja
[ ]b Nein

21) Welche der folgenden Auflagen sind Ihrer Kenntnis nach CC-Auflagen?

Mehrfachnennungen möglich!
[ ]A Schweine: Der Lärmpegel im Stall darf nicht 85 dBA überschreiten
[ ]B Schweine: die mechanischen Lüftungsanlagen müssen täglich überprüft werden
[ ]C Schweine: Beim Kupieren darf höchstens die Hälfte des Schwanzes entfernt werden

[ ]D Schweine: Ab 40 Tieren muss eine Gesamtbodenfläche/Sau von 3,5 m² bestehen
[ ]E Schweine: Alle männliche Schweine dürfen grundsätzlich nur von einem Tierarzt kastriert werden
[ ]F Schweine: Vor dem Abstellen in Abferkelbuchten müssen Tiere sorgfältig gereinigt werden
[ ]G Schweine: Eber müssen andere Schweine hören, riechen und sehen können
[ ]H Rinder: Kälber werden nicht in Anbindehaltung gehalten
[ ]I Rinder: Betonspaltenböden haben eine Auftrittsbreite von mind. 40 mm
[ ]J Rinder: Der Tierbereich des Stalles weist über mind. 8h/Tag eine Lichtstärke von mind. 40 Lux auf
[ ]K Rinder: Die Tiere müssen bei tierärztlicher Untersuchung stets außerhalb des Laufstalls fixiert werden
[ ]L Rinder: Die Futterbarnsohle liegt mind. 10 cm über Standniveau
[ ]M Rinder: Alle Geräte die für das Wohlbefinden entscheidend sind, werden mind. 1 mal/Tag kontrolliert
[ ]N Rinder: Die tägliche Futterration der Kälber enthält genügend Jod
[ ]O LM- und FMS: Es müssen ausführliche Unterlagen über Aus- und Eingänge vorhanden sein
[ ]P LM- und FMS: Gelagerte Pflanzliche Produkte müssen frei von Schädlingen sein
[ ]Q LM- und FMS: Milch muss bei einer Temperatur von 10 °C gelagert werden

Themenbereich Nr. 1: Akzeptanz der Anreizsysteme

22) Inwieweit halten Sie die Einführung des CC-Systems für sinnvoll?

[ ]-2 Vollkommen unsinnig
[ ]-1 Weitgehend unsinnig
[ ]0
[ ]1 Weitgehend sinnvoll
[ ]2 Vollkommen sinnvoll

23) Falls unsinnig: Bitte geben Sie an warum Sie dem CC-System ablehnend gegenüber stehen? Inwieweit würden Sie folgenden Punkten zustimmen?

Bitte verwenden Sie folgende Bewertungsskala:
[0:Trifft überhaupt nicht zu; 1: Trifft weitestgehend nicht zu; 2: Trifft weitestgehend zu; 3: Trifft vollkommen zu]
[ ]A Mangelnde Transparenz
[ ]B Zu kompliziert
[ ]C Unnötige Erhöhung des Kontrollaufwandes
[ ]D Unnötige Erhöhung des Verwaltungsaufwandes
[ ]E Führt zu überflüssigen Doppelkontrollen
[ ]F Führt zu Kostensteigerung
[ ]G Unsinnigkeit einzelner CC-Auflagen
[ ]H Überprüfung von Selbstverständlichkeiten
[ ]I Unsinnigkeit von Kontrollmerkmalen
[ ]J Sonstige:

24) Inwieweit halten Sie die Einhaltung der CC-Auflagen folgender Bereiche für sinnvoll?

Bitte verwenden Sie folgende Bewertungsskala:
[-2: Vollkommen unsinnig; -1: Weitgehend unsinnig; 0: Weiß nicht; 1: Weitgehend sinnvoll; 2: Vollkommen sinnvoll]
[ ]A Rinderkennzeichnung und -registrierung
[ ]B Bodenbeschaffenheit (Rinder)
[ ]C Bewegungsmöglichkeit und Sozialkontakt (Rinder)
[ ]D Luft, Licht und Lärm (Rinder)
[ ]E Tränke und Fütterung (Rinder)
[ ]F Betreuung (Rinder)
[ ]G Eingriffe (Rinder)
[ ]H Freilandhaltung (Rinder)
[ ]I Schweinekennzeichnung und -registrierung
[ ]J Allgemeine Haltungsvorschriften (Schweine)
[ ]K Bodenbeschaffenheit (Schweine)
[ ]L Bewegungsmöglichkeit und Stall (Schweine)
[ ]M Luft, Licht und Lärm (Schweine)
[ ]N Beschäftigungsmaterial (Schweine)
[ ]O Fütterung und Fressplatzbreite (Schweine)
[ ]P Betreuung (Schweine)
[ ]Q Eingriffe (Schweine)
[ ]R Sauberkeit (Lebensmittel- und Futtermittelsicherheit)

[ ]S Kontamination (Lebensmittel- und Futtermittelsicherheit)
[ ]T Vorhandensein von Analysen (Lebensmittel- und Futtermittelsicherheit)
[ ]U Milchuntersuchung (Lebensmittel- und Futtermittelsicherheit)
[ ]V Hygiene Milchvieh (Lebensmittel- und Futtermittelsicherheit)
[ ]W Milchkühlung (Lebensmittel- und Futtermittelsicherheit)
[ ]X Reinigung Melkgeschirr (Lebensmittel- und Futtermittelsicherheit)
[ ]Y Rückverfolgbarkeit (Lebensmittel- und Futtermittelsicherheit)
[ ]Z Abhilfemaßnahmen (Lebensmittel- und Futtermittelsicherheit)
[ ]* Information LM-Kette (Lebensmittel- und Futtermittelsicherheit)
[ ]** Registrierung Landwirt

Themenbereich Nr. 2: Integration der Anreizsysteme

25) Inwieweit halten Sie es für sinnvoll dass Zertifizierungsergebnisse im Rahmen von CC-Kontrollen herangezogen werden?

