Precision livestock farming (PLF) offers an opportunity to sustainably  increase animal productivity, improve animal welfare and health, whilst reducing environmental impact. A potential improvement of animal productivity can be achieved using real time monitoring and management systems, alerting the farmer when problems arise. Production related information generated from PLF systems can therefore enhance farm management in a situation of scarce labour, but we should consider if it is appropriate to attempt to  entirely replace the farmers own knowledge and experience; the level of displacement of human input should be considered for optimal integration of PLF in real farm systems. Training and support are therefore important in adoption of PLF systems in commercial farming practice.

Implementation of sensor systems and automation can improve herd management and reduce labour requirements (Steeneveld and Hogeveen, 2015). However, many sensor systems also have the potential to provide targeted information about other, more complex traits (Friggens and Thorup, 2015) in addition to the detection of health problems and fertility events by offering alerts in response to changing response to environmental conditions or physiological challenge. Common sensor data, such as milk production and activity time series, can be used to predict a complex trait such as lifetime resilience and achieving more sustainable productive lifespan targets (DeVries, 2020). One step toward optimization of farm management with respect to longevity would be the identification of animals that have a high probability of completing several lactations, or, more specifically, that are “resilient” (Ranzato, 2022).  Resilient animals can be considered as animals that avoid early culling by coping well with the farm’s management conditions (Friggens et al 2022). These animals reproduce easily, produce consistently, and react well to imposed challenges and (physiological) stress (Ahlman et al., 2011).

Simultaneously, additional benefits of these technologies can be generated from the calculation of precision phenotypes and their use for the characterization to understand overall and relative performance of animals within the farm context and comparing genetic/environment interaction (Royal et al., 2000). Adriaens et al (2020 and 2021) described how biologically meaningful proxies can be constructed for the cow’s physiological status from the high-frequency milk yield and activity dynamics provided by commercially available sensor systems. These proxies offer potential decision support for breeding, culling and treatment events to optimise herd sustainable productivity (Cabrera 2018). Further potential exists for this approach to be translated into continuous monitoring of animal welfare as PLF technologies offer timeseries data, such as perturbations in daily milk yield or cow activity from accelerometer outputs, that may provide appropriate opportunities for tracking welfare trajectories. This approach might offer practical solutions that will complement the current state of the art such as ‘Welfare Quality’ assessments which require time-consuming human observations and are challenging to achieve at more than restricted annual spot-check level.

**References:**

Adriaens, I.,Friggens. N.C., Ouweltjes. W., Scott.. H., Aernouts. B., Statham, J. (2020) Productive lifespan and resilience rank can be predicted from on-farm first parity sensor time series but not using a common equation across farms. ***J. Dairy Sci.* 103** [**https://doi.org/10.3168/jds.2019-17826**](https://doi.org/10.3168/jds.2019-17826)

Adriaens, I.,  van den Brulle, I.,  D’Anvers,L.,  Statham, J.M.E. , Geerinckx,K., De Vliegher,S.,  Piepers, S., Aernouts, B.(2021) Milk losses and dynamics during perturbations in dairy cows differ with parity and lactation stage*J.Dairy.Sci* 104(1). p.405-418

Ahlman, T., B. Berglund, L. Rydhmer, and E. Strandberg. 2011. Culling reasons in organic and conventional dairy herds and genotype by environment interaction for longevity. J. Dairy Sci. 94:1568– 1575. https: / / doi .org/ 10 .3168/ jds .2010 -3483.

Cabrera, V. E. 2018. Invited review: Helping dairy farmers to improve economic performance utilizing data-driving decision support tools. Animal 12:134–144. https: / / doi .org/ 10 .1017/ S1751731117001665

De Vries A. Symposium review: Why revisit dairy cattle productive lifespan? J Dairy Sci. 2020 Apr;103(4):3838-3845. doi: 10.3168/jds.2019-17361. Epub 2020 Feb 20. PMID: 32089299

Friggens, N. C., and V. M. Thorup. 2015. From monitoring to precision phenotyping: Towards a systemic use of precision livestock measures in dairy herds. Proc. N.Z. Soc. Anim. Prod. 15:146–148.

Friggens, N.C., Adriaens, I., Boré, R., Cozzi, G., Jurquet, J., Kamphuis, C., Leiber, F., Lora, I., Sakowski, T., Statham, J. and De Haas, Y.  (2022).  Resilience: reference measures based on longer-term consequences are needed to unlock the potential of precision livestock farming technologies for quantifying this trait.  Peer Community Journal, 2: (8). *- Animal Science, Volume 1* July 2022 [Peer Community Journal](https://www.researchgate.net/journal/Peer-Community-Journal-2804-3871?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19) 2(8) DOI:[10.24072/pcjournal.136](http://dx.doi.org/10.24072/pcjournal.136)  [*https://zenodo.org/records/6046479*](https://zenodo.org/records/6046479)

Ranzato, G.; Adriaens, I.; Lora, I.; Aernouts, B.; Statham, J.; Azzolina, D.; Meuwissen, D.; Prosepe, I.; Zidi, A.; Cozzi, G. Joint Models to Predict Dairy Cow Survival from Sensor Data Recorded during the First Lactation. Animals 2022, 12(24), 3494; <https://doi.org/10.3390/ani12243494>.

Royal, M. D., A. O. R. Darwash, A. P. F. F. Flint, R. Webb, J. A. Woolliams, and G. E. Lamming. 2000. Declining fertility in dairy cattle: Changes in traditional and endocrine parameters of fertility. Anim. Sci. 70:487–501. https: / / doi .org/ 10 .1017/ S1357729800051845.

Steeneveld, W., and H. Hogeveen. 2015. Characterization of Dutch dairy farms using sensor systems for cow management. J. Dairy Sci. 98:709–717. https: / / doi .org/ 10 .3168/ jds .2014 -8595.