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ONE HEALTH

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ROAD TO ONE HEALTH

It is a heartening fact that the contribution of Indian livestock sector to total agriculture GVA has been registering an increasing trend. The support it renders to livelihood of many small and marginal farmers makes it an important sector for the country's economy as well. India, despite being an important producer of livestock and poultry products, reels under the burden of low productivity. Poor animal health is believed to be one of the main factors behind this.

Animal health is directly related to animal nutrition. Proper nutrition not only promotes growth but also grants strong immunity against diseases. A balanced diet with feed supplements will also increase the quality and quantity of output. But the big question is, do the small holder farmers have the access and knowledge of the right feed to their animals? If not, how can the situation be improved? Efforts should not stop at creating awareness, but policy interventions should follow in the form of incentives or subsidies for balanced ration.

Diseases can also pull down the productivity of animals and poultry. Vaccinations are very effective in preventing the incidence and spread. Here too, the access and availability become determining factors. Infrastructure to store the vaccines and availability of veterinary services to deliver the vaccine is still not at par with the demand. Early diagnosis is the key in animal health management. To facilitate the same, trained personnel and veterinarians becomes an essential component. Unfortunately, the number of veterinarians to provide services are less compared to the demand. There is clearly a gap in terms of infrastructure and services, which needs to be acknowledged and worked upon.

In selecting a breed, apart form the yield parameters, the adaptability of the same to the Indian conditions is important. The indigenous breeds are easier to maintain and are comparatively resistant to diseases. A census of the same and efforts to conserve them can help us create a healthy gene pool for further research purposes.

Human and animal ecosystems are intertwined. The One Health approach is particularly relevant these times which approaches public health, veterinary and environmental sectors in a unified and integrated manner. It gives me immense pleasure that Agriculture Today has taken the lead in recognizing the relevance of One Health and organize 2nd India Animal health Summit to develop a road map encompassing the broader objectives. Events like this can create a momentum and aid in giving voice to the inequities and challenges in the sector. That is what our magazine is all about.

CONTENT

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ADDRESSING ANIMAL HEALTH
CHALLENGES IN INDIAN SMALLHOLDER FARMING

Livestock rearing has been one of the principal avenues for livelihood for the smallholder farmers of India. Contributing about 4.1% to the country's GDP, the livestock and poultry sectors collectively employ more than 8 million people, offering essential employment opportunities in rural areas. Although smallholder livestock farmers play a crucial role in the agricultural landscape contributing significantly to the economy and food security, these farmers are often marred with numerous issues and challenges even during the management of their animals.

Challenges Faced by Smallholder Livestock Farmers

Even though there have been praiseworthy efforts by the Government to have close vigilance on the major disease outbreaks and implementation of several disease prevention programmes, the vastness of the country with the presence of a large livestock and poultry population often makes it difficult for reaching out to every place.

Limited access to veterinary services often impedes the timely detection, prevention, and treatment of diseases. Smallholder farmers frequently face obstacles, such as limited vaccine availability, problems in administering vaccines, and lack of awareness about the necessity of vaccination. Inadequate infrastructure can impede the implementation of modern livestock husbandry techniques and the storage of vaccines and medicines.

Infectious diseases represent a sub-

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A compassionate lady veterinarian attending to a sick pig

Indigenous cattle grazing amidst Meghalaya's enchanting steep hills

stantial threat to livestock herds, causing economic losses to smallholder farmers. Some of the important disease outbreaks, viz., foot-and-mouth disease, lumpy skin disease, African swine fever, etc. can spread quickly within and beyond regions, affecting animal health and productivity. Lack of awareness of appropriate biosecurity procedures among many smallholder livestock farmers increases the spread of illnesses within and across farms. The health, growth, and production of livestock are negatively impacted by inadequate access to high-quality animal feed with suitable supplements and a limited understanding of balanced diets.

Livestock husbandry is directly impacted by climate change related elements such as unpredictable weather patterns, droughts, floods, natural disasters, and changes in vector biodynamics. These challenges can disrupt the availability of water and fodder, increase the prevalence of diseases, and affect the overall productivity and sustainability of livestock operations.

Interstate and international animal movement present significant challenges to animal health due to the potential spread of infectious diseases, difficulties in monitoring and surveillance, and varying animal health standards across regions and countries.

Policy-Oriented Solutions

Ensuring enhanced access to veterinary services

There is a necessity for increased investments in expanding veterinary infrastructure, such as clinics, laboratories, and diagnostic facilities, particularly in rural areas. Access to animal healthcare services can be improved with required trained veterinarians and para-veterinary professionals. Mobile veterinary units equipped with basic diagnostic tools and medicines can reach rural locations to provide healthcare services, timely deworming and animal vaccination campaigns. These units can also be involved to provide information and training to farmers. Remote consultation and diagnosis through telemedicine can greatly help.

Community-based animal health professionals, particularly in rural and distant locations, can play an important role in enhancing animal healthcare services.

Community-based animal health professionals, particularly in rural and distant locations, can play an important role in enhancing animal healthcare services. Under the supervision of veterinarians, these individuals may be trained to offer basic veterinary care, provide vaccinations, and administer medications. They serve as a link between farmers and veterinarians, ensuring that animals receive prompt care.

Disease surveillance and awareness

Disease surveillance systems harness the benefits of the latest technologies

A picturesque sight of a lively herd of Assam Hill goats

and data analysis along with the use of artificial intelligence which can aid in monitoring disease outbreaks and providing early warnings. The development of rapid pen-side tests for livestock diseases is imperative to enhance early detection and enable prompt intervention, ultimately mitigating the spread and impact of the diseases.

Climate-smart livestock farming practices should be promoted by developing and disseminating guidelines for climate-smart livestock management. Early warning systems should be strengthened by improving weather forecasting and early warning systems.

Mass awareness campaigns about the importance of vaccinations should be conducted to educate smallholder farmers. The government should ensure the availability of affordable vaccines and support vaccination drives, particularly targeting high-risk areas and vulnerable livestock populations.

Strengthening biosecurity practices

To stimulate the deployment of biosecurity infrastructure, financial incentives or subsidies might be provided. India urgently requires the development of a comprehensive "National Integrated Plan for Biosecurity" to effectively address and combat livestock diseases. This plan should encompass strategic measures such as surveillance, early detection, prevention, and coordinated response mechanisms to safeguard the health and productivity of the nation's livestock sector.

There is a necessity for increased investments in expanding veterinary infrastructure, such as clinics, laboratories, and diagnostic facilities, particularly in rural areas.

In order to enhance biosecurity measures and mitigate the risk of livestock disease ingressions, it is imperative to establish immune belts, quarantine facilities, and vaccination stations at interstate and international borders.

Empowering smallholder farmers

National and regional programmes may prioritize the development and distribution of high-quality animal feed and supplements at reasonable rates. Smallholder farmers can be educated about balanced meals and proper feed management procedures through training programmes.

Providing smallholder farmers with regular training programmes and workshops on livestock management, disease prevention, and treatment can be accomplished through collaboration among government agencies, non-governmental organizations, FPOs, and agricultural extension services. Encouraging smallholder farmers to get insurance for their livestock can protect them financially in case of disease outbreaks or animal deaths. This can incentivize farmers to seek timely veterinary care and adopt better animal health practices.

Research and development

It is imperative to maintain ongoing investments to foster the creation of regionally suitable interventions. These interventions encompass economically viable vaccines, diagnostic tools, and disease management strategies that are specifically designed to address the unique requirements of smallholder farmers. The productivity of our livestock needs to be enhanced to achieve maximum potential by investing in technology development, upgradation and implementation towards suitable selective breeding and better animal health services.

Recognizing the immense potential within India, it becomes imperative to implement informed and policy-driven initiatives that can enhance animal health outcomes, uplift the livelihoods of smallholder farmers, and drive sustainable agricultural development. By placing animal health as a priority, not only the welfare of livestock can be ensured, but also economic growth and food security of the nation can be fostered.

MOTT MACDONALD

Strengthening animal health systems

We are a unique, forward thinking and specialist global health consultancy focused on strengthening animal, human and environmental health systems. Together with our clients, we take a One Health approach that aims to combat disease and antimicrobial resistance (AMR) across all health systems by improving surveillance, analysis and information sharing.

We are working closely with the animal health sector in many countries in Asia and Africa to strengthen surveillance systems and understand how the complex interactions at the animal-human-environment interface are creating the conditions for disease to spread, and how to mitigate the effects on human and animal health.

Our multi-disciplinary team of specialists comprises veterinary, medical and environmental scientists around the globe. They work collectively to control infectious diseases affecting animals, humans and the environment.

Mott MacDonald is the management agent for the Fleming Fund, a UK aid programme supporting 22 countries across Asia and Africa to tackle AMR by improving surveillance systems. Since the Fleming Fund's inception in 2018, we have designed and commissioned over 80 grants, investing in strengthening 240 human and animal health, and food safety laboratories.

Our services include:

- Animal health programme design and delivery
- Developing disease surveillance systems across multiple sectors
- High quality training and mentorship on AMR
- Development and implementation of One Health strategies for disease control
- Advising on biosafety and biosecurity procedures
- Implementing antimicrobial stewardship protocols in the human and animal health sectors
- Installing information management systems
- Assessing emergency preparedness and response
- Providing external quality assurance
- Evaluating clinical services
- Strengthening laboratory capacity

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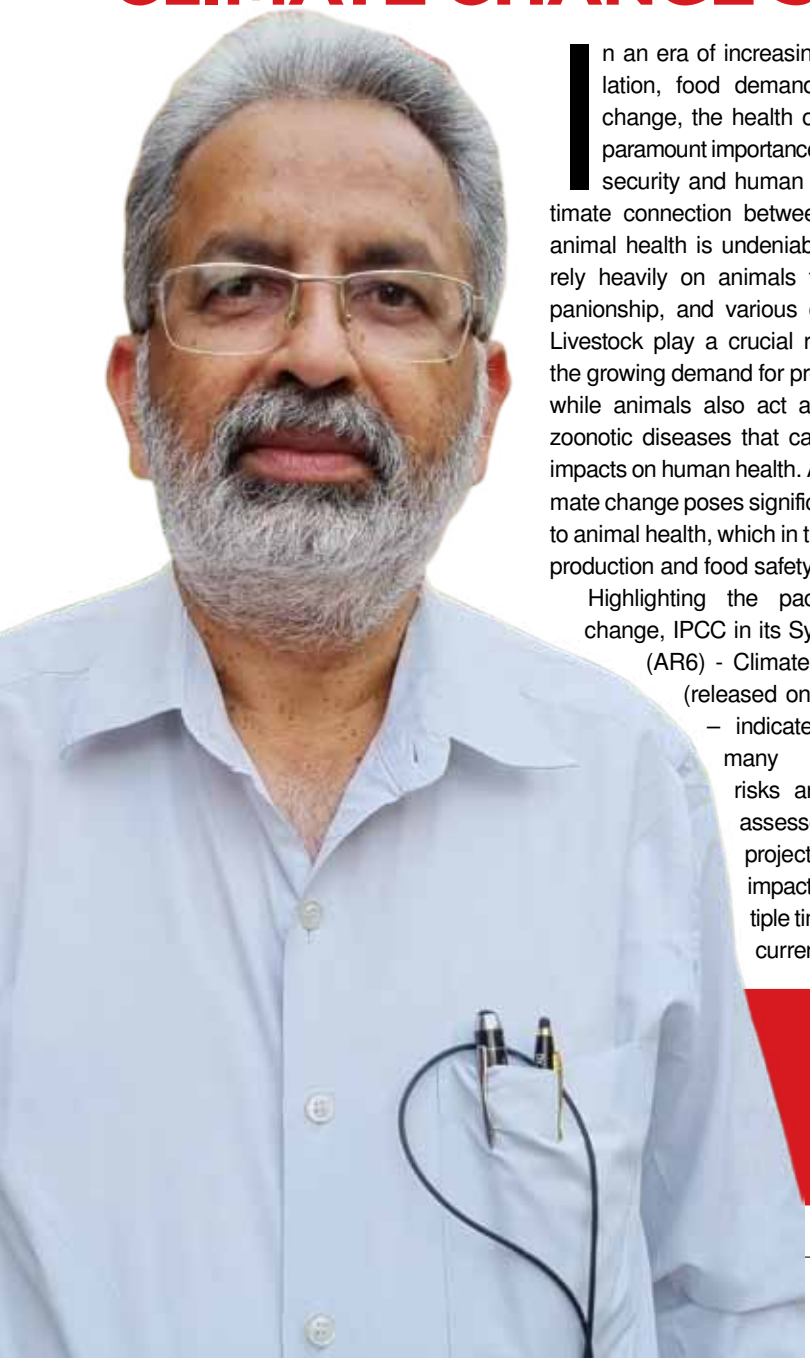
SIGNIFICANCE OF ANIMAL HEALTH

IN INCREASING FOOD DEMAND AND CLIMATE CHANGE SCENARIOS



In an era of increasing global population, food demand, and climate change, the health of animals is of paramount importance to ensure food security and human health. The intimate connection between human and animal health is undeniable, as humans rely heavily on animals for food, companionship, and various other services. Livestock play a crucial role in meeting the growing demand for protein-rich diets, while animals also act as sentinels for zoonotic diseases that can have severe impacts on human health. Additionally, climate change poses significant challenges to animal health, which in turn affects food production and food safety for humans.

Highlighting the pace of climate change, IPCC in its Synthesis Report (AR6) - Climate Change 2023 (released on 20 Mar 2023) – indicated clearly that many climate-related risks are higher than assessed in AR5, and projected long-term impacts are up to multiple times higher than currently observed, for any given future warming level. Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850-1900 in 2011-2020. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred resulting in weather and climate extremes in every region across the globe. Climate change has not only reduced food security but also affected water security, hindering efforts to meet Sustainable Development Goals. In all regions, increases in extreme heat events have resulted in human mortality and morbidity. Occurrence of climate-related food-borne and water-borne diseases and the incidence of vector-borne diseases have increased besides other likely impacts including mental health and socio-politico-economic disturbances.

Role of Animal Health in Meeting Increasing Food Demand

Livestock Production and Food Security

Livestock are central to global food security, providing essential sources of protein, vitamins, and minerals in the human diet. With the world's population projected to

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reach over nine billion by 2050, the demand for animal-derived products will continue to rise. Therefore, maintaining healthy and productive livestock is crucial to meeting this escalating food demand.

Zoonotic Diseases and Public Health

The health of animals is deeply intertwined with human health, particularly in the context of zoonotic diseases. Many pathogens responsible for zoonoses, such as avian influenza, COVID-19, and Ebola, originate in animals and can be transmitted to humans. Proper animal health management, including disease surveillance, prevention, and control, is vital in reducing the risk of zoonotic outbreaks and safeguarding public health.

Antibiotic Resistance and One Health Approach

The overuse and misuse of antibiotics in animal agriculture have contributed to the emergence of antibiotic-resistant bacteria, posing a global health threat. A One Health approach, which recognizes the interconnectedness of human, animal, and environmental health, is necessary to tackle antibiotic resistance and preserve the effectiveness of these life-saving drugs for both humans and animals.

Impact of Climate Change on Animal Health and Its Implications for Human Health

Heat Stress and Production Losses

Rising temperatures and extreme weather events associated with climate change can lead to heat stress in livestock, causing reduced feed intake, decreased productivity, and increased susceptibility to diseases. These impacts on animal health translate into reduced food production, leading to potential food shortages for humans.

Altered Disease Patterns

Climate change can alter the geographic distribution and prevalence of vector-borne diseases, affecting both animals and humans. For instance, the expansion of tick habitats due to warmer temperatures can increase the transmission of diseases like Lyme disease and tick-borne encephalitis

to humans, putting public health at risk.

Food Safety Risks

Changes in climate can influence the occurrence of mycotoxins in feed crops, which are toxic substances produced by fungi. When ingested by animals, mycotoxins can accumulate in animal-derived products, such as milk and meat, posing health risks to humans who consume these contaminated products.

Mitigation and Adaptation Strategies for Ensuring Animal and Human Health

Sustainable Livestock Practices

Implementing sustainable livestock practices, such as improved animal housing, nutrition, and disease management, can enhance animal health and productivity while minimizing environmental impacts. Proper waste management and the reduction of greenhouse gas emissions in animal agriculture can contribute to climate change mitigation.

Early Disease Detection and Surveillance

Enhanced monitoring and early detection of animal diseases are crucial for preventing disease outbreaks and minimizing their impact on both animal and human health. This involves strengthening veterinary healthcare systems and promoting collaboration between animal health professionals and public health authorities.

Climate-Resilient Livestock Breeding

Developing climate-resilient livestock breeds that can withstand heat stress, diseases, and changing environmental conditions is essential for sustaining food production in the face of climate change. Selective breeding and the use of advanced genetic technologies can play a role in achieving this objective.

Education and Awareness

Raising awareness among farmers, veterinarians, and the general public about the importance of animal health in ensuring food security and public health is essential. Education campaigns can promote responsible antimicrobial use, disease prevention, and climate-adaptive practices.

