

REVIEW ARTICLE

Digital Tools for Livestock Management: A Comprehensive Review of Mobile Applications in the Indian Livestock Sector

V. K. Basunathe¹, Aditi Jiddewar², G. P. Shende², D. V. Patil³

¹Department of Vet and AH Extension Education, Nagpur Veterinary College, Nagpur, Maharashtra, India,
²Department of Livestock Production and Management, Nagpur, Maharashtra, India, ³Department of Animal Genetics and Breeding, Nagpur Veterinary College, Nagpur, Maharashtra, India

Received: 01-06-2026; Revised: 15-06-2026; Accepted: 25-06-2026

ABSTRACT

Over the past decade, mobile applications have emerged as transformative digital tools capable of bridging the long-standing information gap between livestock research institutions and farming communities. This review synthesizes evidence from 18 peer-reviewed publications published between 2014 and 2025 to evaluate the landscape of mobile applications developed for the livestock sector in India by the Department of Animal Husbandry and Dairying, Indian Council of Agricultural Research Institutes, State Agricultural Universities, dairy cooperatives, and private organizations. The review examines application functionality, thematic domains, language accessibility, institutional origins, user adoption, and barriers to implementation. Findings reveal a diverse ecosystem of more than 60 documented mobile applications covering dairy management, disease surveillance, breeding, nutrition, poultry, swine, equine management, and veterinary extension services. These applications offer significant advantages in knowledge dissemination, disease management, farm decision-making, and market connectivity. However, major challenges persist, including low digital literacy, poor rural internet connectivity, limited multilingual support, inadequate awareness, and weak post-launch maintenance. The review highlights the need for user-centered design, multilingual interfaces, offline functionality, regular content updates, and stronger extension support systems to maximize the effectiveness of digital livestock tools in India and other developing countries.

Key words: Digital tools, India, information and communication technologies, livestock sector, mobile applications

INTRODUCTION

India's livestock sector occupies a unique position in the national economy and rural social structure. It provides supplementary income and nutritional security to nearly 70 million rural households, most of whom are small and marginal farmers contributing substantially to the country's milk production (Sreeram and Gupta, 2017).^[1] Despite its economic and social significance, livestock productivity in

India remains below global averages. One of the major reasons for this gap is the limited accessibility of scientific and timely information related to animal health, breeding, feeding, and market opportunities among livestock farmers. According to the National Sample Survey Organisation (2005), nearly 60% of farmer households had no access to information on modern livestock technologies, whereas only about 5% of rural households received livestock-related advisory services. This persistent information gap has hindered the adoption of improved livestock management practices across rural India. The emergence of Information and Communication Technologies (ICTs), particularly mobile telephony,

Address for correspondence:

V. K. Basunathe

E-mail: vijaybasunathe@mafsu.ac.in

has created new opportunities for transforming agricultural and livestock extension systems. India's rapid expansion in smartphone usage, with more than 750 million mobile internet users by the early 2020s, has enabled the delivery of information to farmers at scale, at relatively low cost, and in near real time. Mobile applications differ significantly from earlier SMS- and voice-based advisory systems by offering multimedia content, offline accessibility, push notifications, market integration, and interactive decision-support tools. In the livestock sector, these applications can provide information on housing management, breeding practices, disease diagnosis, vaccination schedules, feed formulation, and government welfare schemes in a timely and user-friendly manner (Sonawane *et al.*, 2019^[12] and Monikha, 2023).^[5]

The rapid growth of information and ICTs, especially smartphone-based technologies, has created new opportunities for improving livestock extension services. Mobile applications provide multimedia content, offline accessibility, market integration, and interactive decision-support systems, making information delivery faster and more effective than traditional advisory methods. These applications support livestock farmers through services related to disease diagnosis, breeding, feed formulation, vaccination schedules, and government schemes (Sonawane *et al.*, 2019^[12] and Monikha, 2023).^[5] Recognizing the potential of digital technologies, organizations such as the Department of Animal Husbandry and Dairying (DAHD), Indian Council of Agricultural Research (ICAR) institutes, State Agricultural Universities, dairy cooperatives, and private companies have developed numerous mobile applications for livestock management, health, nutrition, breeding, disease surveillance, and market access.

The present review synthesizes evidence from published literature to provide a systematic and critical assessment of mobile applications developed for the Indian livestock sector. The review examines the functional domains, institutional contributions, technical features, adoption patterns, and challenges associated with these digital tools, while also highlighting opportunities for strengthening mobile-based livestock extension services in India.

