

Role of Technology in Sustainable Dairying

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Sustainable dairying involves producing milk and dairy products in a way that minimizes negative environmental, social, and economic impacts while ensuring the long-term viability and welfare of dairy animals. Sustainable dairying is a multifaceted approach that addresses environmental concerns, animal welfare, and consumer preferences for ethically produced dairy products. The dairy industry plays a vital role in meeting the global demand for dairy products while facing increasing pressure to operate in a sustainable and environmentally responsible manner. As the world grapples with the challenges of climate change, resource scarcity, and animal welfare concerns, the adoption of technology has emerged as a powerful tool to drive sustainability in dairy farming.

Technology has revolutionized the way dairy farms are managed, offering innovative solutions to improve efficiency, reduce environmental impact, and enhance animal welfare. From precision agriculture to data analytics, automation, nutrient management, and animal monitoring, a wide range of technological advancements are being leveraged to promote sustainability in the dairy industry.

This article is trying to explore the role of technology in sustainable dairying, highlighting the key ways in which technological innovations are reshaping the way dairy farms operate. By harnessing the power of technology, dairy farmers can optimize their operations, minimize waste, and improve the overall sustainability of their businesses. Through a combination of cutting-edge tools and data-driven insights, technology is paving the way for a more sustainable future for the dairy industry.

Technologies play a crucial role in promoting sustainability in the dairy industry by offering a range of benefits that help improve efficiency, reduce environmental impact, and enhance animal welfare. Some of the key ways in which technologies are beneficial in sustainable dairying include:

Precision Agriculture: Precision agriculture technologies, such as GPS-guided tractors, drones, and sensors, enable farmers to optimize crop production, reduce input use, and minimize environmental impact. By using precise data on soil health, moisture levels, and nutrient requirements, dairy farmers can make informed decisions to improve yields while minimizing resource use.

Data Analytics: Data analytics tools allow farmers to collect, analyze, and interpret vast amounts of data from various sources, such as sensors, cameras, and farm management systems. By leveraging data analytics, farmers can gain valuable insights into their operations, identify trends, and make data-driven decisions to optimize efficiency and sustainability.

Automation: Automation technologies, such as robotic milkers, automated feeding systems, and smart sensors, help streamline farm operations and reduce labor requirements. By automating routine tasks, farmers can improve productivity, reduce waste, and enhance animal welfare by providing consistent care and monitoring.

Nutrient Management: Technologies for nutrient management, such as manure digesters, composting systems, and precision application equipment, help farmers manage waste more effectively and minimize environmental pollution. By recycling nutrients and using them as fertilizers, farmers can reduce their reliance on synthetic inputs and improve soil health.

Animal Monitoring: Technologies for animal monitoring, such as wearable sensors, RFID tags, and cameras, enable farmers to track the health, behaviour, and productivity of their livestock in real-time. By monitoring individual animals and identifying potential issues early on, farmers can provide targeted care, improve welfare, and optimize production efficiency.

Energy Efficiency: Technologies for energy efficiency, such as solar panels, LED lighting, and energy-efficient equipment, help farmers reduce their energy

consumption and carbon footprint. By adopting renewable energy sources and implementing energy-saving practices, dairy farms can lower their operating costs and contribute to a more sustainable energy system.

The Role of Technology in Sustainable Dairying

Technology plays a pivotal role in advancing sustainable practices within the dairy industry, enabling farmers to optimize production efficiency while reducing environmental impact. Here are key insights from the provided search results:

Data-Driven Technologies

Sensor-based technologies are revolutionizing dairy farming by optimizing feed quality, enhancing milk yield, and improving overall farm efficiency. These innovations allow farmers to make informed decisions based on real-time data, leading to more sustainable practices. Some examples of sensor-based technologies:

Near Infrared (NIR) Sensor Technology: NIR sensors on harvesting equipment predict feed quality by automatically taking samples, providing insights into feedstock quality and optimizing animal nutrition.