[ ]-2 Vollkommen sinnlos
[ ]-1 Weitgehend sinnlos
[ ]0 Weiß nicht
[ ]1 Weitgehend sinnvoll
[ ]2 Vollkommen Sinnvoll

26) Bitte begründen Sie Ihre Entscheidung!

……
……
……

27) Falls zertifiziert: Inwieweit wären Sie dazu bereit Kontrollergebnisse der Zertifizierung bzw. Auditierung der amtlichen Kontrolle zur Verfügung zu stellen?

[ ]-1 Ich bin nicht dazu bereit
[ ]0 Weiß nicht
[ ]1 Ich bin dazu bereit

28) Inwieweit halten Sie die Ersetzung von CC-Kontrollen durch eine Teilnahme an Zertifizierungsstandards (z.B. AMA-Gütesiegel) für sinnvoll?

[ ]-2 Vollkommen sinnlos
[ ]-1 Weitgehend sinnlos
[ ]0 Weiß nicht
[ ]1 Weitgehend sinnvoll
[ ]2 Vollkommen sinnvoll

29) Bitte begründen Sie Ihre Einschätzung!

……
……
……

30) Inwieweit halten Sie die Ersetzung von CC-Kontrollen durch eine Teilnahme an Zertifizierungsstandards für umsetzbar?

[ ]-2 Nicht umsetzbar
[ ]-1 Kaum umsetzbar
[ ]0 Weiß nicht
[ ]1 Weitgehend umsetzbar
[ ]2 Vollkommen umsetzbar

Themenbereich Nr. 3: Kosten der Auflageneinhaltung

31) Wie aufwendig bzw. kostenintensiv war die Einhaltung folgender CC-Auflagen auf Ihrem

Betrieb?

Bitte verwenden Sie folgende Beurteilungsskala:
[0: Kein Aufwand / selbstverständlich; 1: Geringer Aufwand; 2: Mittlerer Aufwand; 3: Hoher Aufwand]

[ ]A Rinderkennzeichnung und -registrierung
[ ]B Bodenbeschaffenheit (Rinder)
[ ]C Bewegungsmöglichkeit und Sozialkontakt (Rinder)
[ ]D Luft, Licht und Lärm (Rinder)
[ ]E Tränke und Fütterung (Rinder)
[ ]F Betreuung (Rinder)
[ ]G Eingriffe (Rinder)
[ ]H Freilandhaltung (Rinder)
[ ]I Schweinekennzeichnung und -registrierung
[ ]J Allgemeine Haltungsvorschriften (Schweine)
[ ]K Bodenbeschaffenheit (Schweine)
[ ]L Bewegungsmöglichkeit und Stall (Schweine)
[ ]M Luft, Licht und Lärm (Schweine)
[ ]N Beschäftigungsmaterial (Schweine)
[ ]O Fütterung und Fressplatzbreite (Schweine)
[ ]P Betreuung (Schweine)
[ ]Q Eingriffe (Schweine)
[ ]R Sauberkeit (Lebensmittel- und Futtermittelsicherheit)
[ ]S Kontamination (Lebensmittel- und Futtermittelsicherheit)
[ ]T Vorhandensein von Analysen (Lebensmittel- und Futtermittelsicherheit)
[ ]U Milchuntersuchung (Lebensmittel- und Futtermittelsicherheit)
[ ]V Hygiene Milchvieh (Lebensmittel- und Futtermittelsicherheit)
[ ]W Milchkühlung (Lebensmittel- und Futtermittelsicherheit)
[ ]X Reinigung Melkgeschirr (Lebensmittel- und Futtermittelsicherheit)
[ ]Y Rückverfolgbarkeit (Lebensmittel- und Futtermittelsicherheit)
[ ]Z Abhilfemaßnahmen (Lebensmittel- und Futtermittelsicherheit)
[ ]* Information LM-Kette (Lebensmittel- und Futtermittelsicherheit)
[ ]** Registrierung Landwirt
[ ]***Sonstige

32) Wie hoch waren Ihre betrieblichen Investitionen im Bereich der Tierhaltung innerhalb der letzten 5 Jahre?

[ ]a 0 bis 10.000 €
[ ]b 10.000 - 25.000 €
[ ]c 25.000 - 50.000 €
[ ]d 50.000 - 75.000 €
[ ]e 75.000 - 100.000 €
[ ]f 100.000 - 150.000 €
[ ]g 150.000 - 250.000 €
[ ]h 250.000 - 500.000 €
[ ]i Über 500.000 €

33) Welcher Anteil der Investitionen war für die Sicherstellung gesetzlicher und Europäischer CC-Auflagen notwendig?

