Smallholder dairy value chain development in India and selected states (Assam and Bihar): Situation analysis and trends

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Contents

List of Tables

List of Figures

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Acronyms and abbreviations

AACP	Assam Agriculture Competitive Project
ADF	Animal Husbandry, Dairying and Fisheries
AGMARK	Agriculture Produce Grading and Marking Act
AHD	Animal Husbandry Department
AI	Artificial Insemination
ALARA	As low as reasonably achievable
ALDA	Assam Livestock Development Agency
APEDA	Agricultural and Processed Food Products Export Development Authority
ASCAD	Assistance to States for Control of Animal Diseases
BAMETI	Bihar Academy of Management on Extension Training Institute
BIS	Bureau of Indian Standards
BLDA	Bihar Livestock Development Agency
BMCU	Bulk Milk Chilling Unit
BQ	Black Quarter
CB	Crossbred
CMU	Central Monitoring Unit
COMFED	Cooperative Milk Producers Federation of Bihar
CPR	Common property resources
CSO	Central Statistics Office
DCS	Dairy Cooperative Society
DDD	Dairy Development Department
DEDS	Dairy Entrepreneurship Development Scheme
DOAC	Department of Agriculture and Cooperation
EGM	Employment Guarantee Mission
ETP	Effluent Treatment Plant
FGD	Focus Group Discussion
FMD	Foot and Mouth Disease
FSSAI	Food Safety and Standard Authority of India
GDP	Gross domestic product
GHG	Greenhouse gases
GHP	Good hygiene practices

GOI	Government of India
Gopalmitras	Community animal health workers involved in providing AI services
HACCP	Hazard Analysis Critical Control Points
HGM	High genetic merit
HH	Household
HS	Haemorrhagicsepticaemia
IACBP	Indo-Australian Cattle Breeding Project
IBD	Indigenous breed development
ICAR	Indian Council of Agricultural Research
ICMR	Indian Council of Medical Research
ICSD	Intercooperation Social Development (India)
IDDP	Intensive Dairy Development Program
IGFRI	Indian Grasslandand Fodder Research Institute
IRDA	Industries Development and Regulation Act
ILRI	International Livestock Research Institute
IRRI	International Rice Research Institute
IVRI	Indian Veterinary Research Institute
JLG	Joint Livelihood Group
KVK	Krishi Vigyan Kendra
LLP	Lab to Land Program
LN	Liquid nitrogen
LPD	Litresper day
LRP	Local resource person
MACS	Mutually Aided Cooperative Societies
MAIT	Mobile AI technicians
MANAGE	National Institute of Agricultural Extension Management
MCC	Milk collection centre
MMPO	Milk and Milk Product Order
MPCE	Monthly per capita expenditure
MPCS	Milk Producers' Cooperative Society
MPI	Milk Producers' Institutions
MSP	Minimum standard protocol
NABARD	National Bank for Agriculture and Rural Development
NADRS	National Animal Disease Reporting System
NCPB	National Control Program on Brucellosis
ND	Nondescript
NDDB	National Dairy Development Board
NDP	National Dairy Plan
NDRI	National Dairy Research Institute
NERDS	North Eastern Region Disease Diagnosis Reporting System

NGO	Non-governmental organization
NLP	National Livestock Policy
NPBBD	National Project for Bovine Breeding and Dairy Development
NPCBB	National Project for Cattle and Buffalo Breeding
NPRE	Nation Project on Rinderpest Eradication
NSS	National Sample Survey
OF	Operation Flood
ORP	Operational Research Project
PED	Professional Efficiency Development
PFA	Prevention of Food Adulteration
PT	Progeny testing
PTD	Participatory Technology Development
R&D	Research and development
RBP	Ration balancing program
RIDF	Rural Infrastructure Development Fund
RKVY	Rashtriya Krishi Vikas Yojana
SAARC	South Asian Association for Regional Cooperation
SC	Scheduled castes
SIQ&CMP	Strengthening Infrastructure for Quality and Clean Milk Production
SMP	Skimmed milk powder
ST	Scheduled tribes
T	Tonne
TOI	Times of India
ToT	Training of trainers
TMS	Traditional milk Sector
VFA	Veterinary First Aid
WAMUL	Western Assam Milk Union Limited

Executive summary

This study provides an overview of the dairy sector in India, with a socio-economic focus on smallholder dairy producers and a geographic focus on the northeastern states of Bihar and Assam. While the national overview is the result of a desk study for which reports and data were consulted, the analyses for the states included visits and discussions with a wide range of stakeholders in the dairy sector.

Consideration of milk processing, marketing and consumption of milk and milk products ensured that the dairy value chain was addressed, in addition to milk production. A closer look was given to inputs and services related to livestock production and dairying.

Per capita milk availability in India increased over the past 10 years by about 27% to 280 g per day, a level recommended by various medical institutes. This availability is substantially lower in the two states analysed as it is only 25% of the national level in Assam and 65% in Bihar. Urban households spend around 70% more on milk and milk products than rural households, although urban household spending on food items has fallen below 50% of total household expenditures, while rural households still spend more than 50% on food. In both groups, expenditures for milk and milk products were 5–10%, while expenses for other livestock products were below 5%. Although expenditures for milk and dairy products remained more or less constant while overall household expenses increased, with increased purchasing power, households also spent more on milk and milk products in absolute terms.

Annual milk production in India increased by 50% between 2000 and 2010 reaching about 120 million tonnes. During the same period, the increase in Assam was only 15%, while Bihar more than doubled its production with a steep increase of 160%. The annual production in Assam at 790,000t s less than 1% of national production, while Bihar has more than 5%of the national production.

With increasing production and achievement of milk self-sufficiency in the 1990s, India moved from a net importer to a net exporter of milk and dairy products. While the country is today the largest milk producer in the world, it does not even contribute to 1% of the world trade in dairy products. Nevertheless, exports increased four times in quantity and nine times in value over the past 12 years. Not surprisingly, the leading milk producing states (Bihar is ranked ninth) are also the major exporters of milk and dairy products.

State animal husbandry departments continue with an impressive veterinary set-up. That said, it is increasingly difficult to maintain the large infrastructure of animal health centres, veterinary hospitals and dispensaries and to assemble the required human resources for an efficient operation. The cooperative dairy sector has also provided animal health services for many years, focussing on animals kept by cooperative members. Recent years saw an increasing number of private service providers emerging in India's animal health sector. Compared to public animal health providers, the big advantage of the often self-employed private service providers is their mobility and availability, although their professional knowledge and skills are not always up to the mark. Commercial dairy farmers, however, are prepared to pay for immediate response and service delivery at the doorstep. In this changed scenario with more private actors, the Government wants greater control and a monitoring role, but unfortunately many of the required control and monitoring systems are either not yet in place or do not function properly.

India's breeding policy for large dairy animals has changed little over the past decade. There are still the three groups of local cattle (Bos indicus), crossbred cattle (with Bos taurus blood) and buffaloes. Among the local cattle a clearer distinction is made between nondescript animals, which can be crossed and local indigenous breeds, which one would like to conserve. Breed conservation has definitely gained more acceptance, but is not necessarily contributing to a more productive dairy herd. The policy for crossbreeding continues to restrict the exotic (Bostaurus) blood level in the crossbred population to a fixed percentage, preferably 50%. For buffaloes, the focus remains to improvelocal animals with the Murrah breed. For dairying, adherence to the breeding policy is weak and indiscriminate crossing of local animals and uncontrolled upgrading of crossbreds occurs. While artificial insemination is well introduced and accepted, the wrong type and poor quality of frozen semen contribute to unsatisfactory implementation of the breeding policy. The last 15 years also saw the emergence of state livestock development agencies that contributed to strengthening various breeding activities, in particular promotion of AI services by private inseminators.

Livestock feeding remains the greatest constraint for development of India's dairy sector. Commercial dairy producers with crossbred cattle or high-yielding buffaloes focus on procuring concentrate feed rather than cultivating fodder, which in many cases leads to 'high input–high output' milk production systems. Other farmers practice less intensive dairying and are neither prepared to spend a lot on costly concentrates nor to use part of their land to cultivate fodder. Feeding large quantities of low-quality paddy straw keeps many dairy farms from reaching their potential. Extensive grazing of specialized dairy animals is rare because not much pastureland is available and remaining areas are heavily overgrazed. The Government of India has long promoted dairying as a 'landless' activity, so many dairy farms heavily rely on concentrates and little fodder is cultivated.

Training and extension activities enjoyed attention over the past years, although their impact is difficult to assess. Livestock and dairy extension should be seen for their technical components such as animal breeding, feeding, health and management. The emergence of private service providers in livestock production sectors has given a new face to extension. While the specialized 'extensionist' has disappeared, various public, cooperative and private service providers such as veterinarians, para-veterinarians, AI workers, feed companies, dairy cooperative managers and milk vendors have taken over extension tasks. The institutions of the Indian Government, including veterinary colleges and agricultural universities that provided training and extension in the past still exist, but many have yet to find a new role, either as coordinator and facilitator of special training, or as provider of a specific technical expertise.

The challenges of the Indian dairy sector are indirectly shown by the reluctance of banks and credit institutes to provide loans to dairy farmers. It appears as if the formal banking sector does not believe in the potential of dairying and there have been bitter experiences in the past with low repayment rates for loans to the sector. The situation will not improve in the near future unless credit for dairy animals can be linked with a functional livestock insurance system.

Increased awareness about food safety in India has direct implications for the dairy sector, especially with urban consumers increasingly conscious about food quality. But despite a number of acts and regulations and increased controls for fresh milk and dairy products, proper implementation of food safety standards has yet to occur. The main problem is that authorities lack the required instruments and power to take effective measures against offenders.

Climate change is a global issue, but it concerns every country and every sector. As a result of the changing climate, India's dairy sector expects that particularly water and fodder will become even more critical factors in the future. Furthermore, rising temperature may affect the reproductive and productive performance of dairy animals, especially crossbreds with high levels of exotic blood.

Overall, the Indian dairy sector performed well over past years as it grew steadily and significantly. While government institutions did not really respond, improvements in the cooperative sector and emergence of the private sector in livestock production and dairying contributed to this growth. Government policies and guidelines, however, created an environment that is conducive to this further development of the sector. On the other hand, livestock production and dairying as a socio-economic instrument for growth that benefits the poor in rural areas has to a large extent

disappeared from government policies. This is ironic, given that 90% of India's milk is produced in rural areas and smallholders account for 80% of total milk production.

Assam

The dairy sector in Assam is weak and not very significant in the state's overall economy. Nonetheless, thousands of farmers keep cattle, buffaloes and goats from which they get milk, though often only in small quantities and rather irregularly, with distinct seasonal production differences.

The low development of the dairy sector is also reflected in the type of milk and dairy products available in the market. The informal sector dominates in rural areas where most milk is either directly consumed by producing households or in the village. Most of the milk is consumed in tea, while a small part is converted into local dairy products for two reasons—farmers produce only small quantities of milk as a marketable surplus and the small surplus does not attract any formal cooperative or private dairy actors, leaving producers to resort to home consumption and cottage processing.

Dairy consumption in urban areas provides a different picture, with a growing demand for quality liquid (pasteurized) milk and dairy products. Present formal milk processors in Assam are not in a position to meet this demand and therefore resort to imports from other states.

Total milk production from cattle and buffaloes in Assam of about 800,000 t grew during 2007–2011 by only 1.4%, another indicator of the weakness of the dairy sector. However, a closer look at the numbers is interesting—while the share of buffalo milk remained at about 13%, milk production from local cattle dropped by 7%. At the same time, milk produced with crossbred animals increased by 27% to about 230,000 t. Despite low growth of the overall milk output, the shift towards increased dairying with crossbreds is a sign of potential in specific areas.

Dairying in many livestock keeping households in Assam remains a side business, though it is part of integrated crop–livestock farming practised by the majority of smallholders. As part of the prevailing crop–livestock system, dairying is seen more in the context of smallholder livelihoods rather than as an isolated commercial undertaking. In this system, the entire household is engaged and it is not a surprise that women contribute more than their share to livestock management at the household level. More specialized and targeted dairy activities are found in Assam among communities that migrated into the state (Nepali, Bihari, Bengali) and among young people who took up dairy as a commercial enterprise.

The low performance of the dairy sector is further reflected in the low quality of services delivered in the fields of animal health, breeding and feed and fodder development. Although government structures are in place, their maintenance and operation are poor, with a low level of outreach. Interestingly, this vacuum is neither filled by cooperatives nor the private sector. The dairy cooperative sector is facing its own economic problems and lacks the resources to establish its own dairy input and service network on a large scale. For potential private investors, Assam's dairy sector is an attractive investment option, but not at the moment.

As a result, the private livestock service delivery system with gopalmitras[1] is not yet strongly established. Artificial insemination, though introduced to and accepted by a large number of farmers, is not really used, partly because farmers with local cattle and buffaloes prefer natural breeding with local bulls, partly because the quality of AI services is poor due to limited skills of the AI workers, but even more so due to low quality of the frozen semen.

Fodder cultivation on farms is limited because there is not a lot of land available where animals can graze and/or where local grasses can be cut. Although grazing and cut local grasses help feed animals, it may not be sufficient to produce substantial amounts of milk. As long as dairy is not seen as a separate, economically interesting option, animals will continue being fed in a 'low input' manner, which hardly considers the animal's feed requirements. The

1 Community animal health workers involved in providing AI services.

state of Assam's cooperative and private sector livestock feed industry, which concentrates on poultry rather than dairy cattle feed, is another indicator of the low priority farmers put on livestock feeding because they see high feed costs as not economically viable.

Of the seven identified dairy value chain paths, the organized sector is involved in only two paths through which only 5% of total marketed milk is handled. In addition, the organized sector handles imports, about 20% of the total milk in the market. While another 20% of milk is processed by the cottage industry into sweets, the remaining 55% of milk in the Assam market is sold as fresh, unprocessed liquid milk from producers directly to consumers (20%) or via different paths that involve informal dairy vendors (35%).

Rapid development of Assam's dairy sector may be difficult to achieve in the near future. To have an impact, any dairy development initiative in the state must address smallholder milk producers with their low quantities of surplus milk and irregular supply and must also include the informal dairy sector that handles more than 90% of the milk that local farmers bring as surplus to the market. Seeing dairy development as one element to improve smallholder livelihoods may rely on an approach that focuses on pro-poor livestock production and dairy development.

Bihar

A vast part of Bihar state is situated on the Gangetic plain, a fertile and water-rich area with highly intensive agricultural systems. Livestock keeping has played an important role in rural livelihoods for centuries and people traditionally consume more than adequate quantities of milk and often home-made dairy products.

Low-income rural households in Bihar spend around 20% of their total food expenses on milk and milk products and the figure rises to one-third for high-income rural households. In urban areas figures are 31% and 26% for low- and high-income households, respectively. More than 50% of fresh milk is converted into dairy products.

The past decade saw steep increases in production as well as consumption of milk. Bihar, with an annual production of 6.5 million tonnes and a national share of 5.5%, is among the top 10 milk producing states in India, with surpluses for export to other states and abroad. This positive development is based on a strong traditional dairy sector where milk output from local cows and buffaloes may not be the highest, but where sound local dairy know-how and skills fuel milk production as well as cottage dairy processing. This favourable environment and promising potential was tapped in recent years by the cooperative and private dairy sector, which linked their dairy activities to adequate, demand-driven provisions of livestock services and inputs.

The cooperative sector, represented by the state dairy federation (COMFED), today has a higher number (>2000) of animal health points in the field than the government animal husbandry department (>1500). With links to the dairy cooperatives, COMFED centres in particular target dairy animals, thereby having a large impact on productivity of the state's dairy herd.

The promotion of private AI workers can be linked to formation of the state livestock development agency, which today performs about 2 million inseminations /year. COMFED centres also provide breeding services (artificial insemination), with about 1.5 million annually. These efforts improved Bihar's dairy herd by upgrading local buffaloes with the Murrah breed and by promoting crossbreeding in cattle. While more than 40% of the milk in Bihar is produced by buffaloes, the share of milk from crossbred animals has already crossed 20%.

Although mainly based on local green and dry fodder and local ingredients for on-farm preparation of concentrate, farmers emphasize feeding dairy animals, in particular high-yielding buffaloes and crossbred animals. The low quality of dry fodder and often sub-standard feed ingredients, however, may still not provide enough feed for dairy animals, with resultant milk yields below the animals' potential. Seasonality in green fodder continues to be a factor affecting dairying, with hardly any green fodder available during the summer months of March to May. Especially in peri-urban

areas and some high-potential dairy pockets, COMFED and some private companies have found a market for industry-produced dairy cattle feeds. Since 2000, COMFED's cattle feed sales have doubled to about 60,000 t.

As a result of dairy promotion activities and good performance of the sector, farmers are interested in further investments, but increased prices for dairy animals are a serious hurdle for many farmers to start a business. Unfortunately, commercial banks are rather reluctant to provide credit to purchase dairy animals unless there is some guarantee from the cooperative sector (COMFED and dairy unions) or credits are linked to some often subsidized dairy schemes.

Positive contributions from cooperatives and the private sector to Bihar's dairy development are limited when looking at the various paths along which marketable surplus milk is handled. The cooperative and private sector together account for handling only 20% of the total surplus milk available. An astonishing 55% of milk is converted into sweets, while only 25% is directly marketed as liquid milk from producers to consumers, mostly via vendors who provide the link between production areas and nearby rural centres and small towns.

To further develop Bihar's dairy sector, efforts should be made to ensure that a larger number of smallholders can intensify their traditional dairy production systems. While animal health and breeding service systems are to a large extent in place, intensification efforts need to focus on improving smallholder feed and fodder resources so that adequate feed is available to maximize milk production from improved animals

Better recognition of the cottage dairy processing industry is recommended—these small, often family-based enterprises are part of Bihar's rural economy, creating income and employment for a large number of people. Producing 'local traditional specialities', these small dairy processors can play an important role in further development of the dairy sector and deserve as much attention as further promotion of large dairy plants to provide safe (pasteurized) milk to a growing urban population.

Smallholder dairy value chains in India and Bihar and Assam

Background: India has a huge population of different livestock—in 2007 there were 199 million cattle, 105 million buffaloes, 72 million sheep, 141 million goats, 11 million pigs and 649 million poultry.

The number of female cattle increased from 59 million in 1982 to 73 million in 2007. There was a marked shift in favour of crossbreds, whose share in the total cattle population increased from 4.6% in 1982 to 16.6% in 2007. Among adult females, the share of crossbreds increased substantially from 8% in 1982 to 36% in 2007. The southern states of Andhra Pradesh, Kerala, Karnataka and Tamil Nadu account for one-third of the total crossbred cattle in the country.

The buffalo population increased steadily during the last 25 years. Except in Punjab, Haryana, Uttar Pradesh, Rajasthan, Gujarat and Andhra Pradesh, cattle outnumber buffaloes. Two-thirds of the buffaloes are concentrated in Andhra Pradesh, Rajasthan, Gujarat, Punjab and Haryana. Adult female buffalo have increased from 33 million in 1982 to 54 million in 2007.

Buffaloes and cows contributed 53.4 and 43.2%, respectively, to total milk output during 2009–10. While the share of buffalo milk remained unchanged, the share from crossbred cows increased from 14.2% in 1991–92 to 22.9% in 2009–10.

Average daily milk yield in 2009–10 was 6.87 kg in crossbred cows, 2.14 kg in indigenous cows and 4.57 kg in buffaloes. Punjab has the highest average milk yield of crossbred cows (10.54 kg/day) and buffaloes (8.51 kg/day).[2] In spite of crossbreeding over the last five decades, of the 180 million bovines in India, only 12% are crossbred but produce 20% of total milk in the country. The average milk production across all bovine animals is 3.6 kg/day.

Feed resources are on the wane due to shifting crop production systems and depleted grazing lands, but reaching a larger segment of bovines through scientific breeding and epidemiological approaches to fight emerging and remerging diseases remains a challenge. Feeding livestock to reach milk production potential is a challenge faced by smallholders with crossbred (CB) cows and graded buffaloes despite several initiatives by the Government of India (GOI). Cultivated fodder production barely meets 5% of the dry matter needs of livestock and other dry matter is provided by agricultural by-products, grazing, etc.

With a growing demand for milk as a major protein source, ILRI has been promoting studies for strategic initiatives to add value to existing smallholder dairy value chains in India. An ambitious dairy improvement plan launched by GOI demands identifying critical implementation gaps in addition to technological innovations and public–private partnerships, as well as improved feeding, breeding, animal health and knowledge management in the smallholder dairy value chain.

2 12th Plan working group document.

In this context, ILRI has been given a mandate to conduct a situational analysis of the smallholder value chain in India and the states of Bihar and Assam. There has been a steady increase in per capita availability of milk in the country from 150 to 250 g/day. Predicted demand by 2020 is estimated at 370 g/day, but growth in milk production is only 3.8% compared to 4.5% during the 1990s. Demand for milk and a supply gap has seen milk prices rise by 21% year-to-year.

Objective: The main objective of this assignment was to prepare a situational analysis report of the smallholder dairy value chains for India and two Indian states (Bihar and Assam). The study provides:

- A detailed situation analysis, including livestock production and productivity trends, state-wide poverty levels and the contribution of livestock to state GDP and household income, with country comparisons;
- Detailed mapping of all value chain actors, their activities and processes and costs and margins at each actor level; and
- Existing business development services, constraints to services and policies.

Deliverables: This report includes four deliverables:

- Overview of the dairy sector in the study area and the country;
- Details on issues related to milk productivity, food safety and the environment;
- Initiatives undertaken in the dairy sector; and
- Relevant regulations on food safety and environment.

About ILRI: The International Livestock Research Institute (ILRI) works to improve food security and reduce poverty in developing countries through research for better and more sustainable uses of livestock, including small-scale livestock and fish systems that make meat, milk and fish available and affordable for poor consumers across the developing world. ILRI plans to work in selected Indian states to strengthen the smallholder dairy value chain. Before undertaking any program, ILRI will analyse the smallholder dairy value chains in the states of Bihar and Assam.

About ICSD: Intercooperation Social Development India (ICSD) aims to improve access of poor and disadvantaged people to services, knowledge and information. ICSD adds value to the development efforts of poor and disadvantaged people and communities and contributes to continuous improvements of their economic, social and ecological situation.

Intercooperation has gained experience and competence in development cooperation over the past 30 years by promoting effective management of natural resources, equitable economic growth and broad-based local governance. It implemented projects and supported partner organizations in more than 20 developing and transition countries. Since 2006, ICSD has been registered as a Not for Profit Company under Section 25 of the Indian Companies Act.

ICSD strives to reduce poverty by enhancing livelihood opportunities through efficient utilization of natural resources and community empowerment, especially that of women. The programs in India span several states, including Kerala, Andhra Pradesh, Odisha, Sikkim, Karnataka, Rajasthan, Chhattisgarh, Goa, Maharashtra, Uttarakhand, Madhya Pradesh, Bihar and Uttar Pradesh. ICSD has rich experience in working with the national and state governments, civil society organizations, research institutions, as well as the corporate sector.

Approach and methodology

This study used a judicious mix of secondary data and a review of information, as well as field data collected by using checklists and data collection instruments. The ICSD study team prepared checklists for interviews with officials and farmers through focus group discussions (FGD). Local NGOs were identified to interview primary value chain actors using the prepared instruments.

