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# Tools for on-farm self-assessment of animal welfare

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Livestock farmers are required to monitor the welfare of their animals regularly and systematically by collecting animal protection indicators within the framework of on-farm self-assessment (German Animal Welfare Act § 11 (8)). They can thus identify potential animal welfare problems at an early stage and initiate remedial measures accordingly. To ensure comparability of on-farm self-assessment, animal welfare indicators must be collected in a standardised way. The aim of this work was to test the feasibility of the indicators for cattle, pigs and poultry which had been proposed for on-farm self-assessments in a previous process. To train livestock farmers on how to apply the indicators, live and online trainings were developed and tested. Data recording sheets and an Excel® application were created to facilitate data collection in the stable. Furthermore, numerous experts jointly developed and agreed on a reference evaluation framework in a multi-stage process (Delphi survey, literature review, expert panels, field studies). The framework includes target and alarm values which livestock farmers can use to compare and evaluate their results. Finally, all tools were evaluated in interviews.

Since 2014, livestock farmers have to carry out on-farm self-assessments (§ 11 (8), German Animal Welfare Act, TierSchG 2006) in order to ensure compliance with the requirements of § 2 of the German Animal Welfare Act. In practice, farmers still have many questions about this systematic self-assessment approach. This is partially because the Act does not include any provisions for implementation of § 11 (8), and farmers are often uncertain about how to perform these assessments. The Scientific Advisory Board for Agricultural Policy at the Federal Ministry of Food and Agriculture (BMEL 2015) sees the routine recording of animal-based indicators as an important success factor for developing sustainable animal husbandry. Furthermore, in its recommendations, the Farm Animal Husbandry Competence Network (KOMPETENZNETZWERK NUTZTIERHALTUNG 2020) also reports that animal welfare indicators are currently not collected adequately. In German language, both the term 'Tierwohlindikatoren' (animal welfare indicators) and the term 'Tierschutzindikatoren' (animal protection indicators) utilised interchangeably in the literature and the Animal Welfare Act. Here, in English language, the more adequate term welfare indicators is used. The Commission on the Future of Agriculture (ZUKUNFTSKOMMISSION LANDWIRTSCHAFT 2021) also recommends that on-farm self-assessment (referred to as 'Tierschutz-Eigenkontrolle') is specified and standardised in regulatory law. In addition, it recommends that livestock farmers are required to complete further training programmes about animal welfare on a regular basis.

In 2016, the Kuratorium für Technik und Bauwesen in der Landwirtschaft e. V. (KTBL), the University of Kassel, the Friedrich Loeffler Institute in Celle, and the Thünen Institute of Organic Farming in Trenthorst jointly published a proposal for the on-farm self-assessment procedure. The proposal includes a description of relevant animal welfare indicators and practical guides for cattle, pigs and poultry kept for different purposes. The practical guides for on-farm self-assessment were developed between 2014 and 2016 in expert panels and elaborated by various teams of authors. At this time, suitable indicators were selected, and data collection methods for identifying potential animal welfare problems in practice were described (ZAPF et al. 2015) in order to provide valid information on the animal welfare problems that are deemed serious. The guides contain method descriptions including illustrated classification tables for each indicator and a flow chart for each animal species as well as formulas for calculating the herd's results. Furthermore, they provide practical tips and explanations on sampling.

The reliable and standardised collection of data on animal welfare indicators is necessary for a meaningful on-farm self-assessment. To ensure standardised data collection, it is recommended that livestock farmers attend a training programme. Experience from previous projects has shown that training improves data quality when using animal welfare indicators (IVEMEYER et al. 2015, VASSEUR et al. 2013, MARCH et al. 2007). Digital applications are frequently demanded by practitioners and consultants in order to facilitate the collection of data. Indeed, some digital tools are already available for various livestock species and used for collecting welfare data (for example 'Tierwohl-Check' (LEHRKE et al. 2022), PRO-Q-BW 2021, FIT-FOR-PIGS 2020, MTool (KEPPLER et al. 2017)). In addition to data collection relating to animal welfare indicators in accordance with § 11 (8) (Animal Welfare Act), German law requires an evaluation of the results. Thus, benchmarks allowing farms to evaluate their own results are necessary for on-farm self-assessments, alongside meaningful animal welfare indicators and feasible data collection methods.