Objectives

- To document major mobile applications developed for livestock management in India
- To evaluate the functional features, language support, and user uptake of these applications
- To analyze the benefits, barriers, and enabling factors influencing mobile app adoption among livestock farmers.

METHODOLOGY

This review follows a structured narrative synthesis approach. A total of 18 peer-reviewed publications published between 2014 and 2025 were collected from national and international journals, review articles, book chapters, and institutional publications. The selected studies focused on the development, implementation, adoption, and impact of mobile applications in the livestock and veterinary sectors. The inclusion criteria for literature selection were as follows: (1) Direct relevance to mobile application development or adoption in livestock and veterinary contexts; (2) Documentation of specific mobile applications, features, or user outcomes; and (3) Publication in peer-reviewed journals or credible institutional repositories.

The data were extracted and categorized under the following themes:

- Application name and developer;
- Functional domain;
- Key features;
- Language support;
- Platform availability;
- Download statistics and user ratings;
- Barriers to adoption; and
- Institutional affiliation.

The extracted information was synthesized to develop a comprehensive understanding of the mobile application ecosystem in the livestock sector.

THE INDIAN LIVESTOCK SECTOR AND DIGITAL IMPERATIVE

India has the world's largest livestock population, including nearly 192 million cattle, 109 million buffaloes, 148 million goats, 74 million sheep, and 851 million poultry birds. The livestock sector

supports over 20.5 million people and contributes about 16% of the income of small farm households. However, livestock productivity in India remains below global standards, largely due to poor access to scientific information, veterinary services, and modern management practices. Conventional extension systems often fail to deliver timely information to farmers because of inadequate funding, limited manpower, and poor geographical reach. As a result, ICT-based solutions, particularly mobile applications, have become increasingly important for livestock extension.

The Digital India initiative, launched in 2015, improved rural smartphone penetration and internet connectivity, creating opportunities for mobile app-based advisory services. Studies have shown that mobile applications improve livestock decision-making by providing timely, location-specific, and practical information (Sreeram and Gupta, 2017^[11] and Prakash *et al.*, 2025).^[9] Mobile applications support multimedia features such as disease diagnosis images, video tutorials, audio guidance, vaccination reminders, and feed calculators. The offline functionality of apps is especially useful in rural areas, where internet access is often unstable or unavailable. These features make mobile applications one of the most effective and scalable ICT tools for livestock extension in India (Daum *et al.*, 2022).^[2]

INSTITUTIONAL LANDSCAPE OF APP DEVELOPMENT IN INDIA

The development of animal husbandry mobile applications in India involves a diverse ecosystem of institutions. Based on the reviewed literature, four broad categories of developers can be identified.

Central Government and Department of Animal Husbandry, Dairying and Fisheries (DAHDF)

The DAHDF has developed flagship apps such as *e-GOPALA* and the Dairy Husbandry Practices series. *e-GOPALA* in particular represents the most ambitious government effort: a comprehensive livestock management platform with features spanning breed information, buying and selling of livestock, registration for government schemes,

nutritional guidance, and disease first-aid. It is available on the Google Play Store and represents a model of integrated digital service delivery.

ICAR Institutes

The ICAR operates a network of over 100 specialized institutes, many of which have developed sector-specific apps. The key contributors documented in the reviewed literature include:

- ICAR-Indian Veterinary Research Institute (IVRI), Izatnagar – developer of apps covering pig farming, animal reproduction, waste management, pig ration, artificial insemination (AI), biosecurity, disease control, veterinary clinical care, vaccination guides, and zoonoses
- ICAR-Central Institute for Research on Buffaloes (CIRB), Hisar – developer of the ICAR-CIRB *Bhains Janan* (Buffalo Reproduction) App and the ICAR-CIRB *Bhains Poshahar* (Buffalo Nutrition) App
- ICAR-Central Institute for Research on Goats (CIRG), Makhdum – developer of *Bakri Mitra*, AI in Goats, CIRG Goat Farming, and Goat Products apps
- ICAR-National Research Centre on Equines (NRCE), Hisar – developer of Infoequine, covering breed management, nutrition, and AI for horses, donkeys, and mules
- ICAR-National Institute of Veterinary Epidemiology and Disease Informatics (NIVEDI), Bengaluru – developer of the livestock disease forewarning (LDF) app and the Leptospirosis app
- ICAR-National Research Centre on Meat, Hyderabad – developer of the Meat App
- ICAR-National Institute of Animal Nutrition and Physiology (NIANP), Bangalore – developer of the Feed Chart App and ICAR-NIANP Smart Tools
- ICAR-Indian Grassland and Fodder Research Institute (IGFRI), Jhansi – developer of Forage India and Fodder and Range Grasses apps
- ICAR-National Bureau of Animal Genetic Resources, Karnal – developer of KISAAN and ICAR Technologies apps
- ICAR-Directorate of Poultry Research (DPR), Hyderabad – developer of the ICAR DPR App

- ICAR-National Research Centre on Pig (NRCP), Assam – developer of Swine App, Swine Summer Stress App, and African swine fever apps
- ICAR-Indian Agricultural Statistics Research Institute (IASRI), New Delhi – developer of NIBLD and Krishi Vigyan Kendra (KVK) Mobile App.

