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From the Pen of Chief Editor

Opportunities and Challenges in Dairy Farming

India's dairy sector stands at a defining crossroads. As the world's largest milk producer, the country has built a strong foundation through cooperative movements, farmer participation and policy support. However, the future of dairy farming will depend on how effectively opportunities are leveraged while addressing persistent and emerging challenges.

One of the biggest opportunities in dairy farming lies in value addition. Moving beyond liquid milk to products such as paneer, cheese, yoghurt, butter, ghee and protein-based nutrition offers farmers higher margins and income stability. With rising urban demand, changing consumer preferences and increased focus on health and nutrition, the scope for branded and specialty dairy products is expanding rapidly. Government initiatives such as White Revolution 2.0, infrastructure funds and support for mini dairies further strengthen this growth potential.

Technology adoption is another major opportunity. Advances in breeding, feed management, animal health monitoring, milking automation and cold-chain logistics can significantly improve productivity and reduce losses. Digital platforms are also enabling better market access, transparency in pricing and efficient cooperative management. When combined with skill development and training, technology can transform dairy farming from a subsistence activity into a modern agri-enterprise.

However, these opportunities come with substantial challenges. Rising input costs, particularly for feed, fodder and energy, continue to squeeze farmer margins. Climate change has intensified heat stress, water scarcity and disease risks, directly impacting animal health and milk yield. Small and marginal farmers, who form the backbone of the sector, often struggle to invest in modern infrastructure and technologies due to limited access to credit and knowledge.

Another critical challenge is awareness and capacity building. Many farmers remain unfamiliar with best practices in animal nutrition, breeding, biosecurity and value addition. Extension services, training programmes and effective communication from cooperatives and institutions must be strengthened to bridge this gap. At the same time, improving milk quality, ensuring food safety and meeting export standards require consistent adherence to scientific management and standard operating procedures.

For India's dairy sector to remain resilient and competitive, a balanced approach is essential. Policy support, cooperative leadership, private-sector participation and farmer education must work together to create a sustainable ecosystem. By addressing challenges with innovation and collaboration, dairy farming can continue to be a powerful engine of rural prosperity and nutritional security for the nation.

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ARTICLE

Commercialization of Patented Veterinary Technology

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Introduction

The veterinary sector is undergoing rapid transformation driven by advances in biotechnology, pharmaceuticals, diagnostics, medical devices, and digital health solutions. However, the true value of these innovations is realized only when they are successfully translated from laboratories to field-level application. The commercialization of patented veterinary technology therefore represents a critical bridge between scientific discovery and practical animal health management, contributing to livestock productivity, food security, and public health within the broader One Health framework (Gibbs, 2014; Thornton, 2010).

Scope of Patented Veterinary Technologies

Patented veterinary technologies encompass a broad range of innovations, including vaccines, diagnostic kits, therapeutic drugs, biologics, feed additives, reproductive technologies, biosensors, and precision livestock farming tools. Patent protection grants inventors exclusive rights, thereby incentivizing sustained investment in research and development by mitigating the risks associated with innovation. In the veterinary domain, where product development requires extensive validation and regulatory approval, intellectual property protection is particularly crucial for attracting industrial partners and financial investment (WIPO, 2020; OECD, 2013).

Pathways for Commercialization

The commercialization process typically begins with invention disclosure and patent filing, followed by technology evaluation, valuation, and identification of appropriate transfer mechanisms. Universities and public research institutions increasingly rely on technology transfer offices to manage intellectual property portfolios and facilitate industry engagement (Ribeiro&McLean, 2020). Common commercialization pathways include exclusive or non-exclusive licensing, formation of start-up or spin-off companies, collaborative research agreements, and public–private partnerships. The choice of pathway depends on market size, regulatory complexity, manufacturing feasibility, and end-user accessibility.

Role of Industry, Start-Ups, and Public Institutions

Private pharmaceutical and biotechnology companies play a pivotal role in scaling patented veterinary technologies owing to their expertise in large-scale manufacturing, quality assurance, regulatory compliance, and distribution networks. Concurrently, start-ups and academic spin-offs are emerging as significant drivers of innovation, particularly in niche domains such as rapid diagnostics, digital veterinary platforms, and precision animal health technologies

(Ribeiro&McLean, 2020). Public research institutions contribute by generating foundational innovations and facilitating their dissemination through structured commercialization frameworks.

Regulatory and Market Considerations

Regulatory approval is a central determinant of successful commercialization. Veterinary vaccines, drugs, and biologicals must undergo rigorous preclinical and clinical evaluation to ensure safety, efficacy, and quality. While these regulatory safeguards are essential, they often impose substantial financial and temporal burdens, especially on small enterprises and academic innovators (WIPO, 2020). Market adoption further depends on affordability, user-friendliness, farmer awareness, and demonstrated cost– benefit advantages under field conditions (FAO, 2011).

Benefits of Commercialization

Effective commercialization accelerates the availability of innovative veterinary products for disease prevention, diagnosis, and treatment, thereby reducing morbidity, mortality, and economic losses in livestock production systems. It also promotes entrepreneurship, strengthens academia– industry linkages, and contributes to employment generation. From a broaderperspective, improved animal health supports food safety, zoonotic disease control, and sustainable agricultural development (FAO, 2015; Gibbs, 2014).

Ethical and Accessibility Considerations

Despite its advantages, patent-driven commercialization raises concerns regarding affordability and equitable access, particularly for smallholder farmers in developing regions. Balancing intellectual property protection with public interest remains a critical challenge. Approaches such as non-exclusive licensing, differential pricing, and public-sector dissemination programs can enhance accessibility while preserving incentives for innovation (OECD, 2013; FAO, 2015).

Future Perspectives

The future success of patented veterinary technology commercialization will depend on the development of robust innovation ecosystems integrating researchers, industry, regulators, and end users. Strengthening technology transfer mechanisms, streamlining regulatory pathways, and aligning intellectual property policies with sustainability and One Health objectives will be essential for maximizing societal impact (WIPO, 2020; Gibbs, 2014).

Conclusion

Commercialization of patented veterinary technology is a vital process that transforms scientific innovation into practical solutions for animal health and livestock production. By effectively bridging innovation and application, commercialization enhances productivity, supports sustainable agriculture, and contributes to global food and health security. Strategic collaboration, responsible intellectual property management, and inclusive commercialization models will determine the long-term success of veterinary innovations.

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From Grass to Milk: Ruminant Bio-conversion of Forage into Nutritional Food

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Abstract

Biodiversity forms the biological foundation of veterinary science, influencing livestock improvement, disease resistance, wildlife health, and the sustainability of rural animal-based livelihoods. In India, the conservation and governance of biological resources are coordinated under the Biological Diversity Act, 2002, through the National Biodiversity Authority (NBA). This article explores the significance of the NBA in shaping policies and practices relevant to veterinary science. It highlights NBA's regulatory role in the access and use of genetic resources, its support for indigenous livestock breeds, the conservation of wildlife, the protection of ethnoveterinary knowledge, and the enforcement of Access and Benefit Sharing (ABS) mechanisms. Emphasis is also placed on the growing relevance of biodiversity governance in combating emerging infectious diseases, preventing biopiracy, and promoting sustainable veterinary research. The article concludes that the synergy between biodiversity management and veterinary science is crucial for national food security, One Health initiatives, and future scientific innovation.

Introduction

The remarkable ability of ruminant animals to transform indigestible plant materials into high-quality milk and meat represents one of nature's most efficient biological processes. Dairy animals like cows, buffaloes, goats, and sheep possess a unique digestive system that converts cellulose-rich forages materials humans cannot digest into nutrient-dense foods that nourish billions worldwide. Understanding this bio-conversion process is crucial for optimizing livestock productivity, ensuring food security, and promoting sustainable agriculture in India.

The Ruminant Digestive System: A Biological Marvel

Unlike monogastric animals, ruminants possess a complex four-chambered stomach consisting of the rumen, reticulum, omasum, and abomasum. The rumen, the largest compartment, functions as a massive fermentation vat hosting trillions of microorganisms including bacteria, protozoa, and fungi. This microbial ecosystem is the key to unlocking nutrients from fibrous plant materials (Bergman, 1990).

When a cow consumes grass or fodder, the feed first enters the rumen where it undergoes mechanical breakdown through rumination the characteristic "chewing of cud." During this process, the animal regurgitates partially digested feed, re-chews it to reduce particle size, and swallows it again. This increases the surface area available for microbial attack and enhances digestibility (Van Soest, 1994).

Microbial Fermentation: The Heart of Bio-conversion

The rumen microbiome performs several critical functions in forage bio-conversion:

Cellulose and Hemicellulose Degradation: Rumen bacteria

produce cellulolytic enzymes that break down plant cell walls, releasing simple sugars. These complex carbohydrates, which comprise 40-60% of forage dry matter, are completely indigestible by mammalian enzymes but are efficiently degraded by specialized rumen bacteria such as Ruminococcus and Fibrobacter species (Krause et al., 2003).

Volatile Fatty Acid Production: The fermentation of carbohydrates produces volatile fatty acids (VFAs) primarily acetate, propionate and butyrate. These VFAs are absorbed across the rumen wall and provide 60-80% of the animal's energy requirements. Acetate serves as a precursor for milk fat synthesis, while propionate is converted to glucose in the liver, supporting lactose production and overall metabolism (Bergman, 1990).

Microbial Protein Synthesis: Rumen microbes utilize both dietary protein and non-protein nitrogen sources (like urea) to synthesize microbial protein. When these microbes flow to the lower digestive tract, they are digested and absorbed, providing high-quality amino acids to the animal. This process allows ruminants to utilize low-quality nitrogen sources efficiently, a feature particularly valuable in resource-limited settings (Firkins et al., 2007).

Vitamin Synthesis: Rumen microorganisms synthesize B-complex vitamins and vitamin K, making ruminants largely independent of dietary sources for these essential nutrients (McDowell, 2000).

From Nutrients to Milk: The Mammary Synthesis

Once nutrients are absorbed from the digestive tract, they are transported via blood to the mammary gland, where milk synthesis occurs. The mammary gland is a metabolically active organ that processes enormous quantities of blood approximately 400-500 liters must pass through the udder to produce one liter of milk (Bequette et al., 1998).

Milk Fat Synthesis: Acetate and butyrate from rumen fermentation, along with long-chain fatty acids from dietary fats, are utilized by mammary cells to synthesize milk fat. The unique composition of milk fat, including short and medium-chain fatty acids, is directly influenced by rumen fermentation patterns (Bauman and Griinari, 2003).

Lactose Production: Glucose, derived primarily from propionate via gluconeogenesis, serves as the substrate for lactose synthesis. Lactose is the major carbohydrate in milk and plays a crucial role in regulating milk volume due to its osmotic properties (Rigout et al., 2003).

Milk Protein Formation: Amino acids absorbed from microbial and dietary proteins are assembled into milk proteins, primarily caseins and whey proteins. These proteins provide essential amino acids crucial for human nutrition, particularly for growing children (Madureira et al., 2007).

Factors Affecting Bio-conversion Efficiency

Several factors influence the efficiency of forage-to-milk conversion:

Forage Quality: The digestibility, protein content, and stage of maturity of forages significantly impact milk production. Young, leafy forages with lower fiber and higher protein content support greater milk yields compared to mature, stemmy forages. Legumes like berseem and lucerne provide superior nutrition compared to mature grasses (Van Soest, 1994).

Feed Balance: Providing a balanced ration that meets energy, protein, mineral, and vitamin requirements optimizes microbial fermentation and milk synthesis. Deficiencies in any nutrient can become a limiting factor for production (NRC, 2001).

Rumen Health: Maintaining optimal rumen pH (6.0-7.0) and microbial populations is essential. Rapid fermentation of concentrates can cause acidosis, disrupt microbial populations and reducing fiber digestion. Adequate effective fiber in the diet stimulates rumination and saliva production, which buffers rumen pH (Krause and Oetzel, 2006).

Genetic Potential: The animal's genetic makeup determines its maximum productive capacity. High-yiel ding breeds like Holstein-Friesian or Murrah buffaloes, when provided optimal nutrition, demonstrate superior bio-conversion efficiency compared to lower-producing breeds (Hayes, et al.2009).

Animal Health and Comfort: Diseases, heat stress, and poor management reduce feed intake and metabolic efficiency, thereby limiting bio-conversion. Maintaining animal comfort through adequate ventilation, shade, and clean housing enhances productivity (West, 2003).

Nutritional Value of Milk: The Final Product

The bio-conversion process culminates in milk, a nutritionally complete food containing proteins, fats, carbohydrates, vitamins, and minerals in balanced proportions. Milk provides:

- High-quality proteins with all essential amino acids required for human growth and development
- Easily digestible fats including beneficial fatty acids
- Calcium and phosphorus in ideal

ratios for bone health
- Vitamins A, D, B12, and riboflavin
- Bioactive compounds with potential health benefits

Indian dairy animals, despite often consuming lower-quality forages compared to their Western counterparts, produce milk with good nutritional quality, though quantities may be lower. Buffalo milk, popular in India, contains higher fat and protein percentages than cow milk, making it especially valuable for dairy products (Kala and Prakash, 2006).

Enhancing Bio-conversion in Indian Context

Indian livestock production faces unique challenges including limited land for fodder cultivation, seasonal forage availability, and predominantly small-holder farming systems. Strategies to enhance bio-conversion efficiency include:

Improved Forage Management: Cultivating high-yielding fodder crops like hybrid napier, maize, and improved varieties of berseem and lucerne. Adopting fodder preservation techniques such as silage-making and hay preparation ensures year-round quality feed availability (Singh and Meena, 2012).

Supplementation Strategies: Strategic supplementation with protein meals, mineral mixtures, and bypass nutrients can overcome deficiencies in basal forage diets, enhancing both microbial fermentation and animal productivity (Ranjhan, 2001).

Feed Processing: Treating low-quality crop residues with urea, enzymes, or alkalis improves their digestibility and nutritive value. Chopping and crushing feeds increases intake and reduces wastage (Wanapat, 2009).

Rumen Modulation: Utilizing feed additives like probiotics, yeast cultures, and organic acids can optimize rumen fermentation, improve fiber digestion, and enhance feed conversion efficiency (Chaucheyras-Durand and Durand, 2010).

Genetic Improvement: Crossbreeding indigenous breeds with high-producing exotic breeds, combined with selection for production traits, gradually improves the genetic potential of the national herd (Bhat et al., 2016).

Environmental Considerations

While ruminants efficiently convert indigestible biomass to food, they also produce methane, a potent greenhouse gas, through enteric fermentation. Improving feed quality, optimizing rations, and incorporating feed additives can reduce methane emissions per unit of milk produced. Sustainable intensification producing more milk from fewer animals reduces the environmental footprint of dairy production (Gerber et al., 2013).