Against this background, this work aimed to test the feasibility of the proposed animal welfare indicators set out in the practical guides for cattle, pigs, and poultry on farms. Furthermore, a secondary aim was to develop training concepts and digital applications to facilitate data collection in the stable as well as to elaborate a framework with reference values to support farmers by evaluating their results.

## Materials and methods

From 2018 to 2020, the practical guides were tested on 121 farms (44 cattle farms, 34 pig farms and 43 poultry farms). The data for the animal welfare indicators were collected on the farms by both the farmers themselves and the project staff. Subsequently, the practical guides were revised by the author teams based on the outcomes of the project, for instance field experience, feedback from livestock farmers and discussions in expert panels.

To train farmers in the handling of the indicators, live and online training modules were developed based on the content of the above mentioned practical guides. In addition, an online test for each animal species was elaborated to measure the success of the training programme . To create these training programme, a large number of photos and videos were collected for the lessons, exercises and online test. The online training module was created using the open-source software "Moodle". This e-learning platform allows the integration of different types of questions and automated feedback function, the implementation of an online test. Obtaining a certificate to proof successful attendance

is possible with a positive test result. The users' results in the online test were compared to scores from trainers as a measure of the interrater reliability by calculating the PABAK (Prevalence-Adjusted Bias-Adjusted Kappa). Half of the farmers took part in a one-day live training, and the other half participated in an online training. This was set up to determine whether the type of training influences the quality of animal welfare data collected in the stable. The outcomes for the training types were compared via an online test. All participants took the same test.

An Excel® application was programmed for each animal category to support digital recording. The tool provides an automated calculation and a summary of the results at farm level. Reference frameworks containing target and alarm values were developed for all indicators and animal species by experts in a multi-stage process (ZAPF et al. 2023, EIKOTIGER-PROJEKTKONSORTIUM 2021a). This process was divided into several steps:

- 2018: Two-step Delphi survey involving relevant stakeholder groups to collect specific suggestions for the target and alarm values
- 2018, 2019: Review of literature on the prevalence or incidence of animal welfare problems in practice or with regard to normative target values and alarm/threshold values
- 2018, 2019: Development of suggestions for target and alarm values based on the results of the Delphi survey and the literature review; experts discussed the suggested values for each species in two panels consisting of approx. 25 representatives from relevant stakeholder groups in each session
- 2020: Inclusion of the results from the field studies performed on 121 cattle, pig and poultry farms.
- Summer/Autumn 2020: Final agreement on target and alarm values per species type in a third panel with the experts who participated in the previous panels

This relatively elaborate approach was chosen in order to achieve a professional, broadly coordinated result.

## Tools developed: Brief description and practitioner assessment
### Practical guides
In general, the livestock farmers from 121 farms considered the collection of the animal welfare indicators for self-assessments as feasible. Furthermore, they reported that the described methods were mostly easy to apply. Nevertheless, to enhance feasibility, reliability, some new indicators were included and others were deleted in the guideline. In addition, in some cases, methods have been modified, and photos were replaced or added. Printable record sheets for data collection were developed for all guidelines, and in some cases sampling descriptions has been modified. The revised guides were published in late 2020 (BRINKMANN et al. 2020, KNIERIM et al. 2020, SCHRADER et al. 2020a). The concept helps to identify deficiencies and to improve welfare at an early stage. With the help of these guides, livestock farmers can independently monitor the welfare of the animals on their farms.

### Trainings
Both the live and online training modules (in German language) were found to be suitable for conveying information on the animal welfare indicators and for preparing livestock farmers to conduct on-farm self-assessments (MICHAELIS et al. 2022). The online tests completed by all participants showed that they had effectively learned the selected animal welfare indicators (MICHAELIS et al. 2022).