The country report was prepared as a desk review, while the report on Bihar is based on in-depth interviews with value chain actors and the Assam report is based on rapid data collection, mainly to update a previous ILRI study.

Desk study: The list of documents reviewed is provided in Annex 1, and includes sources such as the Planning Commission, state and central government statistics, relevant legislation and notifications, FAO and ILRI reviews of dairy sector development and others.

Sample study: To conduct the field study, checklists were designed for interviewing different sets of respondents:

- Farmers, using FGD,
- Officials of animal husbandry departments,
- Officials of dairy development departments,
- Officials of finance institutions,
- Officials of public health departments, and
- Scientists from research institutions.

Similarly, instruments were prepared for investigators to interview:

- Individual farmers,
- Vendors,
- Local service providers,
- Local cottage processors,
- Input suppliers,
- Customers, and
- Proprietors of small hotels and sweet shops.

All checklists and instruments were shared with ILRI for review. They were finalized after incorporating changes suggested by ILRI.

Orientation for field investigators: All field investigators were oriented in a one-day event at Patna for the Bihar team or Guwahati for the Assam team. Investigators were oriented on the value chain concept and the importance of each value chain actor to the study. In the field, the investigating teams were provided follow-up support to conduct the interviews.

Site selection criteria and sample size: Bovine data of 2007 published by the state animal husbandry departments and rural household population of 2001 published by the state governments were used to identify districts. The bovine population of each district was divided by its number of farm households to arrive at the bovine holding per smallholder. District data on bovine holdings by smallholders was divided into low and high halves.

- Two or three districts from the low and high halves were identified.
- The list was shared with ILRI and based on their suggestion, two districts —one from the top 50 percent and other from the bottom 50%— were selected at random.
- Different agro-climatic regions were represented.
- One district from each state was selected from ILRI's operational area.

Block selection: Two blocks from each district were selected for the field study. In Assam, only one block per district was selected. The criteria were milk production and marketing contributions of the block to the district.

Village selection: Representative villages from each block were selected for FGD and primary value chain actor interviews.

Field study: While selecting livestock-keeping households, their involvement in dairying was considered. Preference was given to women-headed households and farmers representing poor socioeconomic groups.

Picture 1.India map indicating Bihar and Assam (highlighted in red)

In each state, the investigators worked in two-member teams. Initially they participated in FGD along with the ICSD team. In these meetings these value chain actors were selected with the help of farmers:

- Individual farmers representing the village and cluster,
- Vendors collecting milk from the cluster,
- Cottage processors from within or outside the cluster but operating in the cluster,
- Hotels located in small to medium towns within or outside the cluster receiving milk from the cluster area,
- Input suppliers located within or outside the cluster from whom farmers sourced inputs, and
- Consumers receiving milk directly from vendors or from any other channel.

The study team collected information from key informants—60 individual farmers, 10 vendors, eight input suppliers, eight hotels, four cottage processors and 60 consumers (Annex 2.)

Overview of the Indian dairy sector[3]

This overview of the Indian dairy sector is based solely on published information from the web and the ICSD library. No field research or consultations were involved.

Predominant production systems and practices

- Extensive grazing and marginal feeding inputs for milk, draught and manure.
- Semi-intensive system of rearing milk cows and buffaloes on a mix of grazing, feeding crop residues, green grass cut and carried from field and tank bunds and concentrates when milk was a primary commodity.
- Rearing dry buffaloes/cows and selling them back to farmers when pregnant.
- Rearing crossbred heifers and selling pregnant heifers.
- Intensive commercial dairies in urban and semi-urban pockets only for milk.

Famers usually prefer traditional production systems, especially smallholders, because modern production systems are not available, accessible, or affordable.

Box 1. Characteristics of the Indian dairy industry

About 80% of the total milk produced in India is from rural areas with diversified, yet integrated crop and livestock activities. Extensive grazing, maximum use of available crop residues and marginal use of external inputs are the most prevalent practices. Women are very much involved in dairy activities. Most farmers across all regions still prefer traditional management practices because dairying in India is well integrated into prevailing farming systems. Many of them, however, are low input–low output dairy production.

Livestock—livelihoods and employment

The Indian dairy sector includes dairy animals—buffaloes, cattle and goats—in that order producing milk and supporting the livelihoods of nearly 70 out of 147 million of rural households. Milk is the main output of the livestock sector, providing 66.7% of the sector's total value, while meat and eggs provide 17.5% and 3.6%, respectively. Wool and hair are negligible (0.2%). Dung, which is used as domestic fuel and for fertilizer, is about 9% of the livestock sector's total output. Buffaloes, cows and goats contributed 53.4%, 43.2% and 3.5%, respectively, to total milk output in 2009-10.

Since 1991–92, the share of buffaloes in total milk production has remained almost unchanged, however, there has been a significant rise in the share of milk from crossbred cows, from 14.2% in 1991–92 to 22.9% in 2009–10.

3 Information in this section is based on published literature.

The growth rate for milk produced by crossbred cows declined from 11.3% during the 1990s to 7.7%in 2000. For indigenous cows the decline during the same period was from 2.5 to 2.2% and for buffaloes from 6.2to 3.6%. Declining growth rates call for efforts in animal breeding, veterinary health, and nutrition management to sustain the dairy sector in the long run. Women are 71% of the labour force in the dairy sector.

Contribution to GDP and growth

Dairy has been identified as one of the growth engines in the 10th Five-Year Plan. Milk has been the single largest commodity behind wheat as a contributor to agricultural GDP at a time when contributions were staggering. The dairy sector demonstrated steady growth during Operation Flood (OF) I, II and III, resulting in significant growth of infrastructure, both in cooperatives as well as the private sector.

Figure 1. Share of agriculture and livestock in GDP.

SHARE OF AGRICULTURE AND LIVESTOCK SECTOR IN GDP -at constant prices						
Year	Total GDP	GDP agriculture		GDP Livestock		
	Rs. Billions	Rs. Billions	% to Total GDP	Rs. Billions	% to Agri. GDP	
2004-05	29715	4766	16.04	1193	25.04	
2005-06	32531	5030	15.46	1268	25.2	
2006-07	35644	5237	14.69	1333	25.46	
2007-08	38966	5570	14.29	1414	25.39	
2008-09	41587	5554	13.36	1532	27.59	
2009-10	45076	5594	12.41	1614	28.86	
2010-11	48860	6029	12.34	1645	27.28	
Source: AH statistics 2012						

Figure 2. Output value at constant 2004–2005 prices (billion Rs.).

Value of Output at Constant 2004-2005 Prices (Rs Billion						
Periods	Livestock	Milk	Food grains	Rice	Wheat	Share of milk in %
1979-81	688	413	1020	440	247	12.40
1989-91	1083	727	1407	651	372	15.37
199-2001	1568	1101	1666	777	506	17.46
2009-2011	2270	1539	1854	828	570	19.3
Source: National Accounts Statistics, Government of India (GoI)						

Milk production in India has increased tremendously during the last four decades, from around 20 million tonnes in the 1960s to 32 million tonnes in 1980–81 to 116 million tonnes in 2010–11. Milk grew at an annual rate of 4.4%

during the 1990s, but declined to 3.8% during the 2000s. Nonetheless, the per capita availability of milk increased during this period, from 128 g/day in 1980–81 to 267 g/day in 2010–11. The significant growth in milk production during the 1980s and 1990s was due to Operation Flood (OF), which emphasized introduction of improved breeding technologies and liberalization of the dairy industry, together with development of dairy cooperatives and horizontal integration of milk markets. The share of the agricultural sector in total GDP declined from 34% in 1981–82 to 12.34% in 2010–11. The share of livestock in GDP declined also, but not as steeply as agriculture. It remained at 5–6% until 2000–01 and then gradually declined to 3.9% in 2010–11. However, the share of livestock in agricultural GDP increased consistently from 15% in 1981–82 to 27–28% in 2010–11.

Contribution of livestock population and productivity to milk growth [4]

Over the last five years, milk production in India increased by 25 million MT compared to the U.S. (6.6 million MT), China (5.4 million tonnes), New Zealand (2.7 million tonnes) and 1.6 million tonnes in the European Union.[5] Today India is the world's largest milk-producing country (127 million tonnes), of which 54% comes from buffaloes, 24%from crossbred cows and 22% from indigenous cows.

Individual productivity per animal has not changed significantly during 1992–2010 in India. Fifty-six percent of increased milk production during 1992–2010 can be attributed to an increase in per animal productivity, while a 43% increase in milk production is attributed to a rise in the number of milk animals in the overall bovine population.

Figure 3. Contribution of different species to milk production.

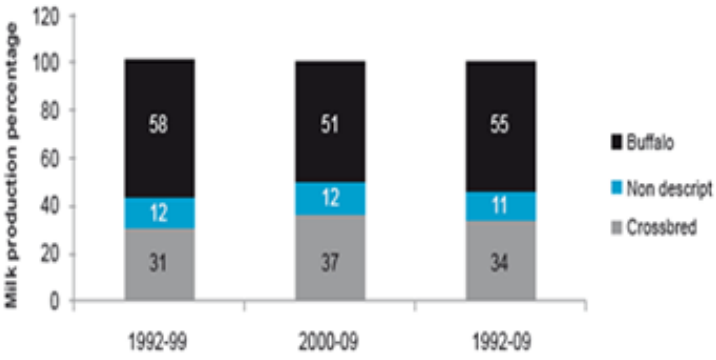
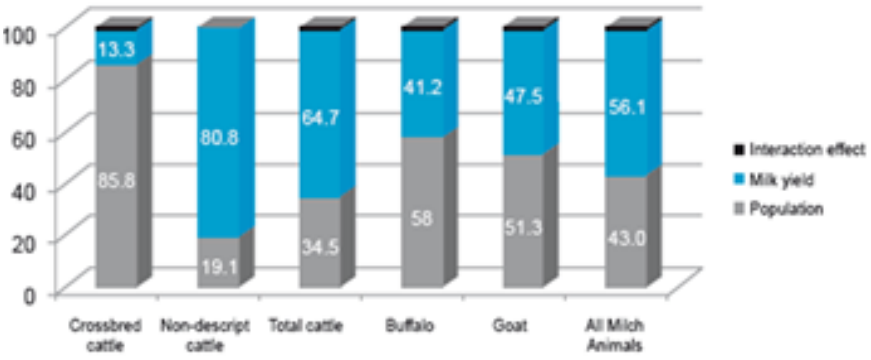


Figure 4. Sources of growth.



4 Asian Livestock, Challenges, Opportunities and the Response: Proceedings of an international policy forum held in Bangkok,Vinod and Purvi.

5 National Dairy Development Board.

Figure 5. Growth trends of subsectors in Indian agriculture.

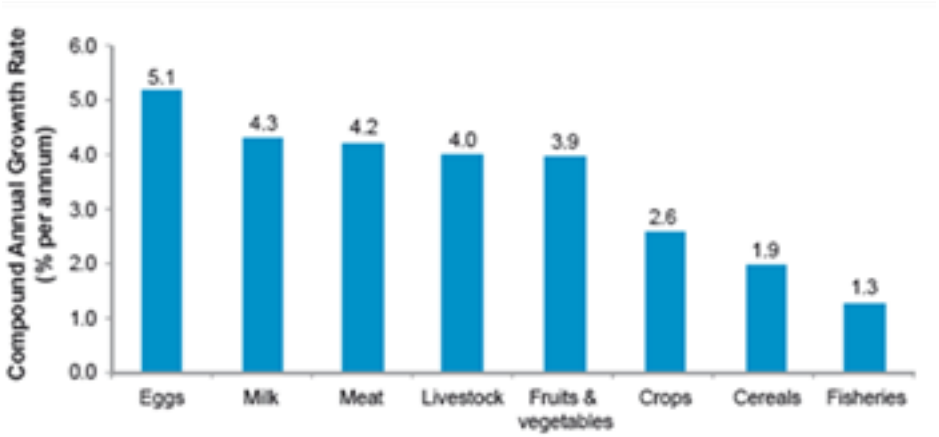
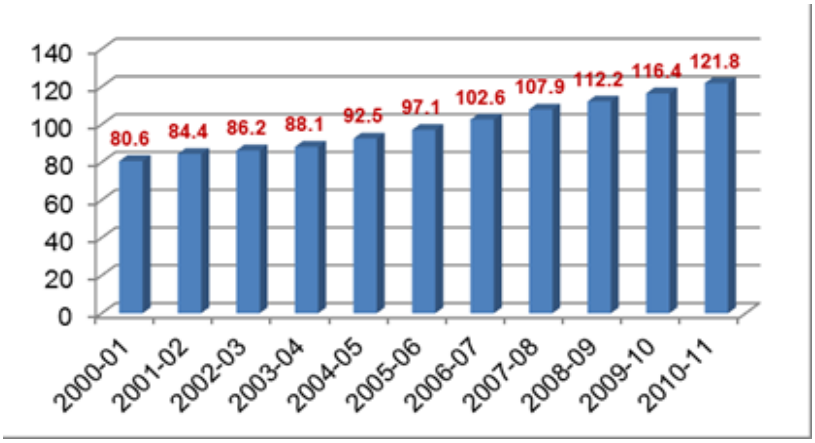


Figure 6. Milk production in India (million tonnes).



The remaining 1% was contributed by an interaction between the population increase and productivity of milk animals. During 1992–2009, crossbred cows accounted for 34% of the additional milk production, with 14% from improved productivity. Indigenous cows contributed 11% to the increase in milk production, with about 80% from enhanced milk productivity. Buffaloes accounted for 55% of increased milk production and improved yield contributed 41% of this increase. The growth in milk production is largely from replacement of low-yielding indigenous cows with cross-bred cattle and buffalo.

Compared to other major subsectors in agriculture, growth in the livestock sector as whole is rising. A large share of livestock feed is crop residues, but the declining trend in crop production will present a challenge for sustainable milk production in the hands of 70 million smallholders. Significant technical, policy and institutional support over the years contributed to incremental growth in milk production.

There is concern over millions of low-yielding cattle and buffaloes as well as the low productivity of high-yielding crossbred cattle and indigenous buffaloes. Under-performance of improved dairy animals may be due to shortages of green and dry fodders, diseases and lack of market integration between milk producers and consumers.

The livestock sector grew at an annual rate of 5.3% during the 1980s, which was almost double the growth rate of the crop sector. In subsequent decades, growth in the livestock sector declined and reached 3.6% during the 2000s. Despite this decline, growth in the livestock sector remained about 1.5 times higher than growth in the crop sector.

Per capita availability vs. production

Estimates of milk production and per capita availability at a national level increased from 220g/day (2000–01) to 281g/day by 2010–11 (Table 1).

Table 1.Estimates of milk production and per capita availability of milk

State	2000–2001	2001–2002	2002–2003	2003–2004	2004–2005	2005–2006	2006–2007	2007–2008	2008–2009	2009–2010	2010–2011
Milk production ('000 t)											
All India	80,607	84,406	86,159	88,082	92,484	97,066	102,580	107,934	112,183	116,425	121,848
Assam	683	682	705	727	739	747	750	752	753	756	790
Bihara	2489	2664	2869	3180	4743	5060	5451	5783	5934	6124	6,517
Per capita availability (g/day)											
All India	220	225	230	231	233	241	251	260	266	273	281

a. Anticipated achievements

Source: Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, GOI

Per capita consumption and expenditure patterns

This section of the report is based on the National Sample Survey data, primarily the 66th round (July 2009–June 2010). During this period there have been changes in per capita consumption and expenditures, with accelerated growth in expenditures. The major change is a gradual reduction in expenditures for food and an increase in spending for non-food items.

Average monthly per capita consumer expenditures (MPCE) in 2009–10 (Table 2) were estimated at Rs. 1,053.64 in rural India and Rs. 1984.46 in urban areas. Thus per capita spending of the urban population—in nominal terms, ignoring rural–urban price differences, if any—was on average about 88% higher than that of the rural population. The urban population spends more on non-food items (55.61% of MPCE), while the rural population is spending more on food items (56.98% of MPCE).

Table 2. All-India level of per capita consumption of livestock products

Expenditure	Rural		Urban	
	Rs.	% of MPCEa	Rs.	% of MPCE
Milk and milk products	80.55	7.64	137.01	6.90
Meat, eggs and fish	49.89	4.74	71.98	3.63
Total food	600.36	56.98	880.83	44.39
Total non-food	453.29	43.02	1103.63	55.61
Total expenditure	1053.64		1984.46	

a. Monthly per capita expenditure

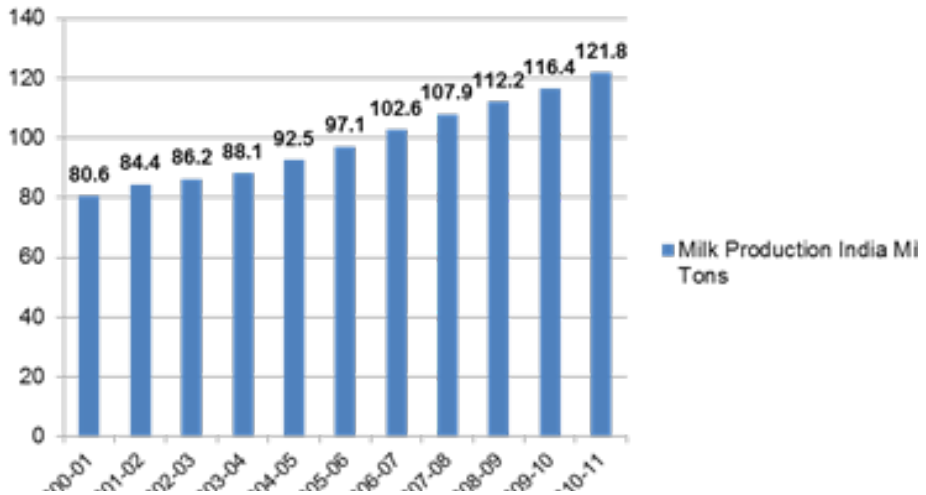
Table 3.Estimated percentage of household monthly consumption of livestock products (rural and urban)

	Rural		Urban	
	2004–05	2009–10	2004–05	2009–10
Milk and milk products	74.9	79.7	88.2	88.0
Egg,fish and meat	58.5	61.9	57.7	56.5

Average monthly per capita consumer expenditures for milk and milk products in 2009–10 were estimated as Rs. 80.55 in rural India and Rs. 137.01 in urban India. Thus the per capita expenditure level of the urban population—in nominal terms, ignoring rural–urban differences in price levels, if any—was on average about 71% higher than that of the rural population.

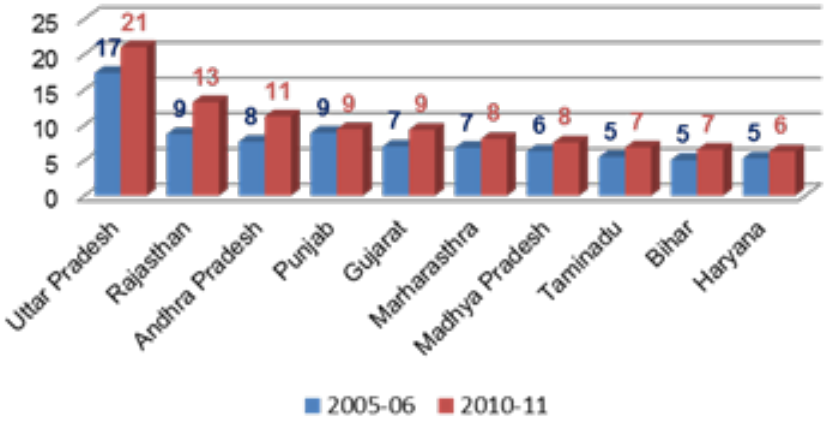
Milk production—distribution and marketing

Figure 7. Milk production in India (million tonnes).



India is the largest milk producing country in the world at 127 million tonnes. Uttar Pradesh, Rajasthan, Andhra Pradesh, Punjab, Gujarat, Maharashtra and Madhya Pradesh are the seven major milk producing states in that order. Six of the 10 leading milk-producing states produce nearly 59% of total milk production (Figure 8).

Figure 8. Ten major milk producing states.



Milk distribution and marketing: Excluding domestic consumption, formal marketing handles nearly 20% of the marketable surplus, while the other 80% goes to unorganized informal markets.

Table 4. Number of dairy plants registered under the Milk and Milk Product Order (MMPO) (2004) and handling capacity

Sector	Number	Capacity
Cooperative	263	43,247,500
Private	765	73,251,500
Government	37	40,46,000
Total	1065	120,544,500

Source: Annual Report 2011–12, Department of Animal Husbandry, GOI.

Nearly 5% of total milk is produced on an industrial scale in some cities and suburbs. Milk produced on these farms is mostly sold fresh locally at a high price. Some dairy farms process and sell pasteurised milk in sachets using their own brand names and also produce products such as ghee, sweets, etc. Currently the dairy cooperative network in India includes 254 cooperative milk processing units, 177 milk unions covering 346 districts and more than 144,246 village-level societies with a total membership of 14,461,000 farmers producing 26,188,000 litres of milk/day from rural areas and selling 21,989,000 litres /day (NDDB 2010–2011).

Besides handling liquid milk, these plants manufacture value-added products. Testing milk for safety and quality parameters at collection centres is almost non-existent. Lack of proper anaerobic waste treatment and waste of dairy by-products are other concerns. Due to quality concerns, the export potential of value-added products has so far not been fully exploited.

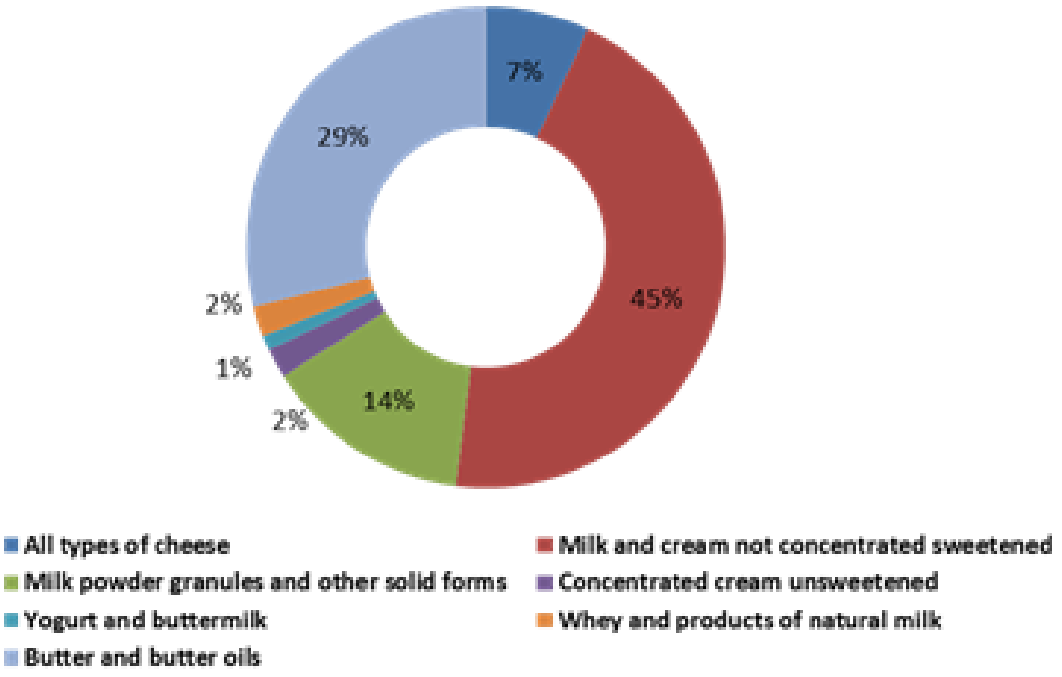
Of 94.5 million tonnes of milk in 2005, 93 million tonnes were reported to be from rural villages and 1.5 million tonnes from urban pockets (Dairy India 2007). Forty-three million tonnes remained in rural areas and 50 million tonnes entered the urban market. The utilization of milk in urban areas, including the 1.5 million tonnes produced in urban dairies, is shown in Table 5.