Conclusion

The bio-conversion of forage to milk by ruminants represents a sophisticated biological process involving complex interactions between the animal, its gut microbiome, and feed resources. Understanding and optimizing this process is fundamental to enhancing livestock productivity and ensuring nutritional security. For Indian dairy farmers, focusing on forage quality, balanced nutrition, and animal health can significantly improve the efficiency of this remarkable transformation, ultimately contributing to rural livelihoods and national food security.

By appreciating the intricate journey from grass to milk, we recognize the true value of our dairy animals and the importance of providing them with optimal care and nutrition to maximize their productive potential.

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Convention on Biological Diversity: Benefits for Livestock Genetic Resources

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Introduction

The Convention on Biological Diversity (CBD) is an international agreement established in 1992 during the Earth Summit in Rio de Janeiro. It aims to conserve biological diversity, ensure sustainable use of its components, and promote fair and equitable sharing of benefits arising from genetic resources. For livestock genetic resources, this convention holds significant importance, especially in maintaining the diversity of animal breeds that are vital for food security, rural livelihoods, and ecosystem resilience.

1. **Conservation of Livestock Genetic Diversity**

   Under the CBD, nations are encouraged to identify, monitor, and conserve livestock breeds that are locally adapted and threatened by extinction. This helps maintain genetic traits like disease resistance, climatic adaptability, and productivity-critical for facing future agricultural challenges.

2. **Access and Benefit-Sharing (ABS) Mechanism**

   The CBD's Nagoya Protocol provides a framework for fair sharing of benefits derived from genetic materials. This ensures that local farmers and pastoral communities, who are custodians of unique livestock breeds, gain recognition and benefits from the use of their genetic resources or traditional knowledge.

3. **Sustainable Utilization of Animal Genetic Resources**

   The CBD promotes the sustainable use of animal genetic resources by balancing livestock production with conservation goals. By integrating indigenous breeds into modern breeding programs, countries can reduce dependence on a narrow range of high-yielding breeds and enhance long-term sustainability.

4. **Support for Research and Development**

   The convention promotes international cooperation and funding for research on conservation, genetic characterization, and breeding of livestock. This benefits post-graduate students and scientists by creating opportunities for academic exchange, research grants, and capacity building in genetic resource management.

5. **Policy and Institutional Frameworks**

   Countries implementing CBD guidelines develop national biodiversity strategies that include livestock genetic resources. This leads to the establishment of gene banks, breed registries, and conservation farms, ensuring that genetic diversity remains available for future generations.

Conclusion

The Convention on Biological Diversity has transformed the global approach to livestock genetic resources by emphasizing conservation, sustainability, and equitable benefit-sharing.

Opportunities and Challenges in The Global Dairy Industry

An Evidence-Based Assessment for a Rapidly Changing Sector

By

Prof. Dr. ARM Ziaul Hasan

Senior Consultant – Industrial Dairy Production & Livestock Systems

Introduction: dairy under pressure, not in decline

The global dairy industry is often portrayed as an industry in crisis—environmentally unsustainable, nutritionally outdated, and economically fragile. This narrative is partially driven by legitimate concerns, partially by ideological opposition, and largely by poor communication from within the dairy sector itself. The reality is more complex and less dramatic: dairy is not collapsing; inefficient dairy systems are being exposed.

Milk and dairy products remain among the most nutrient-dense and cost-efficient animal-source foods available to humans. According to FAO and OECD projections, global demand for dairy will continue to rise over the next decade, driven primarily by population growth, urbanization, and income expansion in Asia and Africa (FAO, 2023; OECD-FAO, 2024). However, this growth will not benefit all producers equally. Structural inefficiencies, climate stress, volatile input costs, labor shortages, and increasing environmental scrutiny are reshaping the competitive landscape.

This article critically examines the key opportunities and challenges facing the global dairy industry, with a focus on practical implications for producers, processors, and policymakers. The objective is not to defend dairy emotionally, but to assess where dairy systems must evolve to remain economically viable and socially acceptable.

The global dairy landscape: growth with divergence

Global milk production now exceeds 930 million metric tons annually, with India, the European Union, the United States, Pakistan, China, and Brazil accounting for more than 60% of total output (FAOSTAT, 2023). While total production continues to increase, growth patterns differ sharply across regions.

In high-income regions such as Western Europe and North America, per capita consumption of fluid milk is stagnating or declining slightly, while demand for cheese, fermented dairy, and specialty products continues to grow. In contrast, low- and middle-income regions—particularly South Asia, Southeast Asia, and Sub-Saharan Africa—are experiencing steady growth in overall dairy consumption, albeit from a lower baseline.

This divergence creates a strategic challenge: a single dairy production and marketing model cannot serve all markets effectively. Mature markets reward differentiation, traceability, and sustainability credentials, while emerging markets prioritize affordability, shelf stability, and basic nutrition.

Major opportunities in the dairy industry

1. **Rising Demand for High-Quality Protein**

Global demand for dietary protein is increasing due to population growth, aging demographics, and greater awareness of nutrition and health. Despite the rapid expansion of plant-based protein products, animal-source proteins—particularly dairy—continue to play a critical role in meeting essential amino acid requirements (Phillips & Van Loon, 2011).

Dairy proteins offer:

- High biological value
- Complete amino acid profiles
- Superior digestibility compared to most plant proteins

FAO assessments consistently show that milk provides essential nutrients at a lower cost per unit of quality protein than many alternatives, particularly in developing regions (FAO, 2021).

Opportunity:

Improving protein yield per cow through genetics, nutrition, and health management allows producers to meet protein demand without proportionally increasing herd size or environmental footprint.

2. **Value Addition: Escaping the Raw Milk Commodity Trap**

Raw milk production offers limited margins and high exposure to price volatility. Long-term profitability increasingly depends on value-added processing, not volume expansion.

High-growth dairy segments include:

- Cheese (natural, specialty, and region-specific varieties)
- Yogurt and fermented dairy products
- Whey protein concentrates and isolates
- Lactose-free and A2 milk
- Functional and fortified dairy products

OECD-FAO projections indicate that cheese and fresh dairy products will account for the majority of dairy consumption growth in high-income markets over the next decade (OECD-FAO, 2024).

Reality check:

Producers and cooperatives that fail to integrate or align with processing and branding strategies will remain price-takers, regardless of production efficiency.

3. **Precision Dairy Farming and Digitalization**

Precision Dairy Farming (PDF) technologies—such as automated milking systems, activity monitors, rumination sensors, and decision-support software—are transforming dairy management. These tools enable early disease detection, optimized feeding, improved reproductive performance, and more efficient labor use (Banhazi et al., 2012).

Evidence from commercial operations shows that PDF

adoption can:

- Reduce health-related losses
- Improve feed conversion efficiency
- Lower labor requirements per liter of milk
- Enhance animal welfare outcomes

Key point:

Technology alone does not improve performance. Benefits depend on management capacity, data interpretation, and staff training. Farms that collect data without acting on it gain nothing.

4. Genetic Improvement and Reproductive Technologies

Advances in genomic selection, sexed semen, embryo transfer, and crossbreeding have accelerated genetic progress in dairy cattle. Modern breeding programs increasingly emphasize lifetime productivity, fertility, disease resistance, and feed efficiency, rather than peak milk yield alone (Pryce et al., 2014).

Genetic improvement contributes to:

- Lower replacement rates
- Improved reproductive efficiency
- Reduced greenhouse gas emissions per unit of milk
- Greater resilience to environmental stress

Hard truth:

Poor genetics impose hidden costs that accumulate silently over years. Feed costs are visible; genetic inefficiency is not—until profitability collapses.

5. Climate-Smart and Low-Emission Dairy Systems

The dairy sector faces increasing pressure to reduce greenhouse gas emissions, particularly methane. At the same time, research shows significant potential for emission reduction through improved management and technology (Gerber et al., 2013).

Effective mitigation strategies include:

- Improved feed quality and digestibility
- Methane-reducing feed additives
- Manure management and biogas production
- Improved herd health and longevity
- Integrated crop–livestock systems

Opportunity:

Emission intensity (emissions per liter of milk) often declines as productivity improves. Climate-smart dairy is therefore compatible with economic efficiency, not opposed to it.

6. Expanding Dairy Markets in Asia and Africa

Asia and Africa will account for the majority of future growth in dairy demand. However, productivity per animal remains low in many regions due to poor genetics, inadequate feeding, limited veterinary services, and weak infrastructure.

Opportunities exist in:

- Smallholder aggregation and cooperative models
- Cold chain and milk collection infrastructure
- Shelf-stable products such as UHT milk and milk powder
- Locally adapted breeding and feeding strategies

Critical point:

Importing Western production models without adaptation has repeatedly failed. Development strategies must align with local resources, climate, and socio-economic conditions.

Major challenges facing the dairy industry

1. Feed Cost Volatility and Resource Constraints

Feed represents 60–70% of total milk production costs in most systems. Volatility in grain and oilseed markets, climate-induced forage shortages, and dependence on imported feed ingredients expose producers to significant financial risk (IFCN, 2023).

Key issues include:

- Inadequate forage planning
- Poor silage quality
- Overreliance on concentrates
- Limited use of alternative feed resources

Reality:

Feed efficiency, not milk price, is the primary determinant of long-term profitability.

2. Climate Stress and Heat Load

Heat stress is a major but often underestimated constraint on dairy productivity. Elevated temperature-humidity index (THI) levels reduce feed intake, milk yield, fertility, and immune function (West, 2003).

Losses due to heat stress can exceed 15–30% of annual production in tropical and subtropical regions.

Mitigation requires:

- Climate-appropriate housing design
- Ventilation and cooling systems
- Nutritional adjustments
- Genetic selection for heat tolerance

Temporary fixes are ineffective. Heat stress management must be integrated into farm design.

3. Animal Health, Welfare, and Biosecurity

Despite advances in veterinary science, preventable diseases such as mastitis, lameness, and metabolic disorders remain widespread. Poor transition cow management alone accounts for substantial economic losses globally (Drackley, 1999).

Common failures include:

- Late disease detection
- Inadequate hygiene and housing
- Overuse or misuse of antibiotics
- Weak biosecurity protocols

Blunt assessment:

Most dairy health problems persist due to management failures, not lack of knowledge.

4. Labor Availability and Skills Gap

The dairy sector increasingly depends on skilled labor capable of managing complex systems. However, labor shortages and high turnover rates are common in many regions.

Challenges include:

- Declining interest in farm work
- Insufficient training
- Resistance to technological change
- Poor human resource management

Automation can reduce labor dependency, but it cannot compensate for poor management or lack of accountability.

5. Environmental and Social Scrutiny

Public concern over greenhouse gas emissions, water use, land degradation, and animal welfare is intensifying. Some criticism is exaggerated; some is justified.

The industry's credibility suffers when:

- Data transparency is lacking
- Environmental impacts are denied rather than addressed
- Welfare concerns are dismissed instead of measured

Fact:

Social license to operate is becoming as important as production efficiency.

6. Policy Uncertainty and Market Distortion

Subsidies, trade restrictions, price controls, and inconsistent regulations distort dairy markets and discourage long-term investment. Short-term political decisions often undermine structural competitiveness.

Stable, science-based policy frameworks are essential for sustainable dairy development.

Plant-Based Alternatives: Context, Not Panic

Plant-based beverages have

gained market share in some urban markets, but their nutritional profile differs substantially from milk. Most contain lower protein levels and rely heavily on processing and additives (Chalupa-Krebzdak et al., 2018).

The real risk to dairy is not substitution, but consumer confusion driven by misleading comparisons.

Dairy's failure lies in communication, not nutrition.

Conclusion: A Selective Future for Dairy

The global dairy industry is not approaching extinction. It is entering a phase of selective survival. Systems that prioritize efficiency, animal health, environmental performance, and market alignment will remain competitive. Those that rely on tradition, volume expansion, and external protection will not.

Dairy does not need emotional defense—it needs discipline, data, and decisiveness.

The future belongs to smart dairy systems, not nostalgic ones.

Personal Thought to Share

After decades of working across dairy systems—smallholder farms, commercial operations, and industrial-scale enterprises in different regions—I have reached a simple but uncomfortable conclusion: the dairy industry does not fail because of cows, climate, or consumers; it fails because of management decisions.

Too many producers blame milk prices while ignoring feed efficiency. They blame climate change while refusing to redesign housing. They blame labor shortages while failing to train or respect workers. And they blame public perception while avoiding transparency. These are not external threats—they are internal weaknesses.

I have seen low-resource farms outperform capital-intensive operations purely through discipline, data-driven decision-making, and respect for animal biology. I have also seen technologically advanced farms collapse because management chased volume instead of efficiency, tradition instead of evidence, and excuses instead of solutions.

Dairy has a future—but not an unconditional one. The industry will reward those who measure honestly, adapt quickly, and manage professionally. Those who expect protection from markets, policy, or nostalgia are not victims of change; they are casualties of resistance.

The cow is not the problem.
The system is not the problem.
The refusal to evolve is the problem.

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Patent Law and Its Impact on Veterinary Pharmaceuticals

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Abstract

Patent law significantly influences the development, availability, and cost of veterinary pharmaceuticals. Because the animal health market is smaller and less profitable than the human pharmaceutical sector, strong patent protection is essential for encouraging companies to invest in new drugs, vaccines, and biologics. These protections have driven major advancements in antiparasitic treatments, vaccines, and emerging therapies modelled on human medicine. However, the same exclusivity that promotes innovation can also limit access by keeping prices high and delaying the introduction of generic and biosimilar alternatives. Global impacts vary widely: wealthier nations often enjoy access to cutting-edge treatments, while developing countries may struggle to obtain affordable medicines for livestock and companion animals. Challenges such as antimicrobial resistance further highlight the need for balanced policies. As veterinary technology evolves, aligning patent incentives with broader goals of affordability, public health, and sustainable agriculture will be crucial to improving animal health worldwide.

Introduction

When people think about pharmaceuticals, they usually think about medicines for humans—life-saving antibiotics, vaccines, cancer treatments, and more. But behind the scenes lies an equally important branch of the pharmaceutical world: veterinary medicine. From household pets and service animals to livestock that support global food systems, veterinary pharmaceuticals play a massive role in public health, food safety, and animal welfare. Yet few outside the industry recognize the heavy influence that patent law—the legal framework governing intellectual property—has on which drugs get developed, how quickly they reach veterinarians, and what they cost. Health professionals must ensure their patients receive timely medical care while also working to enhance their overall well-being. In this setting, the pharmacist plays a key role by applying their expertise to ensure medications and related therapies are used safely and effectively. This practice is known as pharmaceutical care (Valente et al.,2020).

Patent law determines who controls a product, how long they can sell it without competition, and how much incentive companies have to invest in new treatments. The Indian pharmaceutical industry capitalized on the "process patent regime," rapidly expanding its market share by supplying affordable generic versions of medications to developing and emerging countries In human healthcare, this topic receives widespread attention. In veterinary medicine, however, the conversation is quieter but no less important. Animals depend on innovation to treat emerging diseases, antibiotic-resistant infections, and complex chronic conditions. Farmers and pet owners, in turn, rely on access to affordable treatments.

The interplay between protecting innovation and ensuring accessibility sits at the heart of the debate.