The live and online training modules contain identically structured courses on how to collect the animal welfare indicators for the livestock categories "dairy cows and calves", "beef cattle", "sows and suckling piglets", "weaning piglets and fattening pigs", "pullets and laying hens", "broiler chickens" and "broiler turkeys". The modules start by presenting the most important facts about on-farm self-assessment with a short video clip, amongst others. They then provide information on implementation, sampling, animal handling and continues with lessons on each animal welfare indicator. For all indicators, the lessons contain detailed background information on the respective animal welfare problem, method descriptions including illustrated classification tables (Figure 1). Furthermore, each course includes exercise (photos and videos) with an integrated feedback function. In this way, users can practise for the online test (ZAPF et al. 2021).



Figure 1: Exemplary contents from the "Animal welfare indicators" online training module: a) and b) film explaining sampling for sows & suckling piglets, c) film with tips on animal handling for young/laying hens, d) photo for lameness indicator, dairy cow (© Screenshots from the online training module: KTBL)

The online test consists individual tests for each indicator recorded directly at the animal. Users are considered to have passed the online test if they pass all individual tests. To pass, they have to achieve a sufficiently high level of interrater reliability (PABAK ≥ 0.61). Upon passing the test, they are automatically issued a downloadable certificate. The certificate sets out the training content and the estimated time invested in the training programme (between three and five hours depending on

the type of animal) and can serve as a confirmation of participation. Stakeholders from consultancies, veterinary bodies or certification organisations who wish to use a standardised, accurate survey methodology with selected animal-based indicators to assess animal welfare can also complete the training programme and test. The online training module is freely available (EiKoTiGer-Projektkonsortium 2021b). Users striving to obtain a certificate have to register, which is free of charge.

## Excel® application

For data collection, the Excel®-based application "Animal Protection Indicator Data Collection" was developed, including digital data collection sheets for the different categories (EiKoTiGer-Projektkonsortium 2020). The free application, which can be used on a Windows tablet in the stable, facilitates data collection by farmers. In addition to enabling them to enter the data digitally, it automatically calculates and presents the results for individual farms. It is also possible to edit and display several different herds, pens or farm sections side by side. In addition to directly entering data into a tablet in the stable, users have the option of printing out the data collection forms and filling them out in the stable. The data can then be transferred into the Excel® application for further calculations. The data are collected uniquely for internal purposes; i. e. they are not fed into a database, e.g., to allow benchmarking. Based on practical experience, the application was revised during the project. For instance, further functions were added; individual indicators were modified and user-friendliness was improved. Microsoft Excel® version 2013 or later is required.

## Reference framework with target and alarm values

To provide a framework of reference for evaluating the results of self-assessment, target and alarm values were developed for relevant animal welfare problems. These benchmarks were agreed on in a process involving consultants, farmers, scientists, veterinarians, professional associations, animal protection organisations and administrations. In this process, both normative and status quo-based approaches were applied (Zapf et al. 2023, EiKoTiGer-Projektkonsortium 2021). The target and alarm values were set so that action has to be taken on an early stage and farm management measures can be initiated accordingly. These values are available for the categories cattle, pigs and poultry (Table 1, KTBL 2020). These reference values enable users to evaluate the results of their on-farm self-assessment of welfare, as required by the Animal Welfare Act § 11 (8). Hence, livestock farmers can determine whether the level of animal welfare is in a "green range" or whether there is a need to take action to improve animal welfare with regard to a specific indicator. The reference frameworks can be updated to incorporate new indicators or scientific findings.

Table 1: Excerpt from the reference framework with target and alarm values for suckling pigs for evaluation of the results of on-farm self-assessments according to the KTBL practical guide "Animal protection indicators: practical guide – pigs" (Schrader et al. 2020b)