[ ]a 0 %
[ ]b 1 - 10 %
[ ]c 11 - 20 %
[ ]d 21 - 30 %
[ ]e 31 - 40 %
[ ]f 41 - 50 %
[ ]g 51 - 60 %
[ ]h 61 - 70 %
[ ]i 71 - 80 %
[ ]j 81 - 90 %
[ ]k 91 - 100 %

34) Welche betrieblichen Investitionen haben Sie im Tierhaltungsbereich getätigt um die Einhaltung der CC-Auflagen sicherzustellen? Wann haben Sie diese getätigt?

……
……
……

35) Falls Betrieb zertifiziert: Welcher Anteil der Investitionen war für die Erfüllung von Zertifizierungsauflagen notwendig?

[ ]a 0 %
[ ]b 1 - 10 %
[ ]c 11 - 20 %
[ ]d 21 - 30 %
[ ]e 31 - 40 %
[ ]f 41 - 50 %
[ ]g 51 - 60 %
[ ]h 61 - 70 %
[ ]i 71 - 80 %
[ ]j 81 - 90 %
[ ]k 91 - 100%

36) Falls Betrieb zertifiziert: Welche betrieblichen Investitionen haben Sie im Tierhaltungsbereich getätigt um die Einhaltung der Zertifizierungsauflagen sicherzustellen? Wann haben Sie diese getätigt?

……
……
……

37) Wie hoch werden Ihre betrieblichen Investitionen im Bereich der Tierhaltung voraussichtlich innerhalb der nächsten 3 Jahren sein?

[ ]a 0 - 10.000 €
[ ]b 10.000 - 25.000 €
[ ]c 25.000 - 50.000 €
[ ]d 50.000 - 75.000 €
[ ]e 75.000 - 100.000 €
[ ]f 100.000 - 150.000 €
[ ]g 150.000 - 250.000 €
[ ]h 250.000 - 500.000 €
[ ]i Über 500.000 €

38) Welcher Anteil der Investitionen wird voraussichtlich für die Sicherstellung gesetzlicher und Europäischer CC-Auflagen notwendig sein?

[ ]a 0 %
[ ]b 1 - 10 %
[ ]c 11 - 20 %
[ ]d 21 - 30 %
[ ]e 31 - 40 %
[ ]f 41 - 50 %
[ ]g 51 - 60 %
[ ]h 61 - 70 %
[ ]i 71 - 80 %
[ ]j 81 - 90 %
[ ]k 91 - 100 %

39) Welcher Anteil der Investitionen wird voraussichtlich für die Erfüllung von Zertifizierungsauflagen notwendig sein?

[ ]a 0 %
[ ]b 1 - 10 %
[ ]c 11 - 20 %
[ ]d 21 - 30 %
[ ]e 31 - 40 %
[ ]f 41 - 50 %
[ ]g 51 - 60 %

[ ]h 61 - 70 %
[ ]i 71 - 80 %
[ ]j 81 - 90 %
[ ]k 91 - 100 %

40) Inwieweit werden nach Abschluss der Investitionen die gesetzlichen sowie Europäischen Auflagen erfüllt sein?

[ ]-2 Keine Erfüllung der Auflagen
[ ]-1 Kaum Erfüllung der Auflagen
[ ]0
[ ]1 Weitgehende Erfüllung der Auflagen
[ ]2 Vollständige Erfüllung der Auflagen

41) Geben Sie bitte an um wie viel Prozent sich Ihr zeitlicher Verwaltungsaufwand (ausschließlich Kontrollaufwand) durch Einhaltung der CC-Auflagen (bzw. Auflagen des Bundestierschutzgesetzes von 2005, LM- und Verbraucherschutzgesetz von 2006) im Tierhaltungsbereich erhöht hat!

[ ]a Unverändert
[ ]b Weniger als 5 %
[ ]c 5 - 10 %
[ ]d 11 - 20 %
[ ]e 21 - 30 %
[ ]f 31 - 40 %
[ ]g 41 - 50 %
[ ]h Mehr als 50 %
[ ]i Sonstige

42) Falls Betrieb zertifiziert: Geben Sie bitte an um wie viel Prozent sich Ihr zeitlicher Verwaltungsaufwand durch Einhaltung der Zertifizierungsauflagen im Tierhaltungsbereich verändert hat!

[ ]a Gesunken um etwa …… %
[ ]b Unverändert
[ ]c Um weniger als 5 % gestiegen
[ ]d Um 5 - 10 % gestiegen
[ ]e Um 11 - 20 % gestiegen
[ ]f Um 21 - 30 % gestiegen
[ ]g Um 31 - 40 % gestiegen
[ ]h Um 41 - 50 % gestiegen
[ ]i Um 51 - 60 % gestiegen
[ ]j Um mehr als 60 % gestiegen
[ ]k Sonstige

43) Falls Betrieb zertifiziert: Die Einhaltung welches Kontrollsystems verursacht im Tierhaltungsbereich den höheren Verwaltungsaufwand?

[ ]a CC-System
[ ]b Zertifizierungsstandard
[ ]c Gleicher Verwaltungsaufwand

44) Geben Sie bitte an um wieviel Prozent sich Ihr zeitlicher Kontrollaufwand im Tierhaltungsbereich durch Einführung des CC-Systems erhöht hat!