The Economics of Animal Medicine

Developing a new drug is expensive—often costing hundreds of millions of dollars. For veterinary pharmaceuticals, the challenge is even more pronounced. Unlike the human market, which includes billions of potential customers, the veterinary market is dramatically smaller. Even globally, animal health sales represent only a fraction of the human pharmaceutical market. Several studies have shown that patents are far more critical for pharmaceutical companies in capturing the returns from innovation than they are for most other high-tech industries

(Grabowski et al., 2002).

This creates a dilemma:

- High development cost
- Smaller potential market
- Lower expected profits

Without strong patent protection, companies face a significant financial risk. Why invest in new veterinary vaccines, anti-parasitic drugs, or cancer therapies if a competitor can immediately copy the formula?

This is where patent law becomes a critical driver. Patents grant companies exclusive rights for 20 years (or slightly more with extensions), allowing them a temporary monopoly to recoup research investments. For many veterinary pharmaceutical firms, this period of exclusivity determines whether a project moves forward (Noonan et al.,2023).

But the story doesn't end there.

Innovation vs. Access: A Delicate Balance

Patents Boost Innovation—But Also Prices

The upside of patent protection is clear: stronger incentives lead to more research. Over the past few decades, patent-driven investment has ushered in:

- Safer and more precise antiparasitic treatments
- New vaccines for diseases like canine influenza and porcine circovirus
- Innovative dermatological treatments for dogs and cats
- Advanced hormonal and reproductive technologies for livestock
- Biologic therapies modeled after human medicine

Without patents, many of these medical breakthroughs might not exist.

However, the downside is equally clear: patented veterinary drugs are more expensive. Exclusivity means competition is limited or non-existent, allowing higher pricing for a period of time. For pet owners, this can translate into costly prescriptions. For farmers, especially those raising cattle, poultry, or swine, high drug prices influence the cost of food production and overall farm viability.

The Role of Generic Veterinary Drugs

Just as generics revolutionized human medicine, generic veterinary pharmaceuticals can dramatically lower prices and expand access. But generics can only enter the market once patent protection expires.

Here's the catch:

- Many veterinary drugs are modifications of human drugs
- Companies sometimes file secondary patents (on formulations, dosing methods, or delivery mechanisms)
- These can extend exclusivity and delay generic entry

This practice is legal, but critics argue it can hold back affordable veterinary care.

When "Off-Label" Use Fills the Gap

Veterinarians often use human pharmaceuticals off-label when no veterinary-specific product exists or the patented option is too expensive. While legal in many jurisdictions (under controlled circumstances), it raises concerns:

- Dosing animals correctly is complex
- Drug residues in milk, eggs, and meat must be tightly regulated
- Animal physiology differs significantly across species

Off-label use highlights a gap in the market—one that better-aligned patent incentives could help fill.

Global Differences and Emerging Challenges

Developed vs. Developing Nations

Patent systems vary worldwide, and the disparity affects both research and access:

- High-income countries often enjoy advanced veterinary treatments but face higher prices due to strong patent enforcement.
- Developing countries may struggle to access patented treatments at all, particularly for livestock diseases that impact food security.

Some nations allow compulsory licensing during emergencies, enabling generic production even while patents stand. But this mechanism is rarely used in veterinary contexts, despite outbreaks of animal diseases that can devastate economies (Faltus et al., 2016).

Antimicrobial Resistance (AMR): A Growing Concern

Antibiotics are among the most important veterinary medicines, but they intersect with public health in a unique way. Overuse in animals can contribute to antimicrobial resistance—a threat to both humans and animals.

Patent law plays two roles here:

1. It promotes the development of new antibiotics, which is crucial because resistance is rising.
2. It can also make patented antibiotics more expensive, pushing some farmers toward older, cheaper drugs that may exacerbate resistance.

Balancing innovation with responsible, affordable access remains a global policy challenge.

Biologics: The New Frontier

The future of veterinary pharmaceuticals lies in:

- Monoclonal antibodies
- Gene therapies
- Personalized cancer treatments
- Vaccines using mRNA or viral-vector platforms

These cutting-edge therapies rely heavily on patent protection due to their high development costs. But once these patents expire, competition from biosimilars (the biologic equivalents of generics) could drive major cost reductions.

How regulators handle biologic patents will shape the next generation of veterinary treatments.

Looking Ahead: Can Patent Law Evolve for Better Animal Health?

Experts suggest several reforms that might strike a better balance between innovation and accessibility:

1. Targeted Patent Extensions for High-Need Areas

   Diseases that lack effective treatments—such as emerging livestock viruses or rare companion-animal conditions—could trigger additional patent incentives.

2. Encouraging "One Health" Collaboration

   Because animal diseases affect human health, aligning veterinary and human pharmaceutical development may lead to shared benefits. Streamlined pathways for dual-use drugs could lower costs and improve outcomes.

3. Faster Approval Pathways for Generics and Biosimilars

   Improving regulatory efficiency would help affordable options reach the market sooner—without undermining legitimate patent rights.

4. Support for Innovation in Developing Nations

   Grants, partnerships, and cooperative patent pools could help lower-income countries access lifesaving veterinary medicines while still rewarding innovators.

Conclusion: A System at a Crossroads

Patent law may seem abstract—full of legal language and technical definitions—but its effects on veterinary pharmaceuticals are deeply tangible. It influences:

- Which new medicines reach the market
- How quickly innovation happens
- How much treatments cost
- Whether farmers can protect their livestock
- Whether pets receive cutting-edge therapies
- How we address global threats like antimicrobial resistance

At its best, patent law fuels breakthroughs that save animal lives and safeguard global food supplies. At its worst, it can limit access to essential treatments and widen disparities between countries.

As veterinary science advances and animals play an ever-greater role in society, finding the right balance between innovation and accessibility becomes increasingly critical. The future of animal health—and indirectly, human health—depends on getting this balance right.

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Patents on Genetically Modified Animal Breeds -Ethical and Legal Considerations

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Introduction

The introduction of genetically modified (GM) animals for food and biomedical experimentation and the claims of intellectual property rights (IPRs) on products, brands, and processes that involve these animals are indistinguishable. The analysis of philosophically IPRs employed as a legal instrument to protect the control of animal-related innovations and the creation of novel genetic material in animals. It focuses on what kind of moral relation to animals is being formed if patents and other forms of exclusive control are granted for animals used in food production and for their genetic material and how the conclusive human-animal relationship has been criticized. It also explores the open-source approach in animal genetic modification. This article argues that even if animal-related innovations were not granted patent protection, for example on the basis of morality exclusion, there are other forms of ownership that offer just as powerful control as patents over the maintenance of animal life and the direction of its evolution. These forms include the ownership of animals as things, or as tangible property, and trademarks. Together this enables the in-depth self-regulation of business in the development and maintenance of animal breeds and allow other less desirable breeds to disappear. Are patents then as morally acceptable as the ownership of animals as things? The answer to this question depends on what the production of patentable information involves, in particular, what kind of treatment of animals it allows and what kind of sentient beings it brings into existence.

A brief history of patents

The first modern patent act is often thought of as The US Patent Act of 1790. There was similar legislation in France in 1791. Patents related to living matter are relatively newer. One of the earliest patents for living matter was granted to Pasteur for a yeast strain but this was done under the belief that it was an inanimate object and not living (Lesser, 2002). The first specialized patent law applied to living organisms was that of the Plant Protection Act of 1930 in the US and provided what is commonly referred to as Plant Breeders Rights (PBR) to propagate new varieties by asexual methods. In 1961, a similar law was passed in France called the UPOV . Protection in the US was expanded in 1970 with the Plant Variety Protection Act to include sexually reproduced plants. The UPOV was revised in Europe in 1991. Under these laws two principles, “breeder's rights” which allows breeders to use protected varieties without permission of the owner and “farmer's privilege” which allows farmers to collect seeds from their crops and use them, were developed (Lesser, 2002). For years many seed companies have attempted to halt this latter practice by asking farmers to sign contracts prohibiting it.

Animal breeding and genetics – ip protection

The broad area of biotechnology encompasses many of the patent

applications in our field and the US Supreme Court has established guidelines that apply to this technology (Nebel et al., 2002). The Court made it clear in Brenner v. Manson that patent utility implied usefulness and not just "any invention not positively harmful to society." The Court expressed reservations regarding a monopoly on compounds with unknown functions, and that utility must extend beyond proving that the product is a result of scientific research (Nebel et al., 2002). Technologies in the field of animal breeding that may require (or qualify for) IP protection include, but are not limited to: statistical methods for genetic improvement, DNA markers for genetic improvement, transgenic and cloned animals and methods to produce them, new methods to measure traits, methods to identify animals, computer software and other written materials. As previously described, manuscripts, web pages and software can be copyrighted. Other forms of technology can be protected using trade secrets or by patenting.

Ethical, social and economic issues

Many ethical and social issues have been raised related to patenting of animals and genes (Bent, 1989; Brody, 1989; Dresser, 1988; Evans, 2002). These include:

1) Patenting of animals or genes will be destructive to nature and allows man to play "God"
2) Patenting will devalue animal life and hence human life
3) Patenting will increase animal suffering
4) Patenting will lead to a decline in genetic diversity of animals and threaten species
5) Patenting speeds the trend toward commercialization of academic research
6) Patenting will undermine conventional farming and lead to increased industrial farming systems.

Early humans domesticated animals and master breeders and geneticists have transformed them into productive species. Was this playing "God" or interfering with nature? The use of transgenics for making specialized animal lines for disease research is certainly adapting nature but does it devalue life and is it unethical or immoral? These are value judgements that most in society have decided are acceptable (Brody, 1989). Individuals who believe that animals have "rights" will likely be opposed to patenting any invention derived from animal research. The most commonly cited examples are those relating to transgenic animals (i.e., early transgenic pigs) in which some animals had health problems. Production and patenting of specialized lines of rodents for biomedical research that have a tendency to develop specific diseases is also considered unethical by animal rights activists (Brody, 1989). If, however, individuals believe that animal rights are subordinate to those of humans, but that they deserve proper care and welfare then the issue of patenting is much less of a concern. It has been suggested that through the use of gene markers and highly selective breeding, or through the use of transgenics and cloning, that genetic diversity will be greatly minimised. Obviously these methods have the potential to remove within-line variation but they are likely to increase between-line variability. However, it may be argued that the patent system in fact encourages diversity as it promotes and helps establish, via patent-related deposits of biological materials, a broader genetic diversity (Bent, 1989).

Patenting and industrialisation

Economic and governmental issues certainly play a role in the size of the average farm and the level of commercialization of farming. It can be argued that if large companies have exclusive licensing arrangements for genetic tools then small breeders will be at loss. Market pressures related to size of operation and efficiency of production are much larger influences on the industrialization of farming and livestock production than patenting. Other issues regarding patenting that have an economic basis can be discussed. While inventors would prefer broader claims, limited claims encourage competition and further innovation. Licensing of patents exclusively to one company may benefit that company and segments of the public . Langinier and Moschini (2002) concluded "that continued efforts are required to improve the workings of the patent system" to improve the economic performance of the system.

Conclusion

These discoveries and their uses represent the intellectual property of individuals and teams. Rightly said, "The only wealth there is in the world is the wealth that comes from the human mind." Animal breeders have begun to patent their IP and this has raised economic, legal and ethical concerns that might affect the support of public education and research. Patents do not block the spread of knowledge but instead can aid technology transfer. Inventions move more quickly into the market place but certain production sectors may be disadvantaged. While the public is concerned about the safety of products and access to them, it must be assured that patenting will continue to promote progress and not prevent it. Patent applications must not be frivolous and the real costs of patenting must be reasonable. A reasonable percentage of profits from patenting must be reinvested into research to promote future discovery.

Protecting Biodiversity: A Vital Initiative in Animal Husbandry

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Introduction

Biodiversity, encompassing genetic, species, and ecosystem diversity, forms the cornerstone of sustainable agricultural and livestock production systems. Within animal husbandry, the conservation of biodiversity—particularly livestock genetic resources—is increasingly recognized as essential for ensuring food security, ecological balance, climate resilience, and the long-term viability of rural livelihoods (FAO, 2007; FAO, 2019).

Significance of Biodiversity in Animal Husbandry

Livestock biodiversity provides the biological foundation upon which animal agriculture depends. Indigenous and locally adapted breeds of cattle, buffalo, sheep, goats, poultry, camels, and pigs possess unique genetic traits that confer tolerance to heat stress, resistance to endemic diseases, efficient utilization of poor-quality feed resources, and adaptability to diverse agro-climatic conditions. These attributes are particularly valuable in low-input production systems and under the growing pressures of climate variability (Hoffmann, 2013).

Despite their ecological and economic importance, livestock genetic resources are rapidly eroding. Replacement of native breeds with a narrow range of high-yielding commercial germplasm, indiscriminate crossbreeding, habitat degradation, and intensification of livestock production have significantly reduced genetic diversity worldwide (FAO, 2015). This genetic erosion increases vulnerability to disease outbreaks and environmental shocks, thereby threatening the sustainability of animal husbandry systems (Thornton, 2010).

Biodiversity Protection Initiatives in Animal Husbandry

1. **Conservation of Indigenous Livestock Breeds**

   Conservation of native breeds constitutes a central strategy for biodiversity protection in animal husbandry. In situ conservation focuses on maintaining breeds within their traditional production environments, preserving both genetic traits and associated socio-cultural practices. Complementarily, ex situ conservation through cryopreservation of semen, embryos, and DNA in gene banks provides long-term security against genetic loss

(FAO, 2007; FAO, 2015). In India, systematic breed characterization and registration by national agencies have strengthened conservation efforts (NBAGR, 2023).

2. **Sustainable Breeding and Genetic Improvement**

   Contemporary livestock development programs increasingly emphasize selective breeding within indigenous populations rather than indiscriminate crossbreeding. Such approaches enhance productivity while safeguarding adaptive traits critical for environmental resilience and disease resistance (Hoffmann, 2013).

3. **Integrated and Biodiversity-Friendly Farming Systems**

   Integrated livestock production systems that combine crops, animals, fisheries, and agroforestry promote on-farm biodiversity and ecosystem stability. These systems facilitate nutrient recycling, reduce environmental pollution, and enhance ecosystem services, thereby contributing to sustainable animal husbandry (FAO, 2019).

4. **Community Participation and Traditional Knowledge**

   Pastoralists and smallholder farmers are primary custodians of livestock biodiversity. Community-based conservation programs recognize and integrate indigenous knowledge related to breed selection, grazing management, and ethno-veterinary practices, ensuring conservation strategies remain socially acceptable and economically viable (FAO, 2015).

5. **Policy Support and Global Commitments**

   National livestock policies and international frameworks increasingly acknowledge the role of animal genetic resources in sustainable development. Global initiatives under the Convention on Biological Diversity emphasize the conservation and sustainable use of agricultural biodiversity, including livestock species, as a key component of ecosystem resilience (CBD, 2010).