In conclusion, the significance of animal health to human health in the context of increasing food demand and climate change scenarios cannot be overstated. Animals play a crucial role in meeting the growing demand for food and protein, but their health is vulnerable to the impacts of climate change, which, in turn, affects food production and safety for humans. Recognizing the interconnectedness of human, animal, and environmental health is essential for addressing the challenges posed by zoonotic diseases, antibiotic resistance, and climate change. By adopting sustainable livestock practices, investing in early disease detection, and promoting climate-resilient livestock breeding, we can create a healthier and more sustainable future for both animals and humans. A collaborative effort that embraces the One Health approach will be the key to ensuring a secure and prosperous food system while safeguarding human health in a changing world. There is no doubt that animal production system faces numerous challenges as the global climate continues to change. As the population grows and the demand for food increases, it is essential to have market-ready technologies that can help farmers adapt to the changing climate and produce enough food to meet future demands.

Vasudhaiva Kutumbakam
LET ALL BEINGS BE HEALTHY

"Humanimal" is a catchy title of the book by Adam Rutherford, a British Scientist. According to evolutionary theory, that we have studied and grown with, humans are animals. The Homo sapiens of the day are, in fact, primates who share an ancestor with monkeys and other great apes. To further puncture our inflated ego, science tells us that our genome is identical to a chimpanzee's upto a whopping extent of 98%. And yet we consider ourselves unique and exceptional. Really? Humanimal is a new evolutionary history Rutherford expounds—a synthesis of the latest research on genetics, sex, migration, and much more. It reveals what makes us animals—and also why we are truly extraordinary. The Kutumbakam on our Vasudhaiva is a community of "Humanimals".

One Mission – One Health

"Our mission is to improve animal health globally, thereby ensuring a better future for all", reads the Mission Statement of the World Organisation of Animal Health (WOAH), founded and also known earlier by its French acronym as the OIE. "We champion health and a better future for all", says the World Health Organisation (WHO). Both us wish a better future. Better in the context is a synonym of healthy, and a "healthy" future implies "health for all", the man, the animal and the environment. "One Health" is the policy, strategy and intervention Public Health professionals advocate to secure a "better" future. "One Health is an integrated, unifying approach to balance and optimise the health of people, animals and ecosystems. It uses the close, interdependent links among these fields to create new surveillance and disease control methods," thus it defines the WHO in an incomprehensible language.

One Health – A Look Back

The ancient Greek philosopher and physician Hippocrates, considered one of the most outstanding figures in the history of medicine and traditionally referred to as the "Father of Medicine" in recognition of his lasting contributions to the field, was the first in the recorded history of civilization to recognise the relationship between human and animal health. The concept of "One Health", though a recent entrant in the medical lexicon is, in fact, a recognition of what Hippocrates said circa 400 BC in his treatise "On Airs, Waters and Places". "One Health" is an approach that recognizes that the health of people is closely connected to the health of animals and our environment.

Dr. Calvin W. Schwabe, called the father of veterinary epidemiology, too recognized the relationship between animal and public health decades before the current one-health movement. "Veterinary Medicine and Human Health," is his seminal work published in 1964; he wrote, "Veterinary medicine is the field of study concerned with the diseases and health of non-human animals. The practice of veterinary medicine is directly related to man's well-

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being in a number of ways." Through this innovative term "non-human animal", he propounded the concept that public health is inclusive of veterinary health. An early advocate for integrating aspects of veterinary and human medicines, Dr. Schwabe is even credited with coining the phrase "one medicine," although the term's origins are still debated. "One Medicine" as a scientific concept has been linked to the 19th century German physician and pathologist, Rudolf Virchow. He proclaimed that there should be no dividing line between human and animal medicine.

Convergence Between Human and Veterinary Medicine Is Optimal

In simple terms, one medicine is the concept whereby human and animal healthcare advance hand in hand with veterinarians, doctors and researchers collaborating to ensure that all humans and animals benefit equally from sustainable medical progress. The underlying theory is that human and veterinary Medicine could work together as humans and animals share a lot of their biology, and nearly 75% of all known causes of disease are shared between humans and animals.

Divergence began in the nineteenth century when the two emerged as distinctly separate disciplines. However, an increasing concern on the welfare, rights and conservation of animals in recent times has led to renewed interest in the concept. Despite the recognition, the current education, policy and investment in public health are not structured to support collaboration between human and veterinary medicine. In fact, too little is invested, either financially or academically, in developing treatments for animals. If veterinary clinical trials were linked to human drug development, resources could be optimised and treatments developed more quickly for both humans and animals. A convergence between human and veterinary medicine is both possible and desirable so that humans and animals benefit equitably from scientific advances. This would save time and money; but more importantly it would save lives.

If veterinary clinical trials were linked to human drug development, resources could be optimised and treatments developed more quickly for both humans and animals.

One Health is an integrated, unifying approach to balance and optimise the health of people, animals and ecosystems.

Zoonotic Diseases – A Real Threat

According to the WHO as also the World Animal Health Organisation, 60% of existing human infectious diseases are zoonotic i.e. they are transmitted to humans from animals either through direct contact or through food, water and environment; 75% of emerging infectious human diseases have an animal origin. Of the five new human diseases appearing every year, three originate in animals. If this is not scary enough, 80% of biological agents with potential bio-terrorist use are zoonotic pathogens. It is estimated that zoonotic diseases account for nearly two billion cases per year resulting in more than two million deaths; more than HIV/AIDS and diarrhoea put together. One fifth of premature deaths in poor countries are attributed to diseases transmitted from animals to humans. And all the pandemics in recent history, including the Covid 19 which had thrown our lives out of gear these days, have an origin in a zoonotic pathogen. Developing countries like ours have much greater stakes in strong One Health systems on account of small agricultural holdings and mixed farming systems resulting in uncomfortably close proximity of animals and humans.

Investment in Animal Health Remains Low on the Governance Agenda

The size of our human and livestock, including poultry populations, is almost the same. A network of nearly two lakh lakh health institutions across different levels in the government sector form the backbone of health governance, further supported by a large number of private health facilities ranging from village medical practitioners to multi-speciality hospitals. On the other hand only 65,000 veterinary institutions tend to the health needs of 130 + crore animals; and this figure includes 28,000 mobile dispensaries and first aid centres.

Private sector presence in the veterinary services in the country is negligible; close to being non-existent. How many more, and how severe a pandemic would we need to understand that investment in animal health is an investment in human health too.

"When animals behave like humans or when humans behave like animals, don't be surprised because in every animal there is a human and in every human there is an animal!". Mehmet Murat ildan, Turkish writer and thinker has summed it up.

ANIMAL HEALTH

CHALLENGES AND FUTURE STRATEGIES

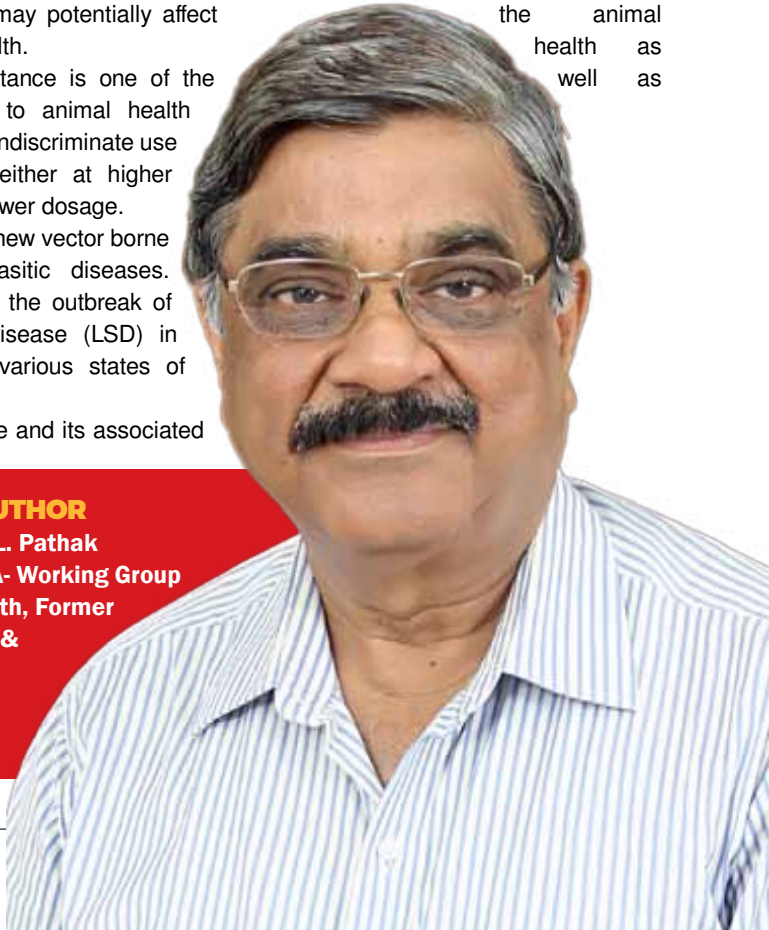
India is growing in its economy and may become the global power in coming years surpassing the developed countries. Even, this appears easy; but, the background of this development is very tough and difficult due to diversified economic system in India. Sustainable and viable systems of economy are the major requirements of present and future which will help to realise the dream of India to become the global leader.

Comprehending Challenges

The most important challenge for this huge livestock sector is animal health. India is still not fully adapted to face an emerging disease or a pandemic in animals. Diseases like FMD, Brucellosis, Anthrax, BQ and tuberculosis are still prevalent in India even after massive vaccination programs.

India in the current scenario faces following issues related to animal health and these can be summarised below

- Lack of disease surveillance system and their effective and timely management and thereby preventing their spread and pandemic
- Poor veterinary clinical and paraclinical services due to less manpower and animal hospitals and therefore, timely and effective management of diseases are slow and faster spreading of diseases.
- Globalisation has opened possibilities of new diseases to enter the country and no agencies are working to stop the entry of these diseases.
- Emergence of new zoonotic diseases which are showing human-animal interface and may potentially affect the animal health.
- Antibiotic resistance is one of the major threats to animal health system due to indiscriminate use of antibiotics either at higher dosage or at lower dosage.
- Emergence of new vector borne diseases, parasitic diseases. Most recent is the outbreak of Lumpy skin disease (LSD) in cattle across various states of India.
- Climate change and its associated changes will become worse in coming years and this will give rise to feed-fodder issues, disease-re-emergence and shifting of reproductive cycles with possibility of reproductive failures.
- Fighting between man-animal for the land for food will be of great concern in the near future and may challenge the animal health as well as



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their sustainable production.

- Lack of livestock extension services in rural areas.

Policy Support

After 2014, Animal Husbandry has undergone drastic changes and has been accorded a proper place in the priorities of National Planning for the first time. The Prime Minister Shri Narendra Modi Ji launched the National Animal Disease Control Programme (NADCP) in September 2019 to control and eradicate the Foot & Mouth Disease (FMD) and Brucellosis amongst the livestock in the country with a total budgetary outlay of Rs. 12,652 Crore. This program intends to vaccinate over 600 million cattle in the country against FMD and Brucellosis. This is the highest budget allocation to Animal Health sector after independence.

India is now producing indigenous vaccines against all major diseases of livestock and poultry. Recently One Health program involving human health, animal health, plants, soil, environmental and ecosystem has been launched to address zoonotic diseases. To increase accessibility of veterinary services at farmer's doorsteps, Mobile Veterinary Units (MVU) have been established in all states and animal mobile medical ambulances are now available in all districts particularly in remote areas with assistance from Central Government.

Strategies to Improve Animal Health

- Effective disease surveillance system with adequate diagnostic facilities.
- Mass and timed vaccination with vaccination tracking system and effective management with a proper database.
- Management of clinical diseases and their suitable therapeutics using effective drugs.
- Strengthening the veterinary practices with more number of mobile ambulance units and veterinary set ups particularly in rural areas.

Promising Indian Animal Husbandry

- World's highest livestock owner at about 535.78 million showing an increase of 4.6%
- First in the total buffalo population in the world - 109.85 million
- Second in the population of goats- 148.5 million
- Second largest poultry market in the world - production of 63 billion eggs and 851 million poultry meat
- Third in the population of sheep (74.26 millions)
- Fifth in the population of ducks and chicken
- Tenth in camel population in the world
- The total milk production in the country is 209.96 million tonnes in 2020-21 and there is an increase of 6.5% in milk yield compared to previous years.

- Feed supplementation, immune augmentation and better shelter management of animals so as to fight against the diseases.
- Prevention of clinical-subclinical parasitic and vector borne diseases and their effective management to stop their spread.
- Early diagnosis of sub-clinical infections with judicial use of antibiotics.
- Intervention of modern disease diagnostic techniques, targeted drug delivery systems, and nanomedicine in animal health and in specific diseases like mastitis.
- Complete eradication of diseases like FMD and brucellosis.
- Feed supplementation and area specific mineral mixture to enhance the animal production.
- Effective drug development against the diseases and replacement of traditional treatment system with the newer and more effective disease treatment system.
- Development of new vaccines and their use at mass scale to prevent the occurrence of diseases.
- Protein manipulation at the molecular level for the development of effective pharmaceutical products based on antibiotics and probiotics; breeding plants specifically to deliver additional nutrients to livestock and improving feed structure utilizing nutraceuticals designed to address specific health and wellness concerns for an animal.
- RNA technologies to regulate gene activity and prevent/mitigate disease.
- Marker vaccines based on DNA as interactions between host and pathogen are better understood and used for identifying vaccinated animals from infected ones during eradication.
- Development and mass delivery of immunization/treatments including aerosol sprays or feed-based delivery of new immunization products.
- Introduction of genome editing technology for management of diseases and proper diagnosis and treatment of diseases.
- Guiding livestock farmers for the implementation of time bound livestock policies made by different state government at the field level.
- Training of rural mass regarding animal diseases, their prevention and timed management.
- Implementation of government policies at village level for effective management of animal health practices.

Traditional system of animal health management cannot be effective in the coming future and will not be able to maintain the requirement of growing human population in terms of animal protein. Therefore, the modern and effective innovations are required to be integrated into the animal health system so as to boost the animal production system and enhance livestock associated economy.

MANAGEMENT OF TRANSBOUNDARY ANIMAL DISEASES

Transboundary animal diseases (TADs) are defined as those diseases, which have significant economic impact and impose a major threat to trade of animal and animal products to several countries in the region and have the potential to cause epidemic. Despite continuous efforts, the control of transboundary animal diseases continues to be a challenge in several parts of the world, though good progress has been made in the development of conventional and molecular diagnostic tests, vaccines, participatory epidemiology tools and remote sensing techniques, etc. Controlling TADs poses several challenges to veterinary services, since disease emergence and re-emergence is linked to a series of socioeconomic activities such as movement of livestock/poultry and humans and complex environmental factors that are beyond the control. Therefore, control of TADs is important from the point of view of regional approaches as has been conceptualized by FAO of United Nations and the World Animal Health Organization/OIE. Also controlling TADs requires a strategy and operational plans with sufficient resources.

In order to successfully control transboundary animal diseases, an efficient infrastructure may be required either to prevent the entry of TADs and/or control immediately after the disease is noticed.

Important Strategies for Control of TADs

There are different approaches for management of transboundary animal diseases. These approaches mainly target prevention of the entry and spread of pathogens. The important practices include strict quarantine protocol to avoid

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National Animal Disease Referral Expert System

In our country, the National Animal Disease Referral Expert System (NADRES) provides monthly livestock disease forewarning at district level which is published in the form of a monthly bulletin to alert the animal husbandry departments, both at the national and state levels to take appropriate control measures. The disease prediction is categorized on the probability values ranging from 0 to 1. Spatial analysis of disease data has been incorporated in NADRES to produce risk maps, hotspot maps and disease maps.

entry of exotic diseases at the time of import of animals and animal products. The early warning systems based on geographical information and remote sensing could be important approaches for surveillance and control of infectious diseases. In addition, adverse climatic conditions may be another important factor which may influence pattern of newer infection.

Depending upon the information input the transboundary animal diseases and related events can be managed with prior preparedness. This information management may include risk assessment, simulation and modelling followed by information analysis and prioritization. Early disease reporting systems which may lead to timely and precise diagnosis is important for control of TADs. Failure to timely diagnose leads to the spread of infection in a wider geographical area of the country and therefore poses difficulty in disease control. There are systems available globally, which may alert predictions of TADs and thereby help in the disease management. The estimation of risk of TADs can be determined in quantitative, semi-quantitative and qualitative terms.

Contingency Planning for Control of TADs

In case of transboundary animal diseases a country must have contingency plan to respond immediately to high threat diseases e.g. as has been the case with African swine fever, Lumpy skin disease and emerging and re-emerging High pathogenic avian influenza (HPAI). For this a written documentation in the form of standard operating procedure, capacity building of the staff at the national level and veterinary hospital level is essential. On several occasions, implementation of a successful contingency plan in case of emergencies will require inter-sectoral/ inter-departmental coordination. Government of India has very good vertical and horizontal linkages with various international organizations like FAO, OIE and WHO. It also has very good inter-sectoral /inter-departmental linkages with research and development organizations both at state and national levels.

The early warning systems based on geographical information and remote sensing could be important approaches for surveillance and control of infectious diseases.

In order to successfully control transboundary animal diseases, it may require an efficient infrastructure to either prevent the entry of TADs and/or control immediately after the disease is noticed. These infrastructures may include quarantine stations at all entry points, BSL-3/BSL-4 facilities for appropriate disease investigations, testing facilities at international borders, disease specific laboratories and emergency vaccine plans.

Factors of Quality of Management of TADs

There are a series of factors which affect timely control of transboundary Animal diseases. These include availability of sufficient quantity of quality vaccine, stakeholders involvement, regulatory standards and mechanism etc. This issue of vaccine can partially be solved with the establishment of vaccine banks for important diseases. Stakeholders' involvement for creating awareness about possibility of epidemics is also an important factor for efficient management of TADs. Proper and adequate regulatory standards and mechanism is also required for safe international trade of livestock and livestock products.