[ ]a Unverändert
[ ]b Weniger als 5 %
[ ]c 5 - 10 %
[ ]d 11 - 20 %
[ ]e 21 - 30 %
[ ]f 31 - 40 %
[ ]g Mehr als 40 %
[ ]h Sonstige

45) Falls Betrieb zertifiziert: Geben Sie bitte an um wieviel Prozent sich Ihr zeitlicher Kontrollaufwand im Tierhaltungsbereich durch Einhaltung der Zertifizierungsauflagen verändert hat!

[ ]a Gesunken um etwa …… %
[ ]b Unverändert
[ ]c Um weniger als 5 % gestiegen
[ ]d Um 5 - 10 % gestiegen
[ ]e Um 11 - 20 % gestiegen
[ ]f Um 21- 30 % gestiegen
[ ]g Um 31 - 40 % gestiegen
[ ]h Um 41 - 50 % gestiegen
[ ]i Um 51 - 60 % gestiegen
[ ]j Um mehr als 60 % gestiegen
[ ]k Sonstige

Themenbereich Nr. 4: Kontrolle von Auflagen

46) Welche Kontrollrate der CC-Auflagen erwarten Sie?

[ ]a Alle 10 Jahre
[ ]b Alle 7 Jahre
[ ]c Alle 5 Jahre
[ ]d Alle 4 Jahre
[ ]e Alle 3 Jahre
[ ]f Alle 2 Jahre
[ ]g Jährlich
[ ]h Halbjährlich
[ ]i Vierteljährlich
[ ]j Sonstige

47) a) Wie oft wurde Ihr Betrieb in den letzten 5 Jahren durch die amtliche Kontrolle überprüft? b) Wie lange dauert eine Kontrolle im Durchschnitt?

…… mal. Eine Kontrolle dauert im Durchschnitt …… Minuten

48) a) Wie oft wurde Ihr Betrieb bereits einer CC-Kontrolle unterzogen? b) Wie lange dauert eine CC-Kontrolle im Durchschnitt?

…… mal. Eine CC-Kontrolle dauert im Durchschnitt …… Minuten

49) Falls Betrieb bereits einer CC-Kontrolle unterzogen wurde: In welchem Bereich wurde ein Verstoß gegen CC-Auflagen beanstandet?

[ ]A Kein Verstoß
[ ]B Bodenbeschaffenheit (Rinder)
[ ]C Bewegungsmöglichkeit und Sozialkontakt (Rinder)
[ ]D Luft, Licht und Lärm (Rinder)
[ ]E Tränke und Fütterung (Rinder)
[ ]F Betreuung (Rinder)
[ ]G Eingriffe (Rinder)
[ ]H Freilandhaltung (Rinder)
[ ]I Allgemeine Haltungsvorschriften (Schweine)
[ ]J Bodenbeschaffenheit (Schweine)
[ ]K Bewegungsmöglichkeit und Stall (Schweine)
[ ]L Luft, Licht und Lärm (Schweine)
[ ]M Beschäftigungsmaterial (Schweine)
[ ]N Fütterung und Fressplatzbreite (Schweine)
[ ]O Betreuung (Schweine)
[ ]P Eingriffe (Schweine)
[ ]Q Auflagen Lebensmittel- und Futtermittelsicherheit
[ ]R Umwelt
[ ]S Flächenerhalt
[ ]T Sonstige

50) Im Falle von Beanstandungen: Die Einhaltung welcher konkreten CC-Auflagen wurde beanstandet?

……
……
……

51) Im Falle von Beanstandungen: Um wieviel Prozent wurden dadurch Ihre Direktzahlungen gekürzt?

[ ]a Keine Kürzung
[ ]b 1 %
[ ]c 2 %
[ ]d 3 %
[ ]e 4 %
[ ]f 5 %
[ ]g 10 %
[ ]h 15 %
[ ]i 25 %
[ ]j 100 %
[ ]k Sonstige

52) Falls Betrieb zertifiziert: Wurde die Einhaltung von Auflagen durch den Zertifizierungsstandard schon einmal beanstandet? Falls ja: welche Auflagen wurden beanstandet? Wie ist die Bestrafung ausgefallen?

……
……
……

Themenbereich Nr. 5: Einhaltungsanreiz der Systeme

53) Falls Betrieb zertifiziert: Die Einhaltung welcher Auflagen hat für Sie eine höhere Priorität?

[ ]a CC-Auflagen (Grundanforderungen an die Betriebsführung)
[ ]b Auflagen Zertifizierungsstandard
[ ]c Beide haben die gleiche Priorität

54) Bitte Begründen Sie Ihre Entscheidung!

……
……
……

55) Die Einhaltung der Auflagen welches Kontrollsystems hat/hätte für Sie einen größeren finanziellen Anreiz?

[ ]a CC-System
[ ]b Zertifizierungsstandard
[ ]c Beide haben für mich den gleichen Einhaltungsanreiz

56) Gibt es CC-Auflagen die Sie bewusst nicht einhalten? Falls Ja: Welche?

[ ]a Nein
[ ]b Ja: ……..

57) Falls ja: Nennen Sie bitte die Gründe für ihre bewusste Nichteinhaltung der CC-Auflagen!