Table 5.Milk production and distribution

Production	Rural consumption	Cooperatives	Private sector	Traditional sector	Total
Total milk (million tonnes)	43.0	8.5	8.5	34.5	94.5
Share (%)	46	9	9	36	100
Sold as liquid milk (million tonnes)	43.0	6.4	3.0	20.7	73.1
Share (%)	59	8.8	4.1	28.3	100

Source: Dairy India 2007

Figure 9. Composition of Indian dairy exports, 2011.



Exports: By 2001 the country emerged as a net exporter of milk. In spite of being the world's largest milk producing country, India does not even contribute to1% of the world trade in dairy products. Nonetheless, India's export of dairy products has grown tremendously in the post-2001 era consequent to lifting quantitative restrictions on dairy exports and removal of excise duties since 2007 (Figure 9). Most exports are milk and cream (not sweetened and concentrated), butter and butter oils and milk powder in different forms.

The value of exports between 2001–02 and 2010–11 significantly increased from Rs. 16.4 million to Rs. 54.8 million and reached Rs. 14120million by 2012–13 (APEDA) (Table 6).

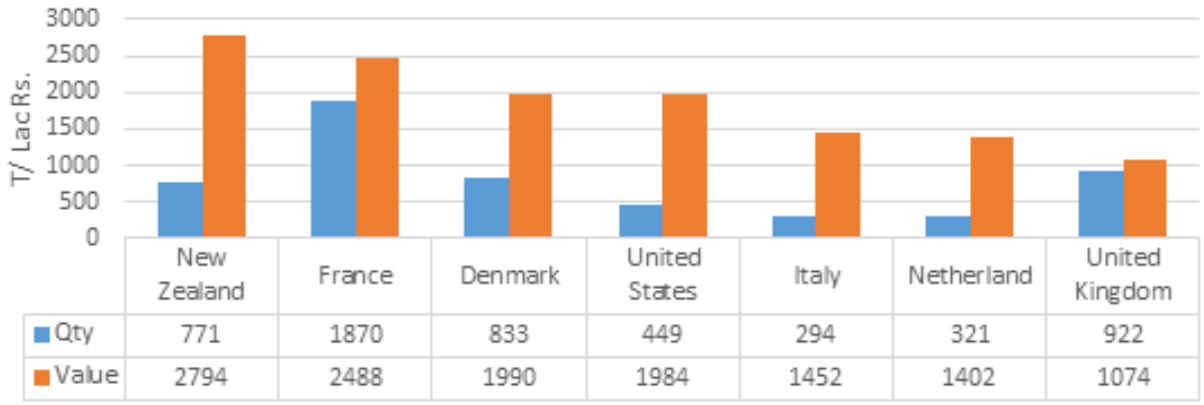
Table 6. Dairy exports from India to 12 leading countries, 2012–13

Country	Quantity (t)	Value (million rupees)
Bangladesh	17,870	2591.1
Egypt	11,261	1790.6
UAE	7026	1428.2
Saudi Arab	5682	991.2
Algeria	6093	951.4
Yemen Republic	5348	828.4
Singapore	5683	693.0
Iran	3965	678.9
Pakistan	4248	664.4
Philippines	2191	417.8
Nepal	3282	309.3
Syria	1500	229.7

Source:APEDA (http://agriexchange.apeda.gov.in/indexp/Product_description_32head.aspx?gcode=0407

Imports: In the 1980s and 1990s, India was mostly importing skim milk powder (SMP) and butter (or butter fats), but currently cheese is becoming the major imported dairy product. This trend is expected to continue because luxury hotels, food processing industries and fast food chains are on the rise. As a consequence, the demand for imported processed cheese and other high-value dairy products is increasing. India is importing milk and milk products from countries such as New Zealand and Australia in larger quantities, but also from France, Denmark, UK, Netherlands and USA. The predominant imported products include different types of milk powder, condensed milk liquids or semi-solid milk, followed by whey in dry blocks or powders.

Figure 10. India's dairy imports, 2012–13.



Source: DGCIS.

Export–import trends: Exports of dairy products from India increased from 2001 to 2005, however, exports declined in 2010. This fluctuation may be attributed to the demand and supply situation in the domestic market as a way to regulate rising prices.

Dairy imports increased between 2001 and 2005, with a surge in 2010. Growth in imports by private companies between 2005 and 2010 can be attributed to:

- Population growth in urban areas,
- Change in demand of urban population,
- Promotion of various branded dairy products by multinational companies and
- Changing GOI policies.

The factors that directly influence export and import trends include:

- Regional and seasonal fluctuations that affect production,
- Domestic market protection policy to benefit producers and manufacturers,
- Price control mechanisms in the domestic market,
- Protection policies imposed by importing countries,
- WTO and bilateral trade agreements, and
- Change in domestic consumption levels, preferences and patterns.

Challenges from demand–supply imbalances: Milk has become one of the essential human commodities and domestic demand continues to grow as a consequence of rising per capita incomes and shifting food preferences. According to GOI estimates, milk demand is projected to grow to at least 180 million tonnes by 2021–22.

Meeting this demand from the domestic supply would require production to grow at 5.5% per year over the next decade. Although India has emerged as the world's largest milk-producing country, the average herd productivity has not increased significantly. The average annual growth rate of milk production has slowed from an average of 4.3% (1990s) to 3.7% in the 2000s.

Box 2. Meeting future milk demand

If India fails to achieve substantial production growth, the country would need significant imports from the world market, which has the potential to cause international prices to spurt because India is such a large consumer. Hence, increasing milk production and improving productivity to meet projected demand is a key development challenge facing the Indian dairy sector.

To accelerate the envisaged productivity, it is essential to increase high-producing crossbred, indigenous cattle and the buffalo population to suit the needs of commercial dairy farms as well as smallholder dairy producers. Addressing feed and fodder requirements and an array of services and input delivery issues involved in AI programs demands a strategic focus.

Considerations to support smallholder dairy value chains

- If concentrated efforts are made to accelerate the growth of milk production, India can be an important exporter of milk and milk products. India has competitive advantages in milk production.
- Producer milk prices are lower in India than in the leading international exporting countries. Prospects for milk exports to neighbouring countries, particularly those of the South Asian Association for Regional Cooperation

(SAARC), most of which are deficient in meeting their requirements with domestic production, are very promising.

- Achieving growth of the dairy sector is essential to ensure long-term inclusive agricultural growth. Productivity-led growth is the only viable option for accelerated sustainable growth of the Indian dairy sector.
- Infrastructure and its delivery is still inadequate and concerted efforts are required to bring desired improvements. Strengthening market links, either through expansion of cooperatives or by facilitating contract farming, would go a long way to ensuring sustainable growth of the Indian dairy sector.
- India can emerge as an important exporter of milk and milk products. For SAARC countries, inclusion of milk in the South Asian Free Trade Area may increase trade among South Asian countries. Non-tariff measures would be a prerequisite for tapping markets in developed countries.

Inputs and services in livestock sector

Livestock productivity is challenged by emerging and re-emerging diseases and an acute shortage of animal feed that is necessary to produce milk, meat and eggs. Preventive health care, improved breeding, scientific feeding/ fodder production and related extension management are the core functions of the state livestock/animal husbandry departments. With large livestock populations and diverse agro-climatic regions, several players share space in livestock health, breeding and extension. In addition to state animal husbandry departments, several private and NGO partners work in the livestock sector.

Veterinary health services

The state animal husbandry departments are the single largest service delivery organizations to render health and related extension services, including planning, input production, procurement and delivery, enabling implementation, monitoring, training, extension and MIS. India has 8732 veterinary hospitals, 18,330 veterinary dispensaries and 25,195veterinary first aid/stockman centres. Private organizations are also involved in production of vaccines and sera that are essential for diagnostic and preventive health care. In addition, milk unions, private dairies, NGOs and private organizations are involved in preventive health coverage and veterinary first aid and many individuals provide minor veterinary health services. Most Indian states have vaccine production units and disease diagnostic laboratories at the regional and district levels to support professionals. These units and laboratories play an important role in disease prevention and containment

Major health issues in bovines: A high incidence of FMD, HS, BQ, trypanosomiasis, babesiosis, and theileriosis is reported on a regular basis, in addition to sporadic incidence of anthrax. FMD disease brings catastrophic loses—falling production, abortions, calf mortality, especially in crossbred cattle and lost draught power. Mastitis is another crippling disease that erodes farmer income. In one of the CALPI publications, Rajasekhar, an epidemiologist, reported an inadequate and improper disease reporting system. Epidemics and endemic diseases could have been prevented and/or controlled to benefit especially smallholders whose access to treatment and risk-bearing abilities are very poor.

Poor veterinary knowledge and services as well as wrong prescriptions for medicines, antibiotics and hormones are widespread. Foot and mouth disease (FMD) in crossbred animals is very damaging, in addition to overall health problems that can kill animals, milk production is highly affected. Another major concern is mastitis that affects at least 20% of dairy animals.

Table 7. Type of disease cases and deaths during 1997–2006

	1997		2001		2003		2005		2006	
Disease	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
FMD	46,022	589	69,329	1396	123,560	2066	67,237	2315	19,660	360
Anthrax	230	153	735	460	319	239	323	242	504	196
Rabies									159	159
Anaplasmosis									97	8
Babesiosis									1781	33
Brucellosis									15	0
HS	6751	3594	8679	3767	4522	1411	4753	2229	5309	1000
BQ	2592	1351	3125	1326	6527	2864	2396	956		
Fascioliasis	9341	105	49,119	4	21,993	10				
Trypanosomiasis									1622	28

Source: Vinod (2007). Animal health for poverty alleviation, a review of key issues for India.

Disease control strategies: Under the Prevention of Contagious Diseases to Animals Act, all state governments undertake epidemiological approaches to contain and prevent diseases through action plans and systematic vaccination protocols. For prevention of vector-borne diseases such as anaplasmosis, babesiosis, and trypanosomiasis, adequate extension training and vector eradication programs are undertaken by field staff.

The country has 250 diagnostic laboratories and 26 vaccine production units across different states, of which 19 are in the public sector and seven in the private sector. A state-of-the-art regional diagnostic laboratory has recently been established in Assam to provide diagnostic services and professional training to staff under NEC. Twenty-one different viral vaccines, 14 bacterial vaccines and nearly 13 diagnostic reagents are manufactured in the vaccine production centre.

Regulation and production of veterinary vaccines and biologicals is under the Drugs and Cosmetic Act 1940, administered by the drug controller of India and state-level drug control departments. Standards for veterinary vaccines in India are outdated and need revision. The Indian Veterinary Research Institute (IVRI) is responsible for monitoring the quality of vaccines and biologicals produced in the country. In addition, a separate National Veterinary Biological Quality Control Centre was established in Uttar Pradesh (Vinod et al. 2008).

The major player in the pharmaceutical industry, Glaxo, now Virbac, accounts for nearly 10% of the market due to its strong presence in the poultry and cattle sector. Next are Zydus Sarabhai, Intervet and Pfizer. The top 10 companies account for more than 60% of the vaccine market. Competition is intense because many companies have similar products on the market and target the same clients.

Table 8. Market share of veterinary pharmaceuticals by categories, 2001

Category	Market share (%)	Growth (%)
Antibiotics	22.0	29.0
Feed additives and supplements	18.5	13.0
Tonics	18.9	30.0
Anthelmintics	8.0	19.0
Biologicals	6.8	40.0
Antibacterial	4.0	15.0
Anticoccidials	1.5	–5.0
Ectoparasiticides	2.7	48.0

Source: Animal Health for Poverty Alleviation: A review of Key issues for India: 2008.

In the cattle segment, FMD vaccine continues to be the biggest revenue earner at 30%. Implementation of FMD-free zones under the ASCAD program created a tangible demand for competitive vaccine production in the country.

Anti-infective medicines constitute the biggest therapeutic segment (28%) of the Indian animal health industry. Traditional husbandry practices among farmers, coupled with poor farm hygiene and sanitary and phytosanitary conditions result in a number of diseases that affect animal health and production. Therapeutic use of anti-infective medicines is widespread in all sectors, and abuse of antibiotics, steroids and hormones is no exception.

Policies: To mitigate problems relating to prevention and control of animal diseases, the Livestock Health Division operates a number of programs, including:

- Prevention of animal diseases through immunization schemes under Assistance to States for Control of Animal Diseases (ASCAD) for vaccination of livestock against economically important diseases;
- Animal Disease Information System, a program under the National Animal Disease Reporting System (NADRS) for online reporting of diseases in progress;
- Control and ultimate eradication of diseases of national importance;
- Control of foot and mouth disease; and
- National Control Programme on Brucellosis (NCPB).

Input and services—genetic Improvement

Genetic improvement is essential to increase milk productivity, but to achieve their potential, bovines need ideal feeding, both bulk and nutritional components. Due to the decline in grazing areas and high cost of concentrate feeds, rearing high-yielding milk animals is becoming costly. The concept of rearing heifer calves as future replacements and to keep dry cattle until the next calving is losing focus because it does not seem viable for backyard dairies. Commercial dairy farmers replace their milk animals once they are dry and buy new ones.

In recent years, fewer smallholders are rearing cattle or buffaloes for milk production, perhaps because they have limited ability for risk, insurance coverage is weak, fodder resources are scarce and feed is becoming more expensive.

Figure 11. Trends in milk animal stocking.

Trends in milch animal stocking pattern/100 HH				
Category	In milk bovine stock per 100 rural house hold			
	1971-72	1981-82	1991-92	2002-03
Landless	16	7	6	1
Marginal	33	28	41	40
Small	64	48	69	63
Semi medium	92	74	80	84
Medium	142	106	102	126
Large	225	153	130	208
Source: Dairy India 2007; page Number 25				

Figure 12. Breeds and their lactation yield.

Breeds	Lactation yield (kg)
***Bos indicus* breeds:**	
Sahiwal	1548-2283
Red Sindhi	1514-1634
Tharparkar	1456-2177
Gir	1312-1804
Hariana	721-1436
Ongole	613-1120
Deoni	879-1049
Non-descript	376-535

Figure 13. Economic parameters of certain dairy/dual purpose cattle breeds and Bos Taurus and their crosses in India.

	AFC	DP	SP	GP	CI
		***Bos indicus* breeds**			
Sahiwal	1210-1250	148-160	1510-160	286	439-580
Red Sindhi	1220-1260	145-1552	142-154	283	425-540
Tharparkar	1444-1494	138-150	138-154	288	430-456
Gir	1401-1434	207-230	155-169	281	511-630
Hariana	1731-1779	158-172	167	290	444-632
Kankrej	1400-1448	130-150	206-220	-	475-506
Ongole	1200-1350	321-380	221-240	286	490-515
ND	1625-1754	271-326	271-284		571-632
		***Bos taurus* breeds**			
HF	801-1080			275	396-425
Jersey	848-871		192		392-453
Brown Swiss	1010	175		287	388-490
Red Dane	897				454-525
		B. taurus x B. indicus			
B.Taurus × *B.indicus*	879-1027	90-94	105-122	278-284	384-400

Herd composition and economic parameters: The country has a number of important local dairy and dual-purpose cattle breeds such as Rathi, Kankrej, Sindhi, Sahiwal, Tharparkar, Gir, Ongole, Haryana and buffalo breeds such as Murrah, Jaffarabadi and Mehasana.

Crossbreeding in India has not demonstrated sustainable results for parameters of economic importance, but depleted grazing land and shifts in cropping patterns make improving the livestock feeding situation challenging.

Figure 14. Comparative performance of different grades of Friesian and Sahiwal cows.

	Sahiwal	¼ (25%)	3/8 (37.5%)	½ (50%)	5/8 (62.5%)	¾ (75%)	7/8 (87.5%)	15/16 (94%)	31/32 (97%)
AFC (m)	38.3	37.5	38.5	36.2	35.9	36.3	36.0	37.0	36.8
FLMY (kg)	1772	1550	2114	2538	2415	2393	2268	2111	1837
FLL (d)	296	284	297	308	292	306	299	294	263
FCI (d)	421	417	445	432	433	468	462	442	463
Mort %	15	19	28	4	16	10	18	16	32
Mort% adult	9	9	11	2	7	11	11	11	12

The eighteenth livestock census reported that cattle increased from 185.18 million to 199.08 million, while buffalo increased from 97.92 million to 105.34 million. Nearly 70%of Indian cattle are nondescript, including indigenous milk and dual-purpose breeds. Improving productivity in a huge population of low-producing cattle and buffaloes is one of the major challenges. Crossbreeding of indigenous cattle with exotic stock to enhance genetic potential has had limited success. Limited AI services, infrastructure and technical manpower coupled with a poor conception rate following artificial insemination have been the major impediments. After more than three decades of crossbreeding, that population is only 16.6%in cattle.

Experience with crossbreeding at different levels has shown that cattle with less exotic blood have demonstrated better economic parameters (production, reproduction) compared to crossbred cattle with higher exotic blood levels. To maintain a 50% exotic inheritance level among Indian Zebu cattle to develop a sustainable milk population for smallholder producers is one concern because genetically superior crossbred bulls are not available in sufficient numbers.

Breeding initiatives and strategies: To increase milk production, GOI has introduced different schemes and projects in the past, but the current project is the National Project on Bovine Breeding and Dairy development (NPBBD):

- Upgrading the nondescript as well as graded buffaloes with the Murrah breed;
- Promoting indigenous pure breeding among Sahiwal, Gir, Kankrej, Haryana, Ongole and Deoni, etc. in their respective breeding tracts;
- Cross breeding of nondescript local cattle with exotic breeds such as Jersey and Holstein Friesian; and
- Mating crossbred cattle with crossbred semen to keep the exotic blood level at 50%.

National Dairy Plan—goals and objectives: A World Bank-funded National Dairy Plan (NDP) at a cost of Rs. 17.6 billion (Rs. 15.84 billion IDA credit and Rs. 1.76 billion GOI share),was approved for implementation during the 12th plan. The project envisages increasing the productivity of milk animals through better organized scientific breeding, strengthening existing semen stations, starting new stations to produce high-quality disease-free semen, setting up a pilot model for viable doorstep AI delivery services through a professional provider, and increased delivery of semen from the present 50 million artificial inseminations (of which only 20 million are presently doorstep delivery) to more than 90 million, with the bulk at doorstep delivery.

Box 3. NDP-1—Initiatives

Subcomponent 1

a. Production of high genetic merit bulls (HGM) through:

- Progeny testing (PT) program in selected breeds,
- Indigenous breed development (IBD) program in selected breeds; and
- Import of exotic bulls/embryos/frozen semen.

b. Semen production:

- Strengthening of existing semen production stations and establishment of new semen stations.

c. Delivery of artificial insemination (AI) services:

- Through trained mobile AI technicians (MAIT) at farmers' doorsteps.

Subcomponent 2

a. Ration balancing program (RBP):

A comprehensive RBP in which extension advice would be provided to dairy farmers through trained local resource persons (LRP) for advising on animal feed and nutrition. Research shows that feeding balanced rations has the potential to increase milk yield, reduce production costs, and contribute to reduced methane emissions.

b. Fodder development:

Extension initiatives/interventions for fodder development, including support for improved fodder seed production, fodder contracting, demonstrations for silage making, and reducing waste of dry fodder through processing and enrichment.

NDP also envisages providing technical support for balanced feeding of milk animals to produce milk quantities commensurate with their genetic potential, reduce methane emissions, and strengthen village-based procurement systems. The project is well conceived and has a strong monitoring mechanism.

Both NCBBP and NDP have similar objectives, focus and approach. While NDP has an outlay of Rs 17.6 billion, the allocation for NCBBP in the 12th Plan has yet to be finalized. Both agencies have an action plan for the next 15 years to enhance bovine productivity, produce quality semen, ensure 75% coverage through AI with delivery at farmers' doorsteps, and create an effective field recording system to monitor production, test, and evaluate exotic bulls, crossbreds, indigenous cattle breeds and buffaloes.

Breeding structure and infrastructure: Bovine breeding activities are implemented under NPBBD, which is an offshoot of GOI's NPCBB. The project began in 2000 in two phases of five years each. Under this scheme, 100% grant-in-aid is given to state-implementing agencies to streamline storage and supply of liquid nitrogen, convert stationary government AI centres into mobile centres, promote private mobile AI service for doorstep delivery, strengthen semen stations and bull production and evaluation for use in semen stations and natural service.

NPBBD has state-level implementing agencies named as Livestock Development Boards/ Livestock Development Agencies. Implementing agencies are governed by a board of directors and an elected chairperson. Funds are provided from NPBBD and the respective state departments.

Each state has one to five frozen bull semen stations to produce frozen semen of high genetic merit as per the Minimum Standard Protocol (MSP) of the Central Monitoring Unit (CMU).Frozen semen depots are located in selected subdivisions where semen and related inputs are stored in bulk and distributed to field AI units/stations. In order to increase the outreach of AI services, NPBBD has involved private AI service agencies such as BAIF, JK Trust and India Gen in the AI service delivery system.

Challenges for implementing AI field programs include:

- Presence of multiple players in field AI programs and the absence of a regulatory framework in current breeding policies resulted in incoherence in implementing the policy.
- Absence of provisions to monitor and assess mechanisms to study the impact of the breeding policy led agencies and individuals to not adhere to policies.
- Absence of a framework to monitor breeding operations hinders proper assessment of the AI chain for further fine-tuning of the field program.
- Production and procurement of breeding bulls for field AI programs needs a strategic focus at the policy level to match the challenges of producing breeding bulls of high genetic merit, especially crossbred bulls.
- Concerns arise for half-bred crossbred bulls for inter-se mating. While intensive selection in half-bred herds is essential to ensure breed development, implementation of selection procedures that includes culling animals is difficult.
- MSP of current frozen semen stations does not suit the needs of commercial dairies. The productivity levels of commercial herds are far superior to the breeding value of the bulls at these stations, so commercial dairies do not use the stations, or do not use them often. Demand for Holstein Friesian (HF) semen for forward crossing (to get close to a pure HF population) is on the rise in certain districts, though this development is not encouraged.
- Inadequate facilities to monitor and assess field AI operations and absence of qualified supervisory staff to monitor performance of AI technicians.

National Livestock Sector Policy 2013: The national livestock policy envisages increasing production and productivity for cows and buffaloes through increased availability of feed and fodder, genetic improvement through cross breeding, strengthening progeny testing, selective breeding, improved disease control and surveillance, etc. The problem of infertility among improved milk animals would be suitably addressed through provision of area-specific mineral mixtures and appropriate feed and fodder.

