

Developing a Sustainable Business Model and Assessing Market Potential for Doorstep Lumpy Skin Disease Vaccination Services for Rural Dairy Farmers in Bihar, India

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I. ABSTRACT

The study of the market feasibility and business viability of doorstep Lumpy Skin Disease (LSD) vaccination services for rural dairy farmers of Bihar, India. With the help of a stratified primary survey of 2,000 respondents in Patna district, the study attempts to estimate farmer awareness about LSD, impact of the disease on cattle and livelihood, gaps in veterinary access, vaccination coverage and willingness to pay for services at their doorstep. According to the results, there is a significant lack of awareness in the respondents as only 5.7% are aware of LSD, whereas 69.8% report having cattle affected. A staggering proportion, 89.6%, cannot access veterinary services with 80.8% of the cattle unvaccinated. Nevertheless, 84.2% farmers prefer doorstep vaccination and 80.3% are willing to pay for it. The business model suggested is sustainable and scalable through doorstep delivery linked to subscription, community, cold-chain and public-private operations. Results provide strong evidence for the feasibility of a structured doorstep LSD vaccination service in rural Bihar, both commercially and socially.

Keywords: Lumpy Skin Disease, LSD vaccination, doorstep veterinary services, rural dairy farmers, Bihar, market potential, sustainable business model, livestock healthcare, willingness to pay

II. INTRODUCTION

A. Background of the Study

India possesses one of the largest dairy industries in the world, which primarily is an important source of livelihood for millions of small and marginal farmers in rural India. In states like Bihar, dairy farming is unorganized and is managed based on traditional practices with yield-limiting low veterinary infrastructure and disease awareness. Lumpy Skin Disease (LSD) is a viral disease of cattle that has quickly spread in recent years. It is highly contagious between cattle and causes other health issues, such as fever or reduced milk and lower fertility. Moreover, it leads to the death of the animal in some cases.

The effect of LSD is biological, but also very economic. Farmers often suffer huge financial losses due to costly treatments, low production, and death of cattle. Even with efforts from the government to vaccinate farmers, there are still gaps in last-mile delivery, timely application and awareness at the farmer's end, especially in remote rural Bihar. There is a compelling need for innovative service delivery models such as organized doorstep vaccination services.

B. Industry / Sector Context

The rural veterinary health care sector in India is characterized by insufficient manpower, delayed diagnosis, and a preponderance of reactive treatment rather than preventive care. Many rural milk producers take the help of local veterinarians or informal service providers who may not be updated on disease knowledge or diagnostics. With this, they are often misdiagnosed and given general medicines and pain-relief injections- neither of which solve the underlying cause of the disease.

The livestock healthcare industry is slowly moving toward preventive solutions, mobile veterinary and public-private partnerships. Veterinary services at the doorstep, backed by cold-chain logistics and trained personnel, offer a new opportunity to increase vaccination coverage and create a viable business model. This study seeks to locate itself in the evolving rural animal healthcare system.

C. Why This Problem Matters

The Lumpy Skin Disease affects the means of livelihood in rural areas on account of capital losses from cattle death (₹70,000–₹80,000 per animal) and monthly income losses due to reduced milk production (₹15,000-20,000 a month). Small dairy farmers are generally at a high risk due to lack of information, delayed treatment and low financial capacity. From a business and policy perspective, lack of LSD control interferes with the rural dairy supply chain and intensifies economic pressure in farming communities.

D. Objectives of the Study

- To analyze how lumpy skin disease affect rural dairy farmers of Bihar.
- To identify the present gaps in the veterinary vaccination and disease prevention services.
- To measure the market viability of providing doorstep LSD vaccination services to dairy farmers living in the countryside.
- To create a long-lasting and expandable business framework for the doorstep vaccination service.
- Propose ways to enhance farmer knowledge and access and improve the efficiency of services.

III. PROBLEM STATEMENT

Lumpy Skin Disease (LSD) has emerged as a new problem of animal health in rural Bihar, severely hitting dairy farmers, whose daily livelihoods depends on dairy farming. The issue has multiple dimensions with linked gaps in disease awareness, diagnosis, preventative care, and service delivery.

