

## Data- Driven Decision- Making in livestock Management

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### Introduction

Rise in population and income development is resulting in the rise of the demand for a wider variety of foods globally. Human nutrition studies have revealed that people are moving towards more affluent food consumption habits (Wiedmann et al., 2020). Livestock management is one area that will gain a lot from this growth. This shift in demand from foods of plant origin to livestock products like meat, eggs, and milk, combined with the ever-growing population, must be addressed without causing any further load on environmental or exhausting the diminishing the global resources. In addition to this, agriculture's age old and conventional methods are also undergoing exceptional changes in this era of technical developments. Introducing the world of data-driven decision-making, a typical example of mankind seeking efficiency, that is transforming how farmers and ranchers manage their animal populations, ensuring both increased productivity and the welfare of the animals in their care. The livestock industries are showing keen interest in examining how data-driven decision making may be used to increase productivity (Koketsu and Iida, 2020). Decisions of the progressive farmers in the field of agriculture no longer only rely on common practises and intuition now a days, thanks to technology for the tools available to farmers today which enable them to collect, process, and interpret a wealth of data coming from every aspect of their livestock operations. A significant amount of real-time data is gathered by sensors designed to keep tabs on animal health, environmental factors, and feeding patterns which when analyzed, reveals intricate insights that have the potential to completely reshape the farming industry. This article will try to enlighten that how by utilizing the power of data we can promote a new era of accuracy and well-informed decisions in the business. When decisions are made on livestock farms utilizing data-driven decision making, they are based on predictions created using the data gathered on the farm and across the supply chain. Data analytics

and machine learning (ML) approaches are being used to make accurate forecasts and support decision-making. According to Neethirajan (2020), ML models are now being used to forecast a variety of factors relevant to decision-making, such as sales and feed performance. The ability to predict the problems and opportunities to correct them beforehand has never been more real. From improving feed formulas to spotting illness early symptoms this data-driven revolution is a symbol of a change towards ethical and ecological farming, where animal welfare is supported by facts rather than presumptions. The potential benefits come with challenges, as with every revolutionary innovation.

In order to maintain a competitive edge in the agriculture industry as a whole and the, data collection and analytics are becoming increasingly important. For ML models to function properly, structured data must be available and easily accessible (Lee and Shin, 2020). In order to put better data analytics into practice, it is crucial to look into the full data analytics pipeline (Pääkkönen and Pakkala, 2015). However, as a flaw of this technology for the application of this into current agricultural workflows one needs to pay more attention to data security, and privacy issues as the computerized system can be hacked or manipulated.

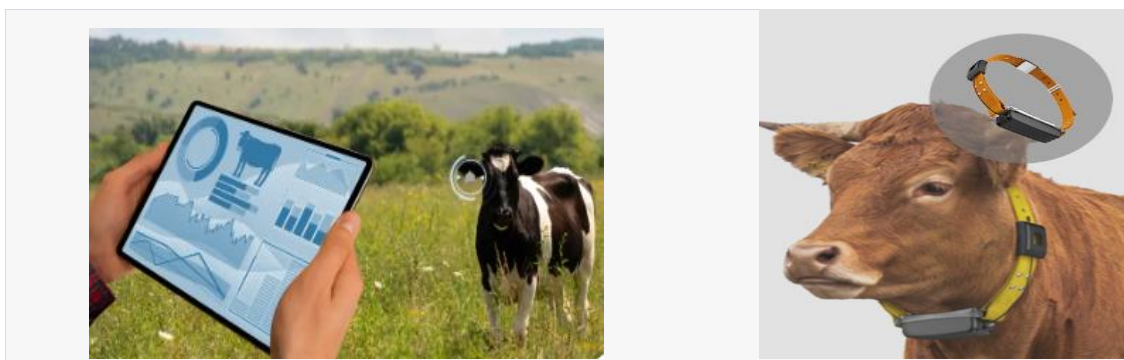
### **Collecting and gathering livestock data**

Livestock data collection includes a wide range of information, such as animal health records, eating patterns, environmental variables, and reproductive data. The progress in Overall technological aspect has favored the emergence of IoT and Cloud paradigms, resulting in the emergence of various technology-related concepts such as Precision Agriculture (measures and responds to the variability of agricultural data gathered by sensors), Smart Farming (applies information and data technologies to perform a more comprehensive analysis of the farming system, taking into account location, historical, real-time data, and other factors) (Wolfert et al., 2017) and IoT (the process of linking several heterogeneous things, such as machinery, cars, or buildings, with electronic devices, such as sensors and actuators, over various communication protocols in order to capture and retrieve data). Smart collars, temperature sensors, and RFID tags are examples of IoT devices that provide real-time monitoring of important parameters, allowing farmers to precisely observe animal behaviours and detect early signs of illness. These technologies generate a continual stream of data that aids in making timely, educated decisions.