State Agricultural Universities

State-level universities have been active developers of localized applications adapted to regional livestock systems and languages. The documented examples include:

- Tamil Nadu Veterinary and Animal Sciences University (TANUVAS) – Feed Calculator, Training Calendar, TANUVAS – VETDERMATOPATHOLOGY, TANUVAS Sheep and Goat Farming, Zoonoses – TANUVAS, Precision Dairy Farming
- Kerala Veterinary and Animal Sciences University (KVASU) – Hoof Care, Cattle Dentition
- Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar – E-Pashupalan
- Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana – Dairy *Prajnan*, Pig Farming, Goat Farming
- Acharya NG Ranga Agricultural University – *Pashu Poshan* App, KVK-Agri tech ATP
- Sri Venkateswara Veterinary University, Tirupathi – Dairy Cattle Ration Formulator
- Dau Shri Vasudev Chandrakar Kamdhenu Vishwavidyalaya, Chhattisgarh – CGKV App
- West Bengal University of Animal and Fishery Sciences – MUUK App.

Dairy Cooperatives and Private Organizations

The private and cooperative sectors have contributed apps that address market linkages, veterinary service access, and farmer empowerment. It includes AMUL Farmers App and AMUL Pashu Seva (GCMMF), Bharatiya Agro Industries Foundation (BAIF)-HolsteinFriesian, Godhan Seva by mKRISHI, and BAIF Pashudhan Mitra. Private-sector apps such as Heritage VET+, Krishify Pashu Mela, Cattle

Market Management System, Pashu Mandi, and Pashu Bazar address livestock market integration. Uzhavan Maadu (Nithra Apps India, Tamil Nadu) and Krishi Vigyan in Hindi (Mobility Apps, Indore) represent localized vernacular apps targeting specific regional farming communities.

THEMATIC DOMAINS OF ANIMAL HUSBANDRY MOBILE APPLICATIONS

The reviewed literature documents applications spanning the full spectrum of livestock management activities. The following thematic domains emerge as the major categories.

Dairy and Cattle Management

Dairy farming constitutes the largest single domain for app development, reflecting the economic centrality of bovine milk production. The e-GOPALA App developed by the Ministry stands out as an integrated platform covering breed information, nutritional guidance, disease first-aid, market linkages, and scheme registration. The Dairy Husbandry Practices series (English and Hindi versions) provides practical guidance for dairy producers. The Dairy Cattle Ration Formulator by Sri Venkateswara Veterinary University enables scientifically balanced feed formulation, whereas the Feed Calculator (TANUVAS) helps farmers estimate milch-animal body weight and feed requirements based on physical measurements.

The Story of Cow's Milk series (English and Hindi), developed by the National Dairy Development Board, educates farmers and consumers about milk production, processing, and quality. The INAPH In-Breeding Check App facilitates informed breeding decisions using the National Animal Disease Reporting System database. The Hoof Care App (KVASU) assists dairy farmers in maintaining optimal hoof health for productivity and comfort, whereas the Cattle Dentition App aids in age estimation for purchasing decisions.

For buffalo-specific production, the ICAR-CIRB *Bhains Janan* App addresses reproductive management, including heat detection, AI, pregnancy diagnosis, and breeding methods – while the companion *Bhains Poshahar* App covers buffalo

nutrition, fodder management, and metabolic disease prevention.

Disease Surveillance and Veterinary Health

Disease management represents a domain of particularly high stakes for livestock farmers, where timely information can prevent widespread herd losses. The LDF app, developed by ICAR-NIVEDI, is a notable innovation in this space, providing a predictive forewarning of disease outbreaks based on meteorological and epidemiological parameters, advising farmers on preventive measures and clinical sample collection protocols. The Leptospirosis app, also from ICAR-NIVEDI, provides detailed clinical information on this zoonotic disease, including transmission cycles, risk factors, prevention strategies, and sample collection guidance.