Milk and Milk Product Order 1992: To enhance the marketing network, GOI liberalized its milk marketing policy, allowing more private players to enter the dairy industry. It issued a milk and milk product order (MMPO) in 1992. Key features of this MMPO include:

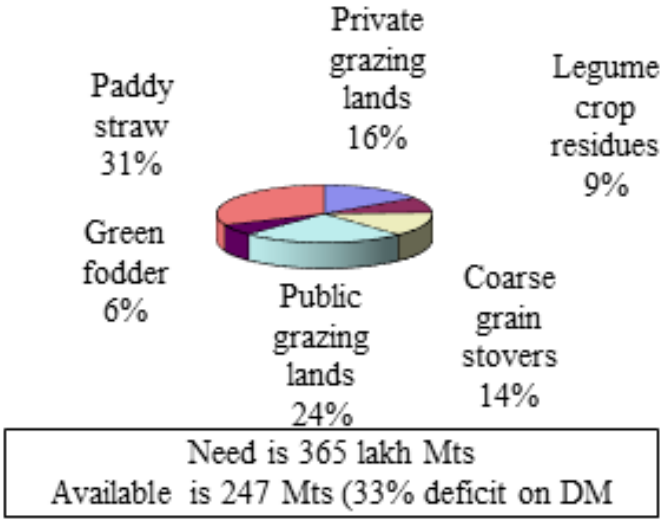
- Any person/company/dairy plant handling more than 10,000 litres of milk/day or 500 tonnes of milk solids/year needs to be registered with the registering authority appointed by the central government.
- The main objective of the order is to maintain and increase the supply of liquid milk of desired quality for the general public and to regulate production, processing and distribution of milk and milk products.
- Registration under the MMPO 1992 is linked to concerns about hygienic conditions and quality and food safety.
- Provision of inspection of dairy plants has been made flexible.
- Provision to grant registration in 90 days has been reduced to 45 days.

Input and services—feeds

Feeding: Livestock production systems in India are mostly based on traditional knowledge, low-cost agricultural residues and agro by-products. State and central governments play an important role in fodder production. The National Seed Corporation and regional forage stations are the primary sources of fodder seeds. Several private companies (Mayco, Agricold, Nuziveed seeds) also produce fodder seeds and supply them to farmers, mostly through agricultural departments. Cattle feed is produced mostly by private companies and cooperatives. Some state governments also produce feed, mostly for poultry or their own livestock farms (Figure 15).

Green fodder feeding is based on the cut-and-carry system, with fodder coming from public/community lands, field bunds, village tank bunds, etc. Some farmers, especially commercial dairy producers, grow fodder on their own land to feed to their dairy animals. Most livestock are reared on crop residues, in particular, paddy straw. Rations are often supplemented with local concentrate feed in the form of broken grains, bran, or oil cakes. Crop residues and crop by-products are the major ingredients (40%) of dairy rations after green fodder (26%) and commercially-produced concentrate feeds (3%). Most small-scale farmers do not feed their dry dairy animals with concentrates, but during lactation they often feed their own mixed concentrates with locally available ingredients. Mostly large-scale farmers (more than five animals), use commercial feed and cultivated green fodder. Barely 5% of the green fodder requirement in the country is cultivated fodder.

Figure 15. Different feeding resources.



Constraints

Most feed requirements are met from crop by-products and grazing on common land. The latter, however, has been dwindling quantitatively as well as qualitatively. A feed and fodder study conducted in Andhra Pradesh during the 1990s listed different sources of livestock feed and implied that only 5% of fodder for livestock comes from cultivated green fodders. The situation is not much different within the national context (Indo Swiss Project Andhra Pradesh 1997).While the livestock population is increasing, the gap between requirements and availability of feed and fodder is increasing, primarily due to decreasing grazing areas and the reduced availability of crop residues as fodder. Continuous shrinkage of common property has led to overgrazing of remaining pastures.

A recent study conducted by Rajashree Dutta (2011) estimated supply and demand for green and dry fodder in the country (Table 9).

Table 9.Supply and demand for green and dry fodder in India (million tonnes)

Year	Supply		Demand		Deficit (%)	
	Green	Dry	Green	Dry	Green	Dry
1995	379.30	421	947	526	59.95	19.95
2000	384.50	428	988	549	61.10	21.93
2005	389.90	443	1025	569	61.96	22.08
2010	395.20	451	1061	589	62.76	23.46
2015	400.60	466	1097	609	63.50	23.56
2020	405.90	473	1134	630	64.21	24.81
2025	411.30	488	1170	650	64.87	24.92

Source: Economics of production, processing and marketing of fodder crops in Gujarat. Research Study No. 144. Rajashree A Dutta 2011.

However, the Accelerated Fodder Development Programme of GOI estimated the deficits as 36% for green fodder, 40%for dry fodder, and 57% for concentrates. There is competition between food for humans and livestock, and farmers opt for more diversity and new varieties of food, cash and horticulture crops. The potential for manufacturing cattle feed is low, although demand for cattle feed is generally higher among farmers with crossbred animals, overall demand is low, because:

- More than 50% of milk is from low-yielding animals and commercial feed would not significantly improve their yields,
- Cattle feeding practices are in general very traditional,
- Farmers mostly prepare mixtures from locally-available ingredients, and
- Cost of concentrate feed is too high for many smallholders.

Feed and fodder policies

The12thPlan puts greater focus on improving productivity of dairy animals by enhancing the availability of quality feed and fodder. As called for in the action plan of NDP, fodder production activities would be mostly promoted through on-farm demonstrations and training, using a cluster approach. The plan also calls for establishing fodder seed production companies and market links with private sector agencies. The ration balancing program in NDP is envisaged to help dairy farmers provide cost-effective, and nutritionally-balanced feed.

Input and services—Knowledge systems

Structure

All animal husbandry departments run livestock extension units. Each state has a state-level extension wing with responsibility to prepare extension materials, as well as conduct livestock exhibitions, calf rallies, milk yield competitions, etc. Under the Ministry of Agriculture, MANAGE (National Institute for Agriculture Extension Management) conducts training for trainers and facilitates on-farm demonstrations. State agricultural and veterinary universities have livestock extension departments to train their students. In addition, these institutes also conduct on-farm research activities in adopted villages.

GOI established Krishi Vigyan Kendra (KVK)[6] to render livestock extension services with an emphasis on training and education for farmers, entrepreneurs, farm women, rural youth, extension functionaries of financial institutions, as well as voluntary organizations. GOI plays a key role in linking research to the field to improve socio-economic conditions for farmers, farmwomen and livestock owners.

Box 4. Role of Krishi Vigyan Kendra and the Indian Veterinary Research Institute

The KVK of IVRI dominates animal husbandry activities—training, demonstrations and on-farm trials for livestock owners. Prior to the establishment of KVK, the two ICAR TOT projects—Operational Research Project (ORP) on livestock and fodder improvement and Lab to Land programs (LLP)—functioned under the Joint Directorate of Extension Education since 1975–76 and 1979–80, respectively. As a policy, activities of ORP, LLP, and KVK were separate, but merged under the umbrella of Krishi Vigyan Kendra during 1993–94.

Source: Pratap S Birtal; National Centre for Agricultural Economics and Policy Research (ICAR); Policy paper 16.

Key actors are from the Panchayat Raj Department, which has an extension officer for animal husbandry in every block with responsibilities to conduct farmer training programs, kisanmela, calf rallies, etc. Most Milk Unions have extension functionaries to provide training on clean milk production. Private milk processing companies also produce extension services for their milk producers. NGOs such as BAIF and JK Trust have livestock extension activities to educate their farmers. In addition to selling inputs such as fodder mini-kits, feed, tools, vaccines and medicines, suppliers provide extension services to farmers on clean milk production and other dairy practices and conduct on-farm demonstrations and training.

Investment

The responsibility for livestock research and education lies with the Department of Agricultural Research and Education and the Indian Council of Agricultural Research (ICAR). ICAR coordinates research on veterinary biologicals, disease diagnosis and vaccine production. This work is carried out with the help of a high-security animal

6 Agriculture Knowledge Centre.

disease laboratory at Bhopal, a virology laboratory at Mukteshwar, and three regional research laboratories, one each at Srinagar, Kolkata and Bangalore (Vinod 2008).

PratapBritaletal (2002) reported that of the total research allocation for the livestock sector, 29.9% is allocated for cattle and another 21.2% for buffaloes. However, the major focus of research is skewed toward milk production. The share of livestock research of the total research outlay of ICAR is presented in Table 10.

Table 10. Share of livestock research in total research outlay of ICAR (million Rs.)

Plan	Total outlay	Research outlay	Outlay for livestock research	Percent of research outlay
V	1535	932	259	27.79
Vi	3399	2497	356	14.26
VII	4250	3172	446	14.06
VIII	13,000	9682	1738	17.95
IX	33,770	24,556	4710	19.18

Source: Assessment of Research Priorities for Livestock Sector in India, National Centre for Agricultural Economics and Policy Research (2002).

Research in livestock production and dairying has had major breakthroughs in frozen semen technology, multiple ovulation and embryo transfer technology. In animal nutrition and health management, research outputs were less prominent, but several biotechnology interventions in milk processing and product preparation have been successful. Other factors contributing to increased productivity in the dairy sector are from on-farm demonstrations and training for farmers and field staff.

Factors influencing farmer knowledge of dairying

The growing demand for milk and falling trends in productivity are major concerns and challenges. The envisaged demand for milk (200 million tonnes by 2020) needs highly focused results from research to optimize productivity. Changes in dairy production patterns and consumer habits demand continuous research and adaptation of existing technologies.

Climate change in the form of heat stress, scarce feed and fodder, changed epidemiological patterns of vector-borne diseases and different bacterial and viral diseases will likely affect dairy production and cause economic losses. These vulnerabilities require new skills and the latest technologies.

Only 5% of farmers are able to access extension services and only 1% of the total outlay is allocated for extension. The major extension focus is on agriculture, while livestock extension receives low priority.

Polices

In the 10th Plan, the Ministry of Agriculture created a provision to support state extension programs and extension departments. A policy framework for agricultural extension was created and the mandate was given to MANAGE. Major guiding elements of the policy framework include:

- Reforming public sector extension,
- Encouraging the private sector to effectively complement and supplement public extension,
- Augmenting media and information technology support for extension,
- Mainstreaming gender concerns in extension, and
- Providing capacity building and skill development for farmers and extension functionaries.

Special KVKs for various livestock activities are to be established. KVKs specifically created for livestock should support farmer education, skills training for para-vets and field guides.

Inputs and services—finances

Credit

Agricultural credit is disbursed through a network of commercial banks, regional rural banks and cooperatives. There are nearly 100,000village-level primary agriculture cooperatives, 368 district central cooperative banks, 12,855 branches, and 30 state cooperative banks with 953 branches that provide short- and medium-term credit. The long-term cooperative sector includes 19 state cooperative and rural development banks with 2609 operational units (in 2005), including 788 branches and 772 primary agriculture and rural development banks (AHDD, Annual Report 2012).

Financial institutions provide credit for bovines, sheep, goats, swine, and poultry to purchase animals, construct animal sheds, purchase equipment, etc. Credits are also extended to establish milk collection centres, processing units, milk storage and cold chain facilities, retail outlets, and to initiate feed and fodder development activities. The sector had about 10% of all loans between 2005–06 and 2009–10. More than 70% in the livestock sector goes for dairy development (12thPlan document).

A venture capital fund that was continued from the 11thPlan was modified and renamed as a dairy entrepreneurship scheme beginning in September 2010. In this scheme, interest-free loans are provided to establish dairy units in Operation Flood areas. Assistance is extended to purchase up to 10 indigenous milk cows. Further assistance can be provided to rear 20 heifers, produce vermin compost and create dairy marketing outlets. Rs. 1084million was allocated in the 12th Plan under this scheme. So far6335 units have been established and Rs282.1 million has been released. The term loan requirement for the sector is around Rs. 782.85 billion for the 12th Plan, while the working capital requirement may be around 25% of the term loan.

Insurance

Institutional mechanisms to protect animals against risks are weak. Currently, only 6% of farm animals (excluding poultry) are covered by insurance. Livestock extension was grossly neglected in the past—only about 5% of the farm households in India access information about livestock technology, a disappointing performance by the financial and information delivery systems (12th Plan document).

Recently, private institutions entered into livestock insurance markets. BASIX, a livelihood promotion institution working in several arid and backward districts in seven states, collaborates with Royal Sundaram to provide livestock insurance.

A centrally sponsored livestock insurance scheme was introduced by GOI in 100 selected districts. Under this scheme 50% of the premium is borne by farmers and the remaining 50% and administrative costs are borne by the government. The scheme is tenable for a maximum of three years and restricted to two animals /beneficiary.

Table 11. Number of animals insured under the GOI livestock insurance scheme

State	2006–07	2007–08	2008–09	2009–10	2010–11
Assam	1138	432	17,470	20,947	30,641
Bihar	10,484	3251	11	893	1808
Total	533,259	451,560	396,908	682,029	816,354

Source: Basic Animal Husbandry Statistics 2012, GOI.


3 00
2 00

Value addition and marketing

Sectors and channels

Milk consumption and marketing in India takes place in three sectors:

- Producer households, characterized by home consumption and direct marketing;
- Informal sector, unorganized actors;
- Organized dairy sector, formal dairy processors and companies/cooperatives.

Across all three sectors milk products are prepared at different scales. In producer households, milk is processed into products such as ghee, dahi, khoa, etc. for household consumption or sale in the neighbourhood. In the informal sector, the marketable surplus that is traded by vendors mostly goes to sweet shops and hotels where they prepare value-added products such as rasgulla, gulab jamun, paneer, or khoa.In the organized sector many more products such as butter, fresh cheese, ice cream and high-end products such as cheese and baby food are produced.

Milk procured through the informal sector is largely sold as unpackaged milk. It often contains several preservatives to control spoilage. Meeta Punjabi (2007) reported that nearly 34.5% of the marketable surplus, or 19% of total production, is marketed as unpackaged milk. About 40%of the total milk, which is 22% of the marketable surplus, is sold as processed products through informal markets. About 14.5% of the marketable surplus (8% of total production) is sold as packaged milk through the formal sector.

Production of value-added products

There are two major product directions in the dairy value chain, traditional dairy products and high-end products.

Five processes deal with traditional products:

- Cultured products—dahi, mustidahi, lassi, buttermilk and srikhand;
- Fat rich products—ghee, butter and cream;
- Acid heat coagulated products—paneer and channa; the latter is the key input to prepare different kinds of sweets such as rasgulla orgulabjamun;
- Heat-desiccated products—kulfi, rabdi, basundhi and khoa; the last is used to prepare different varieties of commercially marketed sweets; and
- Milk-based puddings and desserts that are commonly used during festival seasons.

The main high-end products are milk powder, baby food, table butter, ice cream, cheese, nutritive beverages and chocolate.

Table 12. Milk flow from producer to consumers with share of different players

Parameter	Rural	Cooperatives	Private sector	Traditional sector	Total
Share (million tonnes)	43.0(46%)	8.5 (9%)	8.5 (9%)	34.5 (36%)	94.5
Sold as liquid milk(million tonnes)	43.0a	6.4 (75%)	3.0 (35%)	20.7(60%)	73.1
Converted into products (million tonnes)		2.1 (25%)	5.5 (65%)	13.8 (40%)	21.4
Ghee production (million tonnes)		0.05	0.18	1.52	1.75
Khoa/channa/paneer (million tonnes)		0.10	0.60	2.50	3.20
Milk powder (million tonnes)		0.12	.0.40	–	0.52
Table butter (million tonnes)		0.045	0.01	–	0.055
Cheese/edible casein (million tonnes)		0.003	0.015	–	0.018
Other productsb(million tonnes)		0.70	1.60	3.00	5.30
Value of output					
Liquid milk (million Rs.)	3,86,259	89,600	42,000	310,500	828,350
Ghee production(million Rs.)		7000	25,200	197,600	229,800
Khoa/channa/paneer(million Rs.)		8500	45,000	187,500	241,000
Milk powder(million Rs.)		10,800	36,000		46,800
Table butter(million Rs.)		6300	1400		7700
Cheese/edible casein (million Rs.)		750	9000		9750
Other products (million Rs.)		140,000	320,000	450,000	910,000
Total	3,86,250	262,950	478,600	1,145,600	2,273,400

a. Including conversion into products by housewives, halwais
b. Includes ethnic sweets, fermented products, ice cream
Source: Dairy India 2007.

NDDB (2007) reported that in 2005 India produced 94.5 million tonnes of milk, 93 million tonnes in rural areas and 1.5 million tonnes in urban areas (Table 13). More than 70% of the milk purchased by consumers in Indian metro areas is consumed as liquid milk with tea or coffee, while the balance is consumed as other products.

Table 13. Milk consumption (%) based on end uses in six metro areas

End use of liquid milk	Delhi	Kolkata	Mumbai	Chennai	Bangalore	Hyderabad
Direct consumption	45.91	63.82	37.61	15.58	30.47	30.72
Consumed in tea/coffee	31.67	24.77	49.24	56.14	44.57	42.40
Converted to dahi	19.68	2.95	10.98	27.59	23.44	24.46
Converted to channa/ paneer	0.34	3.19	0.17	0.07	0.05	0.50
Other uses	2.40	5.27	2.00	0.62	1.47	1.92

Source: Technology of Indian Milk Products, A Dairy India Publication 2002.

Current cost structure

Cost structure varies among the different sectors. For the informal sector, Intercooperation (2009) observed that vendors collect milk from villages and sell it in small markets situated mostly within a 10 km radius. Each vendor, travelling on cycle or motorcycle, collects milk from one to three neighbouring villages and in each village from five to 10 producers. The scale of operations at the village level ranges from 20 to 30 litres of milk/day. These vendors make payments to producers based on oral agreements at the beginning of the year (August). In these agreements, the milk price is fixed for an entire year and a continuous supply of milk for the vendor is guaranteed.

Almost all vendors dilute milk with water and the level of adulteration ranges from 20% to 75% depending on the customer's preference and paying capacity. The vendor sells milk to his customers at a price range of Rs. 12 to 25/ litre. On average, a vendor earns about Rs. 5000/year (Table 14). Cooperatives follow mostly the AMUL model where milk from villages is collected through established cooperatives. These cooperatives aggregate milk at collection centres that are managed by the community (cooperative/dairy union members).

Table 14. Income and expenditures at the vendor level

Item	Quantity (kg)	Unit rate (Rs.)	Quantity/year (kg)	Total amount (Rs.)
Raw milk	5–10	16	2970	47,520
Labour (days)	½	50	300	15,000
Cycle maintenance	Lumpsum			2000
Spoilage	50	16	50	800
Container replacement	3	350	3	1050
½ Measure	1	55	1	55
Washing soda (grams/day)	25	.02	9125	182
Food inspector	Lumpsum			300
Total cost				66,907
Sales (with 50% (adulteration)	20	18	7000	126,000
Net income				59,093

Source:Intercooperation, 10 vendor interactions, Nov 2009.

Marketsfordifferent products

Dairy India 2007 reported that about 50% of the total milk produced is consumed as liquid milk. Over time the percentage has slowly increased.

Butter: Butter production has increased from 130,000 tin 1991 to 570,000 tby 2004 with an average compound growth of 12%. Only about 1.1% of the butter is white butter for the table. An estimated 75% of total butter production comes from the unorganized sector.

Ghee: Ghee is the largest commodity among all milk products. When compared to growth of the butter market, the ghee market is growing slowly but steadily. The size of the ghee market has doubled from 1991 to 2004, with an annual compound growth of 6.5%. Three-fourth of the ghee produced in the country comes from[7] Traditional Milk Sector (TMS).

Milk powder: The market potential for milk powder stands next to ghee and butter. In the past, milk powder had a larger market compared to butter. Production of milk powder increased from 150,000 t in 1991 to 235,000t in 2001, with annual compound growth of 6%.

7 Unprocessed milk marketed through informal channel

Malted food: The market for this commodity is much smaller compared to ghee, butter and milk powder, but the market for malted products is larger than for cheese and condensed milk. The production of malted milk food has increased from 41,000 t in 1991 to 68,000 tin 2001.

Condensed milk: The market for condensed milk is small and growth is slow. Production increased from 8000 t in 1991 to 12,000 t in 2001, with annual compound growth of 4%.

Cheese: The cheese market is very small. Cheese production in the country has increased from 2500 t in 1991 to 8000 t in 2001, with annual compound growth of 12.3%.

Ice cream: Ice cream has grown faster in recent years ever since AMUL entered with branded ice cream. Per capita consumption of ice cream increased to nearly 250 ml/year.

Most private sector players collect milk from villages by establishing milk collection centres (MCC), from which milk is transported to a Bulk Milk Chilling Unit (BMCU). At the MCC level a commission agent is tasked to collect the milk daily and send it for processing. Payment to producers is similar as cooperatives.

Net margin and retailing

Dairy India Publication (2002) reported 24,600 retail outlets, with Kolkata accounting for 15,000, Delhi 5000, Mumbai 3000, Bangalore 1000 and Ahmadabad 600. Small retailers handle 14.5% of the traditional sweets sold, whereas 54.4% of sweets are handled by medium-sizes retailers and 31.1% by large retailers.

Table 15.Net margin potential in ethnic dairy products (%)

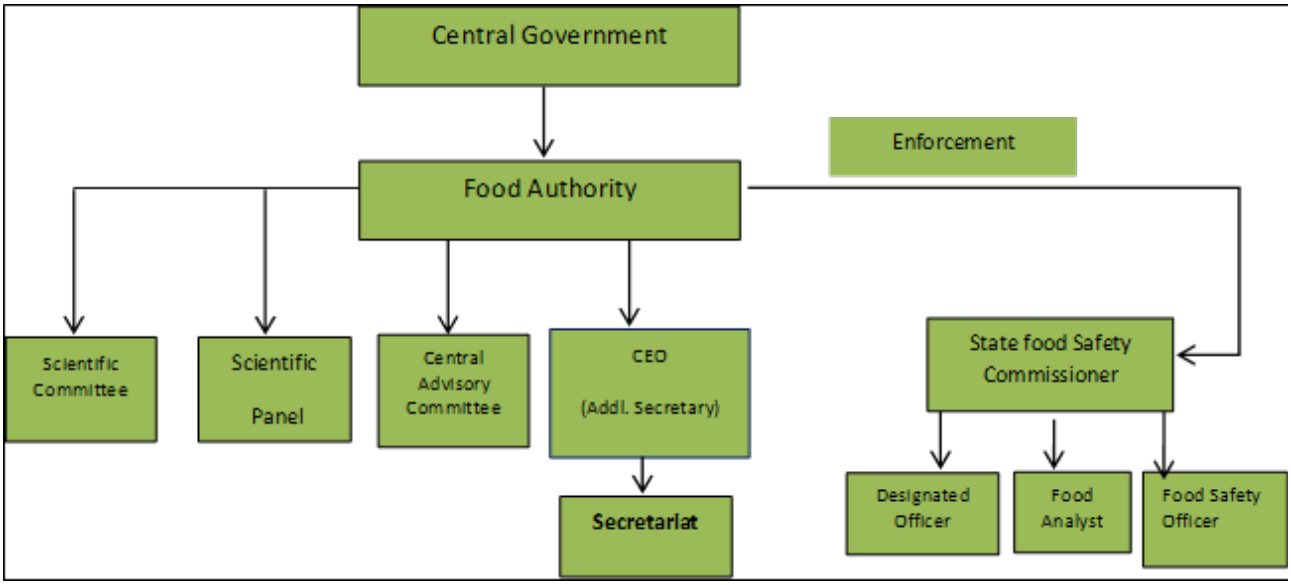
	Dahi	Lassi	Kher	Rasgula	Paneer
Raw material	34	40	33	33	58
Packaging	25	7	17	14	3
Utilities	8	7	4	5	3
Salaries and wags	6	6	4	5	10
Storage and distribution	5	4	3	3	3
Depreciation and interest	6	6	4	5	11
Net margin	16	30	35	35	12

Food safety

Regulations and structure

The Food Safety and Standard Authority of India (FSSAI) was created in 2005 to enforce the Prevention of Food Adulteration (PFA) act. However, FSSAI primarily focuses on implementation of good management practices instead of detection of food adulteration and subsequent prosecution. FSSAI is a single regulator that establishes food standards and regulates manufacturing, import, processing, distribution and sale of food products (Figure 16).