Response to Introduction/ Outbreaks

Timely emergency response to introduction of a new disease is pivotal in disease control and eradication. This response may be in the form of restriction of movement, zoning and culling of the animal and destruction of animal products. All these activities are followed by active surveillance of the disease and adequate compensation. In addition, emergency vaccination can be one of the important responses for disease control depending upon the nature and magnitude of the disease situation. This strategy can be adopted to contain an outbreak in a disease-free country or zone.

Zoning is also very important strategy to control TADs. Zoning along with movement control could be one of the important means to control spread of transboundary animal diseases. The boundaries of the zone can be defined based on epidemiological, economic, social, administrative and legal factors. Also these act as a biosecurity barrier against spread of an infection or disease.

For a country like India, trans boundary animal diseases pose a serious threat to the national economy. The recent epidemic of SARS-COV-2 (COVID-19) is a live example threatening the economy of many countries due to a single disease. As our country is pursuing prevention and control of several transboundary animal diseases at a time (FMD, PPR, CSF, HPAI, LSD & ASF) through different approaches (vaccinations/re-purposed vaccination/ culling etc), synergy in pooling of resources (human resource, clinical materials, infrastructure) becomes utmost important at this juncture.

Ayurveda AND ANIMAL HEALTH

Ayurveda, a centuries old traditional Indian system of health care, is an evidence-based science and one of the oldest medical disciplines. A 5000-year-old science, Ayurveda is a complete system, which emphasizes on living in harmony with the environment. Ayurveda, the Science of Life, based on strong pillar of positive health, is a holistic approach to total healthcare by means of preventive & curative medicine to maintain complete internal-milieu (dhatusamaya), 'Homeo-stasis' or equilibrium of the various dhatus.

The industry academia and the ministries need to work more closely to address the issue of standardization of herbs, its quality assurance, ensuring right use of herbs with proper contents, its scientific validation and much more. In absence of the same, much night by flight operators would take entry in this sector and with limited or no results of the medicines, spoil the name of the sector.

The rich heritage of Pashu Ayurveda holds huge potential for contemporary health issues in the veterinary care especially in reducing antibiotics and chemical use thus in turn reducing antimicrobial resistance

Ayurveda & Herbal Nutraceuticals in Improving Livestock Health

Ayurvedic preparations incorporate ingredients derived from plant origin. The scientific evaluation of plant materials/herbs testify the ancient wisdom blended with modern scientific precision

About the **AUTHORS**

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Executive Director, Ayurvet Limited

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& technology validating their usage for animal & human health care to achieve health, wellness & maximum productivity from livestock.

The Herbal formulations made out of quality and standardized herbs help to improve the health & milk production when used along with proper feed. The most important point is to have the quality, certified and standardized herbs, which in turns shall ensure efficacy of the formulations, or the herbs. This is the new initiative of QCS Herbals- Herbs for Health, which is working with farmers to cultivate quality herbs, process them and make it available to stakeholders.

Ayurvet Limited has taken steps of developing phytogenic/herbal feed additives for animals. Backed up by more than 750 research papers and trials, herbal feed additives are approaching a point where they are a standard ingredient or supplement in modern livestock ruminant and non-ruminant diets.

The Herbal formulations made out of quality and standardized herbs help to improve the health & milk production when used along with proper feed.

Ayurveda in One Health

The rich heritage of *Pashu Ayurveda* holds huge potential for contemporary health issues in the veterinary care especially in reducing antibiotics and chemical use thus in turn reducing antimicrobial resistance. The use of herbal solutions has been in vogue for control of mastitis, replacement of antibiotics as feed supplements, improving overall health and immunity of livestock, thus leading to limited use of antibiotics. Lot of research has been done but needs further support.

Ayurveda in Curriculum of BVSC and AH programme:

The Ministry of AYUSH and our own Ministry of Fisheries, Animal Husbandry and Dairying has inked an MOU towards research, education, skilling and extension services. This for sure would benefit all the stakeholders, apart from improving animal health. The committee formed by the ministry has recommended the suggestive syllabus on herbals/Ayurveda for the UG students. It is good beginning made in the right direction. Several industry players have signed MOU with Universities for research and Development on herbs and on the products developed.

Herbals as Leaders

Herbs Improve gut function

Phytogenic substances from certain herbs viz. *Aegle marmelos, Plantago ovata, Acacia catechu, Corriandrum sativum,* many more herbs and their extracts have been shown to improve gut microflora and to exert pharmacologic actions within the digestive tract, as evidenced by their gut function-modulating efficacy.

Herbs increase feed intake

The addition of certain herbs viz. *Woodfordia fruticosa, Zingiber officinale, Allium sativum, Trigonella foenum graecum* etc. to poultry and pig ration is also known to improve feed efficiency.

Herbs as digestive tonic and growth promoter

Supplementation of certain herbs that have property to modulate the rumen function can be supplemented to animals for efficient cellulose breakdown & digestion, maintenance of normal ruminoreticular functions. Ruchamax is a potent herbal formulation.

Herbs as Hepato Efficiency Enhancers

The herbal ingredients such as *Andrographis paniculata, Eclipta alba, Picrorhiza kurroa, Phyllanthus niruri, Tephrosia purpurea, Tinospora cardifolia* and *Boerhavia diffusa* (Superliv concentrate premix & Liquid) have been proved to improve feed conversion efficiency, body weight gain and reduce mortality in poultry and swine.

Herbs Anti-oxidant, Immunomodulator and antistressors

Herbs with high antistress & antioxidant activity like amla (*Emblica officinalis*), Ashwagandha (*Withania somnifera)*, Tulsi (*Ocimum sanctum*), Shilajit and many more have proved to be potent oxygen free radical scavenger *in vitro* and *in vivo* models.

Antimicrobial effect

The medicinal or antimicrobial properties of plant-derived substances have been well known for centuries. This property is mainly attributed to the essential oils of these plants namely *Trichyspermum ammi, Cinamonum camphora, Mentha piperita* & many more. *Oregano* and *thyme* are among those which have received a great deal of interest.

Traditional system of medicines has stood the test of time for over 4000 years, should not be considered as an alternate to the modern medicine; rather they should complement & enhance the production of livestock. Herbal additives have aroused much scientific interest over the past few years to explore their role as performance enhancers in livestock production. It is upto our scientist & industry how best they use this precious gift from Mother Nature for health and welfare of livestock and in turn humankind.

BREAKTHROUGH INFECTIONS IN VACCINATED POULTRY FLOCKS

Breakthrough infection is defined as the development of an infection in an organism resistant to prophylaxis. An infection of a completely vaccinated bird is called a vaccine breakthrough infection. Breakthrough infections can occur for a variety of reasons, including immunosuppression, vaccine failures and immune escape. In spite of vaccination and the presence of a satisfactory antibody level, it has been observed that in some instances breakthrough infections occur due to mutations that result in altered antigenicity, accompanied by failure of antigen recognition by neutralizing antibody. The emergence of new strains in the field has been suggested as one of the main causes of vaccination failure, resulting in new threats and greater losses to the poultry industry.

Immunosuppressive diseases can increase susceptibility to infections and mortalities, reduce feed conversion and vaccine effectiveness, and influence condemnation at processing and total production cost

About the **AUTHORS**

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Vaccine Escape Variants of Avian Infectious Bronchitis

Avian infectious bronchitis (IB), caused by IB virus, is an acute, highly contagious disease with severe economic consequences in commercial broiler, layer and breeder chickens worldwide. IBV frequently cause respiratory disease in young chickens and reduced egg production and egg quality in hens. In addition, some strains of the virus exhibit a renal (Kidney) and reproductiuve organ tropism and produce up to 30% mortality in affected flocks.

In India, IBV is one of the most common viral respiratory diseases of chickens and it is considered an epidemic virus and widely prevalent in poultry farms. IBV has the ability to mutate or change its genetic makeup either by mutation or recombination. As a result, many serotypes/genetic variants have been identified world over. IBV strains vary significantly from country to country as well as from region to region. IBV variants such as nephropathogenic, QX strains and Indian variants are circulating in India. Currently, a combination of Massachusetts (mass) and nephropathogenic vaccine (attenuated and inactivated) are being used to control IB in India. Despite the wide use of vaccination, the disease still occurs at high frequency.

The Evolving Virulence of Circulating MDV Strains

Despite highly effective vaccines, Marek's disease (MD) causes great economic loss to the poultry industry annu-

ally, largely due to the continuous emergence of new MD virus (MDV) strains and is characterized by T-cell lymphoma and immunosuppression. MDV continues to evolve.

Current vaccines cannot induce sterile immunity, allowing MDV to exist in vaccinated birds and be released into the environment. Thus, current vaccines can lead to MDV evolution. The continuous evolution of MDV is the main factor leading to vaccine immunity failure. MD vaccines consist of viruses of three different serotypes: MDV-1 (CVI988), MDV-2 (SB1 and 301B/1) and MDV-3 (HVT FC126). After the emergence of vv and very virulent plus (vv+) MDV field strains, serotype 1 vaccine (CVI988) became the vaccine of choice worldwide because of superior protection and is now considered the "gold standard" of MD vaccines.

Emergence of New Genotypes of Newcastle Disease

Despite the introduction of vaccines for controlling Newcastle disease (ND) more than 60 years ago, ND is still one of the most significant avian diseases affecting major poultry farms in various countries. The majority of NDV vaccines are of genotypes I and II whilst virulent NDVs are grouped in genotypes III to X. Recently, two novel NDV genotypes, VII and XIII, were reported in India. Although intensive vaccination programs have been implemented in India, genotype VII and XIII NDV outbreaks and sporadic cases occur, even in vaccinated farms.

Repeated outbreaks of virulent NDV among vaccinated chickens indicate the need to revise the NDV vaccination strategy. Furthermore, several underlying factors may have contributed to vaccination failure. In addition, recent studies have shown that genotype-matched vaccines provide better protection against challenge with the virulent genotype VII and XIII NDV and significantly reduce virus shedding and transmission compared to the LaSota vaccine.

Vaccine Escape Mutants of Infectious Bursal Disease Virus

Despite the introduction of vaccines for controlling Newcastle disease (ND) more than 60 years ago, ND is still one of the most significant avian diseases affecting major poultry farms in various countries.

In spite of vaccination with intermediate plus vaccines, outbreaks of IBD are on increase in commercial broilers and layer chicks in recent years. Some of the IBD vaccines may not induce full protection against the very virulent IBDV strains and antigenic variants observed in the field. Exchange of genetic material between the segments of field virulent virus and the intermediate plus vaccine virus results into a novel reassorted virus. Insufficient clean out between successive batches of chicks allow buildup of variant IBDV which results in outbreak at an early age.

Immunosuppression Increase the Risk of Breakthrough Infections

Immunosuppressive diseases can increase susceptibility to infections and mortalities, reduce feed conversion and vaccine effectiveness, and influence condemnation at processing and total production cost. As a result, they have substantial negative impacts on poultry health and welfare, and production performance in the poultry industry.

Vaccines with various levels of attenuation are used to control IBDV. The interaction and coinfection of IBDV, CAV and MDV can cause more severe immunosuppression. Vaccination for MD is often negatively affected by CAV infection leads to MD vaccine breaks. A proper control of IBDV is a must to have proper humoral immune responses needed to control CAV and other pathogens including ND, IB etc. Environmental factors, including management errors and mycotoxins, can also result in immunosuppression.

Vaccine failure in young chicks may be due to the presence of maternal antibody which prevents adequate response to vaccination. These circulating antibodies in the young chicks may neutralize or remove the antigen before it can induce an immune response. Typically, virulent infectious agents are capable of breaking through maternal immunity earlier than modified live or killed vaccines. Vulnerability occurs between the time that young chicks wane their maternal antibody and before they develop their own active immune responses.

MOTHER DAIRY

Serving Farmers and Consumers

Commissioned in 1974 as a wholly owned subsidiary of the National Dairy Development Board (NDDB), under 'Operation Flood', Mother Dairy was aimed at making India a milk sufficient nation. Mother Dairy sources a significant part of its requirement of liquid milk from dairy cooperatives and village level farmer centric organizations. A leading milk supplier in Delhi-NCR, Mother Dairy also offers milk and milk products. Mr. Manish Bandlish, Managing Director, Mother Dairy in a conversation with Anjana Nair, Group Editor, Agriculture Today, dwells on Mother Dairy's prowess in identifying local palate and the importance of quality and sustainability in the business.

tête-à-tête with Anjana

Mother Dairy stands by the quality of its products. How important is animal nutrition in upholding the quality of milk?

Animal health is an essential aspect in the dairying ecosystem. The nutritional composition of milk is directly influenced by the diet and health of dairy animals. For quality milk production, milch animals require a diet that meets their nutrient needs. A well-balanced and nutritious diet also plays a significant role in promoting animal health and reducing the risk of diseases and infections. We emphasize on the importance of feeding cows with quality fodder, mineral mixtures and other nutrient-rich feeds. We also provide regular trainings to our farmers on animal health, hygiene and related aspects. By ensuring optimal animal health and nutrition, we strive to enhance the quality of milk produced.

The price of milk is spiralling. What are the reasons behind this price hike?

Last fiscal year witnessed the unprecedented trend of surge in milk prices on various occasion owing to varied reasons such as rise in input costs such as feed and fodder, flush season not turning as anticipated, pandemic induced delay in AI services impacting the production cycle. In addition, demand saw a huge surge across categories leading to supply mismatch and eventually the movement in prices. However, the prices have stabilised over the recent months.

From collecting milk to diversifying it, Mother Dairy has been a trailblazer. Is India a good market for diversified milk products?

India's transformation from a milk-deficient nation to the world's largest milk producer showcases its remarkable growth in the dairy industry. India is a promising market for diversified milk products, owing to its large population, diverse geographies that encompass different local tastes, and an increasing demand for a variety of dairy products such as flavored milk, yogurts, cheese, butter, and ice cream. Furthermore, the consumption of diversified dairy products, such as flavored milk, yoghurt and cheese, have been witnessing an increase in household consumption. The Indian dairy industry is expected to grow significantly,

India is a promising market for diversified milk products, owing to its large population, diverse geographies that encompass different local tastes, and an increasing demand for a variety of dairy products such as flavored milk, yogurts, cheese, butter, and ice cream.

further creating opportunities to understand local preferences and cater to the diverse consumer base. At Mother Dairy, we have always endeavoured to draw insights from diverse taste palates across regions and bring out products that cater to their needs and preferences. Our products such as Mishti Doi, Aam Doi, Rabri Kulfi, etc are a testament to the same belief.

You have been very successful in creating successful niche brands (Chaas in Delhi and Mishti Doi). Was this the result of a learning process or a well-thought out strategy?

India is a huge and diverse country; taste profiles change every few kilometres. Our approach has always been deeply rooted in understanding these diverse preferences of the Indian consumers. Recognizing the varied tastes and preferences across different regions of India, we aimed to tap into varied segments of the popula-

tion. To achieve this, we carefully studied consumer trends. Leveraging consumer insights helped us in developing products that resonated with the specific tastes and cultural preferences of our target audiences. We sought to create products that would stand out in the market, offering a unique and delightful experience to consumers. Our Mishti Doi, Aam Doi and Chaach are exemplary products, and this fiscal too we have introduced Bengal's much-loved flavour – Nolen Gur – in two exciting formats, Nolen Gur Flavoured Mishti Doi and Nolen Gur Kulfi. We will keep tapping regional flavours.

How has been last year for Mother Dairy? Was there a growth pattern that was seen in any particular segment?

The dairy sector in the last fiscal year witnessed strong consumption patterns across categories. There has been significant growth in the milk category, fermented products like curd, buttermilk, ice creams and long shelf life range products. The consumption of summer products, in particular, reached its peak. Reaching the pre-pandemic levels seemed to be a thing of the past! Overall, as an organization, we recorded a growth of around 16%, primarily due to a huge surge in consumer demand for our varied product categories, which was on account of lifting up of pandemic-infused restrictions, opening up of restaurants, offices, educational institutions, etc. With festivals, wedding and tourism making a comeback, the fiscal also witnessed the revival of the HoReCa segment. All our business verticals collectively contributed to this growth, with dairy products leading from the front. For instance, in the fresh dairy segment, Chaach and Lassi gained immense traction, whereas, amongst the curd segment, all the types of curd – set Curd, Mishti Doi and Yoghurts – exceeded the industry growth rates. On the other hand, FY2022-23 was a comeback year for the ice creams category. It is worth noting that milk, which generally records a single digit across the industry growth has cloaked a double digit growth for us.

Recognizing the varied tastes and preferences across different regions of India, we aimed to tap into varied segments of the population.

How important is sustainability in your business?

At Mother Dairy, sustainability holds significant importance throughout our value chain. By using solar energy in our milk collection units and processing facilities, we utilize renewable energy and reduce our impact on the environment. We also collect rainwater and recycle water to use it efficiently. Our Token Milk initiative helps us prevent more than 700 metric tons of plastic waste each year, and we have switched to environmentally friendly alternatives for spoons and straws. Through our Extended Producer Responsibility program, we have collected and recycled over 19,000 metric tons of plastic waste. Our goal is to become a plastic waste neutral company by FY24. Sustainability is deeply ingrained in our values, and we are dedicated to responsible business practices.