Livestock Biodiversity and Climate Change Adaptation

Livestock biodiversity plays a pivotal role in climate-resilient agriculture. Locally adapted breeds demonstrate superior survival and productivity under extreme climatic conditions, including droughts, heat waves, and emerging disease challenges. Conserving such genetic diversity offers a biological insurance mechanism against climate uncertainty and supports adaptive livestock production systems (Thornton, 2010; Hoffmann, 2013).

Conclusion

Biodiversity protection in animal husbandry is not merely a conservation objective but a strategic imperative for sustainable agricultural development. The preservation of indigenous livestock breeds, adoption of sustainable breeding practices, community participation, and supportive policy frameworks are essential to maintain ecological balance, enhance resilience, and ensure long-term food and livelihood security. Protecting livestock biodiversity today is fundamental to safeguarding the future of animal agriculture.

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One Health Project - Strengthening the Fight Against AMR

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The discovery of various antibiotics throughout the 20th century has been pivotal in saving millions of lives from infectious diseases. However, the widespread and often inappropriate use of these drugs has exerted significant selection pressure on microbes, leading to the emergence and spread of antimicrobial resistance (AMR). Today, AMR poses a serious global public health threat, made even more challenging by its complex and multifactorial nature. This has underscored the need for integrated interventions grounded in the "One Health" approach, which emphasizes the interconnectedness of human, animal, and environmental health. Such a holistic strategy is essential for fully understanding the dynamics of AMR and implementing effective containment measures. This project started with the vision of nurture a sustainable future at the convergence of human health, animal health and the environment – embodying the One Health approach.

ADB-Zenex One Health Project

In April 2022, Zenex Animal Health (Zenex), in collaboration with Asian Development Bank (ADB) envisioned a three-year capacity building program for livestock farmers as well as veterinarians for creating AMR awareness. This project has been started with a goal to nurture a sustainable future at the convergence of human health, animal health and the environment – embodying the One Health approach and an expected outcome not only to improve antibiotic stewardship and minimize usage but to also improve biosecurity, productivity & health, and women participation in livestock farming. The project aimed to train a total of 2,300 livestock farmers as well as 580 veterinarians in India & SE countries - Nepal, Sri Lanka and Bangladesh to be trained under this project having the with the following objectives:

1. Appropriate use of antibiotics and effective alternatives to antibiotics.
2. Biosecurity and farm hygiene standards intended to promote better animal health and productivity.
3. Improved animal welfare standards and practices, over and above and with a more holistic approach than what is currently covered by the company's extension services.
4. Gender sensitization training.

Sathguru Management Consultants (SMC) has been appointed as the implementation partner of the project in March 2023. Several Indian veterinary universities along with three international universities (one each in Nepal, Bangladesh and Sri Lanka) were appointed for implementing this project, as per the blueprint indicative of geographic priority. Regional Leads for implementation and locations to gather participants to enable widespread dissemination of awareness.

Theory of Change

The theory of change proposed for the project by SMC envisions a ripple effect that extends far beyond improved antibiotic stewardship. At its core, the project aims to strengthen farm-level biosecurity, improve livestock health and productivity, and enable greater participation of women in the livestock economy—delivering benefits that span animal welfare, public health, and rural livelihoods. The ToC aligns training, curriculum, and implementation with measurable outcomes:

Table 1: Institutes/Organizations Involved for imparting trainings and target number of Farmers & Veterinarians

Country	University	Training Targets	
		Farmers	Vets
India	PV Narasimha Rao Telangana State Veterinary University (PVNRTVU), Telangana	450	100
	Anand Agricultural University (AAU), Gujarat	450	100
	Guru Angad Dev Veterinary & Animal Sciences University (GADVASU), Punjab	300	100
Sri Lanka	University of Peradeniya (UoP), Kandy, Sri Lanka	400	100
Bangladesh	Sher-e-Bangla Agricultural University (SAU), Dhaka, Bangladesh	350	90
Nepal	Agriculture and Forestry University (AFU), Bharatpur, Nepal	350	90

Table 2: Current Training Status of the project

Until July 2025, the Regional cumulatively conducted 40 trainings for farmers and veterinarians across the region and have achieved training the following number of participants.

Category of Training	Total No. of Trainings
Total Number of Training Programs Completed for Farmers and Veterinarians	40
Number of Livestock Farmers Trained	
a. India	577
b. Other Countries	915
Total Number of Farmers Trained	1,492
Total Number of Veterinarians Trained	332

Note: Out of 1,492 livestock farmers trained, 575 were female, representing 39% of the total and out of 332 veterinarians trained, 124 were female, accounting for 37% of the total.

reduced AMR risk through prudent antibiotic use and alternatives, improved farm hygiene and waste management, higher farmer productivity and profitability, and expanded opportunities for women in livestock farming. Early cohorts already report greater AMR awareness and confidence in biosecurity, signalling progress toward long-term goals. This integrated approach lays the foundation for sustainable livestock systems and healthier communities.

Training Curriculum and

Glimpses or Trainings Across Regions

Farmer's Training


Gujarat Farmer's Training in AAU


Telangana Farmer's Training in TSVU


Punjab Farmer's Training in GADVASU


Nepal Farmer's Training in AFU


Bangladesh Farmer's Training in SAU


Sri Lanka Farmer's Training in UoP

Veterinarian's Training

Gujarat Veterinarian's Training in AAU


Punjab Veterinarian's Training in GADVASU


Telangana Veterinarian's Training in TSVU


Nepal Veterinarian's Training in AFU


Bangladesh Veterinarian's Training in SAU


Sri Lanka Veterinarian's Training in UoP

Effectiveness Assessment

As a technical partner for the entire network, SMC has collaborated with the One Health Education, Advocacy, Research and Training (COHEART) at Kerala Veterinary and Animal Sciences University (KVASU) and developed the curriculum for both farmer and veterinarian trainings. The training curriculum has also been translated to multiple regional languages. The evaluation of each training is performed at the end to ascertain its effectiveness using similar evaluation sheets across all trainings.

The project is currently undergoing as per the scheduled program with minor deviations.

Key challenges identified during project execution:

Time constraint: Initially, the duration of the training was proposed to be 3 days. However, this duration of the training posed challenges across both farmers and veterinarians - farmers find it difficult to leave their animals for an extended period, and the Veterinarians require nomination from State AHD, which prefers shorter training sessions. Finally, the training duration reduced to 1-2 days.

Limited participation of women: In certain regions, especially Bangladesh, women's participation was limited due to a combination of social, cultural and structural barriers, thus making it difficult to achieve a female ratio in farmers' training. To mitigate the challenge, different strategies were adapted to ensure women participate in the trainings which include allowing 2 women from the families or allowing interested women to nominate another female participant from their social network to participate in the trainings. Currently Bangladesh has completed the trainings in the region and has achieved 38% & 18% of females' participation in farmers' and veterinarians' trainings, respectively.

Training delivery: Political instability in Bangladesh, in particular, severely hindered the planning and execution of training programs. With extreme support, swift and appropriate actions from the Bangladesh Regional Leads, trainings were held with lesser publicity to avoid attention in a university environment marred by protests and were organized at shorter notice to accommodate the overall uncertainty of protests.

Administrative hurdle: Due to change in leadership at the university levels and administrative constraints, the implementation of the project has faced certain delay initially in some regions, especially Punjab and Telangana, which was later brough back on the track.

Conclusion

Such collaborative project One Health is crucial for promoting responsible use of antibiotics in rural livestock and agricultural systems where scope of misuse is often high due to limited awareness. The project aims to raise awareness among veterinarians and livestock farmers about the threat of AMR and its impact on human and animal health. It also emphasizes the discouragement of self-medication and over-the-counter use of antibiotics. Further, the farmers are also encouraged to adopt adequate biosecurity measures and nutritional management to keep their herd heathy. Veterinarians, the primary prescribers of antibiotics for animals are also encouraged to ensure judicious antibiotic usage based on accurate diagnosis. They are also urged to engage in effective communication with the farmer to explain the risks associated with AMR.

Block Chain for Tracebility of Animal Products and IPR Protection

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Blockchain technology offers a **secure, transparent, and immutable** system for enhancing the traceability of animal products and protecting associated Intellectual Property Rights (IPR).

Blockchain provides a secure mechanism for managing and protecting IPR related to animal products (e.g., specific genetic lines, breeding techniques, unique processing methods, certifications).

Abstract

A global increase in food demand has increased the risk to food safety. Improvements in food quality, cold chain transit, and preservation are required for safest livestock products. Traceability-driven food supply chain management is likely to implement novel technologies like the Internet of Things (IoT). The capability of the Blockchain in era within the food sector is emerging with use cases across different regions, as shown via the growing number of studies. Credibility, efficiency, and safety are all improved when animal products can be instantly traced from their point of origin to the consumer. Blockchain assures a tamper-proof system that allows an innovative business solution, together with smart contracts. It necessitates more and more training platforms as well as trainers, who can make understanding this technology easy among ground-level participants and animal products entities.

Introduction to animal products

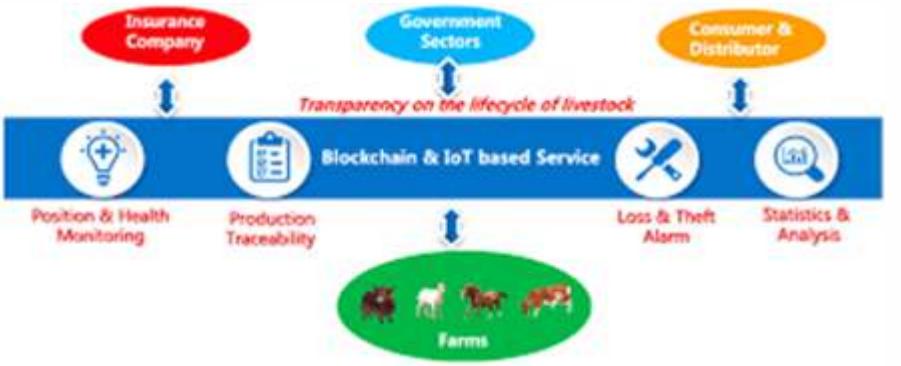
Animal product industrialization has grown speedily, which also leads to development in the scope of animal husbandry and breeding. The world's trade in animal products accounted for sixteen percent of the whole agri-food market. The value of animal products were traded internationally went from €56 billion in 2000 to €152 billion (in current currency) in 2018 . Animal products are becoming more and more popular, so large-scale livestock farming has more important. As seen over the previous decade, it is mandatory to produce adequate safe food. With the increase in the demand for animal products needed, the threat to food safety is growing and wants extra attention World Health Organization stated that the safety of food quality continuously poses new challenges for the food sector and science and millions of people suffer every year due to contaminated foods products. The manufacturing of quality products is the great features of food security, which dictate the research aimed at monitoring the existing quality regulations and standards, start from grass and fodder production, processing products, animal feeding, animal products manufacturing, transportation, and to the purchasing section. In industrialized countries, food safety is of major concern where consumers are more and more demanding superior quality animal products and safer foods . The animal products processing necessitates improvements in food quality and taste, cold chain transportation, and preservation. However, it is

complicated to manage the quality of animal products in the traditional supply food chain.

The food traceability system assembles, stores and transmits adequate history of animal products, from the rearing of livestock on a farm up to the final product for the consumer, at all stages inside the Food Supply Chain (FSC) in order to check the product for quality control as well as safety can be traced whenever required . Traceability is well thought-out as a new quality indicator in the food sector. Information storage and handling becomes mandatory in the animal food industry. Regulations are imposed by food authorities to allow monitoring and identification the raw materials and substances utilized in animal product preparation . Traditional technologies for record-keeping can offer some solutions to the above issues, but that can't solve all the issues. Therefore, it is strongly desired to introduce a new edge think and advanced technologies that create possibilities to solve product quality and supply chain problems.

Introduction to IPR system

The Internet of Things (IoT) technology is able to link computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identification (UIDs) and provides the ability to transfer data over a wide network without requiring human-to-human or human-to-computer interaction. These features encourage people to explore the combined application of IoT and Blockchain-based technology. In this paper, we propose a system of blockchain and IoT based intellectual property protection system, which can process three types of intellectual property: 1) Patents, Copyrights, Trademarks etc.; 2) Industrial design, Trade secrets etc.;



and 3) Plant variety rights, Geographical indications etc. Using blockchain network and IoT devices, the system can help us to establish a trusted, self-organized, open and ecological intellectual property protection system.

Tracebility of animal products

This technology provides a globally distributed database, controlled and shared by a collective, and is founded on a protocol resistant to human interference . The importance of this study lies in exploring the growing use of blockchain in the food supply chain (FSC). Additionally, alongside blockchain, there are other emerging technologies include artificial intelligence, big data analytics, RFIDs, NFC, IoTs, edge computing, cloud computing, among others, contributing to the technological growth supporting the FSC. This article aims to examine currently available blockchain-based animal products-supply-chain frameworks and determine potential gaps in current blockchain-based food-supply-chain frameworks. This should enable identifying opportunities that are available for improved blockchain-based frameworks.

Application of blockchain technology

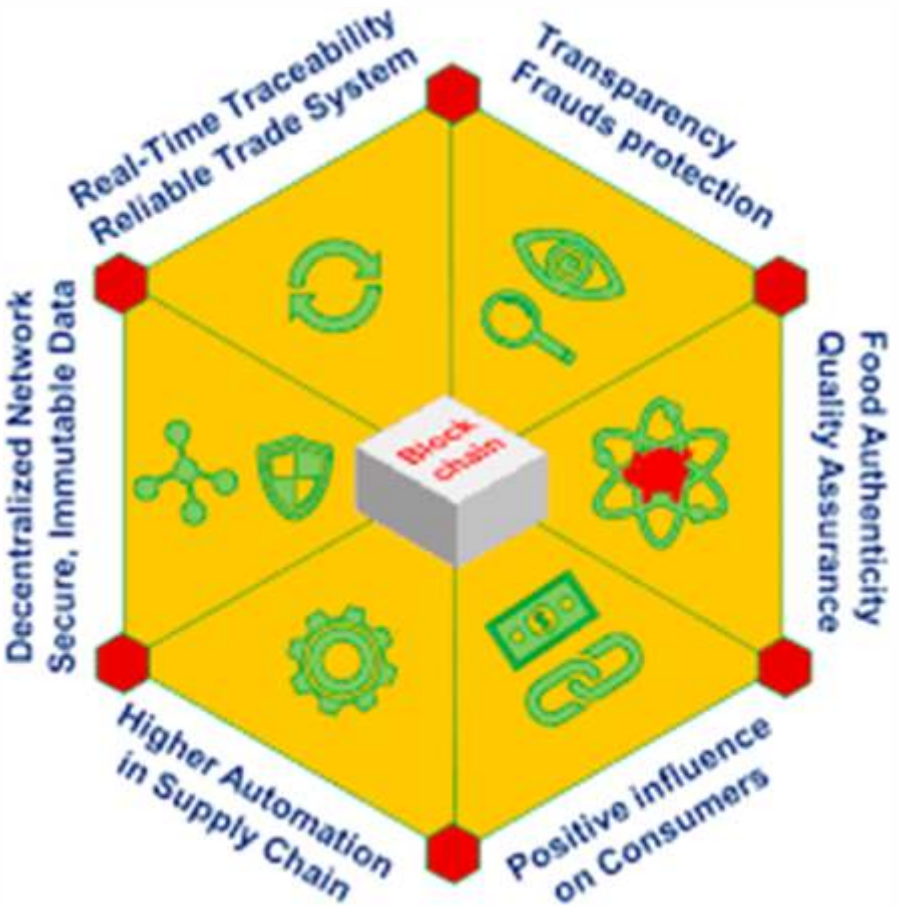
Since the inception of blockchain technology, it has increased interest in its application to various sectors because of building up trust among stakeholders. Globally, more attention is given to research in this area by various organizations and countries. The revolutionizing changes applied in this technology have increased its application in digital data authentication, controlling and storing organizational records, IPR and patent tracking and verification, record of ownership transfer, tracing animal products through the supply chain from producers to consumers. A contract is an agreement having a legal object entered into willingly by two or more bodies/parties . A smart contract is a digitalized computer protocol that allows an agreement to be automatically executed with predefined conditions as well as administers the performance of a contract the need for a contractual clause . The data interoperability, auditability, transparency, cost-reduction, tracing of animal products, and integrity are the important benefits of BCT application with smart contracts.