Figure 16. Structure at the national and state levels.



The FSSAI implementation body includes members from various ministries and representatives from state governments, the food industry, consumer organizations and farmer organizations. The scientific committee and panels helpfix standards while the Central Advisory Committee prioritizes the work. Enforcement of the legislation takes place through the state commissioners for food safety and includes Panchayat Raj bodies and municipalities.

Major safety problems

PFA prescribes minimum standards for residue levels of chemical contaminants and various other provisions. However, effective control mechanisms are lacking.

Standards for residue levels of chemical contaminants in milk need to be reviewed, and where appropriate, revised based on risk assessment/Codex standards. Currently there is no maximum level for any veterinary drugs in milk. Laboratory infrastructure facilities are inadequate within the public sector to check for the presence of residual pesticides, heavy metals and antibiotics. Inspection and monitoring for product quality and safety are inadequate. Overall effectiveness of the PFA act is far from satisfactory. Some major problems related to food safety and quality in milk exports and imports include:

Exports

- Some importing countries have more stringent standards based on the as-low-as-reasonably-achievable (ALARA) principle where Codex has specified a risk-based standard.
- Insistence by some importing countries on infrastructure to meet requirements, e.g., use of milking machines to maintain hygiene.
- Implementation of new regulations by importing countries without adequate notice.
- Rapid alert systems of importing countries are not based on a systematic approach, generating unfounded fears of Indian products in the importing country

Imports

- Emerging food safety threats, such as melamine in baby foods and other dairy products from China.
- Presence of non-permitted food additives in imported foods.
- Inappropriate/inadequate labelling on packages of imported foods.
- Labelling only in foreign languages.

As per the amended MMPO, state governments are authorized to register dairy units of up to 200,000litres capacity. The registering authorities must inspect such units for hygiene and food safety conditions. These visits are mostly irregular and reports are inaccurate and do not provide actual details of the handling capacities of the units.

Many of these registered units do not exist and many others have installed capacities different than what the registration documents indicate, thus the actual installed capacity is not known. Accurate data on actual milk procurement and products prepared is not available. All dairy units must obtain permission from MMPO authorities to produce new products, which they do not do. The hygienic standards emphasised by the Bureau of Indian Standards (BIS) are often not met by the dairy units, and visiting authorities do not emphasise noncompliance.

The Agricultural Produce Grading and Marking (AGMARK) act mainly focuses on quality standards for grading, packing, and marking of agricultural and animal husbandry products, including ghee and butter. AGMARK emphasises compositional characteristics and adulteration only, while no attention is given to bacteria in the milk and milk products.

Box 5. Milk safety

Times of India (TOI) a leading national newspaper reported on 13 September 2013 that eight brands of packaged milk in Hyderabad were either found to be unsafe or sub-standard after they were examined by the state-run Institute of Preventive Medicine. Most of them belonged to multi-national as well as well-known dairy companies. This milk will adversely affect human health because it contained salmonella, e-coli, and harmful chemicals that could cause ‘frequent gastroenteritis, high fever and typhoid,’ she said.

Box 6. Federal Food Safety and Standards Authority of India

In January 2012, FSSAI found milk adulterated with detergents, fat, urea and water. Across the country 68.4% of samples were found to be contaminated. Around 89% of samples tested from Gujarat, 83% from Jammu and Kashmir, 81% from Punjab, 76%from Rajasthan, 70% from Delhi and Haryana, and 65% from Maharashtra failed to conform to the stipulated standards.

Before importing any livestock products it is mandatory to obtain an import permit from the Ministry. Even if the conditions of the Ministry are fulfilled, the system needs improvement because several exotic diseases enter into the country from time to time. Imports of sub-standard products have been reported. There is no national system to monitor contaminant levels in food or for regular surveillance of food-borne diseases in the country. Some instances of food poisoning have been reported in the media. There are a few consumer associations involved with national food standards, but their contribution is small and not effective.

Control strategies

Educating farmers in clean milk production is a first step to improve milk quality. The Animal Husbandry Department initiated a program to provide funds under the scheme Strengthening Infrastructure for Quality and Clean Milk Production during the 10thPlan with an outlay of Rs. 300 million. The Ministry of Food Processing Industries supports the scheme in:

- Quality assurance, Codex standards and research and development;
- Infrastructure development;
- Technology upgrades, establishment and modernization of food processing facilities;
- Human resource development; and
- Strengthening institutions.

NDDB is supporting cooperatives under its Perspective Plan 2010. The program covers good hygienic practices from production level until milk reaches the consumer. Under this program, NDDB provides financial assistance to cooperatives at low interest rates as well as grants to implement good hygienic practices (GHP) to improve milk quality. Forty-three thousand village cooperatives in 175 cooperative milk producer unions are covered thus far. In addition, NDDB established a Centre for Analysis and Learning in Livestock and Food whose mandate is to analyse milk and other food products for safety and quality parameters and carry out relevant research as required.

The Agricultural and Processed Food Products Export Development Authority (APEDA) carries out these extension and advisory activities in the area of food safety:

- Fixing standards and specifications for scheduled export products,
- Providing financial assistance for measures to improve products, and
- Promoting safety and quality, such as implementation of the Hazard Analysis Critical Control Points (HACCP) system.

Assessment and recognition of laboratories is based on availability of the requisite instrumentation and criteria of APEDA. Registered exporters of food products can utilize the services of these recognized laboratories for sampling, testing, and monitoring and obtain test certificates for exports of specified products. Recognition by HACCP implementation and certification agencies is required for effective services to APEDA-registered exporters.

Competitiveness

The Essential Commodities Act (1955) has a direct bearing on the volume of dairy imports and exports, which are regulated by state-level government agencies because they are regarded as 'sensitive commodities' for reasons of food security. In other words, the Indian government has the authority to impose export bans on 'sensitive' products on an adhoc basis, especially for reasons of national food security.

Box 7. Tariffs and duties imposed by India

India applies an import tariff of 30% on all livestock products. However, the bound tariffs are much higher (e.g., 100% for fresh milk, 60% for milk powder, 40% for butter, and 40% for cheese). This gives the Indian Government some leverage to adjust tariff rates upward in case of excessive imports of 'sensitive' products such as dairy products.

Tariffs and duties imposed by India's main dairy trade partners

In its export activities, India is subject to tariffs and duties applied by various countries. Though they are different from one to another, focus here is on tariffs that are applied by some major importers of Indian dairy products—Bangladesh, the Middle East, Nepal and China.

In 2005, Bangladesh was applying an import duty of 25% on dairy products, however, its bound tariff was as high as 200%, allowing for substantial leverage by the Bangladeshi government to regulate dairy imports. Pakistan also imposes a 25% duty on dairy imports (WTO 2007), with a bound rate of 100%.

In the Middle East, tariffs vary—the import duty applied by the United Arab Emirates and by Egypt on most dairy products is as low as 5%, with bound tariffs at 15% for the UAE and between 35 and 60% in Egypt (WTO 2007). In contrast, Morocco applies much higher tariffs for some milk products, e.g., 112% for milk, cream, yoghurt and buttermilk, while they are lower for cheese (75%) and butter (32.5%) (WTO 2002). Morocco's bound tariffs are up to 80–85% and 35% for milk oils and fats.

Finally, Nepal is imposing an import duty of 10% for milk and cream in liquid form and 15% for all the other products. Its bound tariff is 50%. China has an import duty of around 10–15% on the majority of dairy products and 20% for buttermilk, curdled milk, cream and other 'products consisting of natural milk constituents, whether or not sweetened' (WTO 2008). China's applied and bound tariffs on dairy products are the same.

The EU is imposing an average tariff of USD 2359/t on butter (131%), USD 2079/t on cheddar cheese (80%), USD 1478/t on non-fat dry milk (73%) andUSD 1742/t on whole milk powder (86%) (FAPRI).

Indian regulation of exports

As a consequence of the Essential Commodities Act (1955), the volume of dairy imports and exports is regulated by state-level government agencies because they are regarded as 'sensitive commodities' for reasons of food security. This implies, for example, that the Indian government has the authority to impose export bans on 'sensitive' products on an adhoc basis, especially for reasons of national food security. Such an export ban was imposed on milk powders from February to October 2007.

It is not very clear what the sanitary requirements are for milk components that are not intended for human consumption, such as casein, which is often used for industrial purposes. It seems, however, that India's casein exports have been expanding rapidly in recent years, and the U.S. is right now in the process of implementing tariffs on the imports of milk protein concentrate, casein and caseinates, to protect their markets against unlimited imports.


SHREEDURGA DAIRY FARM

Value chain governance

The dairy value chain in India can be split into three broad sectors—cooperatives, private, and informal. Cooperative and private dairies can be grouped as the organized formal sector. The main value chains and dairy channels are linked:

Benchmarking by cooperatives: Cooperatives continue to be the central players in the Indian dairy sector. The cooperative that operates in a particular area is able to benchmark the milk procurement price, especially where all three value chain sectors operate.

Preference to operate in milk surplus pockets: The organized formal sector is mainly present and dominant in pockets of milk surplus. Although the cooperative sector dominates in most milk surplus regions, liberalization of the dairy sector has led to increased competition from the private sector. Despite efforts by the organized formal sector, in most important milk surplus regions the informal sector was able to hold its ground.

Inadequate coordination among key value chains: There is little evidence of coordination among the key dairy value chain sectors and actors, although informal milk vendors and, to some extent private dairies, look at the cooperatives when it comes to fixing milk procurement prices. There is occasional coordination within the value chain to manage surplus and deficits of milk and milk products.

Efforts by the cooperative sector to support other value chain actors: Besides procurement of milk from farmers, cooperatives also invest to enhance productivity of the dairy sector, for example, by providing good yielding animals, access to breeding services, feed at cost or subsidized rates and animal health care services. Such efforts have strengthened dairy production and better-yielding animals. While similar systematic efforts have not been made by the other two key value chain sectors, they are able to harness benefits of such investments by the dairy cooperatives.

Influence of policy framework on value chain governance

In India, the dairy policy framework has historically played a key role in growth of key value chain actors, including:

Operation Flood: Operation Flood (1970–1996) led to establishment of the three-tier cooperative dairy structure in India. It is widely acclaimed that OF has transformed India from a milk deficit country to the world's leading milk producer. However, this initiative was created in a 'protected environment' for the cooperative structure.

IRDA: Until 1991, dairy development was regulated under the Industries Development and Regulation Act (IRDA 1951). There was preferential treatment for milk cooperatives because they were outside the purview of this legislation.

MMPO—1992:IRDA was replaced by the Milk and Milk Products Order in 1992, which introduced the concept of milk sheds, regulating procurement from specified areas, thereby indirectly supporting growth of the cooperatives.

MMPO—2002: In 2002, an amendment to MMPO further liberalized the dairy sector and encouraged entrepreneurs in the private sector. As the milk shed concept was abandoned, private dairies were able to establish themselves in operational areas of the dairy cooperatives, thus promoting competition within the organized sector. Companies such as Reliance, Pepsi and Coca Cola have already planned to make significant investments in the dairy sector in India. Nevertheless, at present, the private sector handles only a small portion of the surplus milk in India, though this may gradually increase in coming years.

MACS and producer companies: In most states in India, except Gujarat, cooperatives have not been able to become truly member-owned organizations. Because most cooperatives continue to be managed by state governments, they are perceived as government organizations. At times weak governance has led to inefficient operation of cooperatives, hence there have been efforts to promote a new generation of farmer organizations such as Mutually Aided Cooperative Societies (MACS) and producer companies that provide more autonomy to the producers. However, at this point it is difficult to predict if such organizations will be able to compete with private dairy companies.

National Livestock Policy 2013: The recent National Livestock Policy provides a policy framework to improve productivity of the livestock sector in a sustainable manner. It envisages supporting low-input production systems to improve the socioeconomic status of a large number of livestock farmers. There is a thrust to increase availability of feed and fodder, animal health care services, improved breeding and biodiversity conservation. In the context of dairying, NLP plans to strengthen infrastructure and handling capacity related to milk processing; strengthen dairy cooperatives; promote clean milk production, hygiene and quality control; and diversify dairy products and value addition.

On-going dairy initiatives from the Government of India

At present, GOI is providing assistance under the Intensive Dairy Development Program (IDDP) to promote dairy in backward and hilly areas and in districts that received less assistance under the OF program. Under the scheme called Strengthening Infrastructure for Quality and Clean Milk Production, GOI aims to improve quality of milk and milk products for domestic purposes and the international market. One scheme provides Assistance to Cooperatives, while the Dairy Entrepreneurship Development Scheme (DEDS) scheme promotes private investment in the dairy sector.

Besides these schemes, efforts have begun under the National Dairy Plan to improve productivity of animals and milk production in India.

Summary

The dairy policy framework and ongoing interventions in the dairy sector relate both to rising domestic demand for quality milk and milk products. The increase in demand is attributed to an increase in purchasing power and health consciousness among consumers. Ongoing interventions also relate to dairying as a potential livelihood to support large numbers of smallholder dairy producers in India.

A closer look at the policy framework and ongoing interventions, however, shows that most government efforts relate to strengthening the organized cooperative dairy sector, and to some extent supporting the private sector in terms of investments. Such efforts will continue to further benefit already-developed surplus milk regions. In the interest of equitable and inclusive growth of the dairy sector and overall socioeconomic development in rural India, the government should focus more on rainfed, drought-prone areas and also support the informal sector.

With popularization and acceptance of breeding services among farmers, there is an increasing thrust on partial or full-cost recovery of services. In this process, a cadre of private service providers has emerged. Besides breeding services, these service providers provide healthcare and other extension services related to livestock and dairying. In fact, this

new group of service providers seems to be emerging as the backbone of dairy- and livestock-based livelihoods in India. It will be important to recognize these actors and further develop opportunities for private service providers. The most common way to protect their own production from import competition is a tariff on imports. The World Trade Organization (WTO) member tariffs are of two types (Table 16):

- Bound rates—ceiling rates as listed in members' 'schedules' or lists of commitments, and
- Applied rates—rates members currently charge, which can be lower than the bound rates.

Table 16.India trade tariffs

HS Code (Level 4)	HS Code Description	Applied tariff (%)	Bound tariff (%)
0401	Milk and cream, not concentrated or containing added sugar or other sweetening matter.	30	40–100
0402	Milk and cream, concentrated or containing added sugar or other sweetening matter.	30–60	40–60
0403	Buttermilk, curdled milk and cream, yogurt, kephir and other fermented or acidified milk and cream, whether or not concentrated or containing added sugar or other sweetening matter or flavoured or containing added fruit, nuts or cocoa.	30	150
0404	Whey, whether or not concentrated or containing added sugar or other sweetening matter; products consisting of natural milk constituents, whether or not containing added sugar or other sweetening matter, not elsewhere specified or included.	30	40–150
0405	Butter and other fats and oils derived from milk; dairy spreads.	30–40	40–50
0406	Cheese and curd.	30	40

Source: Consolidated Tariff Schedules database (CTS), WTO.

Externalities

Impact on the environment

With the rise in demand for livestock products, production systems are changing quickly, but expanding cities and their increasing need for land creates conflicts with the farming sector. More and more industrial dairy farms are now close to urban and peri-urban areas, and might affect urban water resources through pollution and contamination with nitrates, phosphates, pesticides, drug residues, and heavy metals (SubGroup XV of the Working Group of DAHDF 2006). Most dairy processing plants do not use harmful chemicals, but effluent with milk residues needs proper treatment to avoid polluting the water.

Livestock are also a significant source of greenhouse gas (GHG) emissions. In India alone, about 10.09 million tonnes of CH4 were emitted in 2007 from enteric fermentation in livestock and about 120,000 t from livestock manure (NATCOM 2012).Large-scale livestock facilities pollute the air with release of more than 400 gases, mostly from manure, including hydrogen sulphide, methane, ammonia and carbon dioxide. Gasses can be dangerous air pollutants that threaten both the environment and human health. Nitric oxides are also released in large quantities from farms through manure applications, and are among the leading causes of acid rain. The risk of leaks from manure lagoons, overflows, and illegal discharge of waste also poses a direct threat to soil and water systems.

Impact on the ecosystem

Mixed crop–livestock farming systems and grazing systems predominate in India. From an ecological point of view they are the most sustainable—they contribute to land conservation and improve soil fertility because nutrients are returned to fields via manure and grazing. Dung helps the soil increase its water-holding capacity, improves its structure, and creates a good environment for micro flora and fauna in the soil.

Negative effects from livestock are mostly observed in waste lands and forest areas. With 17% of the world's livestock, India has only 0.5% of the world's grazing lands, causing heavy pressure on these areas. Most smallholders depend on common property resources (CPR)to graze their animals, but these areas are shrinking fast. A rapid survey in Rajasthan revealed that 100% of revenue land, 56% of Panchayat land and 24% of forest land are encroached (Working Group DAHDF 2006).

The cattle and buffalo populations in India increased from 283 million in 2003 to 304 million in 2007 (DAHDF 2007). Numbers for goats and sheep, the other two types of livestock that add substantially to the income of subsistence farmers, have increased from 186 million to 212 million(Figures 17 and 18). Although indigenous cattle are the largest livestock category, their numbers are decreasing, a trend that began with the introduction of crossbred cattle.

Figure 17. Distribution of livestock by type in India (2003).

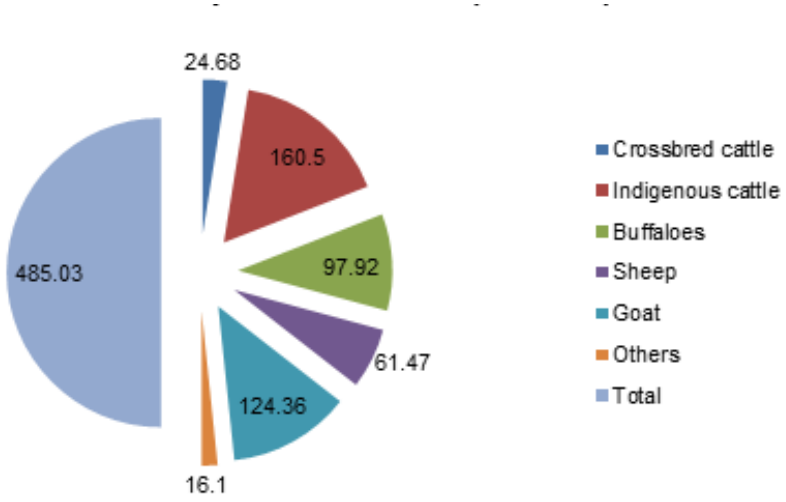
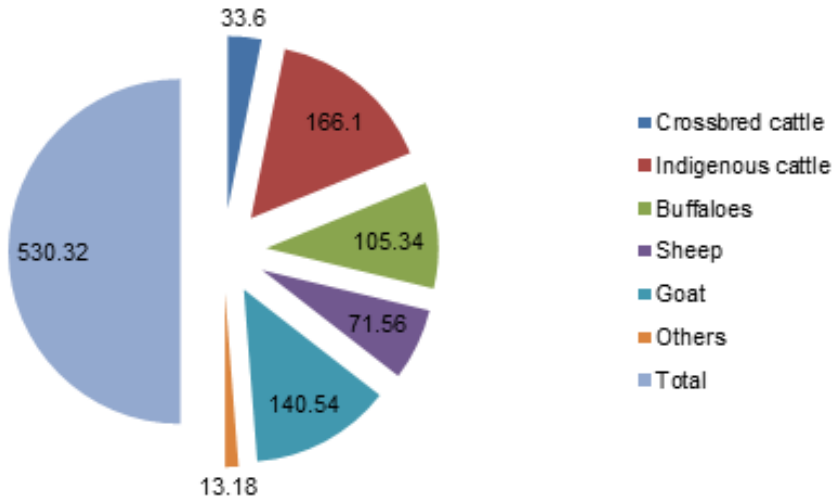


Figure 18. Distribution of livestock by type in India (2007).



Livestock rearing is water intensive, and in 2007 the amount of water consumed by cattle was estimated at about 10.7 billion m3 and about 5.8 billion m3for buffaloes. Of course water is required to produce feed crops, and because globally about one-half of grain production is used to feed livestock, it can be assumed that one-half of the water used for crop production is effectively consumed by the livestock sector (Table 17).

Table 17. Average water consumption for production of selected crops

Crops	Water required/tonne of crop (m3)
Wheat	1805
Barley	499
Maize	2328
Millet	3795
Cassava	394
Sugar beet	63

Rice	1912
Soybean	3340
Rapeseed	1156
Sesame	1291
Cotton	1511
Fodder crops	412

Source: Kekkonen and Hoekstra 2010a and 2010b.

Impact on livelihoods

As a source of milk, meat and eggs, livestock production directly contributes to food security. Although livestock products are expensive in terms of energy but are one of the best sources of high quality protein and micronutrients that are essential for good health, poor people tend to sell rather than consume the animal-sourced foods they produce. As temperatures rise, milk production and animal body weight decreases, thus affecting food and nutritional security.

According to the NSS Office (NSS 66th round; July 2009–June 2010), the total number of workers engaged in animal husbandry was about 13.6 million in rural areas. As estimated by the Central Statistics Office (CSO), the value of livestock output was Rs.3883 billion in 2010–11, which is about 23.9% of the agricultural sector total of Rs. 16,239 billion (NDDB Annual Report 2011–12). With these numbers, livestock play an important role in rural India because they significantly supplement family income and generate employment, particularly among landless labourers, small-scale and marginal farmers and women. Livestock are also good insurance against droughts, famine and other natural calamities.

Climate change and its impact

Climate change is likely to affect livestock health and production and potentially nutritional security. Most livestock thrive in a 'comfort zone'of 10–30°C, but at higher temperatures, animals reduce their feed intake by 3–5%, which also reduces their reproductive and production capacity. Climate change projections using regional climate models indicate a rise in ambient temperature of 2–4°C by the end of this century. Such changes are likely to exacerbate these effects on livestock.

Changes in biodiversity, genetic resources of grassland, temperature and rainfall patterns and increased frequency and intensity of droughts can trigger feed scarcity, especially in dryland areas. Such changes affect digestibility and nutritional quality of forage.

Higher temperatures and less water can affect animal health and a greater range of livestock diseases and disease carriers is likely to evolve. Climate change could also affect the distribution of vector-borne livestock diseases as the geographic ranges of these vectors may change. Climate change poses a serious constraint to further development of the livestock sector.

Development strategies

To produce milk and milk products of international standards and meet growing demand and nutritional requirements, GOI has a number of strategic initiatives (Strategy and Strategic Plan: February 2011, Department of Animal Husbandry and Dairying and Fisheries).