The IVRIDiseaseControlApp provides comprehensive information on important livestock, poultry, and canine diseases, covering symptoms, diagnosis, treatment, prevention, and control. The IVRI Veterinary Clinical Care App addresses frequently encountered field clinical conditions in medicine, gynecology, and surgery. The IVRI-Zoonoses App and the TANUVAS Zoonoses App educate users on zoonotic infections, including transmission, symptoms, prevention, and control measures.

The IVRI-Vaccination Guide App provides detailed information on causative agents, vaccine types, serotypes, vaccination schedules, and commercially available vaccines. The IVRI Biosecurity and Biosafety App supports biosecurity planning on farms, whereas the Bird Flu se Suraksha App addresses avian influenza prevention for poultry producers.

Beyond ICAR-developed apps, studies from Nigeria by Olaitan *et al.*^[7] document that farmers widely acknowledge the benefits of mobile apps in providing real-time outbreak alerts (80%), early symptom identification (70%), preventive guidance (62%), enhanced communication with veterinarians (58%), and health record keeping (56%). A machine-learning integrated framework proposed by Ahmed *et al.*^[1] envisions the next generation of livestock disease apps combining sensor data, big data analytics, and AI-powered diagnostic support – a direction being actively explored in the global digital livestock technology space.

Breeding and Reproduction Management

Reproductive efficiency is a fundamental driver of livestock productivity, and several apps directly address this domain. The IVRI-*Pashu Prajanan* (Animal Reproduction) App, available in seven languages, covers reproductive diseases and disorders in cattle and buffaloes, including anoestrus, repeat breeding, dystocia, uterine torsion, abortion, uterine prolapse, fetal membrane retention, metritis, brucellosis, campylobacteriosis, and IBR-IPV. It also provides guidance on heat detection and AI procedures, with 5000 downloads and a rating of 4.7/5.

For small ruminants, the AI in Goats App, developed by ICAR-CIRG, in collaboration with the UP Council of Agricultural Research, covers all aspects of AI in goats through interactive videos and instructions accessible even to semi-literate users. The *Bakri Mitra* (Goat Friend) App, developed by ICAR-CIRG, covers breed selection, breeding management, nutrition, health, and market linkages for goat farmers in Uttar Pradesh and Bihar. The INAPH In-Breeding Check App uses national database integration to guide farmers on optimal breeding choices for their animals.

The Cattle Fertility App (KVK Karur) provides dairy farmers with evidence-based fertility management tools, while the Dairy Animal Reproduction App, developed by the National Dairy Research Institute (NDRI), Karnal, covers reproductive physiology and management protocols for dairy cattle and buffaloes.

Nutrition and Feed Management

Feed accounts for 60–70% of livestock production costs, making nutrition management critical for farm profitability. The Feed Chart App, developed by ICAR-NIANP, provides a ready reckoner for dairy cattle and buffalo feeding under three scenarios of green fodder availability, enabling farmers to formulate balanced rations with locally available ingredients. The Feed Calculator (TANUVAS) additionally estimates the body weight of milch animals from morphometric measurements – a tool of particular utility in areas lacking weighing equipment. The Feed Calculator by TANUVAS has

achieved 10,000 downloads, reflecting high farmer interest in nutrition decision-support tools.

The Fodder and Range Grasses App developed by ICAR-IGFRI provides comprehensive information on cultivated fodder crops, range grasses, and range legumes, whereas the Forage India App guides farmers in selecting appropriate forage varieties for specific states, seasons, and growing condition combinations. The Forage Seed App helps farmers and seed suppliers source quality forage seeds. The *Pashu Poshan* App (ANGRAU) provides feeding and nutritional guidance for livestock, and the Hybrid Cow's Feeding Cost Calculator (NDRI) helps farmers optimize feed costs for cross-bred dairy cattle.

The IVRI Pig Ration App enables pig farmers to formulate balanced rations for different pig categories based on locally available feed ingredients, whereas the IVRI Pig Farming App covers low-cost feeding strategies as part of a comprehensive pig husbandry guide.

Pig and Swine Management

The IVRI has developed a comprehensive suite of swine-specific apps. The IVRI Shukar Palan (Pig Farming) App covers breed selection, housing, scientific feeding, breeding management, and complete health care for commercial pig enterprises, with 500 downloads and a 5/5 rating. The IVRI Landlly Pig (Pig Variety) App and the Swine App (ICAR-NRCP) provide breed-specific information. The IVRI Pig Ration App supports feed formulation for different pig categories. The Swine Summer Stress App (ICAR-NRCP) addresses the critical management challenge of heat stress in pigs, and the African Swine Fever App (both English and Hindi versions by ICAR-NRCP) provides urgent biosecurity information on this devastating disease. The Pig Master – A Guide App for Pig Farming (RNBV Apps) represents private-sector engagement in this space.