A. What Exactly Is the Problem?

- Rural dairy farmers aren't able to detect lumpy skin disease at an early stage due to lack of awareness and limited vet guidance.
- When fever, body ache, and nodules appear first, it is mistaken for some seasonal illness.
- Local veterinary doctors or informal service providers usually fail to correctly diagnose LSD leading to symptomatic treatment and not preventive treatment.
- Treatment is usually restricted to non-specific medicines or pain-killing injections which offer temporary relief of pain but do not inhibit disease progression.
- Postponed or missed vaccinations lead to an upsurge in the epidemic in the villagers.
- In severely affected cases, the cattle suffer for a long time and die within a short period, resulting in the total loss of the animal.

B. Who Is Affected?

- Farmers in rural areas who raise one or two cattle for household income and are small and marginal.
- The death of a cattle causes a capital loss (often ₹70,000–₹80,000 per animal) along with loss of recurring monthly income due to reduced milk production (about ₹15,000–₹20,000 per month).

- Cattle suffer from high fever, swelling in the body due to painful skin nodules, weakness, and bloody diarrhea.
- The extended rural dairy ecosystem suffers from the lessening of milk supply, increase in financial stress of farming households, and decreased faith in veterinary healthcare systems.

C. Why Does This Problem Persist?

- The remote and semi-rural villages are deprived of vaccination services.
- Poor vet facilities and staff meant response was not timely.
- Farmers are not much aware of the importance of preventive vaccination than curative treatment.
- Relying on treatment rather than preventive measures in health care.
- In rural areas, there have been limited cold-chain and logistical support for vaccine delivery.

D. Research Gap Identified

Despite vaccination being the most effective preventive measure against LSD, there are insufficient studies on sustainable business models that can vaccinate rural farmers at their doorsteps. This study directly fills gaps regarding market demand, willingness to pay, operational feasibility and financial sustainability of such services, which have not been fully examined in a systematic manner.

The lack of affordable and reliable vaccination services against Lumpy Skin Disease at the doorstep in rural Bihar is delaying prevention, causing economic loss to dairy farmers and suffering to their animals; hence there is a need to develop a business-driven vaccination delivery model.

IV. LITERATURE REVIEW

The literature review contains sectional review articles on Lumpy Skin Disease (LSD), rural veterinary healthcare services and vaccines programs and sustainable service delivery models. The aim of the present review is to see the completed studies to establish the lacunae justifying the present research.

A. Studies on Lumpy Skin Disease in Cattle

- Numerous studies have identified Lumpy Skin Disease as a highly contagious viral disease of cattle causing fever, skin nodule, drop in milk yield and infertility, and some times death. According to studies, vaccination has been proved to be the best preventive measure.
- Research shows that LSD affects the productivity of dairy farmers which leads to huge economic losses due to treatment costs. Nevertheless, existing research has largely concentrated on the medical and epidemiological sphere of the disease.

B. Rural Veterinary Healthcare and Access Challenges

- Research on rural veterinary healthcare in India found that farmers are faced with limited trained veterinarians, late diagnosis, inadequate infrastructure, and unawareness about animal diseases, among others.
- As per the existing literature, the rural areas do not have access to preventive health care with vaccination or doorstep services. In states like Bihar, these challenges come to the fore due to weaker livestock healthcare infrastructure.

C. Studies on Vaccination Programs and Preventive Healthcare

- A number of Government and institutional reports highlight the significance of mass vaccination programmes for controlling diseases in livestock. Immunizing the animal population will significantly halt disease spread as well as prevent economic losses.
- Yet, it is noted in literature that in remote rural areas, coverage of centralized vaccination do not get completed due to logistical limitation, manpower shortage and problems of cold-chain management. Most research examines vaccination from a policy or public health perspective without analysing farmer-level adoption and willingness to pay for private/semi-private vaccination services.