Dairy development

- The National Dairy Plan has a proposed investment of more than Rs. 17,000 billion over 15 years beginning in 2011–12 to produce 180 million tonnes of milk by the year 2020–21.
- The scope of Strengthening Infrastructure for Quality and Clean Milk Production (SIQ & CMP) scheme has been widened with higher financial limits, a change in the pattern of financing, and inclusion of additional components based on feedback from stakeholders during a workshop held by the department in July 2010.
- The Dairy Venture Capital Fund has been revamped and launched as a revised scheme called the Dairy Entrepreneurship Development Scheme, with greater outreach and additional components with higher financial limits based on feedback given by the stakeholders during a workshop held by the department in July 2010.
- Independent evaluation of the Intensive Dairy Development Programme (IDDP) will occur during the current year, and based on recommendations of the evaluating agency and stakeholder feedback, the Expenditure Finance Committee will take up modification of the scheme.

Feed and fodder development

The goal of feed and fodder development activities is to improve the health and productivity of livestock through improved nutrition to support efforts to achieve a second white revolution. To reach this goal, GOI has these strategic initiatives:

- After consulting various stakeholders, the department recently launched a Centrally Sponsored Fodder and Feed Development Scheme with nine components. The scheme addresses the issues of assured markets, technological interventions, etc.
- A subgroup under the Joint Secretary with members from Indian Council of Agriculture Research Institute (ICAR), Indian Grassland and Fodder Research Institute (IGFRI), Department of Agriculture and Cooperation (DOAC), and National Dairy Research Institute (NDRI) has been set up for inter-departmental coordination.
- A joint committee chaired by the Secretary (ICAR) and the Secretary (ADF) is monitoring fodder initiatives.
- A cattle feed order has been finalized to ensure quality standards.

Animalhealth

To ensure better livestock health through prevention and control of animal diseases, GOI proposed these strategies:

- Prevention of animal diseases through the Immunization Scheme on Assistance to States for Control of Animal Diseases (ASCAD) for vaccination of livestock against economically important diseases.
- Professional Efficiency Development (PED) for setting up a Veterinary Council of India and state veterinary councils.
- National Project on Rinderpest Eradication (NPRE) to keep the country free from rinderpest, which has been eradicated from the country.
- Animal Disease Information System, a program under the National Animal Disease Reporting System (NADRS) for online reporting of diseases.
- Development of infrastructure facilities for state veterinary institutions, and establishment and strengthening of veterinary hospitals/dispensaries is being implemented.
- Control and ultimate eradication of diseases of national importance:
    - •. Control of foot and mouth disease
    - •. National Control Programme on Brucellosis (NCPB).

R&D partnership landscape

Based on a series of multi-stakeholder consultative workshops during 2013 to examine potential collaboration on research and development in livestock production and animal biotechnology, 19 institutions were identified for R&D partnerships (Agri-Bio Tech Foundation, Hyderabad 2013).

National Bureau of Animal Genetic Resources, Karnal	NBGAR
National Dairy Development Board, Anand	NDDB
National Institute of Animal Nutrition and Physiology, Bengaluru	NIANP
Bharatiya Agro Industries Foundation	BAIF
Regional Forage Research Station, Mamidipally, Hyd	RFRS
Frozen Semen Bull Station, Mattupatti, Kerala	FSBS
State Animal Husbandry Departments	SAHD
Indian Veterinary Research Institute, Izzatnagar, U P	IVRI
Central Institute for Research on Buffaloes	CIRB
Central Research Station, Srinagar, J&K	CRS
Animal Resource Development Department	ARDD
State Veterinary Universities	Veterinary Universities
National Dairy Research Institute, Karnal	NDRI
Project Directorate, Animal Disease Monitoring and Surveillance, Bengaluru	PDADMAS
Tamil Nadu Veterinary and Animal Science University	TNAVASU
Guru Angad Dev Veterinary and Animal Science Uty.	GADVASU
Lala Lajpath Rai University of Animal Sciences, Mathura	LLRUVAS
Department of Biotechnology, Govt. of India	DBT
Sher-E-Kashmir University of Agricultural Sciences and Technology	SKAUST

FODDER BLOCK

Opportunities for research to develop a pro-poor livestock and feed value chain

Hypotheses, research questions, and topics for pro-poor livestock research in India include:

Dairy production system

1. Why are smallholder dairy farmers moving away from the dairy sector?
2. Impact study on self-help, group-based dairy initiatives.
3. Impact of climate changes on smallholder dairy farmers.

Livestock breeding

How to develop indigenous milk breeds in the country and optimize milk production?

Ruminant feeding

Participatory technical development on feeding strategies in drought prone areas.

Animal health

1. Scope for producing thermostable vaccines for commonly occurring diseases affecting milk production
2. Development of easy-to-use diagnostic kits to detect heat, early pregnancy, mastitis, etc.

Dairy processing

Develop technologies to reduce losses in cottage milk products preparation.


PRICE
ITEM
GHEE
1/2 Ltr MC
1 Ltr MC
1 Ltr Cow MC
1Ltr Cow Tin
1/2 Ltr Tin
1 Ltr Tin
2 Ltr Tin
5 Ltr Tin
15 Kg Tin
BUTTER
10 Gm
100 Gm
500 Gm
MILK POWDER
S.M.P. 1Kg PP
Sweet Lassi 1 Ltr
S.F.M. 200 ML
Rasesla 200 ML
Rasesla 1 Ltr
Namkeen Lassi
Plo Milk Bottle


Malai Kulfi
Choco Bar, Mango Duet 20.00
Cone 25.00
Kasatta Slice 5.00
Orange Bar
SWEETS
Kaju Pinni 50gm 8.00
Milk Cake 35.00
FRESH MILK PRODUCTS
Kheer Cup 200gm 12.00
Dahi Cup 100gm 5.00
Dahi Cup 200gm 10.00
Dahi Cup 400gm 19.00
Dahi Pouch 500gm 19.00
Dahi Premium Cup 200gm 11.00
Dahi Premium Cup 400gm 20.00
Paneer 200gm 33.00
Lassi Plain 1Ltr 17.00
Lassi Masaledar 200ml 6.00
Whey Drink 200ml 6.00
MILK
Standard 4.5%Fat
Toned 3%Fat 24.00
Double Toned 1.5%Fat
MILK PLANT MOHAL

Situational analysis of the dairy sector in Assam State

Milk and milk products—consumption and expenditures[8]

Milk in Assam is traditionally used for making tea, including all economic groups in rural areas. In urban areas, liquid milk from peri-urban producers and pasteurised milk are consumed, and for those with higher disposable incomes, milk products such as paneer and cream are also consumed.

Liquid milk and a range of dairy products are available in rural and urban areas of Assam. Availability as well as consumption patterns vary among different population groups, in particular between the rural and the urban populations. Fresh milk is supplied to vendors and consumers as pure whole milk or adulterated with water; the latter often depends on the price the customer is prepared to pay. Pasteurised milk is mostly available in urban areas through formal dairy marketing outlets. A sizable amount of pasteurised milk is also available through imports from neighbouring states. Pasteurised milk is available in sachets in the form of double-toned milk, toned milk, or standardised milk.[9]

Assam produces indigenous milk products such as curd, paneer, and ghee. Most of these products are generally consumed by the milk-producing households and very little is sold in the market. Ice cream, curd, paneer, and ghee are also produced in small quantities by the organized sector and sold in local markets. Milk powder, dairy whitener and UHT milk are procured from outside the state and sold in urban areas.

For a more detailed view of dairy consumption in Assam, data were collected from a few households to study family expenditures for milk and milk products as part of their overall food expenses. The major food expenditure was cereals, followed by non-vegetarian food items and milk. Of total food expenses, 9%was spent on milk and 20% on non-vegetarian food and eggs.

Rural Assamese in general consume about 0.5–1 litre/household per day. Of the total consumption, more than 50% is consumed in tea. Sometimes milk is converted into curd and consumed at the household level. Non-milk producing households purchase paneer from vendors.

Milk consumption of an average income urban family of five is about 15 litres/month. There has been no significant change in liquid milk consumption during the last five years, but recent trends showed increased consumption of products such as paneer, ghee and dahi. In Guwahati, there is a growing demand for packaged pasteurised milk, and demand for UHT milk, unbranded paneer, and demand for branded curd and ice cream is increasing. Guwahati has a number of recently established sweet shops that prefer to buy milk from regular vendors. Compared to other states,

8 The inputs for this section are based on desk and field studies.

9 Double-toned milk should have 1% fat and 9% SNF, toned milk should have 3% fat and 8.5% SNF, and standardized milk should have 4.5% fat and 8.5% SNF.

prices of milk and milk products are high. Liquid milk is sold at Rs. 40/litre. In Guwahati, the major city in Assam, packet milk is 40%of milk sales, whereas it is 5–10% in other major towns in Assam

Milk production

Dairying is an important livelihood activity in a few pockets of the state because milk production in Assam is increasing at a slow pace. The amount of milk from crossbred animals is increasing slightly, whereas production from nondescript animals and buffaloes is declining (Table 18).

Table18.Milk production in Assam (million litres)

Year	Crossbred	Nondescript	Buffaloes	Goats	Total
2007–08	181.33	506.42	109.26	27.38	824.39
2008–09	183.60	507.36	109.89	26.14	826.99
2009–10	202.15	495.55	107.52	24.62	829.84
2010–11	230.79	471.14	106.19	24.60	832.72

Source: Report Provided by Animal Husbandry Department (GoS).

In most districts and clusters, the availability of surplus of milk is low. For families rearing nondescript cows, income from dairying is not significant, and because their milk consumption is low, milk is not significant as a food or for nutrition. However, for families rearing crossbred cows, income from dairying is 20–50% of household income.

Although nondescript cows produce less milk, the calving interval is slightly better, not exceeding 15–16 months. However, short lactation periods (below seven months) and low production of nondescript cows (1 litre/day) lead to a low surplus in villages (Table 19).

Table19.Lactation yield of nondescript cows in Assam (litres/month)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Nondescript	60	60	60	60	30	30	30					
Crossbred	240	240	200	200	200	160	160	100	100	80		

Source:Intercooperation field study, 2013.

There are some pockets with a higher marketable surplus[10] closer to urban areas and in specific clusters in rural areas. About 85% of milk produced in Assam is from cows. The crossbred population is very low, but their share of milk is gradually increasing. More private dairy farms are being established in peri-urban areas close to Guwahati because there is little surplus milk in rural areas and the limited presence of the organized sector. This situation is a growth opportunity in peri-urban areas, mainly by migrant Nepali and Bihar communities. These farms keep good quality crossbred dairy cows and adopt good management practices. In Assam, crossbred cows are mainly kept by the Nepali community and people who migrated from Bihar and West Bengal. In some pockets there is a marginal increase in milk production mainly due to dairy farming with crossbred cows by rural youth. The educated youth, considering unmet demand for milk and a potential income earning opportunity, have started rearing crossbred cows.

10 Milk available for marketing after consumption at the producer household level.

Box 8.Need for enhancing milk production in Assam

Under Operation Flood 1, the West Assam Milk Union Ltd (WAMUL) was established in 1978. Initially it covered five districts of Assam, but since inception the milk union could not perform, and milk procurement dropped as low as 250 litres/day and finally closed for several years. In May 2008, NDDB took over its management, and after an engineering study the dairy processing plant was refurbished and in August 2008 it became operational. About nine milk routes were revived by promoting both Dairy Cooperative Societies (DCS) and Milk Producer Institutions (MPI). There is an emphasis on developing specific milk pockets such as the districts of Barpetta, Kamrup and Morigaon. At present, the union is able to procure 20,000 LPD in the lean season and 37,000 LPD in the flush season. The government of Assam has asked NDDB to submit a proposal for further development of the cooperative milk structure.

The union has ready market demand, but the core problem continues to be lack of milk, attributed to inadequate breeding services and lack of cattle feed. At present, the union is purchasing cattle feed from Uttar Pradesh and selling it at cost to members. Similar problems are faced by private dairies such as Prithvi. The core problem is lack of milk, and without more, it would be difficult to further strengthen the organized dairy sector in Assam.

More than 60% of the pasteurised milk requirement in urban areas in Assam is procured from West Bengal and Bihar. Similarly, milk powder to reconstitute during the lean season is purchased from outside the state. Recently the state started procuring milk from Milk Producer Cooperative Societies (MPCS) and Milk Producer Institutions (MPI) through the Western Assam Milk Union Limited (WAMUL) at Guwahati, which is managed by NDDB. Due to more purchasing power and faster economic growth, the demand for milk in urban areas is increasing at a higher rate than production. Compared to other states, prices of milk and milk products in Assam are high; the price of liquid milk is Rs. 40/litre.

Livelihood of smallholder dairy producers

The profile of smallholder dairy farmers in Assam shows that families with less than two acres of agricultural land and landless households own about two or three cows, of which at least one is in milk. Even households with more land do not maintain significantly larger numbers of dairy animals. The agricultural production system is mostly subsistence and production mainly covers household needs. Traditionally the primary purpose of rearing of nondescript cattle was for draught purposes and dairying was not a major source of income. In a village of about 100 households, 60 rear dairy animals, mainly cows, of which 30 would be milking at any point in time. About five to seven households would have surplus milk of about 1 litre/day for marketing, however, in a few villages households rear crossbred cows. In Assam, animals were traditionally reared for draught and manure, but with mechanization and access to fertilizer, this trend has been slowly declining.

In the focus group discussions, farmers said men and women share the work of dairying, but most dairy activities at the household level (67%) are performed by women. Women performed these specific animal husbandry activities (percentage of women participating):

- Cleaning animals and shed(90%)
- Feeding(50%)
- Milking(70%)
- Healthcare and breeding services (20%)
- Marketing(30%)
- Decision making on the use of income from dairying (70%)

Animal health

The Animal Husbandry Department is the main provider of livestock services in the state. Demand for livestock services is high, especially from farmers who rear crossbred animals and who demand doorstep service delivery. Because access to services is difficult for farmers, delivery is expensive for service providers, even if the services are offered by the government.

A few vibrant milk cooperatives are linked to the government to receive services for their members. In these cooperatives, Gopalmitras is operating, providing doorstep services 24 hours, seven days a week.

The department is providing livestock services through its network of 19 veterinary hospitals, 330 dispensaries, 336 sub-centres, 122 block veterinary dispensaries and 24 key village centres. However, access to curative and quality veterinary treatment is limited by a lack of medicines at these government institutions.

Villages closer to government dispensaries have access to preventive health care services such as vaccination and de-worming, and regularly conduct health camps supported by the Assam Agriculture Competitive Project (AACP). In these programs Gopalmitras also participate. FMD is rampant in the state and is observed even after vaccination for multiple reasons—poor cold chain management for the vaccine, low skills in administering the vaccination and emergence of new FMD strains. Other severe diseases are haemorrhagic septicaemia (HS) and black quarter (BQ).

During 2010 the department treated 6413 contagious and 1,886,994 non-contagious cases across all institutions. In addition, 679,511 animals were protected against bacterial and viral diseases. The department provided facilities at the district level by upgrading laboratories to improve diagnostic systems. The Animal Health Centre at Guwahati has been upgraded to a Regional Diagnostic Laboratory with financial assistance from GOI, while 10 District Diagnostic Laboratories were strengthened under a World Bank project.

The department is planning to construct 60 hospitals/dispensaries, construct a training centre for the veterinary professionals of the North Eastern Region at Guwahati and upgrade the infrastructure of the existing para-vet training centre at Ghungoor, Silchar. These plans, at an estimated cost of Rs. 683.66 million,fall under the Rural Infrastructure Development Fund (RIDF)scheme of NABARD.

Regular outbreaks of FMD are observed in all villages. Next to FMD, mastitis is widely found, in particular among crossbred cattle, while incidence is lower in ND animals. In the past mastitis incidence was high in peri-urban areas of Guwahati, but it is now under control due to the adoption of good milking practices learned from training by ILRI and its partner organizations. The department also reported a high incidence of parasitic diseases across all regions of the state. Animal health camps for vaccination and de-worming of young animals are organized regularly throughout the state under ASCAD and AACP.

Although disease outbreaks occur on a regular basis, they are often not reported to the department, which is then unable to implement NADRS effectively. However, the situation seems relatively better compared to other states such as Bihar. During monthly meetings, field veterinarians at the district office submit progress reports including disease incidence, which are forwarded to the North Eastern Region Disease Diagnosis Reporting System (NERDS) laboratory at Guwahati.

Because a disease reporting system is not functional, it is difficult to assess FMD outbreaks. Officials report at least one FMD outbreak covering a cluster of 10–12 villages across 200 villages (about two blocks) in a year. However, because surplus milk in rural areas is not significant, there are no major implications from FMD. Households that rear crossbred cows show a decline in milk production up to 50% during occurrence of mastitis and FMD. Large-scale FMD vaccination in Bihar has lowered the number of outbreaks, and a disease reporting system is just becoming functional in Bihar, however, a reduced disease incidence may not be attributed to the disease reporting system.

Most farmers rearing crossbred cows are aware of preventive and curative aspects of diseases. They access services by directly linking with government doctors. As already reported, initiatives by ILRI related to clean milk production

in peri-urban areas have led to a reduction in the incidence of mastitis. However, there is no specific preventive or curative practice followed by farmers rearing nondescript cows. They participate in health/vaccination camps as and when organized in the village.

Some constraints included:

- Vaccine is not reaching the site of vaccination in good quality due to ineffective cold chain management. Most institutions do not have refrigerators to store vaccine. Even if they are available, they are mostly not in good working condition. Hence, access to quality vaccination services is very limited.
- Due to a poor disease reporting system from the field, the true picture of disease incidence in the state cannot be developed and timely preventive actions are not taken. The slow reporting increases farmer expenses. Recently, initiatives have been taken to improve reporting.
- Livestock treatment is mostly symptomatic due to the lack of diagnostic facilities at the field level.

Breeding services

The department is providing AI services through its network of 226 AI centres in the state. Across all villages there is an increased awareness among farmers for AI. However, the demand for AI service is limited, especially among farmers keeping nondescript animals. These farmers generally prefer natural services.

Barring a few farmers in peri-urban areas, farmers do not express preference for breed. Most are not aware of the implications of different breeds. The AI services are mainly supply driven and depend on availability of semen veterinary centres.

A profile of the animal population linked to specific breeds is not available. Farmers consider AI services to be expensive; however, the demand for door step AI services is increasing among farmers keeping crossbred animals whereas buffaloes do not get much attention. These farmers mostly prefer services by veterinary doctors, while gopalmitras are less preferred. Overall access to breeding services is limited and wherever provided it is mostly by departmental field staff or through government trained AI workers. More outreach for AI services was observed in villages where there are functional milk cooperatives.

Box 9. Genesis of Assam Livestock Development Agency (ALDA)

The semen station at Khanapara, Guwahati started in 1968–69 under the Intensive Cattle Development Project. It was upgraded in 1975–76 under the Indo-Australian Cattle Breeding Project (IACBP) for production of chilled semen. Subsequently in 1995–96 the semen station was strengthened with new bulls and equipment for production of frozen semen.

In 2004 ALDA was constituted under the Society Act as per guidelines of the National Project on Cattle and Buffalo Breeding (NPCBB). ALDA is producing quality semen and providing training to promote and extend livestock breeding in the state. In 2010–11, ALDA distributed 0.246 million doses of semen and conducted 209,301 AI, from which 87,677 calves were born.

Source: NEA data.

There is one semen production centre at Guwahati that was closed for a long period due to poor standards. Currently the station is operating and recently the department purchased quality bulls which shortly will start producing semen. As of now, the department procures semen from outside (NDDB).

Some concerns and constraints include:

- Farmers are not satisfied with the quality of AI service provided by the government and private service providers.

Some farmers do not make use of the service because it is very expensive (Rs. 400/service).

- In cooperatives where crossbreeding has been adopted, indiscriminate breeding is observed leading to animals with exotic blood levels that are too high, making them susceptible to diseases.
- Linked to the indiscriminate upgrading of animals is a lack of crossbred semen at field institutions. The semen station at Guwahati has only three types of semen —pure Jersey, pure HF and pure Sahiwal. Because farmers are reluctant to 'backcross' their crossbred animals, indiscriminate upgrading is the result.
- High incidence of repeat breeding in crossbred animals is observed due to the increased exotic blood level, but also due to poor reproductive management.
- The state semen station is graded as C due to non-adherence to phytosanitary standards. Efforts are underway to improve standards at the station.
- As per the state breeding policy, Jersey blood level is restricted to 50%. However, in locations with better feeding and management resources the percentage can go up to 62.5%. HF semen is to be used in districts where fodder availability is plentiful, as well as in peri-urban areas and villages with a good dairy market network. However, non-adherence to the breeding policy is a major constraint because it results in animals with high exotic blood levels. Lack of monitoring of AI services leads to high incidence of repeat breeding and increased exotic blood levels.

Animal feeding

Most farmers in Assam do not use premix concentrate cattle feed; they use local feed ingredients and mix them on-farm. Farmers with ND animals do not even use local concentrate feed; they mostly depend on local grasses and kitchen waste. Farmers with crossbred animals mix and administer feed ingredients often in a disproportionate manner. Usage of oil cakes is insignificant because they are expensive. Mostly they use feed ingredients that are readily available at low cost. Farmers are generally not aware of balanced nutrition feeding practices.

Lactating animals are given concentrate feed, whereas dry animals do not get any. The feeding practices of farmers in Dibrugarh district are summarized in Table 20.

Table 20.Feeding practices of farmers with crossbred cows

Sl.No	Name of the ingredient	Quantity/day(kg)	No. of days
1	Rice polish	0.5	270
2	Dry fodder	4.0	360
3	Green fodder	12.0	180

Source: Intercooperation field study 2013.

Since premix concentrate feed is not produced in the state, a lot is procured from Siliguri in West Bengal. WAMUL dairy is procuring feed from Varanasi dairy and supplies it to their milk producers at cost. The government is providing wheat bran at subsidized rates to farmers of cooperatives and other dairy farmers. Most cooperative members supplying milk to WAMUL use cattle feed and cakes for their animals, though feeding cakes to cows is not a general practice because cakes are very expensive.

Some private players produce small quantities of feed for sale in peri–urban areas based on demand. Eighty percent of the feed from private players is purchased by government farms through bids. Feed manufacturers prefer to produce poultry feed that has a continuous demand in higher quantities, and as a result, there is low focus on cattle feeds due to low demand.

Some constraints include:

- Farmers lack knowledge of the importance of feeding dairy animals with balanced rations, but at the same time they feel the cost of cattle feed is too high.

- The scope for producing cattle feed is not good because key ingredients such as maize and cakes are generally not available in the state. Procuring ingredients from outside the state is expensive, hence there are no real incentives to produce cattle feed. The government has no plans to set up a cattle feed plant.
- Poor feeding practices lead to milk production costs that are not viable.

Fodder

The production of cultivated fodder is very low because farmers feed their cattle local grass that is plentiful on private and forest lands during the rainy season. However, the state is facing a 35% deficit of green fodder.

