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Smart, Innovative and Sustainable Livestock Production: Strategies for the Future Animal Husbandry Practices

Dr. Narendra Kumar*, Dr Mahmuda Malik and Dr Poornima Gumasta****
**Professor*
***Assistant Professor*
College of Veterinary and Animal Sciences, Kishanganj- 855107,
Bihar Animal Sciences University, Patna, India
***Corresponding Author:** drnarendra9931004508@gmail.com
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Livestock farming has undergone revolutionary changes, particularly since the last twenty-year due invention of new technology and extension services from the government organizations. Factors such as the increasing use of new technologies, mechanization, rising chemical usage, specialization, and government policies promoting maximum production to agriculture to feed the nation have led to a decline in both the availability and productivity of natural fodder for livestock and poultry. Globally, the climate is changing, and this is impacting livestock. Climate affects livestock growth rates, milk and egg production, reproductive performance, morbidity and mortality rates, and fodder supply. Over the next 25 years, the rural-urban population ratio will reach 50:50. The greatest challenge ahead is to sustain livestock and poultry production for consumers. Sustainable methods of livestock and poultry production should focus on reducing agriculture's negative environmental footprint, while simultaneously maintaining and enhancing the environment and biodiversity associated with agricultural land.

The need for the term **'smart innovative Strategies'** extends beyond the livestock production sector to the entire food sector. For the food industry to be sustainable, it must be commercially profitable for farmers while ensuring that consumers can access quality food products at affordable prices.

Smart, innovative, and sustainable livestock production is the need of the hour to ensure food and nutritional security, enhance farmers' income, generate rural employment, and build climate-resilient livelihoods

Livestock farming can become a major growth engine of rural economy for sustainable rural development, poverty reduction and rural employment, particularly when traditional animal husbandry is integrated with technology like Integrated farming system, value addition to the livestock product, renewable energy and organized markets for consumer.

Integrated Livestock–Crop Farming:

Integrated livestock -crop farming is a modern innovative sustainable agriculture production system in which crop cultivation and livestock rearing are planned and co-ordinated in such a way that the out-put or waste from one component are utilized as input for livestock. It creates circular production system reduce dependence on external input improve resource -use efficiency and enhance profitability.

Integrated dairy, goat, sheep, poultry and pig production with crop farming will open a new door to framers for better income and efficient use of resource. Use of crop residues as animal feed after appropriate processing will create another value addition and employment for labours or local. Application of animal manure after processing as biofertilizer to fields as organic fertilizer. Promote circular farming, where farm waste becomes a resource rather than a disposal problem.

Livestock Waste-to-Wealth Model:

Establishment of community-level biogas plants using cattle dung will bring another revolution in energy sector of our country. Recently country has seen a wonderful example of "**Banas Dairy–Maruti Suzuki Model: Cow Dung to Bio-CNG"** A very good example of innovative and sustainable livestock-based rural development is the collaboration between Banas Dairy, the National Dairy Development Board (NDDB), and Suzuki/Suzuki R&D Centre India. The initiative converts cattle dung into biogas and purified compressed biogas (CBG), which can be used as a renewable fuel in CNG vehicles, including Maruti Suzuki CNG vehicles.

How the Model Works: -

Dairy farmers → Cow dung collection → Biogas plant → Anaerobic digestion → Biogas → Purification → Bio-CNG/CBG → CNG vehicles.

At the same time:

Digested slurry → Organic manure → Crop production → Fodder production → Livestock

Thus, the system creates a circular livestock–crop economy.

Why this model is important for rural development:

The Banas–Suzuki model demonstrates that livestock farming can become an energy-producing enterprise, rather than merely a source of milk, meat or eggs.

Livestock waste management + renewable energy + additional farmer income + organic fertilizer + rural employment + climate-change mitigation + sustainable mobility.

Beside this the Cow dung can produce biogas for cooking, electricity or small-scale farm machinery. Convert slurry into vermicompost, biofertilizer and enriched manure. Development of enterprises for collection, processing and marketing of livestock waste may create more employment and can contribute the GDP of nation. This creates employment for youth while reducing dependence on conventional fuels.

Climate-Smart Livestock Farming:

Selection and Promotion of heat-tolerant breeds and locally adapted animals will be very useful technology for rural economy to counter climate change. Development of low-cost animal shelters with ventilation, shade and rainwater harvesting will conserve the water and enhance the water table of ground. Improvement of feed efficiency and fodder availability. Establishment of fodder banks for drought and flood periods will save the precious livestock life. Promotion of silage and hay-making as rural enterprises will create better return to farmer and prevent labour migration towards city. Use climate information and early-warning systems for livestock management will be very useful.

Breed Improvement Through Technology:

Expansion and doorstep facility of artificial insemination and reproductive management will be another milestone for livestock sector growth. Use of sex-sorted semen, will ensure the female calf and it will reduce the burden on farmers to rear male calf. Establishment of mobile breeding and veterinary services will be boon for this direction for modern livestock farming. Maintaining digital records of pedigree, production and reproductive performance will be very helpful for selection of animals. Encouragement of community-based breeding programmes is need of hour rather than indiscriminate crossbreeding.