What are the future plans of Mother Dairy in terms of products/ venture/ business?

We currently have a strong presence in across major states like Maharashtra, Bihar, Uttar Pradesh, etc. Recognizing the fragility of the dairy business, our primary focus is to build operational efficiencies throughout our value chain. Talking about the health and wellness segment in particular, Mother Dairy already offers delectable dairy-based probiotic options – having functional benefits – under its 'Nutrifit' portfolio, comprising of probiotic drinks and probiotic curd. Owing to increased awareness of safe and hygienically packed products coupled with the increased preference for health and wellness products, the Nutrifit range has garnered acceptance amongst a larger set of audience. As we proceed ahead, we will continue to expand our markets and categories with the best-in-class product experience to enhance consumption while creating new avenues for our farmers.

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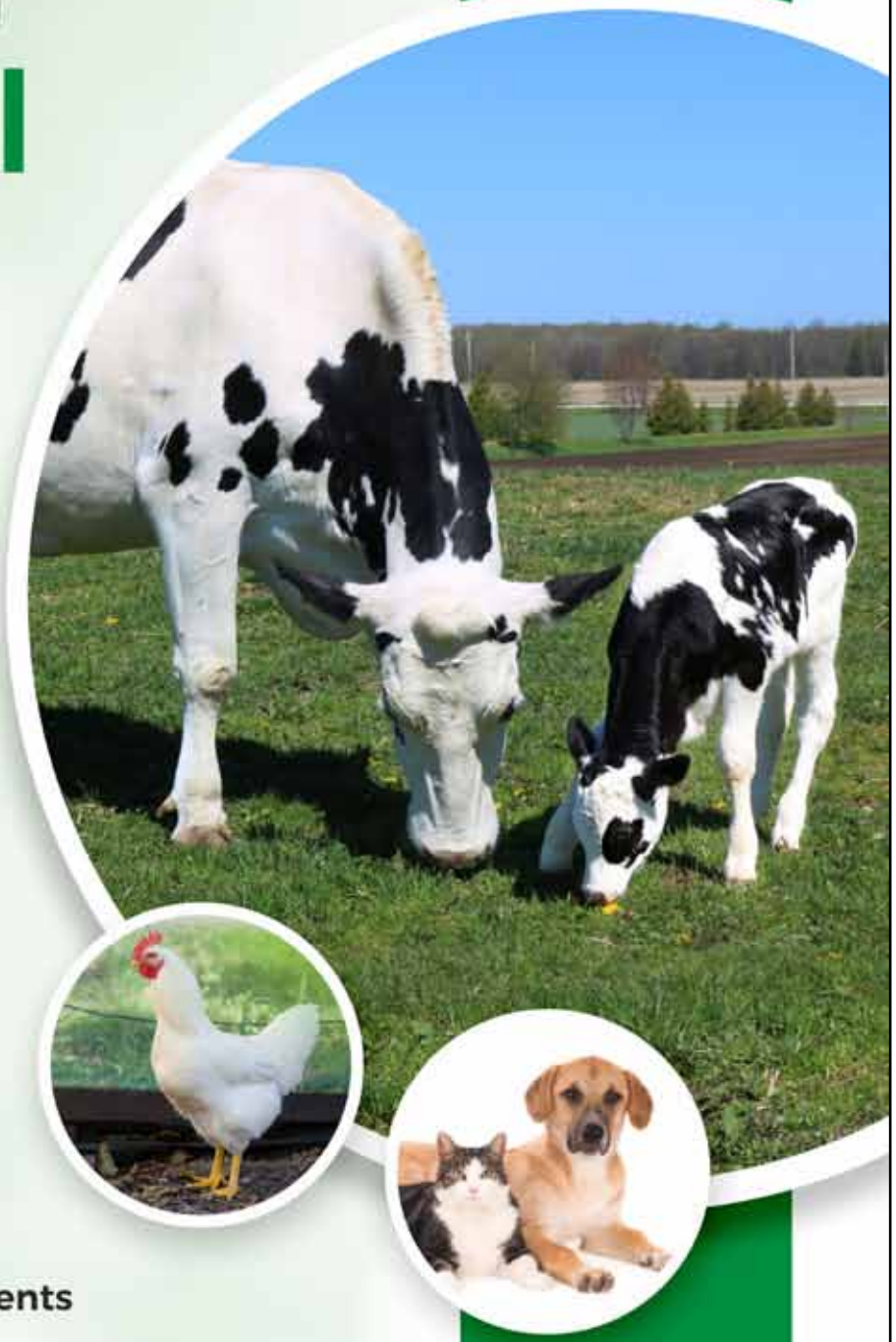

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INTERVIEW

ANIMAL NUTRITION PLAYS A BIG ROLE IN ANIMAL HEALTH

Animal feed industry is a very promising segment with its own share of challenges. In a discussion with Mr. Sandeep Kumar Singh, CEO of Animal Feed Business & Godrej Maxximilk at Godrej Agrovet Ltd. (GAVL), the trends in feed market and the opportunities were discussed. Associated with the company since 2013, he explores value creation projects for the existing businesses thereby ensuring that GAVL achieves long-term sustainable growth. He started his career at Accenture and out of a keen interest in the agribusiness space, he has added significant value to the Animal Feed Business and Industry over the years.

What is the current feed market of India?

Feed per se is a very broad term and what we focus here is concentrate feeds which basically involves processing the agri produce. Indian farmers also tend to feed their cattle with agri byproducts. Keeping that out of the calculation, I believe India's feed market would be somewhere between 45-50 million tonnes per annum. There are three important categories of animal feed – cattle, layer and broiler. The split between the three would be fairly equal with cattle feed occupying the smallest share as lot of agri produce are used in Dairy industry.

What are the trends observed in the feed market?

Dairy farming in India is getting more and more commercially oriented. Earlier animals were mostly kept for household consumption purposes. But now emphasis is on increasing production.So better yielding animals have become more important. The feeding practices also

therefore gets upgraded. Silage was not prevalent earlier. But now there is a shift towards silage utilisation. If the trend persists, the silage market would easily reach upto 2-3 metric tonnes. The shortage of fodder has established commercial ventures which are specialising in converting fodder into silage and making it available to the dairy farm. Oil cakes were fairly cheaper before. But with the instability in prices, farmers are switching to compound feeds. Agri input inflation the deciding factor.

What is the level of awareness among the farmers regarding animal feed?

Farmers are fairly updated. Most of the farmers are aware of the presence of compound feeds and their role in animal nutrition. The awareness levels may not be uniform across India. For instance, in Punjab and Maharashtra, the penetration of cattle feeds is very high. However, in UP and Bihar, it is not true. It is a market of huge opportunity. Last year, Godrej had a market share of 10-13%. As part of the business, we do a lot of market outreach programmes. We have reached out to 40,000-45000 farmers across the country through organised and unorganised farmer meeting at milk collection centres, choupals etc. As part of CSR activities also we run awareness programmes on managing animal health.

How significant is animal feed for animal health?

Nutrition plays a big role in the health of the animal. More so in the reproductive health. If the nutrition is compromised it is reflected in the overall health of the animal. Sometimes farmers give priority to the yield compromising on the reproductive health. They will invest in feeds that cater to that aspect.

Where do we stand in terms of research and development in animal feed segment?

I would say we are at the top of league. Our feed formulations do not consume as much soya and maize as what developed world consumes. In India, indigenisation of feed material is observed where we substitute with locally available raw materials and that which is not fit for human consumption. The Nadir Godrej Centre for Animal Research and Development in Nasik run extensive trials on nutrition. Even the government of India are investing a lot in this area through NDRI, NVRI etc.

Is there any particular area that would wish to see more research?

Yes. I would like to see research on better feeding practices. It will help us in meeting the quality parameter set by the importing countries. Sustainability and methane emissions are the other areas where I would like to see more research happening.

What are the cutting edge technologies currently prevalent in the world?

There is a lot of research happening on increasing protein intake, for instance insect meal. There are many start ups in this area. I haven't observed much movement in that area in India

How is the regulatory environment for feeds in India?

We have a BIS standardisation for cattle feed. It is a fairly new development. For poultry it is yet to be developed. After the creation of Ministry of Animal Husbandry and Dairying, a lot of specific industry level actions are happening. But we need to make farmers aware of the quality standards approved by the government.

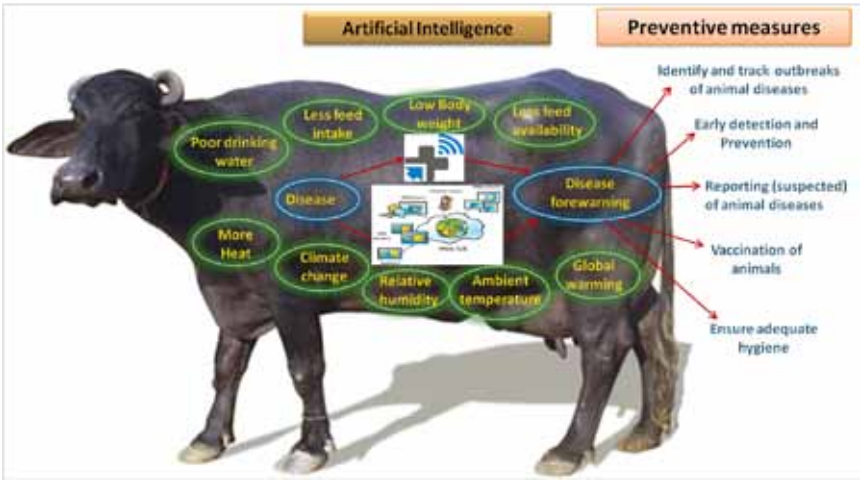
What are the challenges the feed companies face?

Currently the biggest challenge we are facing is inflation. If the price remains high for a long term we have to move towards finding a solution for this. R&D , technology and nutrition have to work to produce a formulation that does not compromise on the quality and the cost of product, It in turn affects the profitability of the firm as the profit margins of feed companies are wafer thin.

Our feed formulations do not consume as much soya and maize as what developed world consumes.

Artificial Intelligence and Machine Learning in Animal Disease Management

The agricultural industry faces numerous challenges in maximizing animal production while ensuring the health and welfare of livestock. Animal diseases pose significant challenges to farmers and livestock producers worldwide, impacting animal health, welfare, and overall productivity. In the dynamic landscape of animal production, where challenges arise from complex interactions between genetics, nutrition, environment, and diseases, innovative solutions are required to maximize productivity and ensure animal welfare. Artificial intelligence (AI) and machine learning (ML) have emerged as transformative technologies that hold immense promise in this pursuit. By leveraging the power of data analysis and predictive modeling, AI and ML offer innovative solutions to minimize the prevalence and impact of diseases, paving the way for optimized animal production and enhanced profitability.



The integration of AI and ML technologies into precision livestock farming enables advanced animal health monitoring and management.

Early Disease Detection

At the forefront of disease prevention, AI and ML algorithms provide early detection capabilities. These algorithms process vast amounts of data, including temperature records, behavior patterns, feeding habits, and physiological parameters, to identify subtle deviations that indicate the onset of diseases before visible symptoms manifest. Such early warning systems enable farmers to take prompt action by implementing appropriate interventions to contain disease

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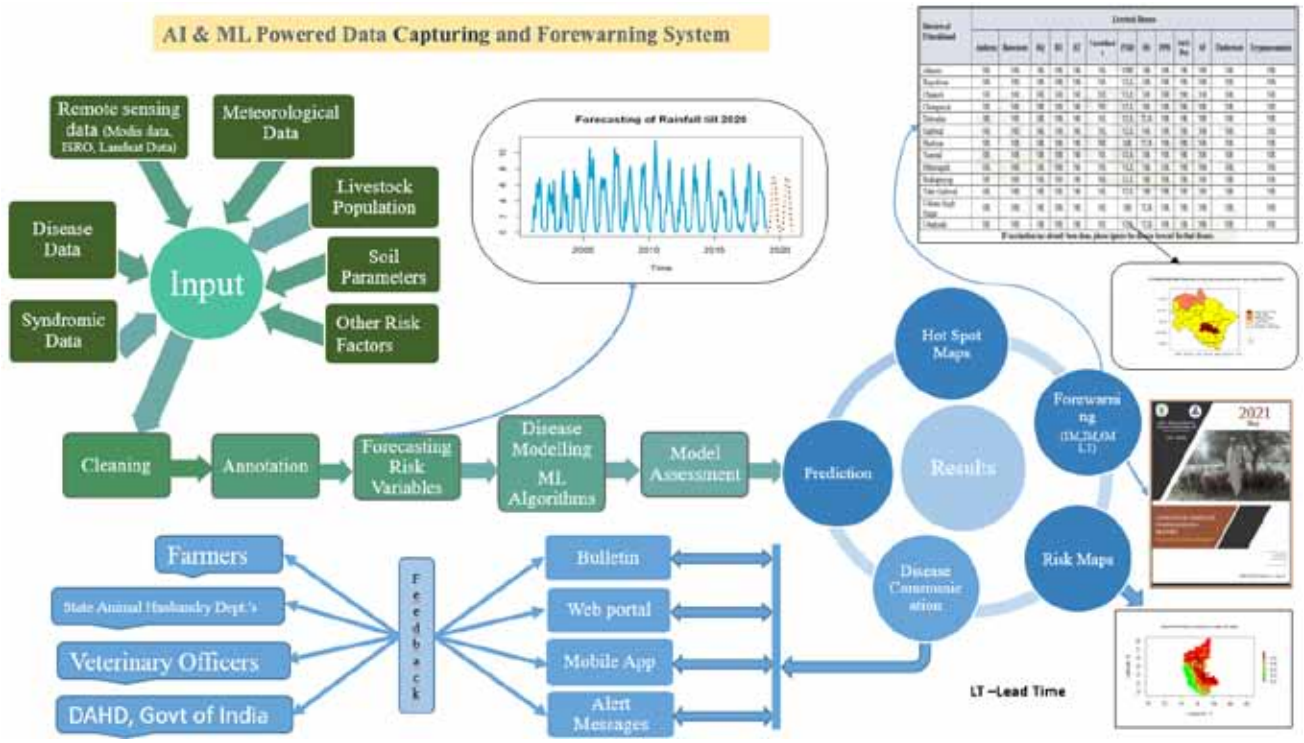


outbreaks and limit their spread within animal populations.

Predictive Analytics

AI and ML models excel in predictive analytics, offering valuable insights into disease outbreaks. By analyzing historical and real-time data, such as weather patterns, environmental conditions, and animal health records, these models can forecast the likelihood of disease occurrences. Equipped with this knowledge, farmers can proactively implement preventive measures such as targeted vaccination programs, customized feed compositions, and optimized animal management practices. Proactive interventions mitigate disease risks, enhance production efficiency, and foster better resource allocation, ultimately maximizing animal productivity.

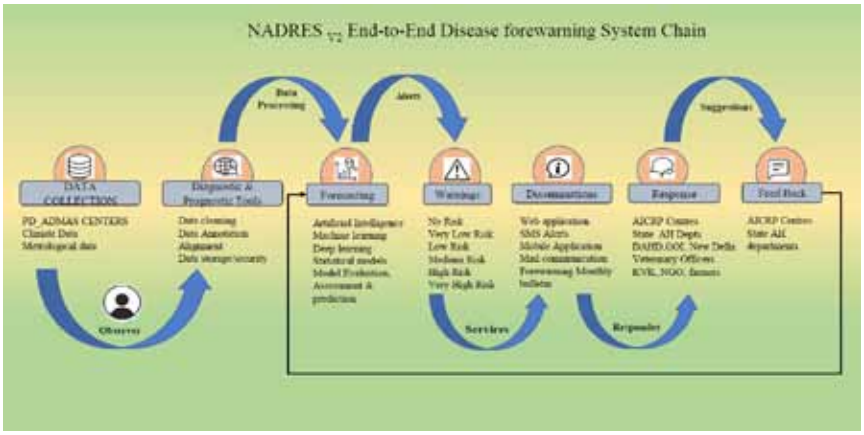
Precision Livestock Farming

The integration of AI and ML technologies into precision livestock farming enables advanced animal health monitoring and management. Real-time data collected through sensors and Internet of Things (IoT) devices, including vital parameters like heart rate, respiration rate, and activity levels, can be collected and analyzed by AI algorithms. These algorithms facilitate the prompt detection of abnormal patterns that indicate potential health issues. This timely detection empowers veterinarians to intervene swiftly, implementing appropriate treatments and minimizing the impact of diseases on animal productivity. Precision livestock farming also allows for individualized care, optimized resource allocation, and improved animal welfare.

AI and ML techniques accelerate vaccine development, representing a significant advancement in disease prevention

Automated Diagnosis and Treatment

AI and ML technologies play a pivotal role in disease diagnosis and treatment, significantly improving accuracy and efficiency. By analyzing medical images such as X-rays, ultrasounds, and histopathological samples, these technologies



can detect even the slightest anomalies, assisting veterinarians in making precise diagnoses. Additionally, AI-powered decision support systems utilize extensive medical literature and clinical data to aid veterinarians in selecting the most effective treatment plans. This integration of technology enhances diagnostic accuracy, facilitates personalized treatments, and ultimately results in improved animal healthcare outcomes. By streamlining diagnosis and treatment, AI and ML empower farmers to effectively manage animal diseases and minimize their impact on productivity.