Blockchain technology for animal food safety

The production, processing and handling of animal foods in a hygienic way to safeguard human health is known as food safety. The growing international trade of foods increases the difficulty to maintain food quality assurance and safety . The safety issues in animal products are mainly due to the use of hormones, antibiotic residues, adulteration, zoonosis, microbial contamination as well as from animal feed with pesticides/ herbicides residues, heavy metals and other contamination products.

The handling of animals and temperature directly affect the safety of animal products mainly meat products. Stress due to fluctuation in environmental temperature change during the transportation of animals to the slaughterhouse can cause quality problems in meat products after slaughter. In the same way, the production, collection, transportation, and processing of milk and milk products also require proper attention. Therefore, real-time monitoring and recording of temperature handling of animals and relative humidity from farm to end are necessary to support products safety and quality as well as to improve the management, productivity and profitability which can be possible by application of BCT along with sensors. The feed provided to animals, administration of veterinary drugs as well as antibiotics and species, breeds and quantity of animals raised and managed by farmers are also necessary to record on the blockchain. As the data on BCT is verified by a consensus mechanism, if the improper or illegal amount of drugs, hormones and antibiotics used by the farmers, the smart contract automatically terminates the transaction and data is not documented in Blockchain . Food industries can minimize food frauds by real-time detection and relating outbreaks to their definite cause.

Livestock product sector addresses consumers' main concern about food safety in the dairy industry . Dey et al. , proposed a FoodSQRBlock (Food Safety Quick Response Block) based on blockchain technology with Google Cloud Platform to emulate an actual food production scenario with milk as a livestock produce example, which digitalizes the information involved in food production and makes it approachable, transparent, and traceable by consumers and producers via QR codes. Other example like, Khanna et al. , developed a blockchain-based platform with the use of smart contracts, QR technology, and IoT to increase the safety and traceability of the dairy supply chain in India, targeting products like milk, butter, and cheese, the aim is to maintain the nutritional quality of dairy products by detecting adulteration and contamination and boosting the efficiency of production. According to them, the framework proved helpful in locating and eliminating adulterated and contaminated food products from a supply chain, which helped build trust between unknown partners-public and made conflict resolution more easily. The goal of this is to build a high-technology system for identifying, managing, and tracing animal products and to improve the management and quality control of breeding, slaughtering, transportation, trade, and consumption.From these studies, we can deduce that implementing a conceptual framework for animal product supply chain traceability can greatly enhance the efficiency, security, and accountability of supply chain information, boost food quality and safety, by means of monitoring, tracing, and management.



Conclusion

The integration of blockchain technology in the animal product supply chain provides a robust solution for ensuring product authenticity and safety through enhanced traceability, while simultaneously offering a secure, transparent, and efficient method for protecting and managing valuable intellectual property rights. Through the use of Blockchain technology, real-time risk point detection for food safety can reduce food fraud and contamination while also strengthening the mechanism for recalling affected batches of products.

Protecting Traditional Knowledge in Animal Breeding: Heritage, Innovation, and Rights in Harmony

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Introduction

Traditional knowledge in animal breeding constitutes one of the most enduring and valuable forms of agricultural innovation. Developed over centuries through close interaction between humans, animals, and ecosystems, this knowledge has enabled rural communities to maintain livestock systems that are productive, resilient, and culturally meaningful. In the contemporary era, however, rapid technological advancement, commercialisation of genetic resources, and changing legal regimes pose significant threats to the survival and fair recognition of this knowledge.

Traditional Knowledge in Animal Breeding

Traditional knowledge in animal breeding refers to the cumulative body of skills, practices, and beliefs that communities use to manage animal reproduction, selection, health, and adaptation. These practices are often location-specific and reflect deep understanding of local environments. Farmers and pastoralists select animals based on traits such as disease resistance, fertility, longevity, draught capacity, milk quality, temperament, and tolerance to heat or poor-quality feed. Such selection systems help maintain genetic diversity and ensure long-term sustainability of livestock populations.

Unlike formal scientific breeding programs, traditional systems rely heavily on observation, experience, and oral transmission. Knowledge is shared within families or communities and is frequently embedded in cultural rituals, social norms, and customary laws. This integration of culture and biology distinguishes traditional breeding knowledge from purely technical approaches and highlights its value beyond productivity alone.

Importance of Protection

Protecting traditional knowledge in animal breeding is essential for several interrelated reasons. First, it plays a critical role in conserving animal genetic resources. Indigenous livestock breeds often possess unique genetic traits that allow them to survive under harsh environmental conditions. As climate change intensifies, these traits are becoming increasingly important for global food security and climate-resilient agriculture.

Second, protection is necessary to prevent biopiracy and unethical commercialisation. In some cases, researchers or corporations have used traditional breeding knowledge or genetic material derived from indigenous animals to develop commercial products without acknowledging or compensating the communities that conserved them. Such practices undermine trust, exacerbate inequalities, and discourage the continued transmission of traditional knowledge. .

Third, recognising and protecting traditional knowledge strengthens the social and economic position of local communities. Legal

recognition can enhance community control over genetic resources, support livelihoods, and encourage younger generations to value and maintain traditional breeding practices.

Legal and Policy Frameworks

At the international level, several legal instruments address the protection of traditional knowledge and animal genetic resources. The Convention on Biological Diversity (CBD) acknowledges the importance of traditional knowledge and calls for its respect, preservation, and maintenance. Article 8(j) of the CBD emphasises the need for equitable sharing of benefits arising from the use of such knowledge.

The Nagoya Protocol further elaborates on access and benefit-sharing mechanisms, requiring prior informed consent and mutually agreed terms when genetic resources or associated traditional knowledge are accessed. Despite these advances, implementation remains uneven, and many countries lack specific legislation addressing traditional knowledge in animal breeding.

Conventional intellectual property rights systems, such as patents, are often ill-suited to traditional knowledge because they emphasise individual ownership, novelty, and fixed duration. Traditional knowledge, by contrast, is collective, cumulative, and continuously evolving, requiring alternative legal approaches.

Approaches to Effective Protection

One promising approach is the development of sui genesis systems specifically designed to protect traditional knowledge. These systems may include community registers, certificates of origin, or legal recognition of customary laws governing knowledge use. Such frameworks allow communities to retain control while preventing unauthorised exploitation.

Community-led documentation initiatives also play a vital role. When managed carefully, documentation can serve as evidence of prior art, helping to prevent inappropriate patent claims. However, safeguards must be in place to ensure that documented knowledge is not misused or accessed without consent.

Ethical research partnerships are equally important. Researchers and institutions working with traditional knowledge holders should adhere to principles of free, prior, and informed consent, transparency, and equitable benefit-sharing. Benefits may take the form of financial compensation, capacity building, co-authorship, or shared ownership of innovations.

Challenges and Future Directions

Despite growing awareness, significant challenges remain. Power imbalances between communities and commercial actors, limited legal literacy, and insufficient institutional support hinder effective protection. Additionally, modernisation and changing livelihood patterns threaten the intergenerational transmission of traditional knowledge.

Future efforts should focus on integrating traditional breeding knowledge into national livestock development strategies, strengthening community institutions, and promoting interdisciplinary collaboration between scientists, policymakers, and knowledge holders. Such integration can enhance innovation while respecting cultural heritage.

Conclusion

Traditional knowledge in animal breeding represents a critical yet often undervalued resource for sustainable agriculture and biodiversity conservation. Protecting this knowledge requires legal innovation, ethical engagement, and genuine recognition of community contributions. By harmonising traditional wisdom with modern scientific approaches, societies can build more resilient, equitable, and sustainable livestock systems for the future.

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Farmer's Right to Indigenous Animal Varieties

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Abstract

Native animal breeds are essential to India's rural livelihood and livestock variety. These indigenous breeds have primarily been maintained and improved by farmers using traditional breeding techniques. But the growing threat of commercialization, crossbreeding, and genetic deterioration emphasizes how vital it is to defend farmers' rights. The significance of native animal genetic resources, the legislative framework for defending farmers' rights, and the function of organizations like the National Bureau of Animal Genetic Resources (NBAGR) are all covered in this article. The difficulties and government programs promoting conservation are also examined. In addition to promoting sustainability and biodiversity, protecting farmers' rights over native animal species also protects traditional knowledge and rural wellbeing.

Keywords

Indigenous breeds, Farmer's rights, NBAGR, Livestock keepers, Traditional knowledge

Introduction

India has a rich history of livestock diversity, including a number of native animal breeds that have developed organically and as a result of farmer-led selection. These breeds are now a vital component of sustainable rural livelihoods since they have adapted to the nation's diverse climate conditions. For generations, Indian farmers have been essential to the development and preservation of these breeds. Cattle, buffalo, goats, sheep, pigs, camels, and poultry that are indigenous to certain areas are examples of indigenous animal genetic resources. In addition to being essential for milk, meat, and draught power, they also have cultural and economic value. However, many native breeds are in danger of going extinct due to industrialization and the increasing prevalence of alien varieties. As a result, it becomes essential to acknowledge and defend the rights of farmers, who are the real guardians of these precious resources.

Importance of Indigenous Animal Varieties

Native or indigenous animal breeds have developed as a result of traditional management practices and natural selection in the context of the local environment. They have characteristics including great disease resistance, heat tolerance, and the capacity to live on little water and nourishment. Because of these qualities, they are very sustainable and appropriate for low-input farming systems. Cattle (Gir, Tharparkar, Sahiwal, Rathi, Ongole), buffalo (Murrah, Mehsana, Banni, Nili-Ravi), goats (Jamunapari, Sirohi, Beetal, Barbari), sheep (Marwari, Chokla, Nali, Deccani), and poultry (Aseel, Kadaknath) are some examples of native Indian breeds. These breeds sustain millions of small and marginal farmers' livelihoods and help ensure food security and climate resilience. The preservation of genetic variety for upcoming breeding initiatives is another benefit of their preservation.

Role of Farmers in Conservation

The preservation of native animal genetic resources is mostly dependent on farmers. They are in charge of maintaining pedigree,

selective breeding, and modifying management techniques to fit regional circumstances. Generation after generation has passed down their traditional expertise of animal care, feeding, and breeding. Acknowledging and defending farmers' rights guarantees that these communities receive compensation for their priceless contributions.

Legal Framework for Protection of Farmer's Right

Legal Structure for Farmer's Rights Protection in India, animal breed registration and characterization are handled by the National Bureau of Animal Genetic Resources (NBAGR), Karnal. The NBAGR identifies the communities or individuals in charge of breed conservation and registers breeds according to their unique characteristics. The Global Plan of Action for Animal Genetic Resources (FAO, 2007) places a strong emphasis on the equitable distribution of benefits obtained from animal genetic resources and the acknowledgement of the rights of livestock keepers.

Components of Farmers Rights

Key elements include capacity building, protection from biopiracy, benefit sharing, access and use rights, and recognition and reward. In order to preserve local breeds, farmers need receive official recognition and support in the form of incentives and training.

Challenges in Protecting Farmers Rights

Despite policy initiatives, several challenges persist: lack of awareness, poor documentation of traditional knowledge, crossbreeding leading to genetic dilution, limited support, and absence of a dedicated legal framework.

Government Initiatives

- Rashtriya Gokul Mission
- National Kamdhenu Breeding Centre
- Breed Registration through NBAGR
- National Livestock Mission encourage farmers to conserve indigenous breeds and biodiversity.

Significance of Protecting Farmers Rights

- Protection of farmers' rights acknowledges their contribution
- Promotes conservation
- Ensures benefit sharing
- Strengthens livelihoods, and prevents genetic erosion. It is vital for sustainable livestock production and rural empowerment.

Conclusion

Farmers' rights to native animal breeds are a symbol of the respect and acknowledgement owed to those who have long safeguarded India's livestock wealth. We can empower rural farmers, encourage fair benefit sharing, and preserve India's traditional knowledge systems for future generations by recognizing and defending these rights.

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Role of Intellectual Property Rights in The Genetic Engineering of Livestock

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Introduction

Genetic engineering has emerged as a groundbreaking tool in modern livestock production, offering new possibilities for improving productivity, enhancing disease resistance, and ensuring sustainable agricultural growth. With advanced technologies such as CRISPR-Cas9, gene knockouts, and transgenesis, scientists can precisely alter the genetic makeup of animals. These developments, however, require substantial investment, highly specialized knowledge, and complex regulatory approvals. As a result, Intellectual Property Rights (IPR) play a crucial role in protecting innovations and encouraging continued advancement in livestock biotechnology. This paper explores the role of IPR in supporting research, commercialization, ethical balance, and global cooperation in genetic engineering of livestock.

Overview of Genetic Engineering in Livestock

Genetic engineering involves modifying the genome of livestock to achieve specific, desirable traits. These may include improved growth rates, enhanced milk or meat quality, resistance to diseases, increased reproductive efficiency, and reduced environmental footprint. Modern gene-editing tools enable precise modifications, reducing the unintended effects often associated with traditional breeding.

Examples of genetically engineered livestock include:

- Pigs engineered for resistance to Porcine Reproductive and Respiratory Syndrome (PRRS)
- Hornless (polled) dairy cattle to enhance animal welfare
- Salmon with accelerated growth rates
- Goats that produce pharmaceutical proteins in milk

Such innovations demonstrate the transformative potential of biotechnology in shaping the future of livestock farming.

Several legal mechanisms are used to protect inventions in genetic engineering:

1. Patents

Patents are the most significant form of IPR in biotechnology. They protect novel genetic constructs, gene-editing methods, engineered embryos, and even whole genetically modified animals. Patents grant exclusive rights to inventors for 20 years, offering strong incentives for investment and commercialization.