[ ]A Prämienkürzung und Bußgeld ist geringer als Investitionssumme
[ ]B Unsinnigkeit einzelner Auflagen
[ ]C Nutzung der Übergangsfrist für bestimmte Auflagen
[ ]D Bauliche Umsetzungsschwierigkeiten
[ ]E Personelle Umsetzungsschwierigkeiten
[ ]F Sonstige

58) Warum halten Sie CC-Auflagen ein? Bitte geben Sie an inwieweit die folgenden Aspekte bei Ihrer Entscheidung berücksichtigt werden!

Bitte verwenden Sie die folgende Bewertungsskala:
[0: Spielt keine Rolle; 1: Spielt eine untergeordnete Rolle; 2: Spielt eine wichtige Rolle; 3: Spielt eine sehr wichtige Rolle]

[ ]A Verhinderung von Prämienkürzungen
[ ]B Verhinderung von Bußgeldern
[ ]C Bedenken hinsichtlich Tierschutz
[ ]D Bedenken hinsichtlich Verbraucherschutz
[ ]E Befürwortung des CC-Systems
[ ]F Überlappung mit Auflagen von ZS
[ ]G Sonstige

59) Falls Betrieb zertifiziert: Welche Gründe waren für Sie relevant um an einem Zertifizierungsstandard (ZS) teilzunehmen? Bitte bewerten Sie die Gründe gemäß Ihrer Wichtigkeit für Ihren Betrieb?

Bitte verwenden Sie folgende Bewertungsskala:
[0: Spielte keine Rolle; 1: Spielte eine untergeordnete Rolle; 2: Spielte eine wichtige Rolle; 3: Spielte eine sehr wichtige Rolle]

[ ]A Verbesserter Absatz
[ ]B Dokumentiertes Eigenkontrollsystem
[ ]C Teilnahme an Fortbildungsveranstaltungen
[ ]D Überprüfung der Produktqualität
[ ]E Mindeststandard über Produktionskette
[ ]F Bewerbung des Prüfzeichens
[ ]G Vertrauen in Zertifikat
[ ]H Reduzierte behördliche Kontrollrate
[ ]I Überlappung der CC-Auflagen mit ZS
[ ]J Gewinnerhöhung
[ ]K Verbesserung betrieblicher Abläufe
[ ]L Verbraucherschutzbedenken
[ ]M Tierschutzbedenken
[ ]N Biologische Lebensweise
[ ]O Sonstige

60) Falls zertifiziert: Inwieweit wurden Ihre Erwartungen an den Zertifizierungsstandard erfüllt?

Bitte verwenden Sie folgende Bewertungsskala:
[0: Erwartungen wurden nicht erfüllt; 1: Erwartungen wurden teilweise erfüllt; 2: Erwartungen wurden vollständig erfüllt]

[ ]A Verbesserter Absatz
[ ]B Dokumentiertes Eigenkontrollsystem
[ ]C Teilnahme an Fortbildungsveranstaltungen
[ ]D Überprüfung der Produktqualität
[ ]E Mindeststandard über Produktionskette
[ ]F Bewerbung des Prüfzeichens
[ ]G Vertrauen in Zertifikat
[ ]H Reduzierte behördliche Kontrollrate
[ ]I Überlappung der CC-Auflagen mit ZS
[ ]J Gewinnerhöhung
[ ]K Verbesserung betrieblicher Abläufe
[ ]L Verbraucherschutzaspekte
[ ]M Tierschutzaspekte
[ ]N Biologische Lebensweise
[ ]O Sonstige

61) Falls Betrieb zertifiziert: Um welchen Anteil hat sich ihr Einkommen durch die Teilnahme an einem Zertifizierungsstandard a) gesamtbetrieblich b) für einzelne zertifizierte Betriebsbereiche verändert?

[ ]A Gesamtbetrieblich: Einkommen hat sich um etwa …… % [ ] erhöht [ ] verringert
[ ]B Einkommen hat sich in dem Betriebsbereich …… um …… % [ ] erhöht [ ] verringert
[ ]C Einkommen hat sich in dem Betriebsbereich …… um …… % [ ] erhöht [ ] verringert
[ ]D Einkommen hat sich in dem Betriebsbereich …… um …… % [ ] erhöht [ ] verringert

62) Falls Betrieb nicht zertifiziert: Um welchen Anteil hat sich ihr Einkommen durch die Nichtteilnahme an einem Zertifizierungsstandard a) gesamtbetrieblich b) für einzelne zertifizierte Betriebsbereiche verändert?

[ ]A Gesamtbetrieblich: Einkommen hat sich um etwa …… % [ ] erhöht [ ] verringert
[ ]B Einkommen hat sich in dem Betriebsbereich …… um …… % [ ] erhöht [ ] verringert
[ ]C Einkommen hat sich in dem Betriebsbereich …… um …… % [ ] erhöht [ ] verringert
[ ]D Einkommen hat sich in dem Betriebsbereich …… um …… % [ ] erhöht [ ] verringert

63) Falls Betrieb zertifiziert: Inwieweit sind Sie mit Ihrer Teilnahme an dem Zertifizierungsstandard zufrieden?

[ ]1 Überhaupt nicht zufrieden
[ ]2 Weitgehend unzufrieden
[ ]3 Neutral
[ ]4 Weitgehend zufrieden
[ ]5 Vollkommen zufrieden

64) Falls Betrieb nicht zertifiziert: Inwieweit ziehen Sie in Betracht ihren Betrieb zertifizieren zu lassen (z.B. Bio-Zertifizierung)?

