

animal-based measures while assessing good health and appropriate behavior. The utilization of data generated along the value chain was limited in the reviewed quality schemes and only one quality scheme allowed the direct application of sensor technologies for providing information on animal welfare. However, several schemes used data from farm recording systems. This was the case especially on animal health. The quality schemes relied mostly on resource-based indicators taken during inspection visits, which reduce the relevance of the welfare assessment. Our results suggest that the quality schemes could be enhanced in terms of data collection by the broader utilization of data generated along the value chain.

To adopt digital animal welfare labelling solutions, such as mobile app-based labels, it is critical that consumers can access the information easily and that they can trust the information which is provided to them. For farmers, as primary data producers, it is essential that they are confident with the way how their data will be used and controlled, and that farmers are benefiting from sharing their data for the purposes of animal welfare labelling.

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What about the customer?

Exploring consumer response to ICT adoption in the livestock sector

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Information and communications technology (ICT) in the agricultural sector provide promising improvements when it comes to access to information, support for decision making, increased productivity and raised expected customer value. Additionally, there is a growing consensus that ICT adoption across agri-food value chains could address many of the sustainability goals for the future. However, in order to reach these positive effects, barriers for ICT adoption have to be identified and overcome.

ICT provide many possibilities to improve transparency and reduce information asymmetry in the food value chain. This is important for several reasons: i) animal health and welfare, ii) the collection of digital data, iii) the value capture of business models, iv) traceability, and v) consumer's informed choices. However, there is little discussion about which type of animal welfare and health related information influence the food purchasing decisions of consumers.



The purpose of the study presented in this paper is to explore the consumers' attitudes and purchasing behaviour regarding meat and dairy products in relation to animal welfare, and their response to ICT adoption in the food value chain.

In order to contribute to filling this knowledge gap, a survey study of food consumers in Estonia, Finland, Germany, and Sweden was carried out in spring of 2022. The questionnaire was developed in a collaboration with the researchers from all participating countries. Further, it was also based on interviews conducted with actors along the food value chain as well as reflections based on the SustainIT project's Living Labs discussions in every partner country. The consumer survey collected 1000 responses from Estonia, 1003 from Finland, 2002 from Germany, and 817 from Sweden. In total, 4822 respondents from four countries answered the questionnaire.

The questionnaire was structured in sub-themes such as: 1) the respondents' characteristics (sex, age, education level etc.), 2) place (rural/urban) and country of residence, 3) diet preferences, 4) food properties, 5) purchasing patterns, 6) perception of animal welfare attributes, 7) dissemination of information and traceability, 8) trustworthiness of public and private actors, 9) consumer use of ICT, and 10) barriers to consumer use of ICT.

Preliminary findings of the consumer survey point towards several interesting observations. In general, differences between consumers in the four countries, and between consumers of different age and education, have been identified regarding several areas. Animal health and welfare is regarded as very important by consumers in some countries, while these factors are regarded as less important by consumers in other countries. The first group of consumers are willing to pay a premium for products produced with a focus on animal health and welfare, while consumers in other countries do not prioritize these aspects. Consumers in some countries focus on environmentally friendly production while consumers in other countries focus on ethical production.

Differences depending on the age of consumers, such as preferences regarding diets, the importance of animal welfare, willingness to pay more for food with high marks regarding animal welfare have also been identified. Further, it is also interesting to observe the differences in the degree of trust for public and private actors between consumers in the four countries.

A conclusion, based on the preliminary analysis, is that groups of consumers perceive animal welfare and animal health in different ways. Consequently, the consumers also assess the importance of these aspects in various ways. Consumers in some countries regard these as very important, while consumers in other countries regard them as less important. Further, expectations on the communicated information, both regarding content and form vary between consumers of different characteristics and countries.

The heterogeneity among consumers regarding characteristics and countries will make it difficult to develop a common EU-standard that fits the specificities of all countries and preferences of their consumers. To develop animal health and welfare as well as economic value there is a need to extract and communicate information that is relevant for consumers. Further, policy makers and actor along the food value chain, such as farmers/primary producers, refiners, wholesalers, retailers, and public and commercial kitchens, must inform and educate consumers. In order to achieve this the following questions, need to be addressed:

- What is animal health and welfare?



- How can it be measured?
- How can it be communicated to the consumers?
- How is it understood and valued by the consumers?

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Insights from a multi-actor living lab approach to ICT implementation in the livestock sector

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The livestock sector in many European countries finds itself at crossroads. There is a wide range of sustainability related issues that need to be tackled to meet the demands of the sustainability conscious value chain actors, improving animal welfare and health and reduction of use of veterinary drugs among others. The value chains within the dairy and beef industries are in a transition process and currently faced with the adoption and integration of information and communication technology (ICT), in particular, to improve the data exchange among and the linkages between actors in relation to animal welfare and health.

Living Labs (LL) are open innovation ecosystems in realistic environments using iterative feedback processes throughout an innovation lifecycle (ENoLL, 2017) characterized by multi-actor user involvement following specific coordination and participation principles (Leminen, 2013; Veeckman et al., 2013). In the agri-food sector, LLs enable open innovation approaches that identify, test and ultimately implement solutions to open questions (Beaudoin et al., 2022). The SustainIT project applies a multi-actor LL approach that pursues an innovative co-learning process adopted by the relevant stakeholders in partner countries to deal with ICT application challenges in the two value chains. The iterative co-learning processes and areas of analyses comprise data structure and exchange within the value chains emphasizing animal health and welfare, the consumers' behaviour and attitude towards animal welfare and ICT integration, new business models and policy interactions regarding animal welfare and the data exchange process among the chain. The LL approach for the four partner countries pursues a framework of within-country co-learning process (referred to as Country Living Lab – CLL) and a co-learning process among research teams in partner countries through a process referred to as