2. Trade Secrets

Companies may safeguard proprietary laboratory protocols, specialized cell lines, or gene-editing delivery systems through trade secrets. Unlike patents, trade secrets do not expire as long as confidentiality is maintained.

3. Copyright and Database Rights

Bioinformatics software, genomic databases, and research publications are protected through copyright laws. These safeguard digital outputs and intellectual contributions associated with genetic engineering research.

4. Trademarks

Biotech companies may use trademarks to brand genetically engineered livestock or biotechnology-based products, helping distinguish them in the

marketplace.

5. Breeders' Rights

Although primarily applied to plants, animal breeders' rights are gaining attention as genetically improved livestock lines become more commercially valuable.

Role of IPR in Advancing Genetic Engineering of Livestock

1. Encouraging Research and Development

Developing genetically engineered livestock requires years of research and significant financial investment. IPR assures inventors of exclusive economic benefits, motivating both public and private institutions to invest in new technologies.

2. Facilitating Technology Transfer and Commercialization

IPR frameworks enable structured licensing agreements between universities, research institutes, and commercial enterprises. These agreements support the safe and regulated distribution of gene-editing technologies, accelerating their adoption in agriculture.

3. Ensuring Ethical and Responsible Use

Clear ownership rights help regulate the use of genetically engineered livestock, ensuring transparency and adherence to national and international guidelines. IPR systems also help track the origin of engineered traits and maintain accountability.

4. Enhancing Global Collaboration

Countries with strong IPR systems attract foreign investment, international partnerships, and global research funding. Harmonization under agreements like TRIPS (Trade-Related Aspects of Intellectual Property Rights) further enables sharing of innovations across borders.

5. Promoting Competition and Innovation

IPR protection prevents unauthorized duplication of innovations, encouraging companies to develop novel biotechnological solutions rather than relying on existing ones.

Challenges and Ethical Considerations

1. High Licensing Costs

Patented technologies may be expensive, limiting access for small and medium-scale farmers. This can widen the technology gap between advanced and developing agricultural communities.

2. Ethical Concerns

Genetic ownership, commodification of living animals, and animal welfare considerations generate ethical debates. Societal acceptance plays a major role in determining the success of genetically engineered livestock.

3. Risk of Market Monopolies

Large biotech companies may dominate genetic resources, potentially reducing genetic diversity and limiting farmers' autonomy.

4. Impact on Developing Nations

Strict IPR regimes may restrict access to advanced technologies in low-income countries, intensifying inequality in global agricultural productivity.

5. Balancing Innovation and Public Good

Policymakers must balance protecting innovators' rights with ensuring that essential genetic technologies remain accessible for sustainable food production.

Future Prospects

As gene-editing tools evolve, IPR frameworks must adapt to address new legal, ethical, and social questions. Future priorities include:

- Developing affordable and fair licensing systems
- Promoting open-source biotechnology for essential traits
- Establishing global guidelines for patents on engineered animals
- Ensuring sustainable and ethical use of genetic tools

Conclusion

Intellectual Property Rights play an indispensable role in shaping the future of genetic engineering in livestock. They promote innovation, attract investment, regulate commercialization, and foster global cooperation. However, challenges related to ethics, accessibility, and equity must be addressed to ensure that biotechnology contributes positively to global food security and sustainable livestock production. A balanced IPR framework is essential for supporting responsible scientific progress while protecting the broader interests of society.

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University of Tennessee and Middle Tennessee State University Host Southern Regional Dairy Challenge®

The Holiday Inn in Knoxville, Tennessee was home base for the 2025 Southern Regional Dairy Challenge held November 16 to 18. The event was hosted by University of Tennessee and Middle Tennessee State University. Seventy-six dairy students from 14 colleges worked to improve their dairy management and communication skills, networked with other students, and explored industry careers. Dairy Challenge is a unique, real-world experience where dairy students work as a team and apply their college coursework to evaluate and provide solutions for an operating dairy farm. The events were coordinated by the southern regional planning committee.

Teams were compiled from different universities into five and six member teams. Teams competed for awards based on their quality of farm analysis and appropriate solutions. Their farm presentations were evaluated by a panel of four judges, including dairy producers, veterinarians, finance specialists and seasoned agribusiness personnel.

Dairy Challenge Applies Learning to a Real-World Dairy

The three-day event began with learning stations at University of Tennessee, where the farm team and industry representatives helped students better understand Tennessee dairy conditions and shared details about reproduction, cow comfort, robotic milking parlors and nutrition. Back at the Holiday Inn, students participated in educational seminars and enjoyed dinner.

Day One concluded with the contest participants receiving in-depth management data from the contest dairy, Davis Bros Dairy. The next day, all students had a short time – only two hours – to visit the contest dairy and witness dairy operations. After a question-answer session with the farm owners, the student teams developed recommendations for nutrition, reproduction, milking procedures, animal health, cow comfort, and labor and financial management.

On Day Three, students presented their recommendations to two groups of judging panels, visited with sponsors at the Career Fair, and learned through educational sessions that included a career panel. As the third day ended, the following teams were announced as first place winners.

Panel A: Team 7 – Team members included Kristina Duncan (University of Florida), George Wilson (University of Tennessee, Knoxville), Rachel Thomason (University of Mount Olive), Whitley Robey (Virgina Tech), Ashley Knox (West Virgina University), and Alondra Leon Santes (Middle Tennessee State University)

Panel B: Team 10 – Team members included Claire Betley (Iowa State University), James Baer (West Virgina University), Mackenzie Crawford (Virgina Tech), Hannah Schmidt (University of Mount Olive), Alyssa Dunn (North Carolina A&T State University), and Ellen Black (University of Tennessee)

Total Industry Effort

The host farms opened their farms for analysis and in exchange, received a wealth of ideas from students and judges. The farm for the 2025 Southern Regional Dairy Challenge was:

- **Davis Bros Dairy** Philadelphia, Tennessee

This event would not have been possible without the University of Tennessee, Knoxville, Middle Tennessee State University, and Jeff Elliot, Southern Region Dairy Challenge Chair, the southern regional planning committee, and all the gracious sponsors, mentors and volunteers.

About Dairy Challenge

The North American Intercollegiate Dairy Challenge is an innovative event for students in dairy programs at North American post-secondary institutions. Its mission is to develop tomorrow's dairy leaders and enhance progress of the dairy industry, by providing education, communication and networking among students, producers, agribusiness and university personnel. Over its 24-year national history, Dairy Challenge has helped prepare more than 10,000 students for careers as farm owners and managers, consultants, researchers, veterinarians, or other dairy professionals. The next national event will be hosted in Sioux Falls, South Dakota, April 12-14, 2026. Four regional events are held in late fall and winter; details are at www.dairychallenge.org.

December 2, 2025
Sent on behalf of North American Intercollegiate Dairy Challenge
Contact: Lauren Mayo, lmmayo@ncat.edu

Annual Event Highlights the Friends of Expo

MADISON, WIS. – On Wednesday, December 10, 2025, World Dairy Expo hosted its annual Friends of Expo celebration, honoring the hundreds of volunteers, paid workers, and partners who make World Dairy Expo possible. Highlighting the evening was the presentation of the 2025 Friends of Expo awards. Receiving recognition this year were Jon Rasmussen, Fond du Lac, Wis., Jen Wackershauser and Emily Novinskie, Platteville, Wis., and Kevin Hoffman, Verona, Wis.

Jon Rasmussen began his volunteer journey at World Dairy Expo in 1996 as a Badger Dairy Club Grounds Chair and has continued to serve in a variety of leadership roles since then. In 2007, he began volunteering with the International Jersey Show and assisted with check-in with multiple breeds and recording placings. He became the Jersey Breed Superintendent in 2012, becoming just the fifth superintendent for the breed in World Dairy Expo history. In 2021, Rasmussen also became the Assistant Overall Superintendent of the Dairy Cattle Show. Dairy Cattle Exhibitors enjoy every interaction with Rasmussen because of his positive

attitude and calm demeanor.

As the Technical Directors for ExpoTV, Jenny Wackershauser and Emily Novinskie began their work supporting World Dairy Expo 12 years ago. Together, they have volunteered more than 960 hours of their time to World Dairy Expo. Arriving each day before 7 a.m. and staying until the last class exits the Coliseum, they spend more than 14 hours a day in the Rush Media Trailer, located near where the cattle enter the Coliseum. The pair directs camera operators and selects the shots that bring three livestreams of the World Dairy Expo Dairy Cattle Show to life. Their combined passion for the dairy industry and unwavering dedication has allowed millions of viewers to watch the Dairy Cattle Show from wherever they are.

Kevin Hoffman's time given to World Dairy Expo touches nearly every corner of the event. From welcoming FFA members and managing the flow of trucks and trailers into World Dairy Expo to organizing the warehouse, moving equipment, and transforming stalling tents with calm, good-natured efficiency, Kevin exemplifies dedication in action. Known for his warmth, humor, and unwavering willingness to step in wherever needed, he brings out the best in others, whether exhibitors, students, or other volunteers. His creativity, mentorship, and genuine care make him a pleasure to work with at World Dairy Expo, says Laura Herschleb, World Dairy Expo General Manager.

World Dairy Expo would not be the event it is without its volunteers, and more, the merrier! If you're interested in becoming a volunteer for World Dairy Expo 2026, visit https://worlddairyexpo.com/pages/Volunteers.php to learn more and complete the Volunteer Interest Form.

Serving as the meeting place of the global dairy industry, World Dairy Expo is the premier forum for the global dairy community to learn, share, create commerce and showcase competition. The annual event will return to Madison, Wis. September 29 – October 2, 2026. Dairy producers can experience the world's largest dairy-focused trade show, a world-class dairy cattle show, attend seminars, meetings and presentations highlighting the latest and greatest in the industry and connect with other producers. Download the World Dairy Expo mobile app, visit worlddairyexpo.com or follow WDE on Facebook, Instagram, LinkedIn, Spotify, or YouTube for more information.

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Dairy, fisheries and agricultural cooperative-based economic activities

The schemes implemented to strengthen rural dairy cooperatives are as under:

1. **National Programme for Dairy Development:**

- Various activities under NPDD Component A and B scheme of DAHD are helping strengthening of Dairy Cooperative Societies in rural areas:
- NPDD component B is being implemented across 9 states. The objective of the scheme is to increase sales of milk and dairy products by increasing farmers' access to organised market, upgrading dairy processing facilities and marketing infrastructure and enhancing the capacity of producers owned institutions.
- Under this scheme, financial assistance is provided for Strengthening Milk Procurement infrastructure at village level strengthening Milk processing & manufacturing facilities of Participating Institutions (PIs), Support for marketing & ICT infrastructure, Productivity enhancement, Training & capacity building of the farmers, staff, officers and board of directors of the Milk unions.
- The total outlay of the project is Rs. 1568.28 Crore comprising Rs. 924.56 Crore as an ODA loan from Japan International Cooperation Agency (JICA), Rs. 475.54 Crore as Government of India's (GoI) grant-in-aid and Rs. 168.18 Crore as State/Participating Institution's (PI) contribution.

2. **White Revolution 2.0:**

White Revolution 2.0 (WR 2.0) has been launched on 25 December 2024 as a cooperative-led initiative of the Ministry of Cooperation, in coordination with the Department of Animal Husbandry & Dairying (DAHD), Ministry of Fisheries, Animal Husbandry and Dairying. The programme aims to expand cooperative coverage, generate employment and strengthen women's participation in the dairy sector.

WR 2.0 envisages the establishment of 75,000 new Multi-purpose Dairy Cooperative Societies (M-DCS) and the strengthening of 46,000 existing DCS over a five-year period from FY 2024-25 to FY 2028-29. By the end of the fifth year, milk procurement by dairy cooperatives is projected to reach 1000 Lakh Kg per Day.

The initiative is being funded under the revised National Programme for Dairy Development (NPDD) of the Department of Animal Husbandry & Dairying (DAHD), Ministry of Fisheries, Animal Husbandry and Dairying which has been aligned with the targets of WR 2.0. Under this scheme, financial assistance is being made available for:

- Setting up of village level milk procurement system
- Milk Chilling facilities for quality milk procurement
- Training and capacity building

Additionally, the following schemed are also being implemented to strengthen the Dairy Cooperatives in the country:

3. **Animal Husbandry Infrastructure Development Fund (AHIDF) and erstwhile Dairy Processing and Infrastructure Development Fund (DIDF)**

The Department of Animal Husbandry, Dairying & Fisheries, Government of India (GoI) implemented the Central Sector Scheme "Dairy Processing & Infrastructure Development Fund (DIDF) Scheme" for the period 2018-19 to 2022-23 for infrastructure development in the dairy sector which was then merged with Animal Husbandry Infrastructure Development Fund (AHIDF). While there has been 2.5% interest subvention under DIDF, AHIDF has provision of interest subvention of 3%.

4. **Supporting Dairy Cooperatives and Farmer Producer Organisations engaged in dairy activities – Interest subvention for working capital loans (SDCFPO)**

To support the Dairy Cooperatives to overcome the

liquidity problems, the Government of India (GoI), in FY 2020-21, introduced the component of "Interest subvention on Working Capital Loans" as component – B under the existing central sector scheme – "Supporting Dairy Cooperatives and Farmer Producer Organizations engaged in dairy activities (SDC&FPO)" scheme.

Under the scheme, an interest subvention of 2% per annum on the working capital loans is being provided to the Producer-Owned Institutions (POIs). Further, for prompt and timely repayment, an additional 2% per annum interest subvention is payable at the end of the loan repayment/interest servicing period to the eligible organizations/ POIs such as Milk Federations, Milk Unions, Farmer Owned Milk Producer Organisations.

Financial assistance and training programmes have been extended for fisheries and agricultural cooperatives, the details of which are as follows:

(I) At present, the Government of India is implementing sector-specific schemes, namely FIDF, PMMSY, and PMMKSSY for the fisheries sector under which cooperatives are eligible beneficiaries. The NFDB, under Pradhan Mantri Matsya Sampada Yojana (PMMSY) Scheme, is facilitating the formation of 6,000 new Fisheries Cooperative Societies (FCS) during 2024-25 to 2028-29, with financial support of Rs 3.00 lakh for each newly formed fisheries cooperative societies towards establishment, maintenance, training of members. A total of 1,225 of newly formed fisheries cooperatives have been supported with financial grant of Rs 3.00 lakh each covering 34 States/UTs

(ii) The National Cooperative Development Corporation (NCDC) has been providing financial assistance to the cooperative sector. As on 25.11.2025, NCDC has cumulatively disbursed ₹4,67,455.66 crore for the development of cooperative societies across the country.

(iii) Training is provided to individuals associated with cooperative societies across various sectors, including agriculture, fisheries and allied areas by National Council for Cooperative Training (NCCT) and NCDC through its National training academy LINAC.

