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8.11   SMART DAIRY FARMING: INNOVATIVE SOLUTIONS TO IMPROVE HERD PRODUCTIVITY

Claudia Arcidiacono[3], Matteo Barbari[4], Stefano Benni[5], Elisabetta Carfagna[7], Giovanni Cascone[3], Leonardo Conti[4], Luigi di Stefano[8], Marcella Guarino[1], Lorenzo Leso[4], Massimo Mancino[3] , Stefano Mattoccia[8], Giulietta Minozzi[6], Simona M.C. Porto[3], Giorgio Provolo[2], Giuseppe Rossi[4], Anna Sandrucci[2], Alberto Tamburini[2], Patrizia Tassinari[5], Nicoletta Tomasello[3], Daniele Torreggiani[5], Francesca Valenti[3].

[1]*Department of Environmental and Policy Science, Università degli Studi di Milano, Via Celoria, 10 - 20133, Milano – Italy*

[2]*Department of Agricultural and Environmental Sciences ,Production, Landscape, Agroenergy, Università degli Studi di Milano, Via Celoria, 2 - 20133, Milano – Italy*

[3]*Department of Agriculture, Food and Environment, Università degli Studi di Catania, Via S. Sofia, 100 -95123 Catania – Italy*

[4]*Department of Agriculture, Food, Environment and Forestry, Università degli Studi di Firenze, Via San Bonaventura, 13 50145 Firenze –Italy*

[5]*Department of Agricultural and Food Sciences, Università di Bologna, Viale Giuseppe Fanin 50 - 40127 Bologna – Italy*

[6]*Department of Veterinary Medicine, Università degli Studi di Milano, Via i Celoria, 10 - 20133, Milano – Italy*

[7]*Department of Statistical Sciences "Paolo Fortunati", Università di Bologna, Via Belle arti, 41, - 40126 Bologna – Italy*

[8]*Department of Computer science and Engineering, Università di Bologna, Viale Risorgimento 2, - 40136 Bologna – Italy*

The increase in food global demand, food safety alarms and new dietary trends are straining the farmers: on the one hand, they have to guarantee the welfare and adequate conditions of life for the animals and reduce the environmental footprint; on the other hand, they have also to develop new strategies to improve farm management reducing costs. The current conditions and the expected developments of dairy sector highlight a strong need for more efficient and sustainable farming systems, both at global and local scale. It becomes important to study housing, herd management and heat stress that can affect the welfare of dairy cows and, consequently, their productive and reproductive performances which impact on the economic and environmental sustainability of the dairy chain.

New techniques can improve environment, welfare and conditions of dairy cows and, consequently, enhance reproduction and production. At the same time, lacks in literature highlight the need to push forward researches on real-time data monitoring, acquisition and processing. Effective tools to cope with these challenges have been provided by Precision Livestock Farming (PLF), which is nowadays increasingly applied and makes it possible to control quali-quantitative parameters related to production, health, behaviour, real-time locomotion of each animal of the herd. ICT are increasingly adopted in every aspect of livestock farming, thus switching the analysis framework from data-poor to data-rich situation.

The research key challenge is therefore to turn those data into knowledge that allows providing real-time support in farming optimization.

This research focuses on dairy cattle farming and specifically on different systems to collect, process and derive useful information from data on animal welfare and productivity (i.e. activity, oestrus detection, drinking behaviour, milk production, etc.). A multi-disciplinary approach involving biosystems engineering, animal husbandry, genetics, data science and deep learning has been adopted with the aim to generate a **decision support system** to help farmers achieving the optimal performances of the farming systems.

Keywords: sustainability; animal housing; numerical modelling; efficient animal production; Precision Livestock Farming