D. Sustainable Business Models in Rural Healthcare

- Studies focused on the delivery models of sustainable healthcare show that doorstep and last-mile service models can offer improved access, efficiency and adoption in rural areas. Research from human health care and agricultural services suggests that combining low-cost local partnerships with scalable operations creates both social impact and financial sustainability.
- But there are limited studies on business model of livestock vaccination services targeting rural dairy farmers. Veterinary vaccination services are yet to benefit from business model frameworks, as they have been generally under-explored.

E. Research Gap Identified

- Most studies about diseases mainly focus on its characteristics and medical treatment. But not on preventive service delivery.
- There is scant literature on doorstep veterinary vaccination services in rural India, highlight research.
- There aren't many studies that have assessed the market potential, farmers' willingness to pay and financial viability of vaccination services.
- Current literature does not offer much help for developing a sustainable business model of LSD vaccination for rural dairy farmers.

F. Relevance of the Present Study

This research will deal with the identified gaps with a shift from treatment to preventive vaccination delivery i.e. focusing on the vaccine delivery and assessing the market potential of LSD vaccination delivery at the doorstep, sustainable and scalable model development appropriate for rural dairy ecosystem, and business, social and health care integration for practical solutions development and implementable solutions.

V. RESEARCH METHODOLOGY

A. Research Design

The research design used in this study is descriptive, analytical. The aim of the descriptive part was to gather information on the profile of the farmers, awareness about the diseases, impact of diseases on cattle, and access to veterinary services. The analytical section assesses associations between parameters, for example, income and willingness to pay, awareness and vaccination status, and gaps in access to services. A quantitative research approach involving the collection of preconceived responses through a primary survey and their analysis using statistical and frequency tools has been used.

B. Data Collection Method

An organized series of questions were prepared and administered in different villages of Patna, Bihar. The questionnaire was prepared in English and Hindi to ensure all could understand it. It covered the subsequent important themes.

- A farmer may be analyzed based on their age, gender, education, income, and the number of cattle owned.
- Familiarity and experience with Lumpy Skin Disease.
- Losses due to LSD (economic, health, ...).
- Veterinary access and vaccination status current.
- People preferred in-house vaccination services.
- Willingness to pay and price sensitivity.
- Inquirer wants yearly subscription based vaccination plans
- Recommendations and support obtained from government.

Villages of Patna district covered during field interviews with enumerators trained for this purpose. The year of the survey is 2025–26.

C. Sample Size and Sampling Method

Responses of 2000 rural dairy farmers from Patna district, Bihar have been taken in the study. Sample Size Selection Statistical adequacy and representativeness of the rural dairy farming population determined sample size. The researchers adopted a stratified purposive sampling method in which respondents across villages and demographic groups were selected to capture a sufficient variation in terms of age, gender, income, education, and cattle ownership. Every participant in the study owned and managed a dairy farm.

D. Study Area

The study was conducted in a number of villages of Patna district, Bihar, including Nadaul, Masaurahi, Punpun, Paliganj, Danapur, Maner, Sampatchak, Bihta, Gaurichak, Dulhin Bazar, Khagaul, Bikram and other locations. The areas are a cross section of the region's rural and semi-rural dairy farmers.

E. Variables Studied

The study investigates the following main variables.

- The independent variables that were considered during the data collection are the farmer age, gender, education, number of cattle, farmers monthly income, primary source of income, LSD awareness, access to veterinary services; distance to veterinary services, vaccination status, etc.
- Variables dependent on a preference for doorstep vaccination, willingness to pay, amount willing to pay, annual plan interest.
- Possibility of government support availability for main challenges and treatment actions taken.

F. Data Analysis Tools

The following tools and techniques were used to analyze the data.

- Frequency Distribution and Descriptive Statistics will help us understand respondent profiles and summarize key variables.
- We use cross-tabulation analysis to evaluate the relationship between farmer awareness and vaccination status and between income levels and willingness to pay.
- Breakdown the percentage shares of respondents in each category.
- Evaluation of demand for doorstep vaccination services using preference and willingness-to-pay data.
- The business model design for the proposed service model will be done using Business Model Canvas.

G. Limitations of the Study

- The data set is limited only to the Patna district and may not cover the entire Bihar region.
- Due to its biased nature, the dataset should be treated with the right caution and primarily indicates dominant trends.
- The stated willingness to pay figures may not reflect true payment behaviour.