Vaccine Development

AI and ML techniques accelerate vaccine development, representing a significant advancement in disease prevention. These technologies analyze genomic data and predict the efficacy of different vaccine candidates, expediting the identification of antigenic regions of pathogens and deepening our understanding of host-pathogen interactions. As a result, the development and deployment of tailored vaccines to combat specific diseases are streamlined, reducing animal susceptibility and safeguarding their health and productivity.

Data-driven Animal Management

AI and ML algorithms analyze vast datasets encompassing animal genetics, nutrition, and environmental factors, enabling farmers to optimize animal management strategies. By identifying correlations between specific factors and disease susceptibility, farmers can make informed decisions regarding breeding programs, nutritional formulations, and environmental modifications. This data-driven approach minimizes disease risks, enhances animal welfare, and maximizes production efficiency.

In conclusion, the integration of AI and ML into animal production practices holds immense potential for minimizing animal diseases and maximizing productivity. These technologies empower farmers and livestock producers to make informed decisions and implement effective interventions. Successful implementation requires access to reliable and diverse datasets, collaboration between stakeholders, and continual validation and improvement of the algorithms to ensure sustainable and responsible implementation. By leveraging AI and ML, we can create a future where animal production is optimized, diseases are minimized, and both animals and farmers thrive.

HETHA – CONSERVING DESI BREEDS

A software engineer decides to quit his white collar job and turns into a dairy farmer. Aseem Singh Rawat – Founder & CEO – Hetha Organics LLP, has come a long way trusting his guts and vision.

Hailing from a middle class family, Aseem after finishing his BTech and Post Graduation in Information Technology joined the rat race. "I worked for many companies across different states in India and abroad. After around 13 years of a 9-5 job I figured out that there is more to life than just bread and butter. Deep within I wanted to be an entrepreneur but the shift from being a job seeker to a job creator was not easy."

The End and the Beginning

He had found a cause closer to his heart. He was appalled by the condition of indigenous cows. He felt the need to create an organisation which could support cows from the beginning until their natural end. He had found a purpose in life.His family and friends were indeed shocked when he left his job. No one believed that his idea would work. It was the beginning of a new journey.

He had well thought out plans about his new venture. He wanted to protect Desi cows. He would not seek donations and his organisation will be self sustaining by marketing organic raw desi cow milk and Panchgavya products to customers. He would not send old cows and bulls to slaughter houses but would provide them with a livelihood.

Hetha was born. " HETHA is the name of my great great grandfather and I found it apt to name the organisation after him as I was using his land to start this endeavour."

He used his own savings as the seed capital. Loan under the Kamdhenu Yojna was also of help.

Benefits of A2 milk

Aseem believes in the quality of his products and has thoroughly investigated its benefits. "Milk has protein. This protein is mostly beta casein which can be A1 or A2 or a mix of both and other types. A2 type milk is easy to digest when compared to A1 type milk and is a healthier option. A1 type milk can cause autism, type 1 diabetes, schizophrenia, bloating and indigestion to name a few .

A2 type milk is easy to digest when compared to A1 type milk and is a healthier option.

Dr. Keith Woodford did extensive research on A1, A2 milk types and wrote a wonderful book on this topic titled " Devil in the milk ..." , it's worth the time".

Producing Own Milk

In an industry dominated with milk giants whose model solely work on the milk procurement and marketing, Hetha stands apart in producing its own milk.

With an admirable herd size at 1000+ indigenous cows and bulls, Hetha produces its own milk and manufactures over 120 cow based products.

"We have a central FSSAI manufacturing license. Since Hetha is also manufacturing cow based Panchgavya medicines we have an Ayurvedic drug manufacturing license too and are GMP certified. We also do organic farming, and are certified from Ecocert."

Marketing

Aseem remembers marketing his first batch of milk. "This was tough. I was the first delivery boy and sales person. I used to put stalls to propagate the benefits of milk from indigenous cows. Slowly we got customers and I very vividly remember using my father's car to make the first delivery of HETHA 's milk to a customer in Uttam Nagar in Delhi. "

But by the virtue of its products, Hetha's name got around. Apart from that, Hetha is a regular in trade shows and Sunday markets. They also make use of Facebook, Instagram, print media are other avenues to reach out to potential customers.

Future Plans

With a turn over of around Rs. 5 crores last year, Hetha has solid future plans.

"We currently have 4 indigenous cow breeds namely, Gir, Sahiwal, Tharparkar and Himalayan Badri in our farms. The current herd size is 1000+ which is spread across 3 main sites and this continues to grow. As our cows and bulls grow in numbers, we need more land, fodder and resources to manage them.

We certainly want to support more indigenous cows and bulls in the future. The Indian cow can survive only if the population understands that a cow is beneficial to humans and our environment until it's very end !

Aseem Singh Rawat

Vaccination
A LOW COST STRATEGY TO MINIMIZE ANTIBIOTIC USE

Livestock sector is a live market and very susceptible to various infectious diseases which threaten efficient livestock production. Therefore, it is important to keep livestock healthy and productive to sustain the animal husbandry for ensuring food security for growing Indian population. Good husbandry practices play key role in keeping the livestock healthy and productive, and also clinical intervention especially use of antibiotics to treat the sick livestock to reduce the loss caused by infectious disease.

Antibiotics and Antibiotic Resistance

Antibiotics are the most powerful tool against bacterial infection and their merits need to be preserved for future generations. However, antibiotics must be used judiciously under veterinary prescription as they are not panacea to deal any type of health problem to avoid development of resistant strains.

Antibiotic resistant bacteria are present since long before the discovery of antibiotics and these bacteria have evolved by natural selection. There are usually million of individual organisms in a bacterial colony and among them some have undergone genetic mutations which improve their ability to escape the action of particular antibiotics. Antibacterial resistance has the potential to affect almost all sustainable development goals (SDGs), particularly those targeting poverty, hunger, health and economic growth.

One Health and Antibiotics Resistance

World health organization, Food and

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Agriculture Organization of the United Nations (FAO) and the World Organization for Animal Health (OIE) together gave a comprehensive approach for better public health called as "one health". The objective of "one health" is to promote multi-sectoral response for increasing awareness, restrict misuse or overuse of antibiotics in livestock, food safety hazards, risk from zoonotic diseases, ensuring environmental protection, best practice improving surveillance and research, having a strategy for prevention and control that include human and animal vaccine and sanitation, optimization of antibiotic use and promoting research and development efforts.

Presently most of the vaccines used for immunization are either live or inactivated in nature. The conventional veterinary vaccines protect animals against the potential dangers of many infectious diseases of bacterial, viral and fungal origin. It stimulates animal's immune system and prepares them to resist the infections caused by pathogenic microorganisms. Vaccination is most effective way to prevent the transmission and the spread of animal disease epidemics which subsequently provide food security and public health.

Success Saga of Vaccination

The impact of veterinary vaccines is witnessed by success of Global Rinderpest Eradication Program This has been a great achievement in animal health area and rinderpest is the second disease after smallpox eradicated globally. Vaccines against other diseases like Brucellosis, Rabies, Foot and Mouth Disease, PPR are being used as main instrument in the eradication program of the respective diseases globally. In addition to assisting in eradication program of animal diseases, vaccines also combat emergence of drug resistance pathogens and emergence of new diseases.

Since the first use of vaccine, the research for vaccinology in past 200 years has generated continuous technical breakthroughs and led to substantial improvements in human and animal health.

Technical Breakthroughs

In the last two decades, veterinary world has observed significant development of novel prophylactics facilitated by advent of biotechnological tools and techniques, and discovery of antigen/gene delivery systems or recombinant vaccines developed using biotechnological tools or genetic engineering representing an alternative strategy by which the limitations of conventional vaccines are taken care. A number of genetically engineered vaccines which are rationally designed have already been introduced in the veterinary market.

How Vaccine Prevents Emergence of Antibiotic Resistance

By preventing disease and proliferation of bacteria

Vaccines are usually inoculated before the infection to restrict the possibilities of colonization of pathogen in host by conferring immunity against it. Thus, it reduces the chances of some bacteria to mutate.

By boosting the herd immunity

Vaccination with sufficiently high level of coverage against transmissible disease indirectly protects the neonates, unvaccinated, immune-deficient and immune-compromised animals in the herd by establishing herd immunity. The risk of disease spreads in herd and possibility to contract infection by unprotected animals are very less in a herd with strong immunity.

By mechanism of action less prone to induce resistance

Broad spectrum antibiotics act indiscriminately and disrupt the microbiome of gut, which may lead to development of resistance in bystander species. Large density of resistance bacteria in gut provides an environment for horizontal transfer of resistant gene among bacteria following gut dysbiosis. While, vaccines are specific and do not break the mircobiome of the gut.

By preventing misuse of antibiotics

Misuse or over use of antibiotics leads to selective pressure and emergence of antibiotics resistance organism. Vaccination against prevailing or endemic bacterial infection avoids the misuse of antibiotics.

By vaccinating against viral infection

Viral vaccines also has important role in preventing bacterial resistance. These vaccines not only prevent the viral infection but also inhibit the growth of opportunistic bacteria which flourish once immunity goes down due to viral infection in animals.

Vaccines are considered as important tools to minimize the antibiotics use in animal production system. However, technological advancement needs to be carried out as a continuous process with regard to their production and administration in livestock and poultry sectors.

REIMAGINING CAMEL AS A DAIRY ANIMAL

Nick-named as 'Ship of the Desert' for its versatile role in sustaining the livelihood of nomadic people, Camel was primarily involved in transport, agricultural work, and other activities. Modern-day transportation facilities, road-network and mechanical support have down-sized its role in the desert, but camel has regained its importance due to its dairy traits and milk production potential. Therefore, camel milk has often referred as 'White Gold of Desert' due to its potential therapeutic application. The milk is a staple food for desert nomad tribes and it plays an essential role in their survival during long journeys in the desert and in during calamities.

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Camel- The Multi Utility Animal

Traditionally, many communities consume milk to improve health and vigour. Also, camel urine has therapeutic usage in traditional medicine. The occurrence of functional antibodies lacking light chains in camels, often referred as 'nanobodies' opens up a new era in camel immunology and its potential application in disease diagnosis, therapeutics and disease control programme. But, its potential biomedical application e.g. immune-diagnostics, climate-resistant phenomena, typical thermo-regulatory mechanism, distinct anatomical and metabolic physiology, render it as a multi-utility animal in times to come.

Nutraceutical Properties of Camel Milk

Camel milk has balanced nutrients and exerts array of biological activities that modulates digestion, nutrient absorption and metabolism, growth and development and resistance to various diseases. The diverse colloidal structure imparts special biological activities of protective and not-allergenic milk proteins. It is also rich in vitamin B3, niacin, carnitine and vitamin C, minerals like Cu and Fe and high levels of IgG and insulin. The vitamin C content is 4-6 times higher than cow milk and is thus an important supplement to fight against heat stress in the desert. The disease-fighting immunoglobulin are smaller in size that allows its penetration and augment the mechanism of immunity.

Camel Milk as the Therapeutic Adjuvant

Diabetes: Camel milk has been used for management of **Type-1 diabetes** due to presence of insulin/insulin like substances in the milk. Significant glycaemic control was observed in patients receiving camel milk 500 ml daily.

Blood pressure: Cholesterol content of camel milk is low (34.5 mg/100 g) and milk fat digestibility is found to be higher than cow and buffalo milk. Besides, fermented camel milk that has enhanced bioactive properties are found to be beneficial in controlling blood pressure and cardiac anomalies.

Tuberculosis: Due to presence of high quantities of antimicrobial components in camel milk its consumption has been shown to have beneficial effects on Tuberculosis as increase in appetite, live weight gain, improvement in content of haemoglobin, Zinc, Iron; reduction in TLC and ESR are observed.

Autism: Use of camel milk therapy has helped to improve Health/ Cognitive/ Behavioural parameters as Autism Treatment Evaluation Checklist (ATEC) scores improved in all categories of affected children. Observations on use of **"Camel milk therapy"** have proved to be useful in children.

Anti-stress: Amelioration of stress is through its antioxidant properties.

Antiallergenic properties: Whey proteins are the main component which constitutes 20-25% of total proteins. Whey proteins of bovine milk contains β-lactalbumin 50% whereas α-lactalbumin is the second component (25%) whereas in camel milk β-lactalbumin is deficient and α-lactalbumin is the major component due to which allergies due to milk are not observed.

Whey-protein: Whey contains substantial quantities of serum albumin, lactoferrin, immunoglobulin and peptoglycan recognition protein. Lactoferrin an iron binding glycoprotein is present in milk and saliva; it exhibits various biological functions as **antimicrobial, antioxidant, immune-modulator** etc.

Anti-cancer: Comparatively higher antioxidant, angiotensin-converting-enzyme (ACE)-inhibition and antiproliferative activity of fermented camel milk provides anti-cancer properties.

Gut-health: Camel milk contains highest concentration of lactoferrin among bovine, caprine and human milk. It is also suitable for people who are **lactose intolerant** and is a natural probiotic drink that promotes the growth of healthy bacteria in the gut.

Skin-health: The antioxidant properties of camel milk has protective activity on skin tissue against free radicals and heals skin issues; wrinkles and dryness and its α-hydroxyl acid acts as anti-aging.

Sustenance of this unique species that can fetch revenue to the native camel breeders through its versatility of usage, presently being of importance is developing camel as 'Dairy animal'. Further, in this changing role, the possible alteration in rearing practices should be safeguard to preserve its medicinal properties by identifying the plant species that transfer its phytometabolites during ruminal and systemic metabolism in to the secretion 'Milk' for the desired health-benefit effects. So, the climate-resistant phenomena, pasturing and rumen ecology, enhanced reproductive and productive challenges, conservation of promising germplasm, etc. need major research and development focus, besides realizing its importance in government policies and planning.

INDIAN ANIMAL HEALTHCARE

CHALLENGES AND OPPORTUNITIES

Holistic healthcare is most essential for disease mitigation, maintaining health and ensuring efficient animal production. Animal Healthcare Industry has been playing a very important role in safeguarding vast livestock resources of the nation. With significant investment in the veterinary products manufacturing, Industry is emerging as an important growth lever of the Indian economy ensuring availability of best possible healthcare solutions to the large livestock population and thereby contributing to farmers' welfare.

With ever increasing demand for animal origin protein, India has untapped potential in animal health sector to emerge as one of the leading players in the world. To leverage this high growth potential and to meet the rising demand, a sustainable and strong farming base will be critical. For achieving this, it becomes equally essential to address key challenges faced by the sector such as inadequate veterinary care, poor farm management and frequent occurrence of the disease outbreaks etc.

Challenges in Animal Healthcare

Though India is the leading producer of milk and poultry products, the global share of the Indian animal health business is quite small. Due to smaller market size, the allocation of financial resources is limited, which hinders innovation and new product development.

Also, the availability of skilled manpower

India has adequate infrastructure for manufacturing veterinary formulations; however, it is highly dependent on import of raw materials/APIs due to the cost and technology advantages

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Manufacturing & sale of Animal Feed and Feed supplements in India are not well regulated; BIS standards & specifications are prescribed for compounded animal feed & mineral mixtures. For import of Animal Feed Supplement / Feed additive products in India, DAHD is the competent authority that issues approved list of Feed Supplements / Additives. There have been on-going discussions at FSSAI & DAHD along with other stakeholders for creation of separate regulations for Animal Feed and Feed Supplements.

for R&D and limited translational research are some of the limiting factors for innovation. Animal biotechnology is yet another area that has not been explored to its potential. Lack of access to biotechnological advances and its cost vs benefit ratio limits commercialization of such concepts.

India is highly dependent on import of raw materials/APIs due to the cost and technology advantages. Many APIs of novel formulations are not manufactured in India, posing challenges for indigenous development of formulations and to become globally competitive.

Inadequate animal health infrastructure and coverage severely affect immunization & disease control programs in many parts of the country. However, current Government has considered animal husbandry as a priority sector and has undertaken many initiatives for overall improvement of the sector and to boost farmer's income.

Regulatory Policies

Regulation and guidelines for veterinary drugs follow the same process applicable for human medicines. New drug approval and registration require submission of adequate data supporting the safety, quality and efficacy of a product in a detailed dossier. Depending upon the nature of the veterinary product, multiple regulatory agencies (including CDSCO, DAHD, GEAC, and IVRI), are involved in approval of new veterinary drug or biological, which makes the process little complex and time consuming. Govt. of India has been very active in the past few years in bringing digital reforms across the sectors. SUGUM, the digital window of CDSCO, facilitates online regulatory submission, review of applications and grant of permissions/licenses.

With the creation of separate veterinary cell at CDSCO, various reforms are undertaken considering the specific needs for veterinary drugs and biologicals. New guidelines for conducting field / clinical trial of new drugs have been prepared by DAHD in collaboration with CDSCO. Recently, DAHD has also launched NANDI portal for grant of NOC for new veterinary drugs and biologicals. In near future, there will be further streamlining of the process through its integration with CDSCO's Sugam portal.

AMR & Animal Healthcare Practice

Many a times, veterinary use & over-use of antibiotics has been projected as the prime cause of emergence of bacterial resistance to the drugs, which in fact is untrue. In general, the effect of antibiotic residues in meat, eggs and milk are insignificant when compared with the issue of selection and amplification of antibiotic resistant strains of bacteria. There has been scientific consensus that the prime driver of AMR emergence in human is due to human use only. Also, limited focus is laid on the of environmental factors in propagating resistance.