[ ]a Ich lehne die Teilnahme an ZS grundsätzlich ab
[ ]b Kommt wahrscheinlich nicht in Frage
[ ]c Kommt wahrscheinlich in Frage
[ ]d Ist in Planung

65) Falls Zertifizierung nicht in Frage kommt: Warum stehen Sie Zertifizierungsstandards ablehnend gegenüber?

[ ]A Zu hohe Investitionskosten
[ ]B Zu hohe Teilnahmekosten
[ ]C Unpassende Betriebsstruktur
[ ]D Mangelnde Transparenz
[ ]E Zu kompliziert
[ ]F Unsinnigkeit einzelner Auflagen
[ ]G Erhöhung des Kontrollaufwandes
[ ]H Erhöhung des Verwaltungsaufwandes
[ ]I Sonstige

66) Falls Zertifizierung in Frage kommt: Welche/s Zertifikat/e kommt/kommen für Ihren Betrieb in Frage?

[ ]A AMA-BIO
[ ]B BIO-AUSTRIA
[ ]C BIOLAND
[ ]D DEMETER
[ ]E NATURLAND
[ ]F BIO-HOFMARKE
[ ]G BK MOORBAD HARBACH
[ ]H BL ENNSTAL
[ ]I ORBI
[ ]J QS
[ ]K IKB
[ ]L EUREPGAP
[ ]M KT-FREILAND
[ ]N AMA-GÜTESIEGEL
[ ]O SCHIRNHOFER
[ ]P Sonstige

67) Falls Zertifizierung in Frage kommt: Warum spielen Sie mit dem Gedanken Ihren Betrieb

zertifizieren zu lassen? Bitte bewerten Sie die Gründe gemäß ihrer Wichtigkeit für Ihren Betrieb!

Bitte verwenden Sie folgende Bewertungsskala:
[0: Spielt keine Rolle; 1: Spielt eine untergeordnete Rolle; 2: Spielt eine wichtige Rolle; 3: Spielt eine sehr wichtige Rolle]

[ ]A Verbesserter Absatz
[ ]B Dokumentiertes Eigenkontrollsystem
[ ]C Teilnahme an Fortbildungsveranstaltungen
[ ]D Überprüfung der Produktqualität
[ ]E Mindeststandards über Produktionskette
[ ]F Bewerbung des Prüfzeichens
[ ]G Vertrauen in Zertifikat
[ ]H Reduzierte behördliche Kontrollrate
[ ]I Überlappung von CC mit Auflagen ZS
[ ]J Gewinnerhöhung
[ ]K Verbesserung betrieblicher Abläufe
[ ]L Verbraucherschutzbedenken
[ ]M Tierschutzbedenken
[ ]N Biologische Lebensweise
[ ]O Sonstige

Themenbereich Nr. 6: Erwartete Aufdeckungswahrscheinlichkeit im Kontrollfall

68) Wie hoch schätzen Sie die Wahrscheinlichkeit ein dass ein Verstoß gegen CC-Auflagen bei der regulären Fachrechtskontrolle (durch Veterinärbehörde) aufgedeckt wird?

[ ]a 91 - 100 %
[ ]b 81 - 90 %
[ ]c 71 - 80 %
[ ]d 61 - 70 %
[ ]e 51 - 60 %
[ ]f 41 - 50 %
[ ]g 31 - 40 %
[ ]h 21 - 30 %
[ ]i 11 - 20 %
[ ]j 1 - 10 %
[ ]k 0 %

69) Wie hoch schätzen Sie die Wahrscheinlichkeit ein dass ein Verstoß gegen CC-Auflagen bei einer offiziellen CC-Kontrolle aufgedeckt wird?

[ ]a 91 - 100 %
[ ]b 81 - 90 %
[ ]c 71 - 80 %
[ ]d 61 - 70 %
[ ]e 51 - 60 %
[ ]f 41 - 50 %
[ ]g 31 - 40 %
[ ]h 21 - 30 %
[ ]i 11 - 20 %
[ ]j 1 - 10 %
[ ]k 0 %

70) Wie hoch schätzen Sie die Wahrscheinlichkeit ein dass ein Verstoß gegen Zertifizierungsauflagen bei der entsprechenden Kontrolle aufgedeckt wird?

[ ]a 91 - 100 %
[ ]b 81 - 90 %
[ ]c 71 - 80 %
[ ]d 61 - 70 %
[ ]e 51 - 60 %
[ ]f 41 - 50 %
[ ]g 31 - 40 %

[ ]h 21 - 30 %
[ ]i 11 - 20 %
[ ]j 1 - 10 %
[ ]k 0 %

Themenbereich Nr. 7: Erwartete Sanktionierung

71) Mit welchen Folgen rechnen Sie im Falle des Verstoßes gegen CC-Auflagen im Bereich der Tierhaltung bzw. Lebensmittelsicherheit im Allgemeinen? Bitte bewerten Sie diese gemäß Ihrer Schwere für Ihren Betrieb!