Small Ruminant Management (Goat and Sheep)

ICAR-CIRG has developed the most comprehensive suite of caprine apps. The CIRG Goat Farming App (in both English and Hindi as “*Bakrimitra*”) provides information on Indian goat breeds, breeding management, nutrition across age groups, fodder

production, shelter management, health care, and goat meat and milk products. The AI in the Goats App supports AI adoption. The Goat Products App addresses value addition and marketing for goat produce. The TANUVAS Sheep and Goat Farming App provides information on breeds, management, disease control, and marketing for small ruminant farmers in Tamil Nadu. The *Avimitra* App, developed by the Central Sheep and Wool Research Institute, Avikanagar, provides breed and management information for sheep producers.

Equine Management

The Infoequine App, developed by ICAR-NRCE, Hisar, provides offline knowledge on equine breeds, management, nutrition, diseases, AI, and pregnancy diagnosis. It also provides information on semen provision for the production of mules, horses, and donkeys, and technologies developed by the center. With 100 downloads and a rating of 4.7/5, it serves a niche but important constituency of horse, donkey, and mule owners across India, particularly in the Marwari horse-farming regions of Rajasthan and the draught-animal-dependent farming communities of hilly states.

Veterinary Education and Training

A distinctive category of apps addresses veterinary education and professional development. The TANUVAS Vet Micro App provides the practical veterinary microbiology course as per the MSVE 2016 syllabus, enabling veterinary students to review course content and take quizzes on their mobile phones. Developed by the Department of Veterinary Microbiology, Madras Veterinary College, the app has a 5/5 rating, reflecting high user satisfaction despite limited downloads (10 at review time).

The IVRI Technologies and Services App by ICAR-IASRI serves as a platform for disseminating technologies developed by ICAR institutes to field officers and extension workers. The Training Calendar App (TANUVAS) assists farmers and extension personnel in browsing capacity-building programs at 20 Veterinary University Training and Research Centers, 3 Farmers Training Centers, and 3 KVKs, with registration facilities and market price linkage through the *Agrimarket* Mobile

App. The KVK Mobile App, KVK-Agritech ATP, MUUK, *Jalpaiguri KVK*, North 24 Pgs KVK, and *Murshidabad Krishi Apps* support KVK-level extension activities in West Bengal and other states.

Market Access and Extension Connectivity

Several apps focus on market linkages and extension connectivity rather than production management *per se*. The e-GOPALA platform includes a livestock market section enabling peer-to-peer buying and selling. The AMUL Farmers App and AMUL *Pashu Seva* connect Gujarat cooperative dairy farmers with veterinary services and procurement channels. The Journey of Milk App educates consumers and producers about the cooperative dairy value chain. Private-sector apps, including *Pashu Mandi*, *Pashu Bazaar*, PASHU MANDI (Bigsys Infotech), *Gaay Bhains ki Kharid Bikri* (Krishify Pashu Mela), Cattle Market Management System (Safasha Business Solutions), and Animal Husbandry Livestock (MJM Design), facilitate livestock trading. The *Pashupalan* App and Dairy Kannada App provide extension content in regional languages for Karnataka farmers.

FUNCTIONAL FEATURES AND TECHNICAL CHARACTERISTICS

Offline Functionality

Offline accessibility is one of the most important and highly valued features of livestock mobile applications in rural India, where internet connectivity is often unreliable. Applications such as IVRI *Shukar Palan*, IVRI *Pashu Prajanan*, IVRI Disease Control, LDF, E-*Pashupalan*, Infoequine, and several TANUVAS applications provide offline functionality. This enables farmers to access veterinary guidelines, feeding recommendations, and disease management information even without active internet connections.

Multilingual Support

Language accessibility is essential because of India's linguistic diversity. The IVRI-*Pashu Prajanan* App supports seven languages, including English, Hindi,

Punjabi, Bangla, Assamese, Gujarati, and Tamil, making it one of the most linguistically inclusive livestock applications. The Infoequine App supports English and Hindi, whereas the IVRI Shukar Palan App and E-Pashupalan App are available mainly in Hindi. The Feed Calculator and TANUVAS Training Calendar support English and Tamil.

The researchers identified limited regional language support as a major barrier to app adoption and emphasized the need for vernacular-language applications in Marathi, Telugu, Kannada, Odia, Malayalam, Assamese, and Bengali (Sonawane *et al.*, 2019;^[12] Monikha, 2023^[5] and Rawat *et al.*, 2025).^[10]

Content Formats

Effective livestock applications use multiple content formats to support users with different literacy levels and learning preferences. Most applications provide text-based information, while many also include photographs for disease diagnosis, video tutorials, audio guidance, and interactive decision-support tools. Apps such as Feed Calculator, Dairy Cattle Ration Formulator, and Hoof Care include calculators and management tools for improving farm decision-making. The TANUVAS Vet Micro App additionally includes quiz-based learning features for educational self-assessment.