VI. DATA ANALYSIS AND INTERPRETATION

A. Respondent Profile — Descriptive Statistics

About 2000 rural dairy farmers from Patna district of Bihar were surveyed. The socio-demographic profile of the respondents are presented in the following table.

Table 1: Socio-Demographic Profile of Respondents (n = 2,000)

Variable	Category	Frequency (n)	Percentage (%)
Age Group	Below 25	501	25.1%
	25–40	489	24.4%
	41–60	488	24.4%
	Above 60	522	26.1%
Gender	Male	1027	51.4%
	Female	973	48.6%
Education Level	Illiterate	816	40.8%
	Primary	605	30.2%
	Secondary	385	19.3%
	Graduate	194	9.7%

Variable	Category	Frequency (n)	Percentage (%)
Cattle Count	1–2	660	33.0%
	3–5	696	34.8%
	More than 5	644	32.2%
Monthly Income	Below ₹5,000	1024	51.2%
	₹5,000–10,000	579	28.9%
	₹10,000–20,000	292	14.6%
	Above ₹20,000	105	5.3%
Primary Income: Dairy	Yes	1425	71.2%
	No	575	28.8%

As per the respondent profile which shows that the sample is fairly distributed across age groups, farmers above 60 (26.1) and below twenty-five (25.1) are slightly overrepresented. Representation of male and female dairy farmers is almost equal. Males dairy farmers are 51.4% and female dairy farmers are 48.6%. Most respondents (40.8%) were illiterate which shows that any service needs to be easy to communicate. Most farmers have either 3-5 cattle (34.8%) or 1-2 cattle (33.0%). This establishes their small-scale operational profiles. Over half (51.2%) of respondents were affected by a low earnings level of 5,000 rupees a month. Most importantly, as high as 71.2% of respondents say that dairy is their primary source of income.

B. LSD Awareness and Disease Impact

This part of study looks into Lumpy Skin Disease awareness among respondents and the consequent health and economic fallout on their cattle.

Table 2: LSD Awareness and Disease Impact (n = 2,000)

Variable	Category	Frequency (n)	Percentage (%)
Aware of LSD	Yes	113	5.7%
	No	1887	94.3%
Cattle Affected by LSD	Yes	1396	69.8%
	No	604	30.2%
Losses Faced	Reduced Milk Production	713	35.7%
	Treatment Expenses	423	21.1%
	Death of Cattle	260	13.0%
	No Loss	604	30.2%
Primary Health Problem	Skin Nodules	796	39.8%
	Fever	602	30.1%
	Reduced Milk Yield	408	20.4%

Variable	Category	Frequency (n)	Percentage (%)
	Weakness	194	9.7%
Frequency of Sickness	Frequently	981	49.1%
	Sometimes	606	30.3%
	Rarely	413	20.6%

Many cattle owners do not know much about LSD despite it affecting their cattle, claim experts. Per a new study, 5.7% recognise LSD by name, and 69.8% claim their cattle are LSD affected. The contradiction of high disease cases and low awareness shows how serious the lack of information is in rural Bihar. Skin nodules and fever are the most common symptoms, 39.8% and 30.1%. Almost half of the respondents (49.1%) say that their cattle become sick often. In terms of economic loss, 35.7% suffered reduced milk production, 21.1% incurred treatment expenses, and 13.0% lost cattle due to death. – catastrophic livelihood damage for small farmer.

C. Veterinary Access and Vaccination Status

This section analyzes the existing access to veterinary service delivery and vaccination coverage and principal constraints to the dairy farmer in rural areas.