Bitte verwenden Sie folgende Bewertungsskala:
[0: Keine Abschreckung; 1: Geringfügige Abschreckung; 2: Hohe Abschreckung; 3: Sehr hohe Abschreckung]

[ ]A Kürzung von EU-Direktzahlungen
[ ]B Bestrafung wegen des Verstoßes gegen nationale Auflagen
[ ]C Erhöhte Häufigkeit von CC-Kontrollen
[ ]D Imageschaden
[ ]E Erhöhte Häufigkeit förderrechtlicher Kontrollen
[ ]F Mündliche Verwarnung
[ ]G Verstoß gegen Zertifizierungsauflagen: Erhöhte Auditierungshäufigkeit
[ ]H Sonstige

72) Mit welchen Folgen rechnen Sie im Falle des Verstoßes gegen Auflagen eines Zertifizierungsstandards im Allgemeinen? Bitte bewerten Sie diese gemäß der erwarteten Schwere für Ihren Betrieb!

Bitte verwenden Sie folgende Bewertungsskala:
[0: Keine Abschreckung; 1: Geringfügige Abschreckung; 2: Hohe Abschreckung; 3: Sehr hohe Abschreckung]

[ ]A Aufforderung zur Nachbesserung
[ ]B Kostenpflichtige Nachkontrollen
[ ]C Vertragsstrafen (z. B. zeitweiser Entzug des Prüfsiegels)
[ ]D Ausschluss aus dem System
[ ]E Sonstige

73) Die Sanktionen welches Kontrollsystems hätten für Ihren Betrieb schwerere Folgen? Bitte beziehen Sie Ihre Einschätzung auf die folgenden Fälle!

[1: Sanktionen CC-Auflagen; 2: Sanktionen Zertifizierungsauflagen; 3: Sanktionen gleich hart]

[ ]a Einmaliger leichter Verstoß
[ ]b Einmaliger mittlerer Verstoß
[ ]c Einmaliger schwerer Verstoß
[ ]d Mehrere einmalige leichte Verstöße im Bereich des Tierschutzes und der LM- und FM-Sicherheit
[ ]e Mehrere einmalige mittlere Verstöße im Bereich des Tierschutzes und der LM- und FM-Sicherheit
[ ]f Mehrere einmalige schwere Verstöße im Bereich des Tierschutzes und der LM- und FM-Sicherheit
[ ]g Erneuter leichter Verstoß gegen gleiche Auflagen innerhalb von 3 Jahren
[ ]h Erneuter mittlerer Verstoß gegen gleiche Auflagen innerhalb von 3 Jahren
[ ]i Erneuter schwerer Verstoß gegen gleiche Auflagen innerhalb von 3 Jahren

74) Welche maximale Prämienkürzung erwarten Sie bei folgenden Fällen?

[ ]A Ein erstmaliger Verstoß gegen CC-Auflage im Bereich Tierschutz: .....
[ ]B Mehrere erstmaliger Verstöße im Bereich Tierschutz: .....
[ ]C Mehrere erstmalige Verstöße im Bereich Tierschutz und Lebensmittelsicherheit: .....
[ ]D Erneute fahrlässige Verstöße gegen CC-Auflagen innerhalb von 3 Jahren: .....
[ ]E Vorsätzliche/r Verstoß/Verstöße gegen eine CC-Auflage: .....

Themenbereich Nr. 8: Erwartete indirekte und soziale Bestrafung bei Verstößen

75) Welchen Stellenwert haben für Sie Bestrafungen indirekter oder sozialer Art im Falle des Verstoßes gegen Tierhaltungsauflagen?

Bitte verwenden Sie zur Bewertung folgende Zahlenwerte:

[0: Spielt keine Rolle; 1: Spielt eine untergeordnete Rolle; 2: Spielt eine große Rolle; 3: Spielt eine sehr große Rolle]

[ ]A Imageschaden
[ ]B Erhöhte Kontrollrate
[ ]C Verbot der Tierhaltung
[ ]D Sonstige

Themenbereich Nr. 9: Individuelle Risikoaversion

76) Vermeiden Sie in der Regel Risiken oder sind Sie ein risikobereiter Mensch?

[ ]-2 Ich bin sehr risikoscheu
[ ]-1 Ich bin eher risikoscheu
[ ]0 Ich bin weder risikofreudig noch -scheu
[ ]1 Ich bin eher risikofreudig
[ ]2 Ich bin sehr risikofreudig

77) Welche der folgenden Möglichkeiten würden Sie wählen wenn Sie Gewinner einer Lotterie wären?[118]

[ ]a Den Barpreis von 5000 €
[ ]b Die 50%-Chance auf 10.000 €
[ ]c Die 20%-Chance auf 25.000 €
[ ]d Die 2%-Chance auf 250.000 €

78) Ich betrachte riskante Situationen als Herausforderung[119]

[ ]-2 Trifft gar nicht zu
[ ]-1 Trifft eher nicht / ein wenig zu
[ ]0
[ ]1 Trifft überwiegend / weitgehend zu
[ ]2 Trifft vollkommen zu

79) Für wie riskant schätzen Sie die folgenden Situationen ein? Für wie hoch schätzen Sie die Wahrscheinlichkeit ein Folgendes zu tun?[120]

Bitte verwenden Sie für Frageteil a) folgende Bewertungsskala:
[0: Vollkommen unriskant; 1: Eher unriskant; 2: riskant; 3: Sehr riskant]
Bitte verwenden Sie für Frageteil b) folgende Bewertungsskala:
[0: Sehr gering; 1: Gering; 2: Hoch; 3: Sehr hoch]