Generally farmers collect fodder available in the field and carry it home to feed their animals after completing their field work. In milk cooperatives, fodder demonstration plots have been set up by the department, though the number of demonstrations is small and often limited to those farmers who keep crossbred animals. The state government is also taking up fodder production with financial support from GOI under RKVY (Rashtriya Krishi Vikas Yojana), AACP (World Bank-assisted program). The department is also focusing on specific districts close to river areas to generate a milk surplus for intervention by a viable organized sector.

Box 10. Fodder development initiative by the department

Under a centrally sponsored scheme free distribution of fodder seeds to farmers was initiated with 100 percent funding from GOI. Through this scheme seeds such as oats, maize, berseem, and sorghum are distributed for both rabi and kharif seasons in Kamrup, Jorhat and Sonitpur districts. Other districts are covered under RKVY scheme. Progress for 2009–10 and 2010–11 is given in the flowing table:[

Year	Seed received (kg)	Seed distributed (kg)	No. of beneficiaries	Area (ha)	Production (kg)
2009–10	57,500	55,866	3,51,100	90,012	28,558,400
2010–11	63,000	37,970	1,15,700	45,564	11,391,000

Source: Assam Economic Survey (2013), Chapter VIII.

Constraints concerning fodder production include:

- Reduction in availability of grazing lands due to conversion to crops.
- Small farmers owning land are not prepared to cultivate fodder, but want to use the land for food crops to improve their food security.
- Although the department is conducting a fodder demonstration program in milk pockets, such demonstrations are not taking place in other areas where the marketable surplus (at present) is still low.

Dry fodder is mainly rice straw. The quality of straw is likely to be good because there is a practice of storing rice along with straw in a special warehouse. Some farmers purchase straw during deficit periods.

Most feed components, including oil cake and maize, are imported, and hence it is not viable to set-up a feed processing unit. Rising feed prices have been a concern for peri-urban dairy farmers, leading to a rise in the price of milk. In general, intensive feeding is very limited and it would be difficult to justify given milk prices. Because the price of liquid milk is high, cost of feed is not a major concern in rural areas. Cost of transportation isRs. 3–5/kg, which may vary with location.

Credit

There is low demand for livestock credit from farmers with ND cows, but there is an emerging demand from rural youth in some areas that are moving into dairy. Even for the youth, access to credit is difficult because finance institutions are not keen to provide credit for milk animals. Past experience of finance institutions with lending money for dairy cattle was very discouraging because more than 90% of farmers who received loans did not repay them.

Farmers generally do not repay loans with the hope that someday their loan will be waived by the government. Some farmers who borrowed money to rear crossbred cattle were not successful because they lacked experience and had little technical support. Those with experience, however, do not have ready access to credit.

Access to subsidy-linked credit is also limited. Some farmers involved in dairying use subsidy-linked credit through Employment Guarantee Mission (EGM). Assam Livestock Corporation is facilitating schemes related to dairy, which includes identification and training of beneficiaries.

Box 11. Dairy farming as a potential enterprise for educated rural youth

For the last two years, Rajib Bargaih of Phutakhulanaogaon village in Dibrugarh district has seriously followed dairying as an enterprise. He belongs to a progressive farming family in the village. Traditionally, the family rears ND cows for agricultural purposes. At present, they have four ND cows, of which two are dry and two Jersey cows are milking. The two Jersey cows produce 20 LPD in the flush season and 10 litres in the lean season. The surplus milk—milk not used by the family—is sold in the village. Consumers in the village pay on a monthly basis.

During the last two years, he has acquired basic knowledge about rearing crossbred cows by developing links with government functionaries. He uses AI services from government veterinarians at a dispensary 17 km away from his farm, cultivates fodder, and usually feeds 6 kg of green fodder/animal per day. He purchases feed ingredients such as wheat bran at Rs. 17/kg and mustard cake at Rs. 22/kg to develop local feed, and generates a gross income of Rs. 800/day (20 litres × Rs. 40) for about 240 days in a year. Overall, he considers dairy a profitable venture, which in his case has been possible because he had access to family capital and could develop links with relevant people, including government functionaries.

Source: Intercooperation, field study, 2013.

Credit is nearly absent for other dairy value chain actors. Even the organized sector did not make much effort to facilitate links to credit. Pruthvi dairy, a private company in Guwahati, developed a mechanism in collaboration with the State Bank of India to provide loans to farmers to establish dairy units. The venture did not work, primarily because after borrowing money, farmers never supplied milk to the dairy. Currently, WAMUL is planning to link cooperatives with banks for animal loans.

Realizing the importance of dairy for employment generation, the Assam Livestock Development Corporation (ALDC), with support from the Employment Generation Mission (EGM), started promoting dairy farming by involving rural youth as entrepreneurs. The corporation facilitates subsidy-linked credit schemes under EGM and provides technical back-up, training, and AI services through the State Animal Husbandry Department. It also facilitates purchase of improved dairy animals from other states, including Bihar, Punjab and Haryana. ALDC intends to develop 10 milk producing clusters involving 150 beneficiaries each to create a sizeable quantity of surplus milk. It has plans to facilitate installation of bulk milk coolers with support from the Dairy Development Department, and collect marketable surplus milk from beneficiaries. In addition, further links from farmers to processing units will be developed. The outreach of such a scheme that involves rural youth, however, is limited. Considering the market demand in villages and small urban centres, it may be worthwhile to further promote dairy enterprises involving rural youth, but with more intense outreach, although it may be ambitious to develop organized dairy processing facilities when there is low marketable surplus at the village and cluster levels.

There are limited efforts to provide credit to dairy farmers because repayment has been such a problem, but there could be access to credit through a formal sector in the state that can vouch for repayment by dairy farmers.

Knowledge

There is an ongoing effort through the NDDB-managed WAMUL and the World Bank-assisted AACP project to strengthen the organized sector in specific potential milk surplus districts. The focus is on an integrated approach to dairy development, including links related to adding value and marketing. Such initiatives, however, would be successful only when the unmet demand in rural areas is met, which can best be done by promoting dairy as an enterprise involving educated youth.

Farmers rearing crossbred animals use health and breeding services from government field officers and gopalmitras who advise them on good practices. Many farmers who keep crossbred animals have through their own efforts developed links with service providers. Most livestock and village institutions do not have any training and extension material to educate farmers about good practices, although farmers are keen to have such material in the form of small publications, leaflets, etc. The state-level training centre is being upgraded to adequately focus on in-service training with support from the World Bank-aided AACP project.

Some constraints and gaps include:

- Farmers with ND cows express a limited demand for dairy training compared to farmers with crossbred cows, and
- The state department has limited field-level training.

At present, different government departments and organizations are working in the livestock sector, including the Animal Husbandry Department (ALDA), Department of Dairy Development (DDD), Livestock Development Corporation and NDDB. However, coordinated efforts related to dairy development among these stakeholders are weak.

The infrastructure related to state-level livestock training may be upgraded with adequate focus on in-service training. However, such training and extension efforts have to be integrated with the overall approach and strategy to promote livestock production and dairying.

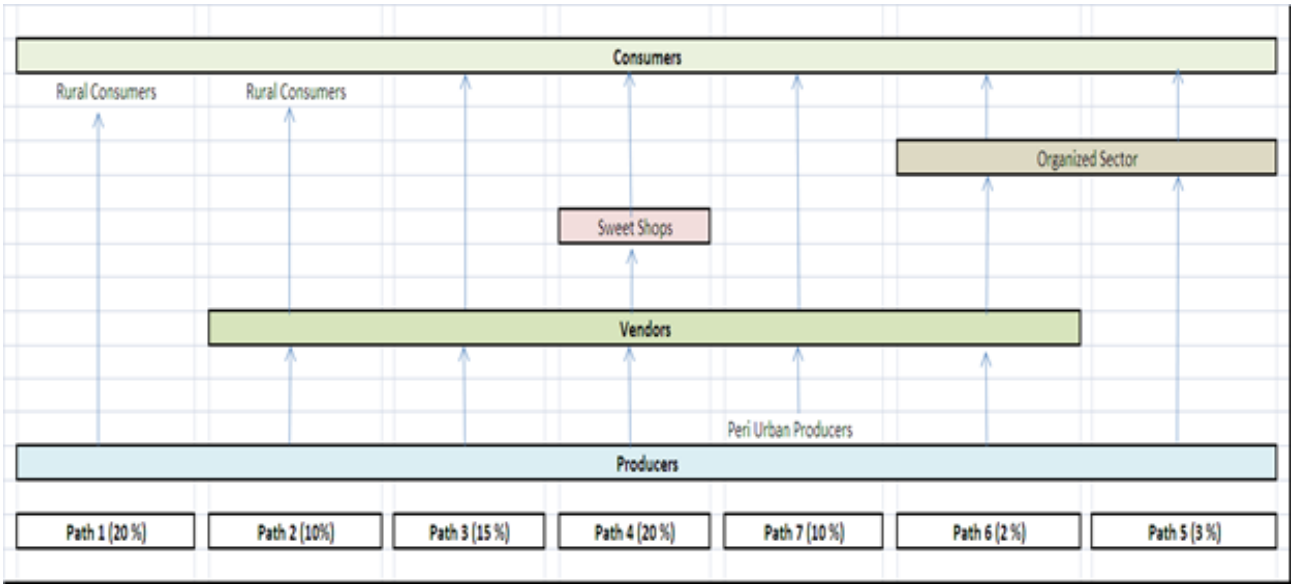
Value chains

Based on interactions with different stakeholders, it is estimated that 70%of milk is consumed in the home, with an assumption that 30 households in a village produce 45 litres of milk/day (average of1.5 litres), and 15 litres are marketed in or outside the village.

Seven distinct value chain paths (with percentage volumes) occur in Assam (Figure 19):

- Path 1 (20%): Producers–rural consumers
- Path 2 (10%): Producers—vendors–rural consumers
- Path 3 (15%): Producers–vendors–urban consumers
- Path 4 (20%): Producers–vendors–sweet shops–consumers
- Path 5 (3%): Producers–organized sector–consumers
- Path 6 (2%): Producers–vendors–organized sector–consumers
- Path 7 (10%): Peri-urban producers–vendors–consumers

Figure 19. Value chain flow in Assam.



The total volume is 80%, while the remaining 20% of milk consumed in the state is imported from other states, and excludes consumption at the producer household level. These paths mainly relate to meeting major urban market demand by the organized sector.

Path 1: Producers–rural consumers

About 20% of the milk produced in rural areas is channelled through this chain. Most villages in Assam are unable to meet their own demand for milk, so this path occurs all over the state. The path is mostly seen in areas with predominantly ND cows. Producers with small amounts of surplus milk generally sell it to needy households during the flush season, but during the dry season some producers even buy milk from other producers. Selling and buying milk takes place either at the doorstep of the buyer or producer. Buyers mostly agree to make payment on a monthly basis, but in many cases they do not adhere to the agreement, therefore some producers would rather sell milk in local markets than to buyers at the village level. Buyers purchase milk mainly for tea. Volumes range from 0.5 lire to 1 litre of milk/day.

Box 12. Dairy farming in Assam villages

Villagers in Ganesh village of Mayang block in Morigaon district never thought that vendors from outside would sell milk in their village. Everyday two vendors come to the village and sell about 40 litres of milk. Such is the scenario in most villages in Assam. With the decline in availability of grazing land and labour at the family level, most households have stopped rearing dairy animals, and at present, only 50 of 150 households in the village rear ND cows. They produce 50 litres of milk that is sold in the village. There is only one progressive farmer who has started rearing crossbred animals and he gets about 25 litres of milk/day. A few years ago, five farmers tried rearing crossbred animals, but they stopped because they could not get access to healthcare services. Incidence of diseases was high in crossbred animals and they required more labour at the family level.

Source:Intercooperation field study 2013.

Path 2: Producers–vendors–rural consumers

About 10% of the milk produced in rural areas is channelled through this path, which predominates in villages with slightly higher amounts of surplus milk. Producers with reasonable surplus milk prefer to sell to vendors rather than to local consumers, and usually these vendors are also producers and at the same time procure from others. Vendors quite often adulterate milk with water before selling it to consumers, but vendors also adopt different prices for different 'types of milk' because the price is linked to the extent of adulteration. Vendors support producers by extending credit to them in case of emergency requirements, and at times vendors aggregate milk from a few producers and sell it to the organized sector. Rural consumers across income groups (except the poorest) buy milk from vendors for making tea at the family level, including producers with dry animals.

Path 3: Producers–vendors–urban consumers

About 15% of the milk produced in villages is channelled through this path, which is prevalent in small towns and markets across the state. Vendors procure milk from a number of villages and sell it to regular customers, and normally such vendors handle 20–40 LPD. They pay Rs. 25–30/litre, and receive monthly payments from their customers. Adulteration, although limited, occurs at the producer and vendor levels, though adulteration at the producer level occurs less often. Vendors obtain reasonable margins not only due tothe difference between procurement and sales prices, but also due to the difference in volume between purchased and sold milk as a consequence of adulteration. The transaction time between milk collection and sale does not take more than three hours, which reduces the risk of milk spoilage. Milk spoilage is during the summer, but it is mitigated by adding neutralizers such as sodium bi carbonate. Most vendors chose their dairy business as a supplementary source of income, but there are a few vendors in small towns who have been in the milk business for more than 15 years. Some large milk producers with reasonably high quantities of surplus milk tried this channel as a supplementary activity but could not sustain it.

Vendors who operate regularly are able to increase their operations up to 75 LPD. In some areas with little surplus milk, new vendors are unable to sustain their businesses and move away from this dairy market channel.

Path 4: Producers–vendors–sweet shops–consumers

About 20 percent of milk produced in villages is channelled through this path. Each vendor collects milk from a few low-surplus villages in a cluster and sells it to sweet shops. Selling to sweet shops satisfies the vendor's need to diversify his customers, but is closely linked to prevailing consumer demands in small towns and demand from sweet shops.

Vendors collect about 60–70 litres of milk during the flush season and about 30–40 litres during the lean season. The link between vendors and sweet shops is specific, regular and at times it is traditional. Most vendors are paid monthly depending on the chhena[11] yield out of the processing; the ratio is about 1kg chhena/6 litres of milk. Vendors operate at a price margin of Rs. 5–10/litre. In this path, milk vending is sometimes considered a supplementary income source. In recent years there has been a steady increase in the demand for milk from sweet shops, mainly due to increased local consumption.

11 Chhena is acid coagulated milk solids used to prepare many milk-based sweets.

Box 13. Milk vending as an enterprise in Assam

Unlike many other vendors who have taken up vending as a supplementary activity, for Debakant Deka, trading milk is his primary occupation. He has been a milk vendor for the last 20 years, but never received any formal training or technical support in this enterprise. Besides his own surplus milk of 1.5–5 LPD, he collects milk from the doorsteps of 40 households spread across seven villages. Quantity varies from 60 LPD during the flush season to 20 LPD during the lean season. Unlike other vendors who pay on a monthly basis, he generally pays producers weekly, but does not provide any other services for producers.

To manage business risks, he has considered selling to both hotels and individual consumers. The other four vendors operating in Jagir Road sell milk to sweet shops and hotels. Hotels usually pay weekly on chhena basis at a ratio of 1:7. He usually buys milk at Rs. 25/litre and sells it at Rs. 35. He considers lack of surplus milk as the key constraint for growth. There is a ready market for milk, and he may be able to sell up to 200 LPD, but that quantity is not available. Such a milk deficit has forced many vendors to leave the business or consider a supplementary activity. Somehow, Debakanta has been able to manage his business.

Source:Intercooperation field study 2013.

Path 5: Producers–organized sector–consumers

About 3% of the milk produced in villages is channelled through this path involving the organized sector. Milk is procured from cooperative societies and milk producer institutions (MPI) of specific clusters and villages. Producers in this path mainly keep crossbred cows. The organized sector collects the milk, processes it, and markets it after pasteurisation as milk products in urban pockets. Many producers get lower prices from this path compared to other paths, so they sometimes sell some surplus milk to local consumers and vendors as well. Producers with reasonably high amounts of surplus milk prefer to link to the organized sector to avoid marketing problems during the flush season. Producer organizations at collection centres also sell raw milk to local vendors and consumers.

In this path, formal dairy stakeholders provide services. WAMUL sells cattle feed to producers and recovers the cost from milk payments once in 10 days. WAMUL does not provide AI and health services for producers.

The Department of Dairy Development also procures milk from MPI and MPCS without providing support services. Most processing units of DDD operate at very low capacity and are not viable. The machinery and technologies for processing in these units is reported to be obsolete, however, with intentions to make milk available in urban areas at reasonable rates this is an effort of the organized sector. In the absence of surplus milk at the village level, the organized sector is becoming less viable. Most stakeholders are aware that it is difficult to manage dairy in the government sector, however, minimum operations continue to retain existing staff with subsidy support.

Because surplus milk is available in very low volumes in most villages, the scope for the organized sector to run their dairy businesses in a viable manner is critical at this juncture, even with increased demand from urban consumers for hygienic, good quality milk.

Path 6: Producers–vendors–organized sector–consumers

Only 2% of the milk produced in villages is channelled through this path. The producers of MPCS on this path have low volumes of surplus milk (0.5–1litre) because they mainly keep ND cows. Because producers do not adulterate milk, they can sell the milk to vendors with links to the organized sector. The vendor collects milk from the producer's doorstep and sells it to the organized sector. Payments from the organized sector to vendors, and from them to producers, takes place once in 10 days.

Path 7: Peri-urban producers–vendors–consumers

About 10% of the total milk produced in the state is channelled through this path. Nepalese and Bihari community people dominate this path and live in peri-urban areas. They are well organized and have some negotiating power. They receive breeding and preventive health services from the veterinary college and retired veterinary doctors. Vendors purchase milk from these producers, add water and sell it to their urban customers.

Urban consumers are usually concerned with the quality of milk supplied by these vendors, and as a result, a preference for pasteurised milk is on the rise. Due to the growing demand for milk in urban pockets and lack of availability of pasteurised milk, many urban consumers still depend on the vendors. Located in urban areas, this path dominates in Guwahati. Generally the volume of milk handled by this path is showing an increasing trend, as is milk handled by the organized sector. Product share and variations across the state could not be assessed because the team did a rapid qualitative study

Competitiveness

- With a growing demand for milk, producers rearing high-yielding crossbred animals have an advantage.
- Value chain paths mainly relate to the surplus at the household and village levels.
- The organized sector faces difficulties to be competitive in an overall low surplus market.

Governance

- There is an inadequate systems approach to dairy development for formal and informal dairy stakeholders.
- There is scope to facilitate organized efforts by producers to procure and market liquid milk.
- There is limited scope for organized efforts that involve processing.

Waste management

- Waste management in the case of peri-urban dairying needs attention because it may become a critical issue.
- Most small-scale dairy processing facilities in the government sector are obsolete; they consume a lot of energy and are potential sources of pollution.
- Effluent treatment is required, even if the scale of operation is low.

Effects of climate change

- Heat stress for animals is increasing due to climate change and increases disease incidence and reduces availability of green fodder.

Adaptation strategies

- Farmers adopt practices of dry fodder storage for feeding during the lean period.
- Farmers conserve indigenous breeds and keep exotic blood levels in crossbreds at 50%.

Food safety

- There is a growing concern about adulteration of milk and other unhygienic practices in both the unorganized and organized sectors.
- The Public Health Department has started setting up the Food Safety and Standards Authority (FSSA). Food safety-related issues are reported when milk samples obtained from the organized and unorganized sectors show a high bacteria count. Enforcement of standards by local bodies, both urban and rural, is not observed.
- The department has facilities to conduct food safety-related tests at the state level as FSSA becomes operational.

Research and development

Past efforts related to cooperative dairies were limited to western Assam, but considering the unmet demand for milk and milk products, upper Assam is now being considered. Various R&D opportunities have been identified that relate to livestock production and dairying:

- The nutrition department at the College of Veterinary Science has identified local grasses, documented their taxonomy, and estimated their nutritive values with the aim to make better use of local grasses in animal feeding and dairying.
- The genetics department at the College of Veterinary Science, together with GOI, is characterizing local nondescript breeds to identify and conserve them.
- The veterinary college and NDRI are setting up an NDRI Dairy-Sub Centre.

Topics related to economic and socioeconomic development include:

- The current thrust of the government is development of the organized dairy sector in Assam.
- The government wants Milk Producers Institutions (MPI) to involve more poor women in the dairy sector.
- Efforts to promote livestock production and dairying as a means to reduce poverty are limited because ongoing efforts relate to all farmers, and there is no specific thrust to reach out to specific groups of economically weak farmers such as smallholders rearing ND cows.
- Poor access to formal credit services for livestock keepers and dairy farmers hampers development of the sector.

Present development strategies to boost dairying in Assam include:

- The state is upgrading infrastructure related to training, artificial insemination, disease diagnostics, as well as veterinary centres.
- Dairying as a self-employment activity under EGM is promoted in rural areas.
- Provision of doorstep AI services through an alternate breeding service delivery system is being considered.
- The infrastructure of WAMUL is being strengthened and initiatives are underway to promote milk unions at district/regional levels and the dairy federation at the state level with support from AACP and NDP.
- WAMUL and Oil India Limited started an initiative in Upper Assam to promote dairying.

Opportunities

Pro-poor dairy value chain development

There is a need for a systems approach to dairy development in Assam to enhance productivity of the sector and milk production, in particular increase productivity of the local cattle population through improved feeding practices and animal health management.

Rearing crossbred cows requires considerable knowledge, risk-taking capacity and long-term investment. Educated youth in rural areas are using these attributes to take up dairying. Field study indicates educated youth as successful in the past, and experience of the State Employment Guarantee Mission has been encouraging. Areas for promotion include:

- Producer organizations at the village/cluster level to create milk surplus pockets,
- Organized efforts related to processing and marketing of milk and milk products,

- Community-level service providers,
- Specific schemes for farmers who rear ND cows,
- Research related to local grasses,
- PTD for low-cost feeding strategies, especially for ND cows, and
- Continuing efforts related to clean milk production involving peri-urban farmers.

Increased production would generate surplus milk for marketing, but in the absence of surpluses, past efforts related to processing and marketing have not succeeded either in cooperatives, private industry, or the government sector. Major feed opportunities are with peri-urban dairy farmers. In rural areas, feed and fodder opportunities exist where there is organized sector intervention, and there are opportunities to enhance milk productivity in ND cows using interventions related to feed and fodder.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Situational analysis of the dairy sector in Bihar State[12]

Milk and milk products—consumption and expenditures

In Bihar milk and milk products are available in rural and urban areas in the following forms:

- Fresh milk is supplied to vendors and consumers either pure or adulterated with water depending on the preference and purchasing power of the customer.
- Pasteurised milk is mostly available in urban areas through organized dairy marketing outlets. Pasteurized milk is available in sachets in the form of double-toned milk, toned milk and standardized milk.
- The state produces a range of indigenous dairy products such as curd, paneer and ghee. Most of these products are generally for self-consumption by dairy producers and very little is sold on the market.
- High-end products such as ice cream and industrial-processed curd, paneer, ghee and milk powder are produced in small quantities by the organized dairy sector and sold in local markets.

The per capita availability of milk in Bihar during 2009–10 was 175 grams compared to 147 in 2004–05. Most rural households consume two to three litres of milk/day as liquid milk and dairy products. Consumption at the producer household level is related to presence of the organized sector. Rural households consume more milk and milk products in areas where the organized sector is not present, but increase in access to markets reduces consumption at the producer household level. Higher consumption is mainly because milk is not collected in the evening by vendors and the absence of market opportunities such as dairy cooperatives.