Table 3: Veterinary Access, Vaccination Status, and Challenges (n = 2,000)

Variable	Category	Frequency (n)	Percentage (%)
Access to Vet Services	Yes	207	10.4%
	No	1793	89.6%
Distance to Nearest Vet	Below 2 km	181	9.1%
	2–5 km	592	29.6%
	More than 5 km	1227	61.3%
Currently Vaccinated	Yes	384	19.2%
	No	1616	80.8%
Vaccination Provider	Government	208	10.4%
	Private	375	18.7%
	NGO	180	9.0%
	Not Vaccinated	1237	61.9%
Doorstep Service Available	Yes	403	20.2%
	No	1597	79.8%
Main Challenge	Lack of Vet Services	737	36.9%
	High Treatment Cost	629	31.4%
	Lack of Awareness	432	21.6%
	Distance to Clinic	202	10.1%

Variable	Category	Frequency (n)	Percentage (%)
Treatment Action Taken	Local Healer	805	40.2%
	Self-medication	605	30.2%
	Private Vet	417	20.9%
	Government Vet	173	8.7%

The data is shocking. While 89.6% of farmers have no access to veterinary services, a further 61.3% are located more than 5 km away from the nearest veterinary clinic.

Nonetheless, 80.8% are not vaccinated and only 20.2% enjoy any form of doorstep veterinary services offered by the farmers. The most commonly cited challenge was lack of veterinary services (36.9%), while high cost of treatment (31.4%) and low awareness (21.6%). The majority of patients seek local healers (40.2%) or self-medication (30.2%) rather than qualified veterinarians. The choice of unqualified professionals may be due to lack of access and low awareness of treatment for diseases.

D. Cross-Tabulation: Awareness vs. Vaccination Status

To understand the relationship between LSD awareness and vaccination uptake, a cross-tabulation analysis was performed.

Table 4: Cross-Tabulation — LSD Awareness vs. Vaccination Status

LSD Awareness	Vaccinated (Yes)	Vaccinated (No)	Total
Aware (Yes)	87 (77.0%)	26 (23.0%)	113 (100%)
Not Aware (No)	297 (15.7%)	1590 (84.3%)	1887 (100%)
Total	384 (19.2%)	1616 (80.8%)	2000 (100%)

The cross-tabulation indicates that awareness is a strong vaccination uptake driver. Out of the 113 respondents who knew about LSD, 77.0% vaccinated their cattle. Among the 1887 unaware respondents, only 15.7% are vaccinated. People will not opt for vaccination services at their doorstep without any awareness. Hence, Awareness campaigns should be considered one of the key components of the doorstep vaccination service.

E. Market Potential — Preference, Willingness to Pay, and Pricing

The preferences and willingness-to-pay data gives an idea about the demand for a doorstep LSD vaccination service.

Table 5: Market Potential — Preference, Willingness to Pay, and Pricing (n = 2,000)

Variable	Category	Frequency (n)	Percentage (%)
Prefer Doorstep Vaccination	Yes	1684	84.2%
	No	316	15.8%
Willing to Pay	Yes	1607	80.3%
	No	393	19.7%
Amount Willing to Pay	₹50	802	40.1%

Variable	Category	Frequency (n)	Percentage (%)
	₹100	641	32.1%
	₹150	383	19.1%
	More than ₹150	174	8.7%
Interest in Annual Plan	Yes	1391	69.5%
	No	609	30.5%
Government Support Received	Yes	389	19.4%
	No	1611	80.6%

The findings convey highly positive market potentials. An overwhelming majority of 84.2% respondents preferred vaccination at home rather than visiting a clinic. Further, 80.3% of respondents were ready to pay for this service indicating a strong latent demand. Of the people surveyed, maximum (40.1%) were willing to pay ₹50 per visit, and then ₹100 (32.1%), ₹150 (19.1%) and more than ₹150 (8.7%). Significantly, an annual subscription plan appeals to 69.5% of farmers, which is very favourable for the creation of recurring revenue streams. Just 19.4% of respondents have received any form of vaccination support from the Government reiterating that the market is not largely serviced by public programs.

F. Willingness to Pay by Income Group

The table below illustrates how the willingness to pay and interest in annual plans varies by income bracket.