| Indicator[1] | Unit | Target range[2] | Alarm range[2] |
|---|---|---|---|
| **Ongoing data collection** **All suckling pig** | | | |
| *Animal losses* | | | |
| Proportion of stillborn piglets among all piglets in the litter | Proportion of animals in % | ≤ 5.0 | ≥ 10.0 |
| Proportion of piglets that died and were euthanised during the suckling phase among all piglets born alive in the litter | Proportion of animals in % | ≤ 12.0 | ≥ 17.0 |
| *Antibiotic use[3]* | | | |
| Therapy index (QS system) or therapy frequency (HIT) | without unit | - | - |
| **Biannual collection of a sample[4]** **Litters in farrowing pen** | | | |
| *Runt piglets* | | | |
| Proportion of runt piglets among all animals in the evaluated litters | Proportion of animals in % | ≤ 3.0 | ≥ 8.0 |
| *Skin lesions on the head* | | | |
| Proportion of litters with three or more piglets with significant lesions on the head (rating score 1) among all evaluated litters | Proportion of litters in % | ≤ 5.0 | ≥ 15.0 |
| *Skin lesions on the carpal joints* | | | |
| Proportion of litters with three or more piglets with lesionson min. one carpal joint (rating score 1) among all evaluated litters | Proportion of litters in % | ≤ 5.0 | ≥ 15.0[5] |

- = not specified

[1] For further explanations of the indicators and a description of the survey method, see KTBL Practical Guide "Animal Welfare Indicators: Practical Guide – Pigs" (Schrader et al. 2020a).

[2] Livestock farmers can compare the results of their on-farm self-assessments with the target and alarm ranges, which are limited by the agreed target and alarm values in order to independently assess whether there is a need for action to improve the welfare situation. The values proposed here are not intended for external control.

[3] Existing benchmark systems can be used to evaluate antibiotic use (e. g. QS antibiotic monitoring (Qualität und Sicherheit GmbH), HIT database (Herkunftssicherungs- und Informationssystem für Tiere)).

[4] Detailed instructions for drawing the sample are described in the KTBL practical guide "Tierschutzindikatoren: Leitfaden für die Practice – Pigs" (Schrader et al. 2020). When collecting smaller samples than suggested, it can be for certain target and alarm values (e. g. skin injuries on the head, skin injuries on the carpal joints) the evaluation may be fuzzy. Thus, already one animal or litter with corresponding findings may be required to reach the early warning or the alarm range. In this case it should be evaluated with a sense of proportion and checked whether this result remains over repeated surveys or whether it is a one-time finding. Small samples can also lead to only the target or alarm value being reached, but not the early warning range. Therefore, if possible, the sample size should be increased.

[5] For improvement, far-reaching measures may be required that can only be implemented in the medium to long term.

Participants in the Delphi survey and experts in the panels stated repeatedly that the reference values are useful and necessary for livestock farmers to evaluate the data they have collected. With the help of these benchmarks, they are able to identify and tackle their farm's problem areas and weaknesses. However, they also named concerns about mixing self-assessments and official inspections, when reference values might be interpreted as "pre-legislative" regulations or used in external controls; the proposed values are not intended for this purpose.

## Evaluation of the tools by livestock farmers

Following the farm visits, structured interviews were conducted with the persons involved in the project who were responsible for data collection on the farms (farm managers, employees). Among other things, the aim was to evaluate the tools developed for on-farm self-assessment (Table 2) as well as the ease of integrating into their workflow and, in general, the benefits of participating in the project. The

livestock farmers rated the tools on a scale from 1 (very good) to 6 (very bad) and had the opportunity to answer several open questions by entering free text.

Table 2: Rating on the quality of the tools developed in the project (school marks 1–6); by farm managers or employees – Results of the structured interviews on cattle, pig and poultry farms

| | Cattle | | | Pig | | | Poultry | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Rating | | | | |
| | n | Median | Mean value (min.–max.) | n | Median | Mean value (min.–max.) | n | Median | Mean value (min.–max.) |
| Guidelines | 38 | 2 | 1.9 (1–3) | 53 | 2 | 1.7 (1–3) | 40 | 2 | 1.8 (1–3) |
| Live training | 21 | 1,5 | 1.5 (1–3) | 25 | 2 | 1.8 (1–4) | 22 | 2 | 1.7 (1–4) |
| Online training | 18 | 2 | 1,7 (1–3) | 27 | 2 | 2.0 (1–3) | 18 | 2 | 2.2 (1–3) |
| Online test | 39 | 2 | 1,8 (1–3.5)[1] | 52 | 2,3 | 2.3 (1–5) | 41 | 2 | 2.0 (1–3) |
| Excel® application | 38 | 2,25 | 2,4 (1–4) | n. s.[2] | n. s. | n. s. | 15 | 3 | 2.8 (1–5) |

The reference framework was agreed on in collaboration with experts following the field test at the end of the project and was not part of the interviews or evaluation due to the timing of the project.