Platform Availability

Most livestock mobile applications are available primarily on Android through the Google Play Store, reflecting the dominance of Android smartphones among about 95% of users in India. Some applications are also hosted on institutional websites, including the Kerala Veterinary and Animal Sciences University platform for Hoof Care and Cattle Dentition Apps, as well as the ICAR technology repository. However, iOS versions are largely unavailable or undocumented, limiting access for Apple device users.

User Ratings and Download Statistics

Download counts and user ratings provide an indication of app popularity and user satisfaction. The

Feed Calculator and TANUVAS Training Calendar recorded around 10,000 downloads, among the highest reported in the reviewed literature. The IVRI-*Pashu Prajanan* App achieved about 5000 downloads with a strong user rating of 4.7/5. Applications such as TANUVAS Vet Micro App and IVRI *Shukar Palan* App received very high ratings despite lower download numbers. In contrast, apps such as *E-Pashupalan*, Hoof Care (50 downloads, 3/5 rating), and Cattle Dentition (600 downloads, 3/5 rating) showed lower downloads and ratings, suggesting that limited language support, narrow application scope, or inadequate promotion may reduce user adoption.

ADVANTAGES OF MOBILE APPLICATIONS IN LIVESTOCK MANAGEMENT

Enhanced Information Access

Mobile applications have become one of the most accessible sources of livestock-related information for Indian farmers. Applications such as e-GOPALA, *E-Pashupalan*, and the IVRI App series provide farmers with research-based guidance similar to that available to veterinarians and extension officers. These applications allow farmers to access information anytime and anywhere, often in regional languages. According to Sreeram and Gupta (2017),^[11] mobile applications deliver personalized and timely information, which is especially valuable in livestock farming where management decisions are highly time-sensitive.

Improved Farm Management Decision-Making

Mobile applications also improve farm management by providing decision-support tools such as feed formulation calculators, ration balancing tools, body weight estimators, heat detection guides, and vaccination schedulers. The Feed Calculator App helps farmers scientifically formulate balanced rations for milch animals based on actual measurements rather than traditional estimation methods, thereby reducing feed costs and improving productivity. Similarly, the Hoof Care App assists farmers in planning hoof trimming schedules and making data-driven management decisions that support animal health, welfare, and overall herd productivity.

Disease Prevention and Control

Early disease detection and appropriate response are critical determinants of livestock economic outcomes. Apps such as the LDF forewarning system, IVRI Disease Control App, and the Leptospirosis App equip farmers and field veterinarians with the information needed to recognize clinical signs early, collect appropriate samples, apply immediate preventive measures, and seek professional assistance promptly. The Dairy Utkal study found that field veterinarians in Odisha rated Normal Health Parameters of dairy animals (mean score 1.97) as the most useful app content category followed by disease information (1.88), drugs related to dairy husbandry (1.86), dairy schemes (1.81), nutrition (1.80), housing (1.74), and breed information (1.67) (Nanda *et al.*, 2022).^[6]

Market Linkage and Income Enhancement

Market access apps – AMUL Farmers App, Pashu Mandi, Krishify Pashu Mela, Cattle Market Management System – reduce information asymmetry in livestock markets, enabling farmers to compare prices across buyers and reach wider markets for their animals and produce. Digital tools have emerged as a valuable means of connecting agricultural value chains, enhancing coordination and market access. They are especially beneficial for smallholder farmers, who often lack the marketing power and bargaining capacity of larger producers. The Training Calendar App's linkage with the *Agrimarket* App provides additional market price information for crop inputs, supporting integrated farm planning (Daum *et al.*, 2022).^[2]

Empowering Field Veterinarians and Extension Workers

Mobile applications also strengthen the capacity of field veterinarians, KVK personnel, and extension workers by providing quick access to technical and clinical information. Applications such as IVRI Technologies and Services App, IVRI Vaccination Guide, IVRI Veterinary Clinical Care App, and Dairy Utkal App are specifically designed to support animal health professionals and extension personnel.

The research conducted by Nanda *et al.* (2022)^[6] among field veterinarians in Odisha found that the Dairy Utkal App provided technical information in a concise and user-friendly format, helping veterinarians improve advisory and healthcare services delivered to livestock farmers. These applications enhance the efficiency of extension services, facilitate faster decision-making, and improve communication between veterinarians and farming communities.