The Government of India has approved the plan to establish new multipurpose PACS/dairy/fisheries cooperatives, aiming to cover all panchayats and villages in the country over the next five years. This initiative is supported by NABARD, National Dairy Development Board (NDDB), National Fisheries Development Board (NFDB), and State/UT Governments. As per the National Cooperative Database, a total of 30,083 new PACS, Dairy and Fishery Cooperative Societies have been registered; and 15,793 Dairy and Fisheries Cooperative Societies have been strengthened as on 15.11.2025 across the country. These newly registered Primary Agricultural Credit Society (PACS) / Dairy Cooperative Societies (DCS)/ Fishery Cooperative Societies (FCS) have been provided with various support measures as under:

- Capacity-building programmes for Members, Secretaries and Boards of newly registered PACS are conducted through National Council for Cooperative Training (NCCT) and NABARD.
- Under PACS Computerization project, capacity-building programs have been introduced as part of the implementation to support PACS in adopting and managing the new software.
- Support from NDDB for dairy cooperatives (training, animal health, breeding, feed and fodder, cold-chain, and digital tools).
- Support from National Fisheries Development Board (NFDB) for fisheries cooperatives, including training, cage culture, biofloc adoption, infrastructure grants, and cluster-based wetland management. The NFDB, under Pradhan Mantri Matsya Sampada Yojana (PMMSY) Scheme, is facilitating the formation of 6,000 new Fisheries Cooperative Societies (FCS) during 2024-25 to 2028-29, with financial support of Rs 3.00 lakh for each newly formed fisheries cooperative societies towards establishment, maintenance, training of members. A total of 1,225 of newly formed fisheries cooperatives have been supported with financial grant of Rs 3.00 lakh each covering 34 States/UTs

This information was given by Union Minister for Home and Cooperation Shri Amit Shah in a written reply in Rajya Sabha.

Microencapsulated B-vitamins help dairy cows produce more milk with fewer emissions

McGill-led study finds that, by making production more efficient, the feed additive also reduced, on average, the amount of land and water needed for dairy herds.

A new international study led by McGill University in collaboration with Jefo Nutrition shows that supplementing dairy cow diets with microencapsulated B-vitamins can significantly reduce greenhouse gas emissions while increasing milk yield and quality. The use of the feed additive cut global warming potential, an internationally standardized measure of climate impact, by up to 18% across seven countries.

The researchers calculated that its use in Canada alone would reduce carbon emissions by half a million metric tons. To arrive at that figure, they considered emissions not only from cows and their manure, but also from other components of dairy production such as feed storage and transport.

"Livestock production contributes about 11 to 19% of global emissions, and feed is one of the most accessible levers producers can adjust," said Ebenezer Miezah Kwofie, study co-author and assistant professor of bioresource engineering at McGill. "Our goal was to look at what can be done to minimize emissions with feed additives and determine how variation from one region to another changes the dynamic."

Working with cows' biology

Most vitamin supplements degrade in the rumen, the cow's second stomach, before they can be fully absorbed. The team used microencapsulated B-vitamins designed to bypass the rumen and release nutrients in the small intestine, where absorption is highest.

"Usually, non-protected vitamins are used after calving, when lactation puts a lot of stress on the animal," said Prince Agyemang, Ph.D. student and study co-author. "This way, they get appropriately released."

This improved nutritional efficiency led to higher milk output and higher fat and protein content – key factors in how milk is priced. Because cows produced more milk per unit of feed consumed, the environmental impact per kilogram of milk decreased. This also reduced pressure on agricultural land and water resources needed to grow feed crops.

Study design and regional variation

The industry partner involved in this project conducted trials on commercial farms in North America, South America, Europe and Australia, with durations ranging from 120 to 213 days of lactation. Diets were standardized for ingredients and nutritional composition so researchers could isolate the effect of the additive.

Environmental impacts were assessed using ISO Standard 14044 and the International Dairy Federation's guide, which evaluates life-cycle emissions from the cradle to the farm gate. The researchers focused on global warming potential per kilogram of fat-protein corrected milk (FPCM), a standard measure that accounts for milk's energy content and allows fair comparison across regions.

Regional differences helped the team evaluate how variations in feed and climate influence the supplement's effectiveness. The additive's strongest effects were found in Latin America, with reductions as high as 18% in Mexico and 10% in Chile.

The environmental cost of producing and transporting the additive was minimal, contributing less than 0.02% to the total carbon footprint per kilogram of FPCM.

Next steps

The team said it plans to model national-level adoption scenarios and explore combinations with other additives, including those that more aggressively target methane emissions. It also hopes to develop tools to help farmers communicate emissions reductions to retailers and consumers.

LANXESS to introduce several new biosecurity solutions for the Indian market at Poultry India Expo

- **New products from LANXESS Biosecurity Solutions cater to the hygiene challenges in farming environments**
- **These will be distributed and marketed through two of LANXESS' partners Huvepharma and Alivira**

India, 28 November, 2025 – Specialty chemicals company LANXESS will be introducing a range of innovative products of LANXESS Biosecurity Solutions for the Indian poultry market at the upcoming **Poultry India Expo** scheduled from 26th to 28th November, in Hyderabad. These products, namely **TH4+®, BioVX™, Virkon® H20 and Glutex™ GQ1,** will be launched at the expo, through LANXESS' distribution & marketing partners, **Huvepharma SEA (Pune) Private Limited and Alivira Animal Health Limited (India).**

Through these new products, LANXESS Biosecurity Solutions aims to bring advanced disinfection and hygiene solutions to support Indian farmers in maintaining healthier and safer farm environments.

TH4+®, a versatile broad spectrum liquid farm disinfectant and **BioVX™**, a multipurpose broad spectrum powder farm disinfectant will be distributed and marketed in India by Huvepharma.

Virkon® H20, a multifunctional drinking water disinfectant and acidifier for Poultry and **Glutex™ GQ1**, a multi-purpose broad spectrum glut-based disinfectant will be distributed and marketed in India by Alivira.

LANXESS Biosecurity Solutions belongs to LANXESS group, a global specialty chemicals company headquartered in Germany. With more than 40 years of experience in the livestock industry and over 100 registered biosecurity products in its portfolio, across more than 80 countries worldwide, LANXESS Biosecurity Solutions, is committed to the health and welfare of animals. LANXESS Biosecurity Solutions researches, develops, manufactures and

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Further information on LANXESS Biosecurity Solutions can be found at

https://lanxess.com/en/products-and-brands/industries/biosecurity-solutions.

supplies most of the active chemical ingredients that are used in its disinfectant formulations ensuring reliable supply and highest quality.

The company operates production sites in Brazil, UK, France and Germany, all adhering to the highest European manufacturing standards. It also has exclusive manufacturing arrangements in the USA and India. Supported with its seven specialized biosecurity R&D centers located in the USA, Brazil, UK, France, Germany, Saudi Arabia and China, LANXESS Biosecurity Solutions is dedicated to bringing new solutions and technologies to farmers to shape the future of biosecurity.

About LANXESS:

LANXESS is a leading specialty chemicals company with sales of EUR 6.4 billion in 2024. The company currently has about 11,800 employees in 32 countries. The core business of LANXESS is the development, manufacturing and marketing of chemical intermediates, additives and consumer protection products. LANXESS has achieved leading positions in the Dow Jones Best-in-Class Index and the MSCI ESG and ISS ESG ratings, among others, for its commitment to sustainability.

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Farmers Urged to Embrace Modern Dairy Technologies: Minister

Coimbatore — Emphasising the need for technological awareness among dairy farmers, Tamil Nadu Minister for Milk and Dairy Development, Mano Thangaraj, on Thursday said that farmers must familiarise themselves with the latest innovations and machinery available in the dairy sector to improve productivity and value addition.

The Minister was speaking at the inauguration of five concurrent expos organised by Media Day Marketing at the CODISSIA Trade Fair Complex in Coimbatore. The three-day exhibition has brought together manufacturers, suppliers, distributors, startups and industry professionals from India and overseas. The event showcases a wide range of innovations, products and advanced technologies related to dairy, food processing, tea, coffee, plastics and waste management.

Addressing the gathering, Thangaraj noted that the dairy sector is witnessing rapid technological advancements, with several new machines and solutions now available in the market. However, he stressed that awareness among farmers needs to improve so that they can understand emerging trends and fully utilise the potential of these technologies to enhance efficiency and profitability.

The Minister highlighted the Tamil Nadu government's ongoing support for dairy farmers, particularly in encouraging value addition and entrepreneurship. He said that the State government is providing financial assistance to farmers to establish mini dairies, adding that loans worth ₹1,280 crore were disbursed for this purpose in the previous year. In addition, farmers continue to receive milk incentives to strengthen their income security.

Thangaraj said that Aavin, the State-run dairy cooperative, is playing a key role in promoting technology adoption by offering training programmes for both farmers and departmental officials. He emphasised the importance of capacity building, noting that officials must also strengthen their leadership and communication skills to effectively support the dairy ecosystem. The government, he added, is in the process of developing standard operating procedures (SOPs) to improve operational efficiency across Aavin's dairy plants.

Speaking to the media on broader social issues, the Minister remarked that poet Subramania Bharathi's works reflected his vision for the nation and society, rather than political affiliations. He said that public discourse should focus on addressing fundamental challenges such as poverty and hunger in the State.

The Minister concluded by reiterating that greater awareness of technology, combined with institutional support and skill development, would enable dairy farmers to move towards sustainable growth and increased value addition.

November 2025 FMMO uniform milk prices continue downward trend

Low prices, negative PPDs contribute to decline.

Federal Milk Marketing Order (FMMO) regional uniform milk prices continued to fall in November, in many cases hitting multiyear lows.

Across all orders, uniform prices declined an average of 98 cents per hundredweight (cwt) compared to October, with declines of $1 or more per cwt in five of 11 FMMOs.

Administrators of the 11 FMMOs reported November prices and pooling data Dec. 11-12. Here's Progressive Dairy's monthly review of the numbers to provide some additional transparency to your milk check.

Uniform milk prices, PPDs

While not an indicator of specific milk prices received by producers, regional uniform prices are a measure of the baseline to calculate milk check levels. In reviewing

TABLE 1 Federal Milk Marketing Order (FMMO) producer price differentials, uniform prices, 2025

FMMO	Producer price differential (PPD)**		Uniform milk price***	
	October ($ per cwt)	November ($ per cwt)	October ($ per cwt)	November ($ per cwt)
Northeast 1*	1.29	0.17	18.20	17.35
Appalachian 5	NA	NA	21.42	20.45
Florida 6	NA	NA	22.62	21.50
Southeast 7	NA	NA	21.91	20.82
Upper Midwest 30*	0.14	-0.56	17.05	16.62
Central 32*	0.13	-1.35	17.04	15.83
Mideast 33*	0.56	-0.66	17.47	16.52
California 51*	-1.37	-2.42	15.54	14.76
Pacific Northwest 124*	-0.75	-1.80	16.16	15.38
Southwest 126*	-0.02	-1.33	16.89	15.85
Arizona 131	NA	NA	17.55	15.96

* FMMOs utilizing multiple component pricing formulas
** Producer price differential at base zone; rates differ within a FMMO
*** Uniform price at standard test
NA / Not applicable
Source: USDA/FMMO reports

individual orders for November (Table 1), uniform prices in all 11 FMMOs reached new lows for the year, with seven of 11 falling below $17 per cwt.

The California FMMO reported another $1.05 decline from October, to $14.76 per cwt. Central, Pacific Northwest, Southwest and Arizona FMMOs also saw uniform prices fall below $16 per cwt. Mideast and Upper Midwest FMMOs recorded uniform milk prices for November at $16.52 and $16.62 per cwt, respectively.

Comparing producer price differentials (PPDs) in November, all affected FMMOs posted declines, with only the Northeast FMMO remaining slightly positive (Table 1). PPDs have zone differentials, and milk handlers may also apply PPDs and other "market adjustment factors" differently to the milk check.

Class prices for November

Most November milk class prices were lower in comparison to the month prior:

- Class I base price: The November 2025 advanced Class I base price was $16.75 per cwt, down $1.29 from October and the lowest since September 2021. It was $5.78 per cwt less than November 2024.
- Class I base price zone differentials: Class I zone differentials are added to the base price principal pricing points to determine the actual Class I price in each FMMO. With those additions, November's Class I prices averaged $20.87 per cwt across all FMMOs. The highest price was in the Florida FMMO at $23.55 per cwt, and the lowest price was $19.35 per cwt in the Arizona FMMO.
- Class I mover formula: November's base skim milk price for Class I was $10.62 per cwt, an increase of 59 cents from October but $1.69 per cwt lower than the base Class I skim milk price in November 2024. The spread in the monthly advanced Class III milk pricing factor ($10.62 per cwt) and advanced Class IV skim milk pricing factor ($8.15 per cwt) was $2.47, a $1.70 change from last month with Class III on top again. The advanced butterfat pricing factor was $1.86 per pound, a 53-cent fall from October to November.
- At $14.54 per cwt, the November Class II milk price was down $1.48 from October and down $6.98 from November a year ago. It was the lowest since February 2021.
- The November Class III milk price rose 27 cents from the previous month to $17.18 per cwt. It was still $2.77 per cwt less than November 2024.
- At $13.89 per cwt, the November Class IV milk price was down 41 cents from October and down $7.23 from same month a year ago.

Component values, tests

The values of butterfat and protein again moved in opposite directions in November. Butterfat fell to $1.7061 per pound, down almost 12 cents from October and $1.20 less than the value of $2.91 per pound one year ago. It was the lowest butterfat value since February 2021.

Meanwhile, the value of milk protein settled at $3.0143 per pound in November, climbing almost 14 cents from October and reaching the highest point since October 2024, when the value peaked at $3.3238 per pound.

The November value of nonfat solids was 91 cents per pound, up

just slightly from October but still the second lowest since November 2020. Other solids inched about a nickel higher to 38.6 cents per pound.

Influencing statistical uniform prices "at test," November's average butterfat and protein tests in pooled milk were up slightly in all FMMOs providing preliminary data. Somatic cell counts in the few FMMOs reporting monthly averages were slightly less in November compared to October.

Pooling totals

As in October, the November uniform price decline was in part the result of the drop in the value of butterfat and Class IV milk, resulting in depooling of higher-valued Class III milk.

The total milk volume pooled through FMMOs in November was 10.1 billion pounds, about 983 million pounds less than in October. A majority of that FMMO pooling decline came in Class III milk.

With lower total milk pooled, Class I pooled milk dipped 210 million pounds in November, to 3.38 billion pounds, yet increased by 1.1% of the total pool to 33.4% Similarly, Class II pooling fell 170 million pounds in November to 1.824 billion pounds, yet again represented about 18% of the total pool.

Class IV pooling increased 4.2% (182 million pounds) to 2.913 billion pounds from October.

In contrast, November Class III pooling fell 5.3% (about 785 million pounds), bringing the monthly total down to 2.003 billion pounds, a multiyear low (Table 2).

Looking ahead

Based on FMMO advanced prices and current futures prices, the outlook for December regional uniform milk prices is mixed and remains low.