Table 6: Willingness to Pay and Annual Plan Interest by Monthly Income

Monthly Income	Willing to Pay (%)	Annual Plan (%)	n
Below ₹5,000	76.3%	63.2%	1024
₹5,000–10,000	84.1%	72.5%	579
₹10,000–20,000	88.7%	79.4%	292
Above ₹20,000	91.4%	83.8%	105
Overall	80.3%	69.5%	2000

Analysis indicates that higher income level can raise willingness to pay. Even in the lowest income group (less than ₹5000/month) 76.3% are willing to pay for doorstep vaccination – confirming strong demand across all income strata. Willingness tends to increase with monthly income, as farmers earning more than ₹20,000 have 91.4% willingness. Importantly, even low-income farmers show significant interest in annual plans (63.2%). Thus, if subscription prices are reasonable, a large addressable market can be unlocked even at the bottom of the pyramid.

VII. KEY FINDINGS

A. Awareness and Disease Impact

- A mere 5.7% of farmers surveyed have heard of the name Lumpy Skin Disease which means there is a big information gap.
- In spite of lesser awareness, it was found that 69.8% of farmers said that their cattle got LSD symptoms indicating a disease burden.
- The symptoms that were often seen include skin nodules (39.8%) and fever (30.1%).

- Almost half of the farmers reveal that their cattle fall sick quite frequently indicating a worrying livestock health condition.
- With the death of cattle due to LSD, 13.0% of farmers have suffered catastrophic loss of livelihood.

B. Veterinary Access and Infrastructure Gaps

- Nearly 90% of respondents do not have access to animal health care which implies the absence of any veterinary service.
- Over 61% of farmers travel more than 5 kilometre to reach the nearest veterinary clinic making the visits irregular.
- Almost 80.8% of cattle are unvaccinated. Thus, most rural livestock remain unprotected against LSD.
- A mere 20.2% of farmers currently obtain any doorstep veterinary service.
- The most frequent response to treatment is consulting local healers (40.2%), whilst self-medication (30.2%) is the second-most frequent neither is effective against LSD.

C. Market Potential and Demand

- A huge 84.2% of farmers want the vaccination service at their doorstep instead of visiting a clinic.
- A large percentage of respondents 80.3% are ready to pay for it.
- 40.1% of respondents are willing to pay ₹50 per visit, while 32.1% preferred ₹100 as their second choice.
- 69.5% of farmers show inclination for annual subscription plans supporting a recurring revenue model.
- There is a strong relationship between awareness of lumpy skin disease (LSD) and vaccination uptake, as 77.0% of aware farmers vaccinate as opposed to 15.7% amongst the unaware farmers.
- A mere 19.4% of the farm population has been able to get a government vaccination, showing a big gap.

VIII. PROPOSED BUSINESS MODEL

In light of the survey results, this report recommends a sustainable, scalable, and socially impactful business model for doorstep LSD vaccination services in rural Bihar. The model is designed using the Business Model Canvas framework.

Table 7: Business Model Canvas — Doorstep LSD Vaccination Service

<p>Key Partners</p> <p>Veterinary professionals, vaccine manufacturers (IAH Bareilly / Hester Biosciences), NGOs, Panchayats, cold-chain logistics providers</p>	<p>Key Activities</p> <p>Doorstep LSD vaccination, awareness campaigns, route planning, cold-chain management, follow-up services</p>	<p>Value Proposition</p> <p>Affordable, timely, doorstep vaccination; prevention of cattle loss; improved farmer income and animal welfare</p>
<p>Key Resources</p> <p>Trained vaccinators, refrigerated transport, vaccine stock, mobile CRM, rural network</p>	<p>Customer Relationships</p> <p>Trust-based community engagement, farmer helpline, loyalty subscription plans, village coordinator model</p>	<p>Channels</p> <p>Village-level agents, word-of-mouth, Panchayat tie-ups, WhatsApp/IVR-based booking</p>
<p>Customer Segments</p> <p>Small & marginal rural dairy farmers in Bihar (1–5 cattle),</p>	<p>Cost Structure</p> <p>Vaccine procurement, cold-chain logistics, vaccinator</p>	<p>Revenue Streams</p> <p>Per-visit vaccination fee (₹50–₹150+), annual subscription</p>

semi-urban farmers, cooperative dairy members	salary, marketing, technology platform, training	plans, NGO/government tie-ups, CSR partnerships
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A. Value Proposition

The key value proposition is delivering low-cost professional LSD vaccine administrations to farmers in a timely manner at their doorstep. The service spares farmers journeying long distances to bring their cows and buffaloes for treatment, reduces downtime for the cattle, and offers a preventive solution before disease strikes, which enables them to avoid losses manifold greater than the service cost. Supporting value recognizes education awareness, revisiting health checks, and digital vaccination certificates.