BARRIERS IN ADOPTION OF MOBILE APPLICATIONS

Despite the substantial benefits documented above, the literature consistently identifies a set of barriers that limit app adoption and sustained use among Indian livestock farmers. Rawat *et al.* (2025)^[10] provided the most systematic analysis of these barriers in the Indian context, categorizing them under infrastructure, technical, economic, socio-personal, and miscellaneous domains.

Infrastructure Constraints

Infrastructure-related problems are major barriers to the adoption of livestock mobile applications. Rawat *et al.* (2025)^[10] identified the lack of app update technology in low-connectivity areas as the most serious infrastructure constraint. Other important barriers include the non-availability of Kisan Call Center services on holidays, poor mobile network coverage, inadequate demonstrations of app usage, high mobile data consumption, and unreliable electricity supply. Similar findings were reported in Nigeria by Olaitan *et al.* (2025)^[7] where high data costs (4.25/5 severity), limited internet access (4.12/5), low digital literacy (3.80/5), and inconsistent network coverage (3.65/5) were identified as major obstacles to mobile app adoption among livestock farmers.

Technical Constraints

Technical difficulties also significantly affect the use of livestock mobile applications. According to Rawat *et al.* (2025)^[10] the inability to operate mobile applications was the most important technical constraint. Other problems included app complexity, insufficient time to practice app usage, excessive

phone memory usage, limited access to extension services for troubleshooting, and language barriers. Sonawane *et al.* (2019)^[12] observed that many applications fail to consider the varying levels of digital literacy among farmers. Developers often assume that users possess adequate technical skills, which reduces the usability and effectiveness of these applications among rural livestock farmers.

Socio-Personal Constraints

Lack of awareness about livestock-oriented mobile applications is one of the major socio-personal barriers affecting adoption among farmers. This indicates inadequate promotion and outreach of such applications within farming communities. Lack of encouragement from family members and local communities, along with unwillingness to learn new technologies, also significantly affects adoption decisions. Social and cultural factors, including socio-religious beliefs and group influence, further shape farmers' attitudes toward technology use. Rawat *et al.* (2025)^[10] emphasized that awareness campaigns through WhatsApp groups and social media platforms can help expand the farmer user base.

Economic Constraints

Economic limitations also restrict the adoption of mobile applications among livestock farmers. The high cost of smartphones capable of supporting modern applications remains a challenge, especially for small and marginal farmers in economically weaker communities. Although many livestock applications are free to download, recurring expenses related to mobile data and internet connectivity create an additional financial burden. Moreover, some private-sector applications require subscription fees, which further reduce accessibility for low-income farmers.

Content and Quality Constraints

Several content and quality-related issues limit the effective adoption of livestock mobile applications. Many apps are not regularly updated after launch, leading to outdated and unreliable information that reduces farmer trust. Language barriers also remain

significant, as many applications are available only in English or Hindi, excluding farmers from non-Hindi-speaking regions. In addition, poor translation quality and the lack of audio-based guidance reduce accessibility for low-literacy users. Michels *et al.* (2019),^[4] found that perceived ease of use and perceived usefulness are the most important factors influencing app adoption and continued use among dairy farmers in Germany. These findings suggest that Indian app developers should focus on user-centered design approaches to create simple, reliable, and farmer-friendly applications.

Based on the synthesized evidence, the following recommendations are offered for app developers and research institutions, policy makers, and extension agencies.

App developers and research institutions

App developers and research institutions should adopt user-centered design approaches by involving farmers, veterinarians, and extension workers in needs assessment, prototype testing, and app refinement before launch. Applications should support multilingual content by including regional languages such as Marathi, Telugu, Kannada, Odia, Bengali, and Malayalam in addition to English and Hindi.

To improve accessibility for low-literacy users, apps should incorporate audio guidance and pictorial decision-support tools. Developers should also implement lightweight offline-first systems so that applications remain functional in areas with poor internet connectivity. Regular content updates and timely notifications are necessary to maintain farmer trust and ensure information accuracy. Furthermore, integrating data analytics can help monitor user engagement, identify useful features, and support continuous improvement of livestock mobile applications.

Policy makers and the animal husbandry department

Policy makers and the Animal Husbandry Department should establish a centralized digital repository containing all government-developed animal husbandry mobile applications along with descriptions, download links, and user-support resources. There is also a need to fund systematic evaluation studies to assess the impact of mobile

applications on farmers' knowledge, attitudes, practices, and livestock productivity.