[1] Some participants did not want to specify a single mark and gave, e.g., the school mark 3–4, which resulted in the decimal place.

[2] n. s. = not specified; no data were collected on this item.

The livestock farmers rated the ease of integrating on-farm self-assessment into their workflow as good, with higher scores from pig and cattle farmers than from poultry farmers (CIMER et al. 2021). The majority of the interviewed persons, especially farmers with dairy cows and laying hens, stated that their view on the animals had changed as a result of these assessments. Cattle and laying hen farmers stated a relatively high likelihood that they would continue the on-farm self-assessments, but it was considerably lower on turkey and fattening pig farms. The high amount of time and effort needed were mentioned most frequently as an obstacle regarding the further implementation of on-farm self-assessments. The most frequently mentioned benefit was 'raising awareness regarding animal welfare issues' (CIMER et al. 2021).

Participating farmers rated the practical guides as good (median: 2 each species; mean: 1.7 to 1.9). Although the majority of them rated the application of the indicators as positive, many urged for bureaucratic simplifications (e.g. bundling data recording and documentation in relation to the action plan to prevent tail biting and docking and welfare self-assessment). In the long term, this could increase acceptance of the implementation of on-farm self-assessments. The benchmarking used in the project to provide feedback to the farms was seen as an incentive to compare one's own livestock welfare status with that of other farms. However, it was implemented exclusively at the farms participating in the project.

Both training modules and the online test were rated as good by the participating livestock farmers (Table 2). Initial analyses of the data from the field surveys also showed that most of the indicators

were easy to collect for livestock farmers on their farms. Furthermore, the indicators were collected sufficiently reliably (Rauterberg et al. 2020, 2021).

The Excel® application for data collection was used by 88 % of cattle farms (n = 42) and rated as good by 38 farms on average (Table 2). The pig farmers participating in the project recorded the animal-based indicators only by using the printed survey forms from the Excel® application, i.e. these livestock farmers did not use the digital application. These data recorded on paper were used for further scientific analyses of the data. Only a few of the poultry farmers used the Excel® application as they often used their own systems for data collection. The experiences reported back were taken into account when revising the Excel® application to enhance its feasibility. A possible limitation of the application's usage is that it only operates on a Windows notebook or tablet with Microsoft Excel® version 2013 or later.

Overall, participation in the project was rated as positive by most livestock farmers. Some farmers implemented measures to improve animal welfare after having identified farm's weak points already after the first data collection phase (e.g. improvement of lying comfort for dairy cows, improvement of water supply for beef cattle, implementation of improvements in the management of calves dehorning, provision of additional manipulable material for laying hens, optimisation of feeding for broiler chickens, regular monitoring and, if necessary, correction of watering rates in pigs' troughs, continuous recording of shoulder lesions of sows and earlier treatment of the animals).

## Conclusions

Independent and systematic data collection on animal welfare indicators is seen as particularly beneficial to enhance awareness on relevant animal welfare problems by livestock farmers. In addition, on-farm self-assessment provide a basis for evidence-based management decisions and constitute an opportunity to train employees. The approach presented here, which combines training modules, helps farms to identify weaknesses, improve their management and comply with the legal requirement to conduct on-farm self-assessments.

The tools developed for on-farm self-assessments, which consist of practical guides, live and online training, an Excel® application and a reference evaluation framework, have proved to be a suitable aid for livestock farmers. They enable farmers to systematically and regularly monitor the animal welfare on their own farm and to evaluate the impact of improvements. The tools developed should be reviewed periodically and should thus evolve accordingly as new expertise on animal welfare monitoring on-farm emerges.

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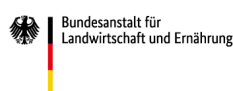
## Acknowledgements