B. Revenue Model and Pricing Strategy

Based on the willingness-to-pay data, the following tiers are recommended.

- There is a basic visit that costs ₹50 and includes vaccination in the lowest-income segment which is 40.1% of the market.
- The cost of each vaccination visit is ₹100 (targeting middle segment 32.1% of market).
- Annual subscription plan is ₹300-500 per year covering 2-3 scheduled vaccination visits (69.5% are interested in annual plans).
- Premium Package ₹150+ per visit. Additional services are available like health check-up, digital records.
- Partnerships with government vaccination schemes (e.g. NADCP), CSR funding from dairy cooperatives and NGO co-funding for Below Poverty Line (BPL) farmers can supplement revenue.

C. Operational Model

- Covid 19 vaccination for Village Level Vaccination Teams will be done through scheduled rounds in villages by trained and certified vaccinators.
- Cold-Chain Logistics to ensure vaccine transport and last-mile delivery at required temperature compliance.
- The farmers make reservation for vaccination via IVR (missed call), WhatsApp, and village level coordinators.
- Minimization of travel expenses: After designing Vaccination Calendar of a week by village cluster this objective is achieved.
- Post vaccination follow up in 10–15 days through village coordinator/mobile calling.

D. Community Partnership Model

The functioning framework relies on community trust. The demand aggregators are local Panchayats, SHGs, and dairy cooperative institutions that create awareness and booking. They are trained local youth or village-level coordinators that will act as the interface between service provider and farmer households and will help in building trust to ensure last-mile reach.

E. Financial Sustainability Assessment

Based on the survey with 2000 farmers conducted, Patna district's addressable market is conservatively estimated at 1600 paying customers. 80.3% of the surveyed farmers are willing to pay and use the fruit and vegetable packaging. The revenue potential from this cohort alone is estimated at an annual ₹3.2 lakh, assuming an average revenue ₹100 per vaccination visit across 2 visits per annum. If you look at the entire rural farming population of Patna district, which has more than 2 lakh dairy households, the market potential will be in crores. The subscription model also improves the predictability of revenue and lowers CAC over time.

IX. RECOMMENDATIONS

A. For the Business/Service Provider

- We will launch a pilot programme in Patna district over an affordable cluster involving 5-10 villages. This will be done in areas where the density of cattle is huge and access to veterinary facilities is poor.
- To enhance the understanding of LSD and increase vaccine uptake, it is crucial that the company invest in a community awareness programme before the launch of the service.
- Create a tiered pricing approach starting at ₹50 per visit for the lowest income segment while offering premium packages for higher-income farmers.
- Offer an annual plan at a price of ₹300 – ₹500 to ensure recurring revenue, and minimize impact of seasonal demand.
- They should employ existing local trust networks like panchayats, self-help groups, and dairies to manage customer acquisition costs.
- Vaccine efficacy and vaccine operational efficiency would need investments in cold-chain infrastructure and route optimization technology.
- Get the local youth recruited and trained as vaccination coordinators in villages to trust at the ground level and also create rural employment.

B. For Policymakers and Government

- Collaborate with the private sector on last-mile veterinary service delivery to address public gaps through private operators.
- The private doorstep vaccination service which operates in the under-served rural area may be provided subsidy for vaccine supply and cold-chain support.
- Doorstep vaccination services are already part of existing government scheme like NADCP (National Animal Disease Control Programme).
- Organize LSD awareness campaign at KVKs, panchayat, community radio, etc. to overcome deficit knowledge on LSD.
- Think about creating direct benefit transfer (DBT) mechanisms so that farmers below the poverty line can avail of vaccination services from the private sector at subsidised rates.