Recently, Indian Federation of Animal Health Companies (INFAH) that represent approximately 85% of the Animal Health Industry of India compiled an estimated usage of antibiotics in organized animal healthcare for the year 2020 and 2021 and submitted to Department of Animal Husbandry & Dairying (DAHD). The estimated data on antibiotic usage in 2020 and 2021 were 912 MT and 963 MT respectively. Besides, there is no systematic, comprehensive data on the prevalence of AMR infections in livestock.

Animal healthcare companies are also focusing on various growth strategies including collaborations, in-licensing, mergers and acquisitions in order to enhance their market presence; also making continued efforts to bring in more advanced and innovative products to ensure optimum health and productivity of animals and the market is expected to maintain its growth momentum with the continued thrust on product innovation by leveraging newer technologies.

SAFEGUARDING ANIMAL HEALTH

UNVEILING THE VITALITY OF MANAGEMENT AND POLICY FRAMEWORKS

Livestock sector assumes socio-economic significance in developing countries like India due to the multi-functionality of livestock performing output, input, asset and socio-cultural functions. In India, the sector contributes one third of the gross value added (GVA) from agriculture and allied sector and exhibites compound annual growth rate of over 8%. Rapid population growth, urbanization and income growth in India as well as across the globe is fuelling a massive increase in global demand for food from animal origin. Driven by the drivers of demand, the Indian agriculture is slated to witness livestock revolution in the next one or two decades. However, challenges to sector increasingly been seen with changing socio-economic as well as climatic conditions. Poor production performance of Indian farm animals and quality of the animal based products has always been major concern, especially when it comes to competing in the international market. Moreover, in recent years, there has been a growing concern regarding animal health issues, particularly following the outbreak of lumpy skin disease (LSD) that affected over 20 lakh cattle in India and killed about 1 lakh of them.

The health of animals plays a crucial role in harnessing the desired productivity levels of farm animals. In India, where there are limited feed resources and a significant number of bovines with inferior genetic makeup already posing challenges in the sector, a further decline in productivity resulting from poor animal health only compounds the difficulties faced by farmers. This situation does not bode well for the livestock industry.

Enhancing Feed and Fodder Resources

The animal health institutions of our country have demonstrated unwavering dedication for decades and the contribution of the Indian veterinary fraternity in the global eradication of Rinderpest is also a source of pride. While the progress made so far has been encouraging, in order to elevate the animal health delivery mechanisms in our country to international standards, a lot more needs to be done.

For this, putting in place better systems and standards would be the starting point. This would imply a plethora of activities to be carried out, foremost being improving animal nutrition by ensuring balance feeding with sufficient quality of feed and fodder. Imbalanced feeding adversely impacts productivity, health and welfare of animals. Also, the improved breeds of livestock, unless fed properly, will be unable to realize their complete genetic potential. The recent estimated deficit in green fodder is 11.24 % while the country is experiencing 23.4% shortage in dry fodder and around 29 % in concentrates. As per few reports, devoting around 14-17 % of land for fodder cultiva-

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tion will be ideal for meeting the current fodder shortages in the country, but fodder is being cultivated on 8.4 mha (nearly 4%) area from last few decades. It is true that sparing more area for fodder is intricate in the wake of rapid intense competition for additional land from commercially important crops. Therefore, there is an urgent need to have practical and meaningful strategies for enhancing feed and fodder resources for ensuring animal nutrition and thus health as well as performance of farm animals.

Deficient Veterinary Services

There are currently around 69,000 Veterinary Institutes (VIs) in the country, catering to over 536 million livestock. The National Commission on Agriculture (NAC) has recommended having one veterinarian for every 5,000 animals, but the ratio is almost 50% in most of the Indian states. Reportedly, Uttar Pradesh- the state with highest livestock population has on an average one veterinary hospital for 21000 animals. Therefore, it is imperative to increase the number of VIs to strengthen disease surveillance and control, as well as research and development capabilities in the animal health sector. In doing so, states with significant livestock populations should be given priority, as there is a noticeable disparity in the number of VIs across different states. For example, states such as Bihar, Madhya Pradesh, Gujarat, and Telangana, which have substantial livestock populations, do not feature in the list of top ten states in terms of the number of VIs.

Moreover, it is important to upgrade the quality of veterinary services to ensure that high-quality animal health care is provided at affordable rates to farmers, particularly for large animals. Additionally, veterinarians who graduate from colleges should be provided with continuing veterinary training to keep them updated on various animal health issues. This will enable them to stay informed and provide the best possible care to livestock.

Livestock Insurance

Livestock insurance i.s another crucial area of concern in animal health management as it provides financial protection, incentivizes disease prevention, ensures timely treatment and care, supports farm sustainability, aids in risk management, and contributes to economic stability in the livestock sector. Currently, the insurance scheme does not even cover 1% of the cattle population. A recent report by the standing committee on agriculture, animal husbandry and food processing has stated that not even a single livestock has been insured during 2022-23 under the livestock insurance scheme. In the past few years, insurance coverage has witnessed decreasing trend.

The National Commission on Agriculture (NAC) has recommended having one veterinarian for every 5,000 animals, but the ratio is almost 50% in most of the Indian states.

Generating Farmer Awareness

While developing strategies for animal health care and disease control, generating suitable level of awareness among farmers and their capacity building is also imperative for ensuring their understanding of the importance of animal health management, particularly when they involve interventions on their animals, such as balance feeding, vaccination, disease testing, isolation, or removal from the herd. Capacity building of farmers is often overlooked in the rush to push the results of research and development products to farmers. Farmers in many developing countries including India are resource strained, poor and still have weaknesses in their development. The provision of education becomes essential to instill in them the conviction that embracing scientific procedures is beneficial, while neglecting these procedures would result in losses.

Currently around 731 Krishi Vigyan Kendras (KVKs) - the front-line agricultural extension centres, are functioning in the country to transfer newly developed technologies and outcomes of research and development into the farmers' fields. By mandating these KVKs to conduct practical demonstrations and field events showcasing the financial advantages and positive impacts of animal health management, it is possible to foster a positive change in farmers' attitudes. Farmer's own recognition of the need for animal health care and disease control would pave the way for a sustainable long-term livestock health management strategy.

UNVEILING THE POTENTIAL

TRANSFORMING CATTLE HEALTH & FARM PROFITABILITY THROUGH DIGITAL TECHNOLOGY

The livelihoods of many small and marginal farmers depend significantly on livestock, with dairy farming standing out as it offers a consistent source of income. However, these farmers face a myriad of challenges in their daily operations, particularly in maintaining optimal cattle health & profitable lactation cycles. The combination of low yield per animal and high production cost, along with very limited access to reliable advisories, veterinary care, animal husbandry services, nutrition & credit makes the situation even more difficult. If their operations become unviable, the chances of farmers exiting the sector increases. Thus, leveraging latest digital technologies to enhance cattle health & profitable lactation cycle management is very important for the future of farmers and India.

Cattle Health and Smallholder Dairy Farmers

Let us visualize a dairy farmer with 2 to 3 low-yielding cattle burdened by soaring production costs. Lacking access to advisories on proper feeding and management practices, she resorts to feeding her cattle with whatever is available rather than what is truly required for the cattle. Consequently, the cattle fail to exhibit their genetic potential and continue to be low yielders. The farmer neither has the knowledge of what the right nutrition is, nor does she have access to purchase affordable quality feeds.

Poorly maintained cattle face further setbacks. Unhealthy cattle face additional hurdles in getting pregnant, leading to a significant loss of milking days. The struggle compounds if there is a lack of access to efficient inseminators or vets. Missed insemination opportunities, unsuccessful inseminations and delayed pregnancies result in the loss of many milking days. The farmer, desperate to salvage some productivity, continues milking the animal, but this only serves to further diminish milk yield in subsequent lactations. In the absence of proper nutrition, regular checkups and preventive measures like vaccination and deworming, the risk of animal falling ill increases further contributing to loss of milking days.

The intertwining web of these challenges highlights the urgent need to address cattle health among smallholder dairy farmers. By providing the right feed and implementing improved animal husbandry practices, the potential for income generation can be multiplied manifold.

Digital Technologies in Dairying

Digital Technology has the potential to reshape the story of distressed small hold dairy farmers by empowering them with advisories and tools to enhance the well-being of their animals. Through a unique blend of human wisdom and artificial intelligence, digital applications act as a guiding force, providing practical and actionable guidelines for better feeding, breeding, and management practices. This serves as a catalyst for improving cattle health and, in turn leading to increased farm profitability.

Let us re-visualize the same farmer, weighed down by low-yielding animals, high production costs, limited access to quality veterinary and animal husbandry services, and inadequate credit options.

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However, here, the farmer is armed with a smartphone and embraces various technological solutions like Stellapps digital suite of products comprising of SmartFarms™ and mooON™.

Image Processing for Cattle Health

SmartFarms™ and mooON™ offers an AI powered image processing feature which tells the overall health of the cattle by processing visuals of cattle from multiple views and thus mimicking the intelligence of experts to judge the body condition score, an indicator for cattle health. It goes one step further by suggesting the tailored feed regime to help cattle achieve their ideal health condition.

Personalized Feed Regime

Stellapps' feed calculator unlocks cattle's true potential. It would craft a personalized feed regime tailored specifically understanding the cattle's nutritional requirement to perform at its genetic best. It considers the availability of alternatives and provide a cost optimised regime. With easy-to-understand visuals, farmer clearly see the marginal benefits of increased milk yield in relation to the marginal increment in the feed cost. Farmer can choose from variety of quality feed and mineral mixtures listed in SmartFarms™ and can get it conveniently delivered and paid for through milk credits. Feed calculator prioritizes feeds with lower carbon footprint, promoting sustainable feeding practices and paving the way towards a greener future. Partnering with climate champions or carbon markets can offer ways to incentivize farmers who follow sustainable practices.

AI Powered Digital Companion - Para-Vet

Stellapps also offers an AI powered digital companion to farmers, mimicking the expertise of a veterinarian or para-vet. When the farmers observe sickness symptoms in their animals, they can enter their observations and the app offers instant diagnosis along with immediate steps the farmer can do to control the disease. It suggests multiple therapeutic techniques like allopathy, ethnoveterinary empowering farmers to choose the treatment option that best suited their preferences, resources, and beliefs. It also facilitates virtual communication with veterinarians for expert opinions, bridging the gap in limited access to vet care. SmartFarms™ being a true companion sends timely reminders for critical activities such as observing heat cycles, pregnancy diagnosis checks, initiating dry-off, deworming, and vaccination. Farmer can access credit, insurance, advisories, and various other services through the same App. Through one interface the farmer can avail all the services at her village.

When developing solutions for smallholder farmers, it is crucial for solution providers to confront their own biases. Accessibility and affordability should be prioritized in app development. Complex, resource-intensive, expensive, and overly sophisticated solutions will never be suitable for smallholder farmers. App builders must never overlook the importance of offline functionality or the need for localized language support. It is imperative to be sensitive to local cultural norms and values. By embracing these principles, app builders can ensure that their solutions truly serve the needs of smallholder farmers.

Digital technology providers should harness the power of artificial intelligence, vision technology, machine learning, and voice recognition to create transformative solutions that pave way for a brighter future. As a leader in leveraging Digital Power in the world, India must provide the power of 'Digital' to the farmers as well.

Asha Mahila Milk Producer Company Limited

EMPOWERING RURAL WOMEN

Incorporated in Pali, Rajasthan on 21st March 2016, Asha Mahila Milk Producer Company Limited provides livelihood to rural women by Setting up a transparent Milk Procurement System and providing Technical Input Services. Asha directly works with women farmers, providing them with training and resources to improve their milk production techniques and quality, thereby positively impacting the overall agricultural sector. Wholly owned by women farmer members, all producer directors are women.

Million Milestones

Currently, Asha is working in 650 villages in Pali, Sirohi, Jalor, Dungarpur & Udaipur and associated with more than 35000 farmer women.

Asha Mahila Milk Producer Company achieved reached a significant production target of 1.5 Lakh Kg of milk per day, on 15th August 2020 and Introduced their first milk product brand name, "Marudhara Ghee". They successfully established a BVM in Pali, Udaipur & Sirohi District and their Blocks by which they could directly sell milk and dairy products to urban consumers. The launch of 'Calcium', a stainless-steel utensil specifically designed for removing plastic milk cans, is a remarkable achievement for Asha Mahila Milk Producer Company. In collaboration with the National Dairy Development Board (NDDB), Jalandhar, they also provide training in mobile artificial insemination. Asha has entered into tie-ups with HDFC Bank and SBI Bank to provide financial support to its milk producers. As part of their commitment to the welfare of their milk producers, Asha Mahila Milk Producer Company provides seasonally different types of good-quality green fodder seeds free of cost as well as based on actual cost.

In FY-2022-23, total Profit of Asha Mahila Milk Producer Company was Rs. 2.42 Crore and total turnover was Rs. 225 Crore.

Awards &Recognitions

YEAR	AWARD	AWARDED BY
2020	Agri Business of the Year	Franchise India-Entrepreneur.com
2021	Small Business of the Year	Franchise India-Business Ex.com
2021	Best Milk Producer Company (Rajasthan)	Topgallant Media-AAJ TAK News-India News
2021	1st Runner up West Region	MANAGE-Samunnati
2021	Most Socially Responsible Company of the Year	Franchise India-Tech-Innovation-Summit
2021	CSR Initiative of the year	MSME India Business Award
2022	Best Social Impact Startup	Franchise India-Entrepreneur.com
2023	Best Case Study Presentation	QCFI Vadodara Chapter's 5th HR
2021	Dr.V. Kurien Innovative Dairy Farmers' Awards-2021	Pashudhan Praharee-A leading Informative
2022	Dr.V. Kurien Innovative Dairy Farmers' Awards-2021	Pashudhan Praharee-A leading Informative

The comapny participated in 49th Dairy Summit (IDF) & the Chief Executive & BODs of Asha Company met Prime minister Shri Narendra Modi, Chief Minister of Uttar Pradesh Shri Aditya Nath Yogi, Minister of Health and family welfare Shri Mansukh L. Mandaviya & Krishi Mantri Mr. Narendra Singh Tomar.

Financial Self-Sufficiency

Asha initially operationalised with the financial support of DHANII (Dairy Health and Nutrition Initiative of India Foundation), Tata Trusts Dairy Mission and Technical support of NDDB Dairy Services. Today, the company has achieved self sufficiency by steadily increasing their profitability and ensuring sustainable revenue streams. They have become less dependent on external funding and grants, thereby enabling them to invest in infrastructure development, capacity-building programs, and providing better income opportunities for their women members. In FY-2022-23, total Profit of Asha Mahila Milk Producer Company was Rs. 2.42 Crore and total turnover was Rs. 225 Crore.

Converting Challenges to Learning Experiences

The journey of Asha Mahila Milk Producers Company was not without its share of challenges. One of the most significant hurdles they faced was the outbreak of lumpy disease among their dairy cows. This disease caused painful lumps in the udders, affecting the quality and quantity of milk production. The onset of lumpy disease was a devastating blow to Asha Mahila. The women relied heavily on the income generated from milk production, and the disease threatened their livelihoods. It was a challenging time for both the producers and the company as a whole. However, the women of Asha Mahila refused to let this setback dampen their spirits. They immediately sprung into action and sought the expertise of veterinarians and dairy experts to diagnose the disease accurately and find suitable treatment options.

Asha Mahila Milk Producer Company reached a significant production target of 1.5 Lakh Kg of milk per day, on 15th August 2020 and Introduced their first milk product brand name, "Marudhara Ghee".

To overcome the challenge posed by the lumpy disease, Asha Mahila implemented a multi-faceted approach. Firstly, they ensured that all the affected cows received timely medical attention and appropriate medication. The women diligently followed the prescribed treatment regimen and closely monitored the recovery process. Additionally, the company invested in educational programs and workshops conducted by veterinary experts aimed at the prevention and management of lumpy disease.

The women of Asha established a system of routine health check-ups, where trained professionals would visit the farm periodically to conduct thorough examinations. This proactive approach enabled them to identify any potential signs of lumpy disease or other health problems promptly.

Future Optimistic

With the Financial Support of JICA, Asha is planning to expand its operational area with an increase of 450 Villages. Asha is also seeking to Incorporate new Fodder PCs in its Operational District with the support of National Dairy Development Board. The company is also planning to introduce Milko Chiller Facilities in Some MPPs to resolve the issue of Milk Rejection and maintaining the quality of milk. They are also planning on launching new products i.e., Rasgulla & Butter-Milk. 5000 Biogas Plants and opening Animal Health Care Center at Salumbar Area is also in their agenda.

BAKRAW

UTTARAKHAND'S OWN SUCCESS STORY




The Uttarakhand State Cooperative Development Project [UKCDP-Sheep Goat Sector] is accelerating the holistic development of the sheep and goat sector in Uttarakhand with the support of National Cooperative Development Corporation [NCDC]. Treading the path of success, a state level Uttarakhand State Sheep Goat and Rabbit Farmers' Cooperative Federation Limited [USGCF] has been established. More than 250 primary sheep goat cooperative societies at the village level was established, encompassing more than 10,000 sheep and goat farmers which includes 7,000 women member.

The brand "BAKRAW- the Himalayan Goat Meat" has been conceived to sell the Himalayan goat meat through unique model of Meat on Wheels [MOW] and an e-commerce platform for easy access and wider reach.