Radio Frequency Identification (RFID) tags provide a technique for tracking and identifying individual animals. When RFID tags are attached to each animal, they allow for more precise tracking of movement patterns, behaviors, and health statuses. Gas sensors to measure potentially dangerous levels of gases in the air inside barns. GPS and geolocation sensors are very useful for livestock that are free to roam in open grazing systems. Farmers may track the locations and movements of their livestock with these gadgets. Sensors are also used to track several elements of livestock behavior and



physiology like hygrometer and air thermometers etc used in the barns. By capturing movements and behavioral patterns, activity monitors provide insights into animal health and reproduction cycles. Health monitors with sensors for heart rate, respiration rate, and body temperature have the advantage of detecting health issues early, allowing for prompt interventions and limiting illness spread among the herd. The integration of data collected by these sensors and gadgets goes beyond simply observation and into action. Information is delivered to centralized platforms for analysis and transformation into meaningful insights via data transmission and analytics. This technique enables farmers to make informed real-time decisions, leading in better resource allocation, optimised feeding strategies, and faster remedies for animal health issues.



(a) Radio Frequency Identification (RFID) tags in cattle

(b) GPS cattle Tracker

### Benefits of Data-Driven Decisions in Livestock Management

The incorporation of data-driven decision-making in livestock management has ushered in a new era of accuracy and efficiency in agricultural practices in recent years. Farmers and livestock managers may optimize resources, increase animal health and wellbeing, and improve farm sustainability by leveraging the power of data analytics and technology.

1. **Capital Optimization:** Farmers may modify feeding schedules and adjust diets to fulfil the individual demands of each animal by analyzing past data. In (2018) Dunn and associates discovered that data-driven feeding techniques resulted in a 15% reduction in feed expenditures and a 10% increase in overall cattle output.
2. **Prediction of Market Demand:** Farmers can change their production plans to meet shifting demands by analyzing past data on customer preferences and market trends. This eliminates overproduction and food waste while assuring a consistent supply of high-quality products.
3. **Environmental Sustainability:** Farmers may construct more efficient housing conditions that reduce energy consumption and the environmental imprint of livestock operations by analyzing data on environmental elements such as temperature, humidity, and air quality.
4. **Preventive Health Care:** Data analytics aid in the early detection of health disorders and the execution of timely interventions in proactive health management. Smith et al. (2020), for



example, revealed that real-time monitoring of dairy cow behavior using IoT devices resulted in a 25% reduction in veterinary expenditures due to early disease diagnosis

5. Improved Reproduction Methods: According to the findings of Garca-Ruiz et al. (2019), combining genetic data into breeding decisions resulted in a 12% increase in milk yield and a 9% improvement in reproductive rates in dairy cows. Farmers can use genetic data analysis to select animals with superior qualities for breeding, resulting in healthier progeny and enhanced herd genetics.



(c) Monitoring of Livestock Health

### Challenges and Considerations

The incorporation of data-driven decisions in livestock management has various benefits, but it also introduces new obstacles and issues that must be addressed to ensure successful implementation and ethical practice. These difficulties transcend technical, ethical, and practical dimensions, need careful consideration and strategic planning. Compliance with data protection standards is critical for retaining consumer and stakeholder trust. Farmers and livestock management must take strong cybersecurity precautions to avoid data breaches and unauthorized access. Along with this, Poor data quality, whether caused by sensor failure or human mistake, can also lead to inaccurate conclusions and actions so to maintain the accuracy of obtained data it is critical to create data validation methods and perform frequent maintenance. Furthermore, in the challenges of these technology one can add the implementation cost of these sensors and devices which only the high earning farmers can afford, also the poor farmers lack knowledge and skills to implement these technologies. Adopting data-driven decisions necessitates a strong technology foundation not all farmers, particularly in rural areas, may have access to advanced technology or dependable internet connectivity. To promote equal adoption of these practices, it is critical to bridge the digital gap. At last farmers and stakeholders can reap the benefits of data-driven decisions while guaranteeing ethical, efficient, and sustainable livestock management practices by identifying these issues and taking a strategic approach.

## Conclusion

Globalization has facilitated agricultural trading worldwide. Adoption of data-driven decisions in livestock management stands out as a beacon of progress and potential in the shifting landscape of modern agriculture. Farmers and stockbreeders must upstage themselves by offering high-quality products, information about the origin of the product, and the processes it has gone through in the value chain till it reaches the retail site. To that purpose, the agri-food business must adopt technology like the Internet of Things and other smart agricultural technologies that provide monitoring and traceability. However, in the midst of these exciting developments, it is critical to recognize the problems and concerns that come with the adoption of data-driven decisions. A comprehensive approach is required to ensure data security and privacy, as well as to bridge technological divisions and address ethical problems. Collaboration among stakeholders, including farmers, researchers, and technology specialists, is critical in overcoming these obstacles and achieving a seamless integration of data and agriculture. Finally, the future holds enormous promise for data-driven decisions in cattle management. It is a road towards greater efficiency, animal welfare, and environmental sustainability. We go on a transforming journey as we embrace this trip with a spirit of innovation, accountability, and teamwork.

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