Mobile Veterinary and Telemedicine Services:

A mobile animal-health enterprise can provide:

- Vaccination,
- Deworming
- Pregnancy diagnosis
- Artificial insemination
- Basic laboratory diagnosis
- Emergency treatment
- Teleconsultation with specialist
- Local trained youth can be employed as para-veterinary workers, livestock health assistants and digital service providers under professional supervision.

Village-Level Livestock Diagnostic Centres:

Establishment of small diagnostic units equipped for:

- Blood and faecal examination
- Milk quality testing
- Pregnancy diagnosis
- Disease screening
- Digital reporting
- Post-mortem support and sample collection

This can reduce livestock mortality and create skilled employment for veterinary graduates, technicians and trained rural youth and can better contribute the economy of our country.

Fodder Entrepreneurship as Tool for Sustainable Dairy:

Development of village-level businesses for:

- Fodder cultivation
- Hydroponic fodder
- Azolla production
- Silage preparation
- Hay production
- Complete feed and mineral mixtures
- Fodder seed production

"One village–one fodder enterprise" could provide both employment and year-round feed security.

Value Addition and Local Processing:

Instead of selling raw livestock products, rural communities can increase income through:

- Milk → curd, paneer, ghee, khoa and cheese
- Meat → hygienically processed and packaged products
- Eggs → graded and packaged eggs
- Goat/sheep milk → specialty products
- Manure → compost and biofertilizer
- Wool/hides and other by-products → appropriate value-added products
- Women and self-help groups can play an important role in these enterprises.

Digital Livestock Economy:

Create a digital livestock platform connecting farmers with:

- Veterinary services
- Input suppliers
- Buyers
- Milk collection centres
- Insurance
- Banks and credit
- Government schemes
- Training programmes
- Digital records can also improve traceability, breeding decisions and market access.

Livestock Producer Organizations and Cooperatives:

Small farmers often receive low prices because they sell individually. Formation of Farmer Producer Organizations (FPOs), dairy cooperatives and livestock producer groups can enable:

Bulk purchase of feed and medicines

- Collective marketing
- Better bargaining power
- Cold-chain facilities
- Processing and branding
- Access to institutional finance

Youth Livestock Start-Ups:

Create a "Rural Livestock Startup Mission" providing training, mentoring and credit for enterprises such as:

- Dairy farms
- Goat and sheep units
- Poultry units
- Hatcheries
- Feed manufacturing
- Fodder production

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- Mobile veterinary services
- Dairy processing
- Biogas
- Organic manure
- Livestock transportation
- Digital livestock services

Women-Led Livestock Enterprises:

Women can be organized into SHGs for:

- Backyard poultry
- Goat rearing
- Dairy production
- Mushroom production using livestock manure
- Vermicomposting
- Milk processing
- Egg and meat marketing
- Preparation of value-added livestock products
- This creates household-level income and local employment.

Livestock-Based Tourism and Learning Centres:

Develop rural livestock experience centres, dairy farms and integrated organic farms where visitors and students can learn about:

- Indigenous breeds
- Organic farming
- Dairy production
- Biogas
- Sustainable agriculture
- Traditional livestock practices
- This can generate additional rural income.

Indigenous Breed Conservation as An Economic Activity:

Indigenous cattle, buffalo, goat, sheep and poultry breeds can be conserved through community breeding centres, while developing markets for products associated with locally adapted breeds.

Circular Bioeconomy Model:

A particularly promising model is:

Crop residue → Animal feed → Livestock → Milk/meat/eggs → Human consumption →
Dung/manure → Biogas + Biofertilizer → Crop production → Feed

A "Livestock-Based Rural Enterprise Cluster" could be developed at village or block level with five interconnected components:

- Livestock production + Veterinary care + Fodder bank + Biogas/organic manure + Value addition & marketing
- The cluster could be supported by Veterinary University/College + KVK + Animal Husbandry Department + Panchayat + SHGs + FPOs + Banks + private enterprises.

Expected Outcomes:

- Increased household income
- Creation of local employment for rural youth

- Women empowerment through livestock enterprises
- Reduction in livestock mortality
- Better utilization of crop and animal waste
- Reduced dependence on fossil fuels
- Improved soil fertility
- Climate-resilient livestock production
- Increased value realization from milk, meat and eggs
- Development of self-sustaining rural livestock enterprises
- Core concept:
- "From livestock as a subsistence activity to livestock as a circular, technology-enabled rural enterprise."
- **One health** integration of animal health, human health, environmental sustainability, and antimicrobial-resistance management.

Conclusion:

Therefore, the main focus should shift from "livestock as a traditional farming activity" to "livestock as a smart, circular and technology-driven rural enterprise."

Strong linkages among farmers, veterinary institutions, dairy cooperatives, industries, financial institutions and government agencies can accelerate this transformation.

Ultimately, smart livestock production can create a triple benefit— "Healthy Animals, Prosperous Farmers and a Sustainable Environment" to achieve one health, while generating new opportunities for rural youth and women and contributing to climate-resilient and self-reliant rural development to become India "Viksit **Bharat by 2047**"

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