Animal Care Technologies: Technologies like pedometers and "Fitbits for animals" monitor animal bodyweight, health, comfort, eating habits, and rumination to maximize production efficiency and ensure animal well-being.

Rumination Sensors: Sensors located inside the rumen monitor rumination activity vital for cow production. Companies like Smart bow offer acid monitors to detect digestive issues like ruminal acidosis, enhancing cow health management.

Heat Detection Sensors: Various companies provide sensors to detect heat cycles in cows, aiding in determining the best time for insemination. These sensors monitor cow responsiveness to a teaser bull, helping optimize breeding practices.

Calving Sensors: Wearable sensors like Moocall Calving sensor attach to a cow's tail to monitor contractions and alert farmers before active calving, improving calving management and efficiency.

In-line Milk Sensor: Technologies like Soma Detect offer in-line sensors that measure milk components

like fat, protein, somatic cell counts, progesterone, and antibiotics at every milking, ensuring milk quality control.

Environmental Benefits

Modern dairy technologies have significantly reduced the environmental footprint of milk production. Advancements in genetics, farm management practices, and animal care have led to a substantial decrease in greenhouse gas emissions, land use, water consumption, and feed usage while increasing milk yield.

Some examples of genetic advancement, animal care, and management technologies used in sustainable dairying:

Genomic Selection: Genomic selection involves analyzing an animal's DNA to predict its genetic potential, enabling breeders to identify animals with desirable traits at a young age for faster genetic progress.

Gene Editing: Gene editing allows precise modification of an animal's DNA to introduce specific genetic changes, offering the potential to introduce desired traits more efficiently while being highly regulated and conducted ethically.

Cow Health Trackers: Technologies like cow health trackers monitor animal bodyweight, health, comfort, eating habits, and rumination to maximize production efficiency and ensure animal well-being.

Motion-Activated Cow Brushes: These brushes enhance cow comfort and welfare by providing cows with the opportunity for grooming and relaxation, contributing to overall animal well-being.

Cow Pedometers: Pedometers monitor cow activity levels, aiding in assessing overall health and well-being. This technology helps farmers track cow movement patterns for early detection of health issues.

Dairy 4.0 Technologies

The adoption of Industry 4.0 technologies like robotics, Artificial Intelligence (AI), Internet of Things (IoT), Big Data, and blockchain is transforming the dairy sector from farm to table. These technologies are driving automation, optimization, and profound changes in milk and dairy product production processes.

Some examples of robotics, artificial intelligence, Internet of Things (IoT), and blockchain-based technologies used in sustainable dairy farming include:

Robotics: Mobile robots equipped with sensors are deployed to study the behaviour and eating patterns of dairy cattle precisely, aiding in monitoring environmental conditions and analysing feeding data for improved management.

Robotic Milking Equipment: Generates data to monitor lactation cycles, allowing farmers to adjust feed rations for improved productivity and sustainability. This technology also enhances animal welfare by providing valuable data.

Artificial Intelligence: AI is utilized in dairy farming for tasks like identifying 'shy feeders' through RFID tag data analysis, monitoring feeding behaviours in real-time to detect abnormal patterns, and automating weight collection through sensor-based walk-over-weighing systems for accurate weight tracking.

Internet of Things (IoT): IoT technologies are employed in dairy farming for various applications such as monitoring animal health, tracking animal locations, and ensuring real-time milk quality monitoring and supply chain management through embedded devices and blockchain implementation.

Blockchain: Blockchain technology is utilized in the milk supply chain for dairy cattle to enable real-time tracking, ensuring accurate milk quality and quantity monitoring to prevent supply chain losses and enhance traceability in the dairy industry.

Overall, technologies offer dairy farmers valuable tools to enhance sustainability by improving efficiency, reducing waste, and promoting responsible stewardship of resources. By embracing technological

innovations, dairy farms can achieve long-term sustainability goals while meeting the growing demand for dairy products in a responsible manner. These advanced technologies play a crucial role in enhancing efficiency, improving animal welfare, and ensuring sustainable practices in dairy farming.

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