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The Mission

Over 10,000 Sheep and Goat Farmers of Uttarakhand including 70% women are organised into Primary Sheep and Goat Societies under the roof of Uttarakhand Sheep Goat Rabbit Farmers' Cooperative Federation Limited [USGCF]. An economically viable unit of twenty females and one male of higher genetic potential are being established for each cooperative farmer member under this project supported by NCDC. This backward linkage will be supported by scientific sheep-goat rearing techniques, taking complete care of health, immunization, de-worming, feed supplement, insurance and supporting farmers' interest in line with Contractual Farming Act of Government of India. The value chain improvement will be bolstered by efficient

marketing channels with the aim to provide quality conscious consumers in India and abroad with healthy, hygienic and high quality Himalayan Goat Meat via direct and e-commerce platforms.

Helping Farmers

Multipronged assistance and guidance is given to farmers, and the members of the organized primary cooperative societies are provided with

- High-quality sheep and goats for breed improvement and propagation of the stock.
- Timely Veterinary interventions for proper weight gain and growth of the progeny.

From Unorganised to Organised

Small steps have brought radical transformation and hence have initiated multiple arrangements and reforms in the sphere.

The federation enters into a "buy-back contract" with the sheep and goat farmers, under which the ownership of the produced progeny remains with the USGCF. This ensures a ready market for the farmers to sell their goats and sheep. With well monitored multi-level and multi-dimensional efforts, the goats thus reared provide hygienic and healthy meat. The federation is also persistently working towards creating a wider network of market linkages with prestigious hotels, academic institutions including LBSNAA Mussourie, colleges and consumers.

The brand "BAKRAW- the Himalayan Goat Meat" has been conceived to sell the Himalayan goat meat through unique model of Meat on Wheels [MOW] and an e-commerce platform for easy access and wider reach. They have also entered into new territories in NCR Region in India and also abroad, supporting the 'Vocal for Local' spirit in the process.

Socio-economic Impact of the Project

The foundation of the project lies on a unique approach that positively impacts a multitude of stakeholders across the entire spectrum of the value chain- both socially and economically.

The federation enters into a "buy-back contract" with the sheep and goat farmers, under which the ownership of the produced progeny remains with the USGCF.

The Federation has been able to create sustainable livelihood opportunities in rural areas and opening of multi-field income avenues for the farmers with the provision of technical (veterinary services, insurance, improved breed etc.) and marketing support. A projected revenue of Rs.1200 cr. has been estimated, of which 70% is expected to reach the rural sheep goat farmers.

This has also supported 10,000 sheep goat farmer beneficiaries and a large number of indirect beneficiaries such as logistic services providers, para vets, feed manufacturers and others. Enhancement of the nutritional security of the hill populace and availability of safe and hygienic meat to the quality conscious urban consumers in the state and outside the state are added advantges.

Unique Marketing

The brand "BAKRAW" has been conceived to sell the Himalayan Goat Meat through Meat on Wheels [MOW] and an e-commerce platform for easy access and wider reach. The unique concept called Meat-On-Wheel has been introduced to ensure best quality Machine cut, hygienically packed BAKRAW meat door delivery within 90 minutes of the order booked online, on-call and walk-ins. This concept also helps customers to get the products from their nearby locations as different locations for MOW has been identified.

BAKRAW App has been introduced for both Android and IOS users for a better online order booking experience for the customers. To make BAKRAW and Uttara Fish (an initiative of Uttarakhand Government for the upliftment of fish farmers) products easily accessible for its customers, BAKRAW-the Himalayan Goat Meat opened 3 highly equipped and air-conditioned Franchised Outlets in Dehradun City.

To expand the reach of BAKRAW Products an agreement has been signed between Himalayan Goat Meat and Needs Supermarket, a reputed modern retails chain, for the sale of BAKARW meat through 28 outlets in Delhi-NCR. BAKRAW meat is also being served in prestigious institutions like LBSNAA Mussourie, 7&5 Star Hotels, Restaurants and Govt. Institutions. The brand has expanded its reach in the international market through Exports. Currently BAKRAW has 10,000+ Happy Customers.

ANTIMICROBIAL RESISTANCE IN THE ANIMAL SECTOR

KEY CONCERNS AND IMPLICATIONS

Antimicrobial resistance (AMR) is a growing global health concern that threatens the effectiveness of our existing arsenal of antibiotics. While AMR is primarily associated with human health, the role of the animal sector in this issue cannot be overlooked. The use of antimicrobials in veterinary medicine, livestock production, and aquaculture has contributed significantly to the development and spread of antimicrobial-resistant bacteria.

If left unaddressed, AMR poses a significant global threat and is projected to result in an estimated loss of 10 million lives and an annual decline in global GDP ranging from 1.1% to 3.8% by 2050.

Antimicrobial Use in Animal Agriculture

There is a well-established correlation between the level of antimicrobial resistance (AMR) developed by microbes in the animal population and the level of antimicrobial consumption in that population. The high level of resistance in E. coli against medically important antibiotics is attributed to the overuse of these antimicrobials in animals. Extensive use of antimicrobials in animal populations, create selective pressure on bacteria, favouring the survival and proliferation of resistant strains. Over time, this can lead to the emergence and spread of antimicrobial-resistant bacteria.

Antimicrobial residues in milk and milk products are a well-known concern. While pasteurization and heat treatments are effective against pathogens, their impact on drug residues is limited. Mastitis treatments and contamination can lead to broad-spectrum antibiotic resistance in milk. Factors contributing to residue presence include extra-label drug use, over-the-counter antibiotic sales, poor farm records, and non-compliance with withdrawal periods. Detecting, quantifying, and controlling residues in milk require involvement of policymakers. Two related aspects are maximum residue limits, which specify the allowed concentration of residues, and withdrawal periods, which indicate the time between drug administration and milk collection. Monitoring and regulation of these aspects are crucial for public health protection and tackling antimicrobial resistance.

Amplification and Transfer of Resistant Genes

Resistant strains can emerge in animals due to direct administration of antibiotics, transmission from other animals, or contact with contaminated environments. These strains can subsequently infect humans through the food chain, posing a significant public health risk. The transfer of resistance genes between bacteria, including zoonotic pathogens, is another major con-

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cern. The genetic exchange of resistance elements can occur through horizontal gene transfer, plasmids, or transposons, exacerbating the spread of AMR.

Antimicrobial resistance (AMR) poses several issues and concerns in the animal sector

Impact on animal health

Antimicrobial resistance reduces the effectiveness of antimicrobial drugs in treating bacterial infections in animals. This can lead to prolonged illness, increased mortality rates, and decreased productivity in livestock and other animals. Infected animals may require more extensive treatment, longer recovery periods, or even be untreatable, resulting in significant economic losses for farmers and the industry.

Limited treatment option

The development of resistance in bacteria can render certain antimicrobial drugs ineffective, leaving veterinarians with fewer treatment options. As a result, they may have to resort to using higher-tier antibiotics or combination therapies, which can be more expensive, less effective, or have potential side effects. Research and innovation for developing new antimicrobials is another significant challenge.

Transfer of resistant bacteria to humans

When humans come into contact with antimicrobial-resistant bacteria in animals through direct contact, consumption of contaminated animal products, or exposure to animal waste, they can acquire resistant infections. This limits the effectiveness of antimicrobial treatments in human medicine.

Intensive farming practices

The animal agriculture often employs intensive farming practices, such as concentrated animal feeding operations, to meet the growing demand for animal products. These practices often involve the routine use of antimicrobials for disease prevention and growth promotion, which creates ideal conditions for the development and spread of antimicrobial resistance.

Recognizing the interconnectedness of animal, human, and environmental health, adopting a One Health approach is essential to tackle AMR comprehensively.

Environmental contamination

The use of antimicrobials in animal production can result in the release of drug residues, metabolites, and resistant bacteria into the environment. These contaminants can enter soil, waterways, and ecosystems through animal waste or runoff, contributing to the dissemination of resistance genes. Environmental contamination further exacerbates the AMR problem by promoting the selection and persistence of resistant bacteria outside the animal population.

Zoonotic diseases and public health impact

Many zoonotic diseases, such as Salmonella and Campylobacter infections, can be transmitted between animals and humans. When animals carry antimicrobial-resistant bacteria, zoonotic infections become more difficult to treat in humans. This can result in more severe illnesses, increased healthcare costs, and potential outbreaks of resistant infections in human populations.

Global trade and food safety concerns

Antimicrobial resistance can affect international trade in animal products. Countries may impose restrictions or bans on the import of livestock or animal products from regions with high levels of antimicrobial resistance. Additionally, consumers are increasingly concerned about the safety and quality of animal-derived food products, leading to demands for reduced antibiotic usage and increased transparency in farming practices.

One Health Approach

Recognizing the interconnectedness of animal, human, and environmental health, adopting a One Health approach is essential to tackle AMR comprehensively. Collaboration between veterinary and human healthcare professionals, policymakers, researchers, and the agricultural industry is crucial in implementing responsible antimicrobial use practices and mitigating the impact of AMR.

Initiatives to Control Antimicrobial Resistance (AMR)

If left unaddressed, AMR poses a significant global threat and is projected to result in an estimated loss of 10 million lives and an annual decline in global GDP ranging from 1.1% to 3.8% by 2050. To combat this issue, the World Health Organization (WHO) devised a comprehensive strategy in 2015, consisting of five key objectives: reducing infection rates, promoting responsible use of antimicrobials, enhancing public understanding of AMR, strengthening knowledge through research and surveillance, and pursuing sustainable development of new medicines, vaccines, and diagnostic tools. Most of the western countries have established well-coordinated strategic action-plan framework aimed at controlling the emergence and spread of AMR. In 2017, India conceived the National Action Plan for AMR, which focuses on surveillance, increasing awareness, prevention and infection control, research, responsible antimicrobial use, and fostering collaboration between the healthcare and livestock sectors. However, we have to go a long way to implement the National Action Plan for AMR in the field level.

To address the issues of AMR effectively, it is imperative to promote responsible antimicrobial use practices, prioritize disease prevention through improved animal husbandry and biosecurity measures, and invest in alternative strategies such as vaccines and probiotics. Quick sensitivity tests before prescribing antibiotics is vital. Raising awareness, implementing regulations, and fostering collaboration among stakeholders are vital steps towards preserving the effectiveness of antimicrobials and safeguarding both animal and human health in the face of the growing threat of AMR.

RICH - FACILITATING RESEARCH AND INNOVATION

Telangana state in its tenth year of formation has many accolades to its credit. From ensuring supply of drinking water to every household to 24-hour uninterrupted power supply and turning the parched lands into the new rice bowl of India, Telangana today is also the hub of innovation.

Research and Innovation Circle of Hyderabad (RICH)

Launched in 2017 by the Government of Telangana, RICH aims to foster greater collaboration between various entities in the research and innovation space.

"When Telangana was formed, the state was very keen to launch Innovation as its USP. One of the important stakeholders that they considered were Research and Academic institutions. In Hyderabad alone, there are over 40 academic and research institutions undertaking world-class research in various sectors, ranging from agriculture sciences to deep tech. The state wanted an entity that could act as a bridge between different players in the research and innovation space. So RICH began with the mandate of mining out innovations happening in these institutions and to see if and how they can be scaled up with the goal of benefiting the society at large," says Ms. Rashmi Pimpale, CEO, RICH.

MS. RASHMI PIMPALE, CEO, RICH.

What does RICH do?

RICH now leads the Hyderabad Science & Technology City Cluster under the Office of Principal Scientific Adviser to the Government of India. RICH partners with Research Institutions, Industry, Government and Start-ups to fast-track Innovation to Market in Food & Agriculture, Lifesciences, and Sustainability. In each of these three verticals, RICH's activities primarily fall in the following categories:

- **Work extensively with start-ups and innovators**

RICH identifies the generic problems that start-ups face and helps build the ecosystem to bridge the gaps. RICH also helps them to connect with research institutions, funding agencies, industries, hospitals, government, among others. "We also run cohort-based programmes for start-ups wherein we call for applications, select promising start-ups and travel along with them in their journey." Rashmi elaborates.

- **Conduct Capacity Building/Ecosystem Building Activities**

RICH conducts several knowledge dissemination based webinars or seminars for start-ups on specific topics. Additionally, last year, RICH, in collaboration with Syngene International Limited and Biocon Foundation, launched a programme for promoting and retention of women in STEM careers (Science Technology Engineering and Mathematics). Through this programme they offer scholarships and internships for young women from tier 2 and tier 3 cities of India.

- **Undertake and implement large, complex projects**

We identify major complex problems that are important to the State and bring in multi-disciplinary stakeholders together to solve these problems by project managing pilot solutions. We also work closely with the Government departments to strengthen public policy support to the innovation ecosystem.

Food and Agriculture Vertical of RICH

RICH has been associated with many

agri start-ups and the support offered by to each one of them is different. The difference is attributed to the stages they contact them. They collaborate with state agriculture university (PJTSAU) and Department of Agriculture through a programme called Agritech Innovation Pilots (AIP). The feedback from AIP has been helpful for the start-ups in refining their technology platform and business model.

Supporting Startups

RICH has supported over 110 agri start-ups till date. xMachines, an agrobotics start-up was part of the first cohort in AIP. "We at xMachines have been working with RICH since 2020. Since the beginning of our association, RICH has been proving to be a valuable partner for our company. RICH has always acknowledged the innovative work we do at xMachines and has helped in recommending us to various agri-eco system partners." says Trivikram Kumar, founder of xMachines. Through AIP, it was able to refine its AI-based technology engine and widen the robot platform capability to undertake direct seeding, spot application of weedicides and land preparation.

RICH has also helped many start-ups to evolve into successful businesses. BioPrime is a Pune based start-up that offers microbe-based crop nutrition products. The team worked with RICH in refining its value-proposition and to sharpen their technology offering. RICH introduced BioPrime to Delta Agrigenetics, a company engaged in developing proprietary hybrids and crop varieties having superior yield potential, quality and resistance to major pests and diseases. The collaboration not only led to the development of two new formulations that would help farmers monitor their crops, but also helped BioPrime identify and expand to 7 states across India. BioPrime has raised US$2.7mn till date.

Association with Department of Agriculture, Telangana

RICH also works closely with the Department of Agriculture, Government of Telangana in meeting the state's goal

of advancing farm productivity and promoting farm and off-farm agribusiness based enterprises in the rural sector. A recent initiative in this regard was a Data in Climate Resilient Agriculture (DiCRA) project with the United Nations Development Programme (UNDP). DICRA is an open access digital public good platform for monitoring climate change in agriculture that was piloted in Telangana. Along with UNDP and partners such as MistEO, RICH collated 25 climate resilient practices from the state and organized CRA based workshops for over 100 citizen scientists. These are now available on the DiCRA platform.

Engaging with RICH

RICH is open to collaborate with start-ups, corporates and civil society organizations that contributes to the overall goal of agriculture development. RICH supports start-ups with business development services, mentoring, market linkups, and funding through the Start-up India Seed Fund Scheme. With other entities, RICH looks to implement development projects ranging from farm-based livelihood improvement to nutrition-sensitive agriculture interventions.

Future Plans

RICH along with partners is developing Government of Telangana Agri Sandbox, that will comprise of two components - Regulatory and Policies, and Start-up validation. .

RICH is also working with The Agri Collaboratory – a group of experts dedicated to devote their time and expertise in agri sector activities- to see how to increase farm credit access to farmers. RICH is in talks with geo spatial data institutions to use the expertise and the data available with these institutions for the benefit of start-ups. On the development project side, RICH is looking for funding agencies such as CSRs to pilot a nutrition-linked agricultural development initiative in Vikarabad, Telangana.

ANIMAL HEALTH
TRENDS, SCOPE AND POLICIES

India's animal population encompasses a diverse range of domesticated animals, reflecting the country's rich cultural, ecological and agricultural heritage. The domesticated animals contribute to agriculture, dairy production, and livelihoods of millions of people in the country.

TRENDS IN ANIMAL HEALTH PRODUCTION

Increasing Demand for Animal Products

As global populations grow and incomes rise, there is a rising demand for animal-derived products, including milk, meat, eggs, and other by-products. To meet the increasing demand of animal protein, it necessitates enhanced animal health production practices while ensuring animal welfare as well as for food safety.

To meet the increasing demand of animal protein, it necessitates enhanced animal health production practices while ensuring animal welfare as well as for food safety.

Focus on Animal Welfare and Ethical Production

The concerns regarding animal welfare and consumer awareness have led to a greater emphasis on ethical and sustainable animal health production. The present day demands for the products obtained from animals which are reared in humane and environmentally controlled systems.

Precision Livestock Farming

Artificial intelligence driven technological advancements, such as remote sensing, sensor-based monitoring systems, and big data analytics, are transforming animal health production. Precision livestock farming especially suitable to large scale dairy farms (Precision dairy farms) enables real-time monitoring of animal health parameters, targeted interventions, early disease diagnosis, and, improving overall productivity and welfare.

SCOPE OF ANIMAL HEALTH PRODUCTION

Animal health production encompasses a wide range of activities and disciplines, including:

Disease Prevention and Control

The occurrence of contagious and infectious diseases, outbreaks and various epidemics affecting the animal health necessitates for implementation of various preventive measures such as regular vaccination programs, strict adherence of biosecurity protocols, and standard hygiene practices, to minimize the occurrence and spread of infectious diseases within animal populations.

Veterinary Care

Veterinary professionals play a vital role in ensuring the health and well-being of animals. This includes providing appropriate and most suitable care, after the diagnosis, and treatment for animals to manage diseases, injuries, and other health conditions and is need of the hour in mitigating infectious diseases.

