UNIVERSITY OF LIFE SCIENCES
"KING MIHAI I" FROM Timisoara
Multidisciplinary Conference on Sustainable Development
30-31 May 2024

Digital Transformation in Small and Medium Dairy Farms to Improve Productivity and Resilience

Andra-Sabina Neculai-Valeanu[1], Adina-Mirela Ariton[1], Ioana Porosnicu[1,2], Catalina Sanduleanu[1,3], Gabriela Amaritii[3], Ciprian Radu[1]

[1]Research and Development Station for Cattle Breeding Dancu, 707252, Iași, Iasi-Ungheni no. 9, Romania
[2]University of Life Sciences, Faculty of Veterinary Medicine, Iasi, 700489, Iași, Aleea Mihail Sadoveanu 8, Romania
[3]University of Life Sciences, Faculty of Food and Animal Science, 700489, Iași, Aleea Mihail Sadoveanu 8, Romania

Abstract

Small and medium-sized dairy farms (SMDFs) face increasing pressure to improve productivity, efficiency, and resilience in a competitive global market. Digital transformation offers a powerful set of tools to address these challenges. Sensor-based monitoring of animal health and milking performance can provide real-time insights for informed decision-making. Additionally, the paper explores how automation in tasks like feeding, milking, and manure management can optimize resource allocation and reduce labour requirements. Furthermore, the integration of data analytics empowers farmers to identify trends, optimize feed rations, and predict potential issues, ultimately improving herd health and milk production. This integrated approach fosters not only productivity and efficiency gains but also strengthens farm resilience. By enabling proactive management practices and data-driven decision making, SMDFs can better adapt to fluctuations in market prices, resource availability, and environmental conditions.

Keywords: *digital transformation; small and medium-sized dairy farms; animal health and milking performance; farm resilience*

Introduction

The dairy farming industry is undergoing significant changes driven by technological advancements and evolving market demands. Small and medium-sized dairy farms (SMDFs) are particularly vulnerable to these changes due to their limited resources compared to large-scale operations. Digital transformation, encompassing a wide range of technologies such as sensors, automation, and data analytics, provides an opportunity for these farms to enhance their productivity, efficiency, and resilience. This paper explores how these technologies can be integrated into SMDFs to address their unique challenges and leverage opportunities for growth and sustainability.

Digital transformation in small and medium dairy farms

Sensor-based monitoring

- **Animal health**: Sensors can be used to monitor body temperature, respiration rate, activity levels, and milk yield. This data can be used to early detect signs of illness and take preventive measures [3].
- **Milking performance:** Sensors can be used to track milk yield, flow rate, and milking duration. This data can be used to identify cows with potential milking problems and optimize milking machine settings.
- **Environmental conditions**: Sensors can be used to monitor temperature, humidity, and air quality. This data can be used to create a more comfortable environment for cows, which can improve herd health and milk production [4].

Automation

- **Feeding:** Automated feeding systems can deliver on an individual or group basis, saving labour costs and ensuring the correct amount of feed.
- **Milking:** Robotic milking systems can milk cows automatically, freeing up labour for other tasks and improving the convenience and flexibility of milking schedules.
- **Manure management:** Automated manure removal systems may improve herd health by reducing exposure to pathogens.

Data analytics

- **Identify trends:** Data analytics can be used to identify trends in animal health, milking performance, and environmental conditions. This information can be used to predict potential problems and take preventive measures.
- **Optimize feed rations:** Data on milk yield, cow weight, and activity levels can be used to create customized feed rations that meet the individual needs of each cow. This can improve herd health and milk production.
- **Predict potential issues:** Data analytics can be used to identify cows that are at risk of developing health problems. This information can be used to take early action to prevent the problem from developing.

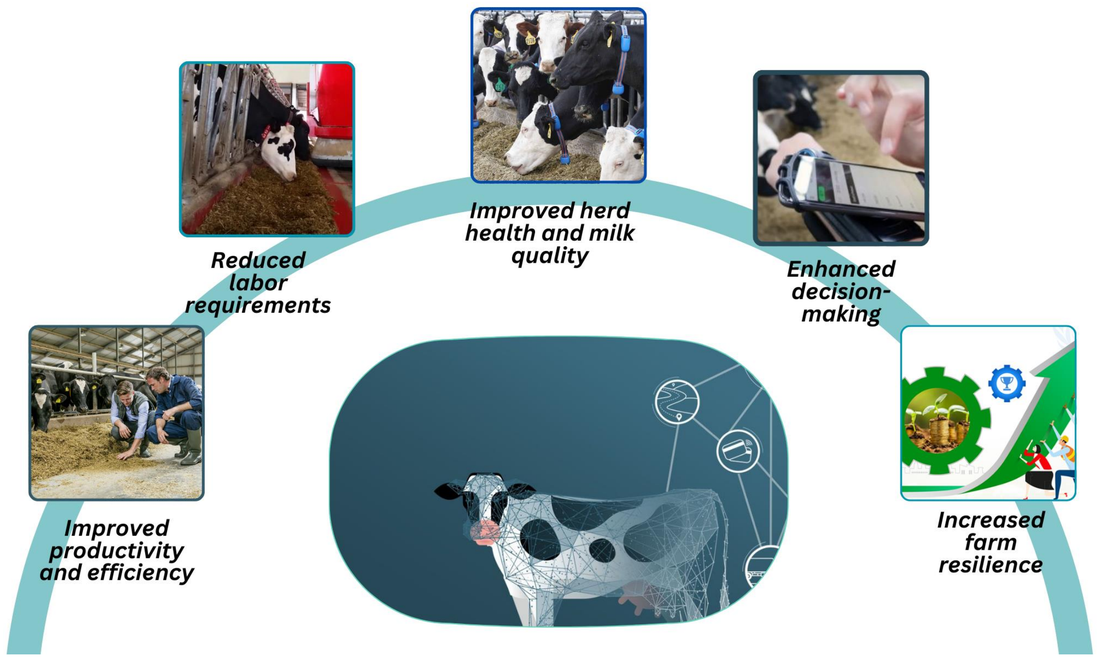

Figure 1. Benefits of digital transformation

Conclusions

✓ Digital transformation is a powerful tool that can help SMDFs improve productivity, efficiency, and resilience. By adopting sensor-based monitoring, automation, and data analytics, SMDFs can gain valuable insights into the operation of their farm and make more informed decisions. This can lead to significant improvements in animal health, milk yield, and overall farm profitability.

Selective References

1. Neethirajan S. (2023). Artificial Intelligence and Sensor Technologies in Dairy Livestock Export: Charting a Digital Transformation. Sensors (Basel, Switzerland), 23(16), 7045. https://doi.org/10.3390/s23167045
2. Bianchi, M. C., Bava, L., Sandrucci, A., Tangorra, F. M., Tamburini, A., Gislon, G., & Zucali, M. (2022). Diffusion of precision livestock farming technologies in dairy cattle farms. Animal : an international journal of animal bioscience, 16(11), 100650. https://doi.org/10.1016/j.animal.2022.100650
3. Tse, C., Barkema, H. W., DeVries, T. J., Rushen, J., & Pajor, E. A. (2018). Impact of automatic milking systems on dairy cattle producers' reports of milking labour management, milk production and milk quality. *Animal : an international journal of animal bioscience*, *12*(12), 2649–2656.

Acknowledgments

This work was supported by The Academy of Romanian Scientists, grant Young Scientists 2024-2025