



## 1. Animal Welfare Workshop

### Title presentation

How precise are tools measuring animal-based welfare indicators in dairy cattle?

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### Abstract

The ClearFarm project (H2020, grant agreement No. 862919) proposes to use Precision Livestock Farming (PLF) technology and integration of animal-based data to provide animal welfare information. In order to achieve the project goal, valid and reliable sensor technologies should be used. In the context of ClearFarm project, the aim of this study was to provide a systematic overview of commercially available and externally validated PLF technologies, which could be used for sensor-based welfare assessment in dairy cattle. Following PRISMA guidelines, a systematic literature review was conducted to identify externally validated sensor technologies. Out of 1,111 publications initially extracted from data bases, only 42 studies describing 30 sensor technologies (including prototypes) met requirements for external validation. Moreover, through market search, 129 different retail technologies with application for animal-based welfare assessment were identified.

Based on literature search, only 18 sensors currently sold had been externally validated (14%). The highest validation rate was found for systems based on accelerometers (30% of tools available on the market have validation records), while the lower rates were obtained for cameras (10%), load cells (8%), miscellaneous milk sensors (8%) and boluses (7%). Validated traits concerned animal activity, feeding and drinking behavior, physical condition and health of animals.

Majority of tools were validated on adult cows. Non-active behavior (lying and standing) and rumination were the most often validated for the high performance. Regarding active behavior (e.g. walking), technologies showed lower performance (including precision and accuracy). Also, tools used to assess physical condition (e.g. body condition score) and health evaluation (e.g. mastitis



detection) showed lower performance as well. The performance of feeding and drinking behavior assessment varied largely depending on the measured trait and used sensor.

Regarding relevance for animal-based welfare assessment, several validated technologies had application for good health (e.g. milk quality sensors detecting mastitis) and good feeding (e.g. load cells detecting feed intake). Accelerometers-based systems have also practical relevance to assess good housing (e.g. measuring animals' activities such as lying or standing). However, currently available PLF technologies have low potential to assess appropriate behavior of dairy cows. To increase actors' trust towards PLF technologies and prompt sensor-based welfare assessment, validation studies, especially in commercial herds, are needed. Future research should focus on developing and validating technologies dedicated for assessment of appropriate behavior and for monitoring health and welfare in calves and heifers.