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Nutrition and Feed Management
It is said that majority of the recurring expenses are to meet the nutrition requirement of the animals. Developing suitable feed formulations and implementing optimal nutrition programs, and feeding strategies to meet the dietary needs of animals for growth, reproduction, and overall health should be implemented.

Animal Genetics and Breeding
Employing selective breeding techniques, genetic improvement programs, and assisted reproductive technologies to enhance desired traits, improves animal health, and will optimize production efficiency in commercial farms.

POLICIES AND REGULATIONS

The various regulatory bodies and governments establish policies and regulations to ensure the animal welfare, safety, and quality of animal health production. These policies may include the areas as provided:

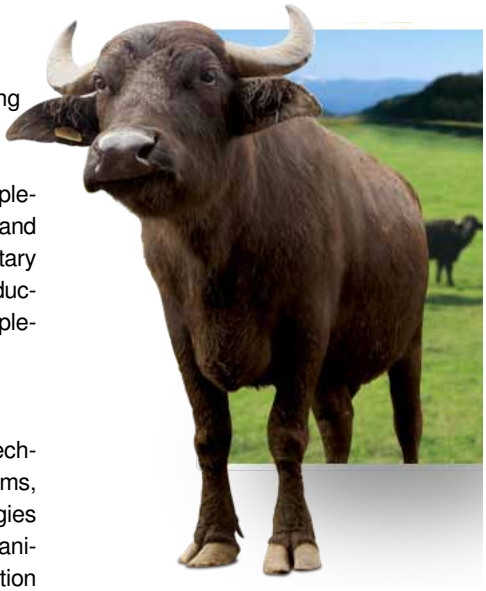
Standards for animal welfare
These standards include the guidelines and regulations to ensure the humane treatment of animals throughout their lives, including housing conditions, transportation, and slaughter practices.

Food safety and quality assurance
The policies should be implemented to ensure the safety and quality of animal-derived food products, including standards for hygiene, inspection, residue control, and traceability.

Disease surveillance and control
Establishing frameworks for disease surveillance, early detection of various infectious and contagious diseases and control programs to manage and prevent the spread of animal diseases, including zoonotic diseases that can impact human health.

DIFFERENT PRODUCTION SYSTEMS

Based on the geographical location, the cultural practices and demand of the



market, the animal health production systems may vary. Some common production systems include:

Intensive Farming System
Intensive farming systems involve high stocking densities and controlled environments, enabling efficient production and resource utilization. To maximize the productivity, these systems often employ latest technologies and best management practices.

Extensive Farming System
These systems provide animals with ample space and natural environments, allowing for grazing and for natural behaviors. In these systems animal welfare and the preservation of natural ecosystems are prioritized.

Organic and Free-Range Systems
These systems adhere to strict standards that prioritize animal welfare, natural feed, and the absence of synthetic chemicals. Animals have access to outdoor areas and are raised without routine use of antibiotics or even growth promoters.

ROLE OF THE PUBLIC AND PRIVATE SECTORS IN ENHANCING ANIMAL PRODUCTION

Public Sector
The public sector, which is represented by government agencies, plays a crucial role in policy-making, regulations, disease surveillance, disease control. It establishes standards, guidelines, and legislation to ensure animal welfare, food safety, and disease control. Public sector entities also support research and development initiatives, promote education, and coordinate public awareness campaigns.

Private Sector
The private sector includes several stakeholders, including veterinarians, farmers, animal health product manufacturers, and service providers. This sector contributes to animal health production through developments in nutrition products, veterinary care, disease prevention, improving genetics and technological advancements. The private sector plays a vital role in delivering services, innovative products, and expertise to support animal health, welfare, and productivity.

COLLABORATION BETWEEN THE PUBLIC AND PRIVATE SECTORS

For effective animal health production, the collaboration between the public and private sectors acts like a bridge. The following benefits will be obtained by working together.

- **Align Objectives**
Public and private sectors can collaborate to align their objectives, combining expertise and resources to address common challenges, such as disease control and prevention, animal welfare, and sustainability.

- **Exchange of Knowledge**
Sharing scientific research, best practices, and data between the public and private sectors can enhance decision-making, policy development, and innovation in animal health production.

- **Capacity Building**
Collaboration can support capacity building initiatives, such as training programs, knowledge transfer, and technology adoption and transfer, benefiting both sectors and contributing to overall sector development.

ONE HEALTH CONCEPT: KEY TO SUSTAINABLE TRANSFORMATION

The concept of one health has gained high attention in recent years. The incidents of the spread of new zoonotic diseases like Bird Flu, Swine Flu, etc. from and through animals has highlighted the point that the health of animals cannot be seen in isolation from the health of human beings.

One Health – Many Reasons

The interface of humans and animals has increased because of the expansion of humans to wider geographies. The consumption of animal-based food has increased in the last two decades. The livestock as integral farming has increased to meet the demand. The movement of humans, animals, and animal products has increased because of more international travel. The whole earth's ecosystem is changing because of uncontrolled land use, deforestation, and intensive farming practices. The animal habitats are infiltrated by humans and this opened new opportunities for diseases to pass to animals or from animals to humans. The various initiatives by all stakeholders in animal welfare should take cognizance of supporting animal health by striking a balance following the One Health Approach.

The livestock population in India has increased by 4.6%, from 512 million in 2012 to nearly 536 million in 2019 and it has outpaced the growth of veterinary services

One Health is an intersection of human health, animal health & environmental health

Source – Article, Science Direct, Crop protection practices and viral zoonotic risks within a One Health framework

Current Status of Animal Healthcare in India

Today industry studies indicate significant gap in terms of animal healthcare infrastructure and veterinary doctors, para vets, and skilled manpower. Though the central and state government has undertaken animal healthcare on priority and set up the infrastructure at a different level, the participation from the private players is very minimal.

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Country wise adequacy of Veterinary Services in South Asia

Adequacy of Veterinary Services in South Asia: Country Ranking in terms of personnel per Sq. Km			
Country	Number of Personnel	Number Per Square Km	Rank
Sri Lanka	3484	0.0616	1
Pakistan	12850	0.0531	2
Bhutan	793	0.03734	3
India	120098	0.036526	4
Maldives	2	0.0169	5
Bangladesh	8872	0.016	6
Nepal	14275	0.0067	7

RANKING OF COUNTRIES IN SOUTH ASIA BASED ON VET PERSONNEL PER SQ. KM (2012)
PRIMARY DATA SOURCE: OIE

1. *Total veterinary personal in India is estimated based on WAHIS, OIE data for 2012 and data of para-professionals (52000) as indicated in 2012 report of Indian planning commission.*
2. *Personal per sq.km for India is calculated taking area as 3.288 million Sq. m.*

www.vethelplineindia.co.in

Source – Vet Helpline India

The livestock population in India has increased by 4.6%, from 512 million in 2012 to nearly 536 million in 2019 and it has outpaced the growth of veterinary services.

In India, though veterinary service is predominantly public service and free, the availability and access in most rural areas are poor. In many areas, farmers in the actual sense are paying for what is termed as free or subsidized service

Animal healthcare infrastructure in India

Veterinary Institutions, Gaushala, AI Centres, and Registered Vet Practitioners	
Particulars	Footprint (Nos)
Veterinary Hospitals /Poly Clinics	12,076
Veterinary Dispensaries	25,571
Veterinary Aid Centres (Stockmen Centres/ Mobile Dispensaries)	28,168
Total	65815
No. of AI Centres	101770
AH Department	57200
Others	44570
No. of Gaushalas	
AH Department	115
Others	5840
No. of Registered Vet Practitioners* as on 31.03.2013 Source : answer against query in Rajya Sabha	63,228

Answer against query in Rajya Sabha

Looking at the current scenario of animal welfare, the lack of infrastructure and trained manpower in animal health care, an integrated approach is critical to achieve sustainable animal healthcare in the country

that too is limited to the prevention of major diseases. There is a shortage of veterinary doctors and para-vets and India is ranked 4th among major South Asian Countries in terms of no. of personnel per Sq. Km.

In 2015, the USA reported to World Organization for Animal Health (OIE) a total of 87,009 veterinarians out of which 75,593 (86.9%) are private veterinarians. In contrast, during the same year, India reported 70, 767 veterinarians out of which only 3,116 (4.4%) are private veterinarians. In the above statistics, the veterinarians in academics and training institutions which are 6,800 and 2,181 for USA and India respectively as public veterinarians were also considered

Manpower Deficit

The low percentage of private veterinarians is a concern. There is significant variation in the availability of the veterinarian across the states. Most of the veterinarians are in few states like Rajasthan, Uttar Pradesh, Maharashtra, Gujarat, etc. which is obvious as the livestock population is also concentrated in these states.

There is also a definite gap between the requirement of skilled and trained manpower in animal healthcare vis-à-vis the number of trained professionals passing out from different institutions.

This gap is widening every year and varies among different states.

Integrated Approach to Sustainable Animal Health

Looking at the current scenario of ani-

Demand Supply gap in trained veterinary manpower

State	2020			2025		
	Supply	Demand	Gap	Supply	Demand	Gap
Uttar Pradesh	4,979	11,633	(6,654)	5,763	12,788	(7,025)
Haryana	1,490	2,456	(966)	1,927	2,925	(998)
Punjab	1,396	1,330	66	1,524	1,264	260
Jammu and Kashmir	959	1,416	(457)	1,127	1,588	(461)
Gujarat	2,842	4,491	(1,694)	3,099	4,995	(1,896)
Tamil Nadu	2,984	4,938	(1,954)	3,693	7,242	(3,549)
West Bengal	3,768	7,121	(3,353)	4,078	8,218	(4,140)

Source – A quantitative analysis of the supply and demand of veterinary manpower in India: Implications for policy decisions P.V.K. Sasidhar & P. Gopal Reddy

mal welfare, the lack of infrastructure and trained manpower in animal health care, an integrated approach is critical to achieve sustainable animal healthcare in the country.

Sustainability could be achieved by synchronizing infrastructure led interventions comprising Animal Shelter, Veterinary Hospital, and Skill Academy with advocacy led interventions comprising knowledge transfer, policy enablement & fund infusion.

Infrastructure Led Interventions

The infrastructure comprising three components viz., animal shelter, veterinary hospital and skill academy could be developed by various states for meeting the welfare needs of different kinds of animals. While the animal shelter could address the needs of stray & diseased animals, veterinary hospital could provide for requisite clinical care and diagnostics for disease detection. The provision of ambulances and rescue vans could enable wider service coverage area. The training center could be developed for training the Vets, Para vets, animal handlers. The infrastructure of veterinary institutions could also be utilized for training purposes by entering into service-based contracts with the selected training partners.

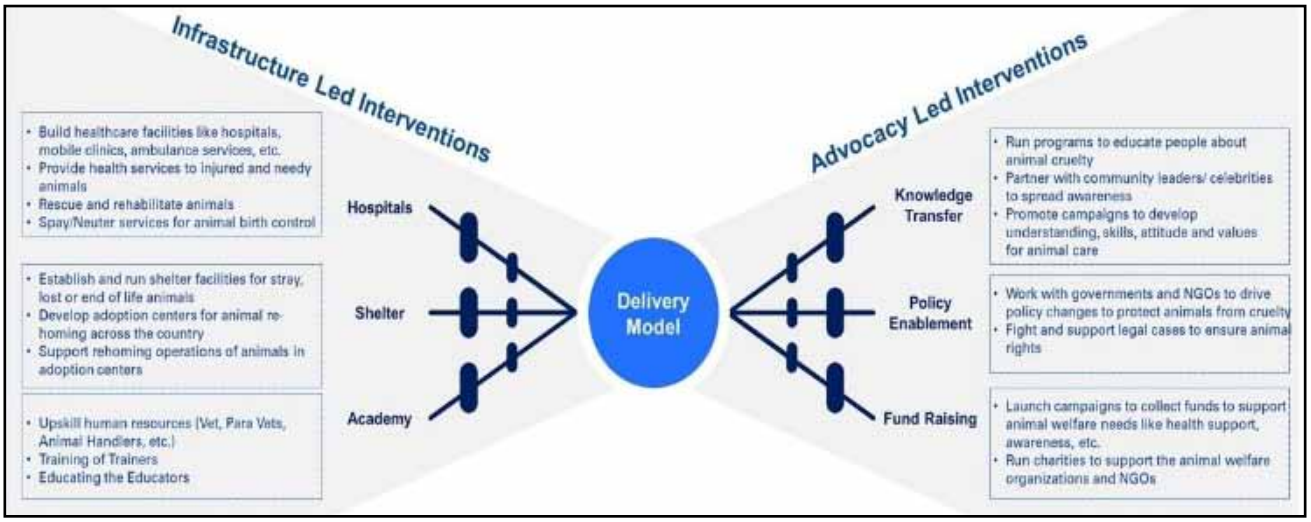
Advocacy Led Interventions

There is a critical need to make people aware of animal cruelty which could be accomplished through advocacy led interventions. The advocacy approach could bring stakeholders together in forging partnerships for spreading awareness on animal care and welfare. Focused programs and campaigns could be organized by the program proponents to develop skill, attitude, and values for animal care.

The support of the Government and NGOs working in animal welfare to drive policy level changes would be critical to implement PCA and to ensure implementation of animal rights and prevention of animal cruelty. The skill academy could periodically review the changes and modifications on animal acts and submit observations to government for taking necessary action and amendments. To ensure sustainability, funding will be required from various sources for the welfare-oriented components which could be raised through campaigns supporting the cause of animal welfare by the stakeholders participating in the eco-system.

The integrated approach to sustainable animal health will recognize that the health of animals is closely connected to the health of people and our shared environment and will enable strike a balance to accomplish One Health objectives.

Integrated approach to sustainable animal health



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ADVANCES IN DAIRY ANIMAL NUTRITION, HEALTH, AND MANAGEMENT

Research on the nutrition and feeding of dairy animals has recently made strides in a number of different fields. With an increase in demand for dairy products, farm owners, decision-makers, and researchers are working to find a sustainable solution through improved animal health and welfare, increased animal productivity, nutrition, feed utilisation, and feed quality. Scientists and nutritionists are developing novel feeding techniques to address issues and provide wholesome nutrition in areas with inadequate infrastructure and amenities for animal health.

Advancements in Dairy Nutrition and management

The biggest improvements in dairy health over the past 3 decades have come from shifting the emphasis from individual animals to herds and from treating disease to preventing it. Given that feeding makes up around 60%–70% of the total cost of milk production on dairy farms, a steady supply of high-quality feed and fodder ensures higher productivity. Consequently, nutrition management is essential for maximising the potential of dairy animals. To help dairy farmers sustain their farms, experts develop various animal feed improvements that may be simply implemented on any farm. Moreover, the advantages of dairy foods for human health are now acknowledged on a global scale, and sustainable dairy production and consumption are predicted to increase steadily over the next few years, particularly in underdeveloped nations.

The biggest improvements in dairy health over the past 3 decades have come from shifting the emphasis from individual animals to herds and from treating disease to preventing it.

There is no denying the value of Nutrition and Dairy products, which involve supplying nutrients such as proteins. To improve the nutrition and health of dairy animals, researchers have been experimenting with a variety of feed supplements and additives. These include probiotics and prebiotics, which boost nutrition absorption and intestinal health. Precision nutrition has become increasingly important in the management of dairy animals. Using this method, meals are created that are specifically catered to each animal's nutritional needs, taking into consideration traits including breed, lactation stage, and milk production capacity. Additionally, the importance of using biosensors in the livestock business is rising. The main purpose of biotechnology in livestock production is to boost animal feeds by increasing their nutrient content and value. Animal nutrition uses biotechnology to enhance the gut environment, promote the growth of advantageous bacteria and microorganisms, and enhance the capacity of

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certain functions to be carried out.

Digital Innovation and Animal Health

Digital innovation has the potential to revolutionise the animal health industry. Artificial intelligence and user-friendly technologies are being used in this process. It will help with the appropriate diagnosis of animals so that any potential illnesses can be found and treated at an early stage with much greater accuracy. Compared to conventional, in-clinic analysis of samples that is prone to human error, this could offer more accuracy. In light of proper health management, vaccination is a field that can't be ignored because it is a crucial strategy for safeguarding animals, food sources, and livelihoods. Therefore, research and development for novel vaccinations against formerly fatal and expensive diseases are being done to protect animals from multiple deadly diseases.

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Feed Automation

Feeding accounts for over 70% of the total cost of milk production on dairy farms. To reduce this cost loss and improve nutritional value, automated feeding systems, feed preparation, mixing, and distribution facilities must be developed. Precision animal farming methods have been developed in the dairy industry because of developments in sensor technologies and automation. These devices keep an eye on a number of factors, including milk output, rumen function, body temperature, and activity levels. They provide real-time data for the early diagnosis of health problems and optimising management decisions. This technique enhances farm output and animal welfare. This marks yet another advancement in the field of dairy sector when it comes to animal nutrition and overall health management.

Currently, there is a discernible rise in the demand for dairy products around the world, and the industry is globalising, increasing the size and volume of the global dairy trade. In order to maintain prolific breeds of young animals, balanced animal nutrition and improved animal health through real-time diagnostics, it is crucial to apply current technology and stay updated with the most relevant methodologies. It's vital to remember that these developments are always changing, and additional gains in the management, nutrition, and health of dairy animals depend on continued research and innovation.

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