C. For NGOs and Development Organizations

- Assist in stimulating demand in villages that commercial incentives may not be sufficient enough.

X. CONCLUSION

The research establishes the urgent need for doorstep Lumpy Skin Disease vaccination services for rural dairy farmers and the viability of the market for such services in Bihar, India. The primary survey was conducted on 2,000 respondents of Patna district who revealed that the scenario of LSD awareness is found to be near-complete (94.3%) while high prevalence of cattle diseases (69.8%) has been assessed and near-zero veterinary access (89.6%) along with chronically low coverage with vaccination (0.8% vaccinated). However, it is also observed that there lies strong farmer preference for doorstep services (84.2%) as well as robust willingness to pay (80.3%).

These findings indicate that the problem is large, urgent, and commercially addressable. Farmers are not hapless victims; they are willing participants in a solution what matters is 'accessible', 'affordable' and 'trusted'. To sustain the delivery of this solution at scale, we have proposed a business model that draws on community partnership, various pricing methods, subscription method and cold chain logistics.

The model has the potential of having a huge social impact which is beyond just business viability. It can prevent cattle deaths, protect farmer's income, stop animal suffering, and strengthen the rural dairy ecosystem that millions of Bihar's farmers rely upon. Doorstep LSD vaccination services is not merely a commercial offering but a public good being delivered privately. This holds the capability to change livestock health care in rural India.

The analysis reveals that with dedicated investment, community support and policy enactment, a doorstep LSD vaccination model can be economically sustainable and socially transformative – and that the time to act is now.

XI. REFERENCES

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XII. APPENDIX

Appendix A: Survey Questionnaire Summary

The following key questions were included in the structured survey instrument administered to 2,000 respondents:

- What is your primary source of income? (Dairy / Non-dairy)
- How many cattle do you own? (1–2 / 3–5 / More than 5)
- Are you aware of Lumpy Skin Disease (LSD)? (Yes / No)
- Have your cattle been affected by LSD symptoms in the past? (Yes / No)
- What type of loss have you faced due to cattle illness? (Reduced milk / Treatment expenses / Death / No loss)
- What is the primary health problem observed in your cattle? (Skin nodules / Fever / Reduced milk / Weakness)
- How frequently do your cattle fall sick? (Frequently / Sometimes / Rarely)
- Do you have access to veterinary services? (Yes / No)
- What is the distance to your nearest veterinary clinic? (Below 2 km / 2–5 km / More than 5 km)
- Have your cattle been vaccinated for LSD? (Yes / No)
- Who provided the vaccination? (Government / Private / NGO / Not vaccinated)
- Is doorstep vaccination service available in your village? (Yes / No)
- Would you prefer a doorstep vaccination service? (Yes / No)
- Are you willing to pay for doorstep vaccination? (Yes / No)
- How much would you be willing to pay per vaccination visit? (₹50 / ₹100 / ₹150 / More than ₹150)
- Would you be interested in an annual vaccination plan? (Yes / No)
- Have you received any government vaccination support? (Yes / No)

Appendix B: Village-Wise Sample Distribution

Table 8: Sample Distribution by Village — Patna District

Village / Block	No. of Respondents	% of Sample
Punpun, Patna	157	7.8%
Nadaul, Patna	149	7.5%
Danapur, Patna	148	7.4%
Maner, Patna	145	7.2%
Sampatchak, Patna	143	7.2%
Bihta, Patna	141	7.0%
Gaurichak, Patna	132	6.6%
Dulhin Bazar, Patna	131	6.5%
Khagaul, Patna	131	6.5%
Bikram, Patna	124	6.2%
Other Villages, Patna	599	30.0%
Total	2,000	100.0%

Appendix C: Data Source Declaration

The primary dataset used in this study — 'LSD_Patna_2000_dataset.xlsx' — was collected through a structured field survey conducted across Patna district, Bihar during 2025–26. The dataset contains 2,000 respondent records across 26 variables. As noted in the title, the dataset is a biased sample, and findings should be interpreted as directionally indicative rather than statistically representative of the entire Bihar rural dairy farming population. All data was collected with respondent consent and handled in accordance with research ethics guidelines.