[ ]A 10 % Ihres Jahreseinkommens in ein mäßig wachsendes Wertpapierdepot zu investieren: …… / ……
[ ]B 5 % Ihres Jahreseinkommens in eine sehr spekulative Aktie zu investieren: …… / ……
[ ]C 5 % Ihres Jahreseinkommens in eine konservative Aktie zu investieren: …… / ……
[ ]D 10 % Ihres Jahreseinkommens in Staatsanleihen (Schatzbriefe) zu investieren: …… / ……
[ ]E Ihr Tageseinkommen auf das Ergebnis eines Sport-Ereignisses setzen: …… / ……
[ ]F Das Einkommen einer Woche im Casino setzen: …… / ……

80) In finanziellen Dingen bin und bleibe ich risikobereit[121]

[ ]-2 Trifft gar nicht zu
[ ]-1 Trifft eher nicht / ein wenig zu

---

[118] This question is used in investor profile surveys of many financial service providers (such as "Brandtner Vermögensstrategien", see http://www.renditestrategie.de/anlegertyp-bestimmen, accessed 12 January 2012).
[119] tetralog (ed.) 2002 as cited by Schneider, T. 2005. *Preference-Based-Recommender-Systeme – Individuelle neuronale Präferenzmodellierung am Beispiel von Investmentfonds*. Deutscher Universitäts-Verlag GmbH, Wiesbaden, p. 135.
[120] See Johnson, J. G., Wilke, A. and Weber, E. U. 2004. DOSPERT-G – Domain-specific Risk-taking Scale – German version. http://www.abc.mpib-berlin.mpg.de/users/johnson/DOSPERTG.pdf, accessed 12 January 2012.
[121] See journal "Capital" (Vol. 10, 2003, p. 88) as cited by Braun, K. 2012. Wer vorzüglich investiert, verliert. http://www.versicherungsmakler-hennef.de/texte/investment/artikel/wervorzglichinvestiertverliert/, accessed 12 January 2012.

[ ]0
[ ]1 Trifft überwiegend / weitgehend zu
[ ]2 Trifft vollkommen zu

81) Ich nehme gerne mal ein Risiko in Kauf, wenn es etwas zu gewinnen gibt

[ ]-2 Trifft gar nicht zu
[ ]-1 Trifft eher nicht / ein wenig zu
[ ]0
[ ]1 Trifft überwiegend / weitgehend zu
[ ]2 Trifft vollkommen zu

Themenbereich Nr. 10: Persönliche Erfahrungen

82) Welche Erfahrungen haben Sie mit der amtlichen Kontrolle hinsichtlich der folgenden Gesichtspunkte gemacht?

Bitte verwenden Sie folgende Bewertungsskala:
[-2: Sehr schlechte Erfahrungen; -1: Schlechte Erfahrungen; 0: Neutral; 1: Gute Erfahrungen; 2: Sehr gute Erfahrungen]

[ ]A Nachvollziehbarkeit
[ ]B Transparenz
[ ]C Gerechtheit
[ ]D Freundlichkeit
[ ]E Kooperationsbereitschaft
[ ]F Beratung
[ ]G Sanktionierung
[ ]H Sonstige

83) Welche Erfahrungen haben Sie im Allgemeinen mit EU-Recht gemacht?

[ ]-2 Sehr schlechte Erfahrungen
[ ]-1 Schlechte Erfahrungen
[ ]0 Weder gute noch schlechte Erfahrungen
[ ]1 Gute Erfahrungen
[ ]2 Sehr gute Erfahrungen

Themenbereich Nr. 11: Moralische Bedenken

84) Inwieweit spielen für Sie moralische Bedenken bei der Einhaltung von gesetzlichen Auflagen eine Rolle? Bitte bewerten Sie Ihren Einfluss hinsichtlich folgender Aspekte!

Bitte verwenden Sie folgende Bewertungsskala:
[0: Spielen keine Rolle; 1: Spielen eine untergeordnete Rolle; 2: Spielen eine große Rolle; 3: Spielen eine sehr große Rolle]

[ ]A Rechtskonformität
[ ]B Tierschutz
[ ]C Verbraucherschutz
[ ]D Sonstige

Themenbereich Nr. 12: Ergänzende Indikatoren

85) Welche durchschnittlichen biologischen Leistungen weisen Ihre Tiere auf?

[ ]A Milchkühe: Milchleistung: …… kg / Kuh und Jahr
[ ]B Mastschweine: Tägliche Zunahmen: …… g / Schwein
[ ]C Färsen und Bullenmast: Tägliche Zunahmen: …… g / Rind
[ ]D Sonstige

86) Welchen Anteil an Tierverlusten hatten Sie im Jahr 2008?

……

……
……

87) Welchen Anteil an Nachkommen hatten Sie im Jahr 2008?

[ ]A Sauenhaltung: Abgesetzte Ferkel pro Sau und Jahr: ……
[ ]B Rinderhaltung: Abkalberate: …… % der Kühe haben gekalbt

88) Wie hoch waren Ihre Tierarztkosten im Jahr 2008?

.....
.....
.....

89) Wie ist das Jahr 2008 für Ihren Betrieb ausgefallen?

[ ]a Sehr schlechtes Jahr
[ ]b Schlechtes Jahr
[ ]c Durchschnittliches Jahr
[ ]d Gutes Jahr
[ ]e Sehr gutes Jahr