TABLE 2 Monthly FMMO Class III-IV milk utilization, 2023-25

	Class III milk		Class IV milk	
2025	Percent	Pounds (million)	Percent	Pounds (million)
November	19.8	2,003	28.8	2,913
October	25.1	2,779	24.6	2,731
September	31.6	3,645	21.4	2,468
August	53.4	6,978	8.2	1,074
July	53.9	6,772	8.1	1,018
June	34.5	4,181	23.6	2,860
May	35.9	4,639	25.0	3,235
April	49.3	7,163	18.4	2,677
March	44.3	6,562	22.7	3,355
February	42.2	5,336	21.1	2,670
January	49.2	6,231	11.1	1,406
2024				
December	52.9	6,268	7.4	871
November	46.9	5,518	11.6	1,365
October	25.8	2,805	23.8	2,591
September	27.8	2,972	23.7	2,529
August	54.9	7,119	7.4	955
July	58.1	7,381	6.1	778
June	58.4	7,163	7.7	950
May	58.7	7,549	6.7	868
April	57.1	7,236	6.8	865
March	56.5	7,389	7.8	1,027
February	56.5	6,790	6.9	830
January	54.8	7,079	6.8	885
2023				
December	56.1	7,104	8.1	1,019
November	55.2	6,840	6.8	837
October	55.7	7,134	6.4	814
September	54.2	7,112	9.7	1,272
August	57.2	7,358	6.2	804
July	58.3	7,462	7.8	1,001
June	58.0	7,335	7.7	971
May	56.0	7,537	10.1	1,363
April	39.5	5,362	27.3	3,712
March	50.5	7,527	17.1	2,545
February	52.9	6,934	14.0	1,836
January	53.4	7,550	12.5	1,772

Source: USDA/FMMO reports

- Class I base price: As announced previously, the advanced Class I base price rebounded in December 2025, rising $1.46 per hundredweight (cwt) from November's low to hit $18.21 per cwt. Despite the increase, the December 2025 Class I base price is $3.22 per cwt less than December 2024 and the lowest for that month since 2018.
- Class I base price zone differentials: Class I zone differentials are added to the base price principal pricing points to determine the actual Class I price in each FMMO. With those additions, December's Class I prices should average about $22.33 per cwt across all FMMOs. The highest price is in the Florida FMMO at $25.01 per cwt, and the lowest price is $20.81 per cwt in the Arizona FMMO.
- Class I mover formula: The December 2025 Class I base skim milk price was $12.74 per cwt, an increase of $2.12 cents from November 2025 and $1.76 per cwt higher than December 2024. The spread in the monthly advanced Class III skim milk pricing factor ($12.74 per cwt) and advanced Class IV skim milk pricing factor ($8.49 per cwt) was $4.25, widening $1.78 from November, with Class III being the "higher-of" and used as the Class I mover in the milk pricing formula. The advanced butterfat pricing factor was $1.69 per pound, a 17-cent fall from November to December.
- Other class prices: December 2025 Class II, III and IV milk prices will be announced on Dec. 31. As of trading on Dec. 11, the Chicago Mercantile Exchange (CME) December Class III milk futures price settled at $15.87 per cwt, down $1.31 per cwt from November's price. The December Class IV milk futures price closed at just $13.77 per cwt, down 12 cents from November. If Class III-IV futures prices hold, the December Class III-IV milk price gap will be $2.10 per cwt, still providing incentives for Class III depooling and pressuring uniform prices.

Other information

- With the government shutdown over, the USDA updated milk production and price summaries and forecasts.
- For those tracking Dairy Margin Coverage (DMC) margins, the next date on the USDA Calendar for the USDA Ag Prices report is Dec. 15, and will likely contain September/October prices impacting DMC margins. As of Dec. 12, the September DMC margin forecast is $10.42 per cwt and the October DMC

margin forecast is $9.86 per cwt.

Then, according to the USDA schedule, things get back to "normal" and November prices are released Dec. 31, followed by the release of December 2025 prices on Jan. 30, 2026. November-December DMC forecast margins were unchanged from earlier this week: $9.31 for November and $8.30 for December.

White Revolution 2.0 Set to Transform India's Dairy Sector: Amit Shah

New Delhi, December 6 — Union Home and Cooperation Minister Amit Shah on Saturday said that White Revolution 2.0 will play a decisive role in strengthening India's dairy sector and significantly improving the income of livestock farmers across the country. He made these remarks while inaugurating Banas Dairy's newly constructed Bio-CNG and organic fertiliser plant at Vav–Tharad in Gujarat and laying the foundation stone for a 150-tonne milk powder manufacturing facility.

The event was attended by Gujarat Assembly Speaker Shankar Chaudhary, Union Ministers of State Krishan Pal Gurjar and Murlidhar Mohol, along with senior government officials and representatives from the cooperative sector.

Highlighting the extraordinary growth of Banas Dairy, Amit Shah described its journey as a "miracle created by ordinary people with extraordinary dedication." He recalled that the cooperative began with just eight village-level societies in 1960 and has since evolved into Asia's largest milk-producing dairy cooperative, setting a benchmark for farmer-led development.

Shah underlined the critical role of water infrastructure in transforming agriculture in north Gujarat. He referred to initiatives such as the Sujalam-Sufalam water project, noting that farmers in the region—who once depended on a single crop annually—are now able to cultivate and harvest up to three crops each year. He added that comprehensive research is currently being documented to showcase this water-driven development as a replicable model for rural transformation across India.

Emphasising the contribution of women, Shah said that the dairy cooperative movement in Banaskantha has become a global example of grassroots empowerment. He noted that milk procurement and cooperative operations carried out by the "mothers and sisters of Banaskantha" have ensured direct weekly payments to women, strengthening household incomes and promoting financial independence.

During the event, the minister also unveiled several new initiatives aimed at value addition in the dairy sector, including a protein processing plant and a fully automated paneer manufacturing unit. He said that focusing on high-value dairy products is essential to substantially increase farmers' earnings beyond traditional milk sales.

A key highlight of Shah's address was the Bio-CNG initiative, which he described as a model for cooperatives nationwide. He explained that the project supports India's transition towards a circular dairy economy, where cattle waste is converted into valuable resources such as organic fertiliser, biogas and electricity. According to him, this approach not only addresses environmental sustainability but also creates additional income streams for farmers.

Shah informed that the government has already established six new national-level cooperative organisations covering sectors such as seeds, organic produce, exports and dairy. These cooperatives, he said, are designed to ensure that profits flow directly to farmers rather than intermediaries.

Assuring livestock farmers of tangible benefits, Shah stated that the circular-economy model would increase farmer incomes by at least 20 percent even at current milk production levels. He added that Banaskantha would serve as the central hub for implementing this nationwide strategy.

Linking the cooperative movement to India's legacy of nation-building, Shah recalled the vision of Sardar Vallabhbhai Patel and paid tribute to Dr B R Ambedkar on his death anniversary. He said that the Indian Constitution has provided equal opportunities for all sections of society, enabling cooperative institutions to thrive.

Concluding his address, Shah said that White Revolution 2.0, backed by new national missions and infrastructure funding, will further modernise India's dairy sector and ensure that the successful "Banas model" reaches farmers across the country, ushering in a new era of sustainable and inclusive rural growth.

You Butter Believe It: Butter Consumption Hits Historic High as

Yogurt, Cottage Cheese, and Ice Cream Notch Growth in 2024

WASHINGTON, December 16, 2025—Consumers continued their preference for wholesome dairy products in 2024, as new data from the U.S. Department of Agriculture (USDA) shows U.S. per-capita dairy consumption at near historic highs. Butter consumption hit a new record last year, while yogurt consumption showed the strongest overall growth followed by cottage cheese and regular ice cream in 2024. Cheese consumption remained unchanged from a record high the previous year.

USDA's Economic Research Service reports that Americans consumed 651 pounds of dairy per person in 2024 on a milk-equivalent, milk-fat basis, a level that nears historic records dating back to 1975 when USDA began tracking dairy consumption trends.

Looking at specific dairy categories:

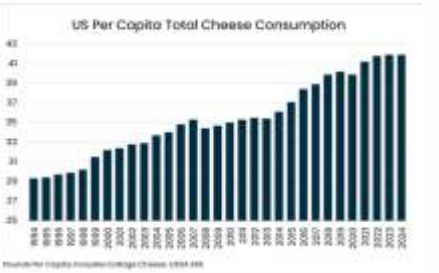
- Butter consumption surpassed all previous records, reaching an all-time high of **6.8 pounds.**
- Total cheese consumption was unchanged at **41.9 pounds** per person.
- Consumption of cottage cheese rose to **2.4 pounds,** the highest level since 2009.
- Yogurt consumption continued its impressive growth, increasing to **14.5 pounds** in 2024, a 6% increase from 2023.
- Regular ice cream consumption also grew in 2024, reaching **12 pounds** per person.
- Milk consumption saw a modest decline to **127 pounds** per person.

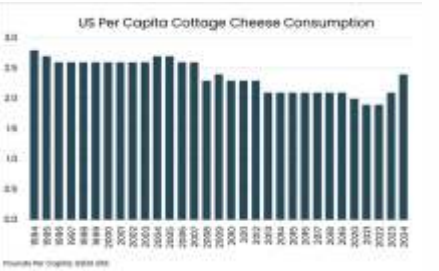
In the past decade alone, domestic per capita consumption of cheese (including cottage cheese) is up 13% and butter consumption is up 21%. In the past 20 years, yogurt consumption has grown 58%. Overall, USDA data show Americans' per capita consumption of dairy is up 0.6% over the past five years, 8% over the past 15 years, and 12% over the past 30 years.

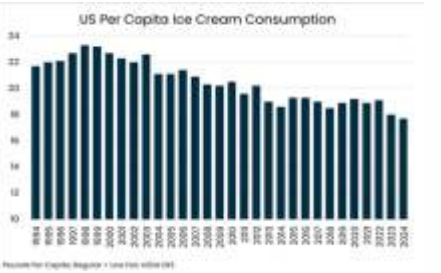
"American families continue to consume dairy foods at near record levels because dairy delivers what matters most today—flavor, affordability, and complete nutrition," said Michael Dykes, D.V.M., president and CEO of the International Dairy Foods Association in Washington, D.C. "Consumers are leaning into high-protein foods, gut-healthy options, and simple, wholesome ingredients, and dairy meets every one of those needs. Surging sales of yogurt and cottage cheese only underscore the transformation happening for U.S. dairy. Dairy was perfectly made for this moment, and you can see that reflected in Americans consuming more of their favorite dairy year over year."

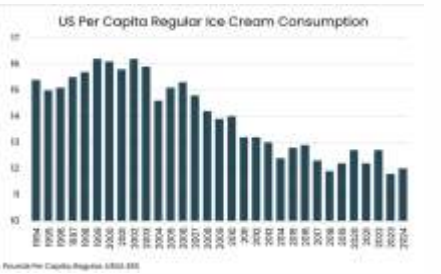
Dairy processors are responding to this consistent surge in demand by making historic investments of more than $11 billion in new and expanded manufacturing capacity across 19 states. More than 50 projects have launched across the country, including new and modernized manufacturing plants, major facility expansions, and new warehousing and logistics capacity. These investments build on the billions-of-dollars already deployed over the past decade to strengthen U.S. dairy processing.

The charts below illustrate the consistent growth trend in per capita consumption of dairy products.









Editorial Calendar 2026

Publishing Month:
January
Article Deadline :
18th, Dec. 2025
Advertising Deadline :
20th, Dec. 2025
Focus :
Opportunities and Challenges

Publishing Month:
February
Article Deadline :
18th, Jan. 2026
Advertising Deadline :
20th, Jan. 2026
Focus :
Budget

Publishing Month:
March
Article Deadline :
18th, Feb. 2026
Advertising Deadline :
20th, Feb. 2026
Focus :
Summer Stress Management

Publishing Month:
April
Article Deadline :
18th, March 2026
Advertising Deadline :
20th, March 2026
Focus :
Cold Chain

Publishing Month:
May
Article Deadline :
18th, April 2026
Advertising Deadline :
20th, April 2026
Focus :
Nutrition

Publishing Month:
June
Article Deadline :
18th, May 2026
Advertising Deadline :
20th, May 2026
Focus :
Milk - Production & Preservation

Publishing Month:
July
Article Deadline :
18th, June 2026
Advertising Deadline :
20th, June 2026
Focus :
Monsoon Management

Publishing Month:
August
Article Deadline :
18th, July 2026
Advertising Deadline :
20th, July 2026
Focus :
Sustainability

Publishing Month:
September
Article Deadline :
18th, August 2026
Advertising Deadline :
20th, August 2026
Focus :
Processing & Packaging

Publishing Month:
October
Article Deadline :
18th, September 2026
Advertising Deadline :
20th, September 2026
Focus :
Disease Prevention

Publishing Month:
November
Article Deadline :
18th, October 2026
Advertising Deadline :
20th, October 2026
Focus :
Biosecurity

Publishing Month:
December
Article Deadline :
18th, November 2026
Advertising Deadline :
20th, November 2026
Focus :
Winter Stress

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Front Gate Fold 2A	25,000	400	☐	Back Gate Fold 2A	20,000	300	☐	Up to Page 9	15,000	250	☐
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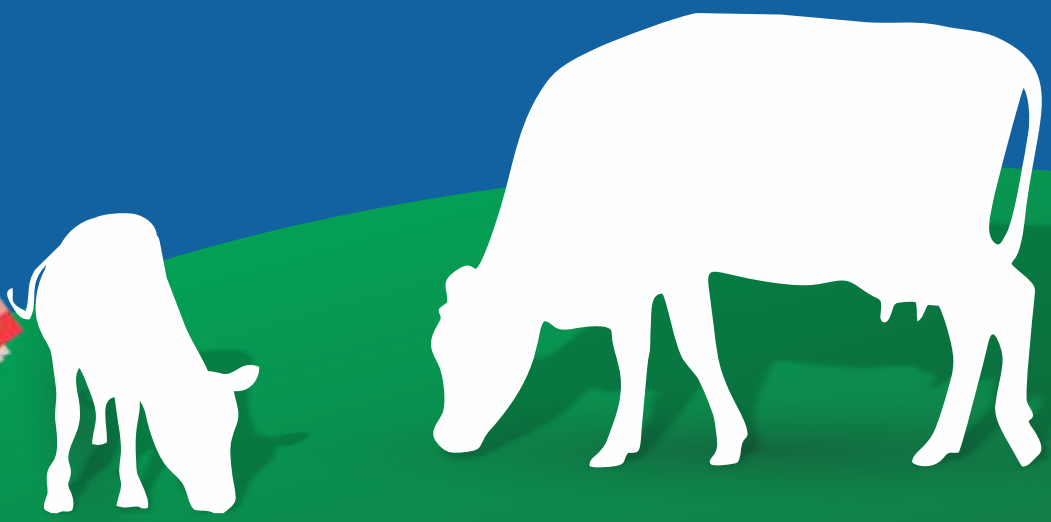

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