To ensure reliability and user trust, minimum quality standards and formal app-vetting mechanisms should be developed to monitor data accuracy, update frequency, and data security. Promotion of mobile applications should be integrated into KVK training programs, *Kisan Call Centre* services, and veterinarian capacity-building activities. In addition, governments may consider introducing low-cost smartphone schemes or digital support initiatives for marginalized livestock farmers to reduce hardware-related barriers to mobile app adoption.

Extension services and KVKs

Extension services and KVKs should conduct targeted awareness campaigns to promote livestock mobile applications through farmer training camps, agricultural melas, and village-level demonstrations. Social media platforms and WhatsApp groups can be effectively used for continuous outreach and farmer engagement. Field veterinarians and KVK scientists should be trained to guide farmers in downloading, installing, and using important livestock-related applications through practical demonstrations and hands-on support. In addition, extension agencies should establish feedback mechanisms between farmers and app developers to quickly identify usability problems, technical difficulties, and content gaps, thereby supporting continuous improvement of mobile applications.

CONCLUSION

Mobile applications are increasingly redefining livestock extension and farm management systems in India by enabling rapid, low-cost, and scalable dissemination of scientific knowledge. Although significant progress has been made in developing species-specific and management-oriented applications, their long-term impact depends on improving accessibility, usability, multilingual inclusiveness, and institutional support mechanisms. Future research should focus on evaluating the measurable effects of these digital tools on productivity, animal health outcomes,

income generation, and farmer empowerment. With sustained investment and user-centered innovation, mobile applications can become a cornerstone of digitally enabled livestock development in India.

REFERENCES

1. Ahmed MK, Sharma DP, Worku HS, Babu RB. Framework design for machine learning integrated mobile based livestock disease data management, diagnosis, and treatment. *J Surv Fish Sci* 2023;10:1482-94.
2. Daum T, Ravichandran T, Kariuki J, Chagunda M, Birner R. Connected cows and cyber chickens? Stocktaking and case studies of digital livestock tools in Kenya and India. *Agric Syst* 2022;196:103353.
3. Diez E, Wohllebe A. Mobile apps in veterinary medicine: Literature review on opportunities and benefits for veterinarians, animal owners and animal welfare. *Int J Mobile Applic Technol* 2025;1. Available from: <https://doi.org/10.51137/wrp.ijmat.2025.edmt.45846>
4. Michels M, Bonke V, Musshoff O. Understanding the adoption of smartphone apps in dairy herd management. *J Dairy Sci* 2019;102:9422-34.
5. Monikha CR. Mobile application: A transformation in livestock farming. *Biotica Res Today* 2023;5:149-52.
6. Nanda SM, Swain P, Das BC, Panda N, Shweta K, Dash SK, *et al.* Effectiveness of the mobile app dairy utkal among the field veterinarians of Odisha. *Pharma Innov J* 2022;SP-11:825-30.
7. Olaitan MA, Bamidele J, Joel OJ, Eleke UP, Joel AF, Sennuga SO. Effect of mobile applications on livestock disease management in Abuja, Nigeria. *J Agric Ext Rural Econ* 2025;2:E3634FF81.
8. Prakash KV, Ganguli D, Goswami A, Debnath C. Animal husbandry mobile apps in transformation livestock farming. *Int J Curr Microbiol Appl Sci* 2021;10:518-30.
9. Prakash KV, Ganguli D, Goswami A, Bera S. Animal husbandry mobile apps in transforming livestock farming. *Int J Vet Sci Anim Husbandry* 2025;10:1-14.
10. Rawat U, Singh SK, Singh A, Khandait V, Rashmi. Constraints perceived in using livestock-based mobile applications by dairy farmers in Uttar Pradesh. *Int J Livest Res* 2025;15:15-21.
11. Sreeram V, Gupta J. Mobile-based applications for livestock information dissemination: The way forward. *J Glob Commun* 2017;10:84-90.
12. Sonawane N, Tekam D, Bhanotra AK, Sawant M. Role of mobile application in animal husbandry development. *Asian J Anim Sci* 2019;14:16-22.
13. Tara N, Roy G, Sharmi SJ, Sufian KI, Haq MM. Effective Mobile Apps in Agriculture Focusing on Land Crop and Animal Farming towards Smart Farming. Conference Paper; 2020. Available from: https://www.researchgate.net/publication/345813504_effective_mobile_apps_in_agriculture_focusing_on_land_crop_and_animal_farming_towards_smart_farming
14. Thannithi W, Intawicha P, Phuwisaranakom P, Saengwong S. Design and evaluation of a mobile application for enhancing farm management and performance assessment in fattening beef cattle. *J Adv Vet Anim Res* 2024;11:203-11.