Where milk is collected only once a day, producers remove cream from the evening milk before selling it to vendors and that cream is converted to ghee. Rural families not involved in milk production prefer to buy milk directly from local producers, consume the liquid milk in tea and convert the cream into curd and ghee for home consumption.

In rural areas, major household expenditures for food include cereals, pulses and milk. Families from lower income groups may spend up to 20%of their money on milk and milk products, while households with higher incomes spend 30%.The milk consumption pattern across rural households is more or less similar (Table 21).

Table 21. Food expenditures in Bihar households

Area	Household income profile	Monthly food expenditure (Rs.)	Milk (Rs.)	Chicken, fish, mutton (Rs.)	Eggs (Rs.)	Milk expenditure (%)
Urban	High	15,000	4000	1500	90	26
	Low	8000	2500	400	100	31
Rural	High	7500	2500	400	90	33
	Low	4500	900	900	60	20

12 The inputs for this section are based on desk and field studies.

Purchase of milk and milk products in most households is decreasing but increasing among vegetarian households. Reasons for this decline are high prices and limited consumer purchasing power. Ghee (clarified butter) and dahi (yoghurt) are mainly consumed as by-products. Although there is a preference for milk sales by households linked to the organized sector, with an increase in per capita availability of milk and increasing disposable income, consumption of milk and milk products in both rural and urban areas is increasing. Milk products include curd and ghee in rural areas and paneer and sweets in urban areas.

The share spent on milk and milk products compared to total expenditures is decreasing, but there is an absolute increase in quantity and expenditures related to milk and milk products. In rural areas, families purchase milk from neighbouring farmers or from vendors coming to the village. In most cases, farmers and vendors deliver milk to the consumer.

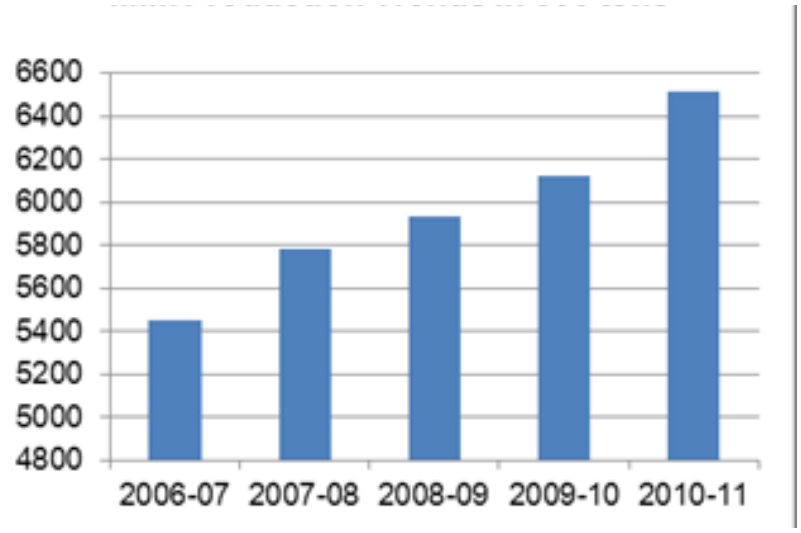
In urban households, average milk consumption in a family of five is 30-40 litres /month. The household also consumes about 2 litres of curd and 1 kg of paneer during the month. Across different locations there has been no significant change in liquid milk consumption over the past five years.

Production

Dairy is an important livelihood activity of the rural poor in Bihar who produce nearly 6.5 million tonnes of milk annually, which is 5.44% of India's total milk production. About 80% of the total milk production in Bihar is from landless poor, agricultural labourers, and small-scale and marginal farmers (Discussion with GM COMFED, 12 October 2013)

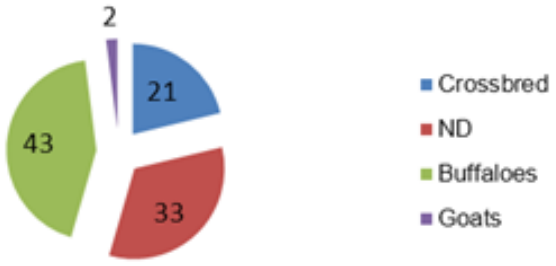
Milk in Bihar is produced by cattle, buffaloes and goats (Figure 16), with buffaloes making the largest contribution (Figure 20). Based on its milk production systems, the state is broadly classified into the north Bihar flood-prone area and the south Bihar drought-prone area.

Figure20. Milk production trends.



Source: Bihar Animal Husbandry Statistics 2012.

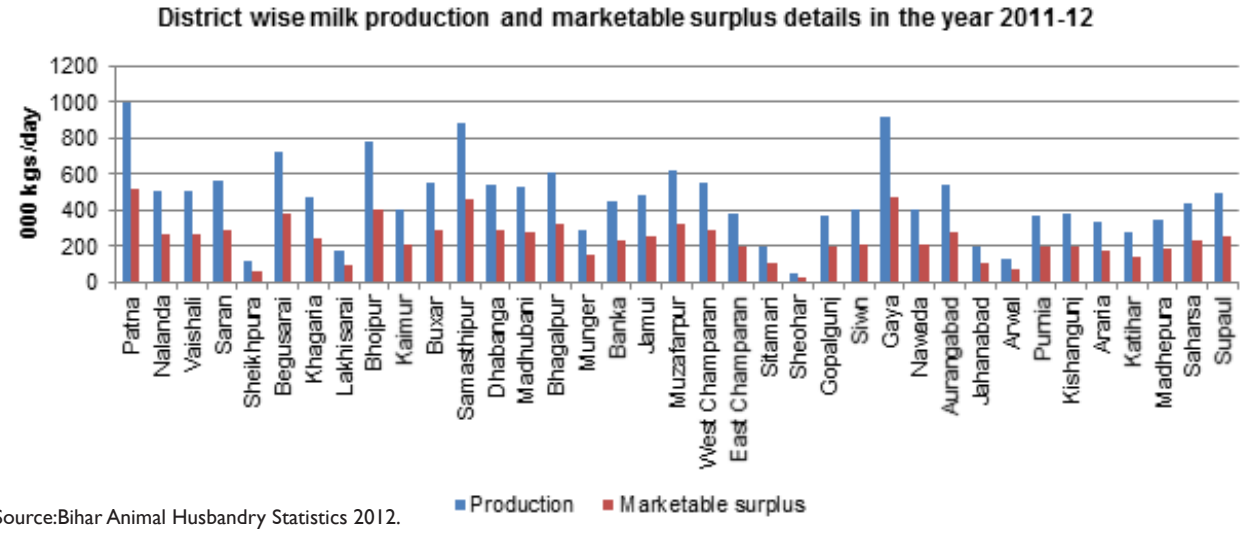
Figure 21. Milk produced by different species (%).



In the flood-prone villages there is higher marketable milk surplus, with buffaloes contributing significantly to milk production, but the share of cow's milk is increasing.

In drought-prone villages the available marketable surplus milk is low compared to the flood-prone districts (Figure 22). The share of the cow's milk is higher and more than 90% is produced by nondescript animals.

Figure 22. Milk production by district and marketable surplus.



Source:Bihar Animal Husbandry Statistics 2012.

There is a steady increase in the marketable surplus from drought-prone districts. Despite these changes, it is still difficult for farmers to produce a marketable surplus because so many animals are low producers. Cooperative Milk Federation (COMFED) is the single largest organized sector, covering 7,892 villages and 300,000families spread across 31 districts. North Bihar is associated with more rearing of buffaloes, intensive dairy management practices including feeding green fodder, small herd size, higher milk yields anda cooperative/ organized dairy sector. The scenario is reversed in south Bihar.

Figure 23. Different agroclimatic zones of Bihar (Zones 1 and 2 are north and Zone 3 is south).

Agro-Climatic Zone	Districts	Area (,000 ha)	Average Rainfall (mm)	Soil and Topography	Main Crops
Zone -I North West Alluvial Plains	Bettiah, Motihari, Gopalganj, Siwan, Vaishali, Seohar, Muzaffarpur, Samastipur, Sitamarhi, Madhubani, Darbhanga, West & East Champaran	Net Cultivated-2281 Gross Cultivated 3260	1234.7	Medium acidic, heavy textured, sandy loam to clayed, flood prone. (Large area remains under water called Chaur, Maun & Tal lands)	Rice, Wheat, Maize, Arhar **Hort. Crops** Litchi, Mango, Makhana, Water Chestnut.
Zone - II North East Alluvial Plains	Purnea, Katihar, Saharsa, Madhepura, Araria, Kishanganj, Supaul, Khagaria, Begusarai	Net Cultivated-1147 Gross cultivated 1677	1382.2	Light to medium textured, slightly acidic, sandy to silty loam. (large area comprise of Tal and Diara lands)	Maize, Mustard, Jute, Sugarcane **Hort. Crops** Mango, Bel, Banana, Papaya, Cucurbit, Chilly, Turmeric, Potato
Zone - III South Bihar Alluvial Plains	Patna, Gaya, Buxar, Jehanabad, Nawada, Nalanda, Rohtas, Bhojpur, Aurangabad, Kaimur, Banka, Munger, Jamui, Lakhisarai, Shekhpura, Bhagalpur	Net Cultivated-241 Gross cultivated 3408	1102.1	Old alluviam to sandy loam.	Rice, Gram, Wheat **Hort. Crops** Mango, Guava, Banana, Bael, Jackfruit, Onion, Potato, Chillies, Marigold

Box 14. Promotion of the cooperative dairy structure in Bihar

About three decades ago, the government of Bihar promoted the Bihar State Dairy Corporation. When the corporation was not able to meet expectations, in 1982 the government invited the National Dairy Development Board (NDDB) to organize the dairy sector in Bihar. Initially, NDDB agreed to compensate for losses of the corporation and was given full autonomy to develop a three-tier dairy cooperative structure. NDDB started the Patna Dairy Project with an initial procurement of 500 LPD involving 500 employees of the dairy corporation. At that time, there was no organized milk supply in Patna city. Trust by farmers was slowly built up, and within five years Pataliputra Milk Union was able to collect 250,000 LPD.

In 1993, a model dairy project led to formation of COMFED as the Milk Federation. Slowly the network of COMFED was expanded to 22 districts, but has now been extended to all 38 districts in Bihar. It is operating at 85 percent capacity utilization with peak-season handling of 1.5 million LPD and 1.1 million LPD during the lean season. It started producing milk products including peda, paneer, cold coffee, gulab jamun, etc. COMFED, with initial support from NDDB, has been able to promote the organized milk sector in Bihar, and has even started selling liquid milk of about 50,000 LPD to locations such as Delhi.

COMFED is collecting milk from surplus interior villages with better roads, which enables quick transportation of milk through public transport. Presence of the organized sector is visible beyond the main roads where the road network is good. COMFED said that improved roads in recent years have supported milk procurement. Generally there is production growth in villages where the organized sector collects milk.

Box 15. Production increases due to market channels

Although Kalyanpur village in Arai block of Muzaffarpur district was known for milk production, it never had access to the organized dairy market. Most farmers in this village depended on local vendors who in turn depended on sweet shops as buyers. Interventions by COMFED started making a difference in this village. Most households (425) in the village are small with marginal farmers who keep buffaloes. There are about 1000 buffaloes and 50 cows (mostly crossbred). The village generates 600 litres of surplus milk during the peak season and 300 litres during the lean season. Although more farmers (250 out of 350) continue to sell to vendors, 150 sell their milk to the COMFED-promoted cooperative in the village. Some households prefer to sell to both vendors and the cooperative.

Overall milk production has increased with presence of the cooperative. Ten years ago there was a surplus of 300 LPD, which has now increased to 600 LPD. The price paid by both vendors and the cooperative is quite competitive, with the formal cooperative sector setting the benchmark price (now about Rs. 22/litre) and vendors paying a slightly higher price (an additional Rs.1/litre). Even vendors welcome intervention by the organized sector because it creates additional surplus milk that they can try to tap.

Source: Intercooperation field study 2013.

In villages where a number of cottage processors are available, producers with surplus milk prefer to sell to these processors instead of selling to the organized sector. These processors sell to sweet shops in towns and cities, and in specific cases, meet demands from social functions such as weddings.

Overall milk consumption and production are steadily increasing in Bihar, and consumption of indigenous sweets and paneer is increasing in rural areas. Traditionally, Bihar people prefer milk and indigenous milk sweets. With increasing purchasing power among urban consumers, more is spent on milk and milk products, mainly in the form of pasteurised liquid milk, ghee, paneer, ice cream, dahi, lassi,etc. (Table 22).

Increased milk production is mainly due to the presence of large numbers of crossbred cows, making Bihar self-sufficient in milk and milk products, and with the large number of crossbred cows, production differences between lean and flush seasons are reduced. Milk production will increase if ND cows are replaced by crossbred cows, mainly in south Bihar. Most traditional dairy families would like to continue, and with population increases the number of dairy households would also increase. According to farmers, crossbred buffaloes produce 6–8 LPD during the flush season and 2–4 LPD during the lean season; crossbred cows, 4–5 LPD during the flush season and 1.5 LPD during the lean season; and ND cows, 2 LPD during the flush season and 0.5–1 LPD during the lean season.

Table 22.Marketing of milk and milk products by COMFED (t)

Product	1995–96	1999–00	2003–04	2006–07	2009–10	2012–13
Ghee	5.05.9	642.9	991.2	1214.3	981.8	1716.9
Table Butter	55.1	82.3	44.79	138.6	74.5	106.2
Ice cream	243.0	468.7	257.53	290.6	472.3	1083.2
Lassi	237.4	2223.6	1615.1	2287.0	3216.9	6426.0
Misti Dahi	81.5	401.7	538.7	549.2	820.2	1503.5
Peda	115.5	333.7	413.1	736.1	745.7	1241.5
Paneer	57.4	272.9	679.8	1242.3	1701.5	3022.2
Sudha Spl	21.6	180.6	224.2	357.7	870.4	1193.3
Plain Curd	18.3	160.7	790.6	1508.4	2723.0	4628.1
Kalakhand	5.7	95.8	67.0	154.8	152.8	184.4
Rasgulla		44.7	95.2	292.6	487.1	1278.4
Gulabjamun		45.7	98.5	241.1	335.8	1104.6

Source: Report provided by COMFED.

Farmers mostly use male animals for agricultural activities, including cultivation, and dung is increasingly used as a domestic fuel and fertilizer.

COMFED, with its large cooperative network in the state, is able to manage surplus production, but also deficits by linking the unions within the state. In the last 10 years, the state has not imported any milk from outside except milk powder in specific instances to reconstitute milk. Bihar has been supplying milk regularly to West Bengal and Assam, and exporting indigenous sweets to West Bengal and Jharkhand. It is likely that Bihar will emerge as a milk-powder-exporting state.

Animal health

The Department of Animal Husbandry is the single largest agency providing livestock health services to farmers in Bihar. The department has a network of 39 hospitals, 783 veterinary dispensaries and1595 first aid centres. Apart from the government, private service providers also provide livestock health services.

Farmers keeping crossbred cows and good buffaloes started demanding good quality livestock services. With an increase in the value of their animals—from Rs.30,000 to Rs. 55,000—timely health care services are important for farmers. Most farmers prefer doorstep services, but because the department is not in a position to meet such demands, farmers generally access doorstep services through private providers. Most farmers spend Rs. 1500–2000/ animal annually for health services and medicines.

Government health services

Farmers would like to use the services of qualified veterinary doctors, but access to government services is limited to emergencies. These services are mainly offered at institutions that are inconvenient for farmers. Limited doorstep services and lack of medicines at veterinary institutions discourage farmers from using government services, however, the department has been protecting animals against infectious diseases such as FMD, HS, and BQ through vaccination campaigns. The department uses private service providers for vaccination, paying themRs. 2/vaccination, but there are instances of disease outbreaks even after vaccination, especially FMD outbreaks. Cold chain management is a serious concern for the department. Vaccines are mainly stored in private medical shops or at times in local cold storage due to lack of adequate infrastructure in field institutions. Irregular power supplies are another major constraint in cold chain management.

A National Animal Disease Reporting System links each taluk, block, district, and the state headquarters to a Central Disease Reporting and Monitoring Unit at New Delhi. This system would enable the field staff to directly communicate livestock disease data to a central monitoring unit, but the system is almost defunct in Bihar because of inadequate computers and computer literacy. With systematic efforts it is slowly improving.

COMFED and private services

COMFED has 2183 field-level Veterinary First Aid (VFA) centres in the field that provide preventive health services. In 2012–13, COMFED conducted 1,772,610 vaccinations to protect animals from FMD, HS and BQ. It procured the vaccines from Indian Immunological Limited and from private companies.

Farmers prefer private breeding and animal health services due to easy access to the provider and inputs, round-the-clock availability and flexible payments (credit). There are at present trained AI technicians working in Bihar and a private semen station at Patna. BAIF and JK Trust have a mandate from the Bihar government to provide breeding and animal health services in specific areas of the state.

The Department of Animal Husbandry has outsourced AI services to organizations such as BAIF and JK. They provide AI services through gopalmitras. Most of the farmers use AI and other health care services from local gopalmitras that may be linked to COMFED, JK Trust, BAIF, or the Animal Husbandry Department. There are overlapping areas or competition among institutions, so it is difficult to assess performance of one institution compared to others.

There has not been survey of AI coverage, so it is difficult assess performance and quality of services. However, for JK Trust the conception rate is 52% and the calving ratio is 2.8. Gopalmitras associated with JK Trust are able to earn Rs. 5000–20,000/month; one-third from AI, one-third from sale of inputs and the balance from health services.

Disease incidence, constraints andpolicies

FMD, HS, BQ,theileriosis, mastitis, and surra are the most common diseases in large ruminants in Bihar. Compared to ND animals, crossbred cattle are highly susceptible to FMD, mastitis and protozoan diseases. Poor housing and unhygienic management practices are the main causes for a high incidence of mastitis, vector-borne diseases and infectious diseases. In flood-prone areas, there is a high incidence of parasitic infestations such as fasciolosis. Regular deworming for control is not practiced except in some areas where COMFED operates.

Indiscriminate usage of antibiotics and hormones, often administered by poorly trained livestock service providers, is a major constraint, putting animals (and via livestock products), humans at risk. The department has not developed any system of quality control and regulation of services provided by private animal health workers.

Box 16. Local services as a source of income

Most dairy farmers in a cluster of 50 villages in Dobhi block in Gaya district know a private service provider asan, 'animal doctor'. However, he has not received any formal training related to animal health, and gets frozen semen and liquid nitrogen from the local government veterinary centre for Rs. 60/dose. He charges Rs. 80 for his AI service and adds travel costs, and also provides vaccination services (FMD, HS/BQ) on a cost basis, as well as treatment services including medicines. There is excessive use of antibiotics, hormones and deworming medicines. He handles about 50 cases in a month and his income is Rs. 12,000.

Source: Intercooperation field study 2013

There is no adherence to the prevention of contagious diseases act and vaccination protocols are not properly followed. Another constraint is inadequate diagnostic facilities in the veterinary dispensaries.

The department has been focusing on preventive animal health care to reduce farmer spending on curative health. It is planning to improve health services through mobile AI and health service units, but so far this has not materialised. Under the improved mastitis program, assistance from NDDB is provided to screen and treat subclinical cases. Data are compiled, but because the reporting system is not functional, the data are considered unreliable.

Breeding services

Much like health services, breeding services are provided through the Animal Husbandry Department, the Bihar Livestock Development Agency (BLDA), COMFED, BAIF, JK Trust and private AI workers (PAIW).

Key features of the breeding policy include:

- Pure breeding of indigenous breeds for milk and field work,
- Crossbreeding of nondescript cows for milk,
- Mating of crossbreds to produce a crossbred population with 50% exotic blood, and
- Upgrading nondescript buffaloes with the Murrah breed.

Breeding is performed using artificial insemination (AI). AI is widely accepted in the flood-prone Gangetic basin compared to drought-prone areas. The higher level of acceptance is from increased awareness ofAI among farmers and demand for AI services, especially in flood-prone areas. In drought-prone areas with low marketable surplus milk, farmers prefer natural breeding for their animals. Irrespective of location, farmers using AI prefer quality service due to its direct impact on the animal's reproductive and productive performance. The conception rate of AI, performed by either PAIW or government service providers, is not more than 35%.

Most farmers prefer PAIW because their service is easily available; the next preference is for COMFED AI workers followed by government AI workers. Preference for doorstep AI service is based on a better conception rate and reduced costs for labour and time (no walking with the animal to an insemination centre).Farmers are used to paying for breeding services, andthose with crossbred animals are more willing to pay for the service.

The state has limited facilities for producing semen. BLDA has one frozen semen bull station but it does not conform to the Minimum Standard Protocols prescribed by GOI. To revitalize the breeding station, new breeding bulls have been added. The current shortage of frozen semen is met by purchases from NDDB, ABC Salon, SAG and BAIF. BLDA is procuring liquid nitrogen from COMFED.

The Bihar government engaged BAIF and JK Trust to provide AI services by allocating villages to them to prevent overlapping of services rendered by BLDA and COMFED. Recently, BLDA did not extend the agreement with JK Trust and BAIF due to a policy issue. Revised government guidelines say it is the responsibility of the service provider to follow up with the AI calf for two months, but both BAIF and JK Trust are not happy with this guideline and hence did not extend the agreement.

There are 4500 private AI workers providing breeding and livestock health services. These workers collect semen from a private semen station in Patna. In addition, they procure frozen semen from the distributor that has been providing frozen semen to BLDA. There are instances of procuring frozen semen directly from departmental AI centres.

The government has fixed AI charges at Rs.25 for scheduled-caste and scheduled-tribe farmers and Rs. 35 for others. AI service providers are allowed to collect additional money to meet their travel expenses, thus most AI providers charge more than the fixed rate. AI workers said the cost of their services is Rs.80–100, excluding transportation cost that varies with distance to villages, and in some cases the transportation cost alone may be Rs. 100to Rs. 200 (Table 23]

Table 23.Details for AI service providers, 2012–13

Service provider	No. of centres	No. of AI performed
BLDA	1401	19,48,000
COMFED	2329	15,65,603
BAIF	240	28,000
JK Trust	300	60,000
Private AIW	4500	250,000

Source:Intercooperation field study, 2013.
Figures for BLDA, BAIF, JKT and PAIWs are based on discussion.

One key breeding concern is not adhering to breeding policies so that crossbred blood levels rise beyond 50% among those animals, as well as inbreeding due to inappropriate semen allocation and monitoring. Stakeholders said that exotic blood level is a major issue because farmers do have adequate resources to manage animals with high genetic merit. There is, therefore, a need to create awareness among farmers, educate AI service providers and monitor AI services in the state.

Poor heat detection and insemination skills as well as poor infrastructure are other concerns that lead to a high incidence of repeat breeding, an irregular supply of liquid nitrogen and ultimately poor semen quality. Privatization of AI services is ongoing, but a lack of a proper monitoring and assessment makes it difficult to check the work ofAI workers.

Feed

Concentrate feed is mainly provided to lactating animals, while dry and young animals do not receive concentrates. Farmers in drought-prone areas prepare homemade concentrate mixtures from locally available ingredients for lactating animals. The proportion of ingredients varies and often does not meet required feed standards, and sometimes farmers purchase low-grade feed ingredients at a lower price and prepare poor-quality feed.

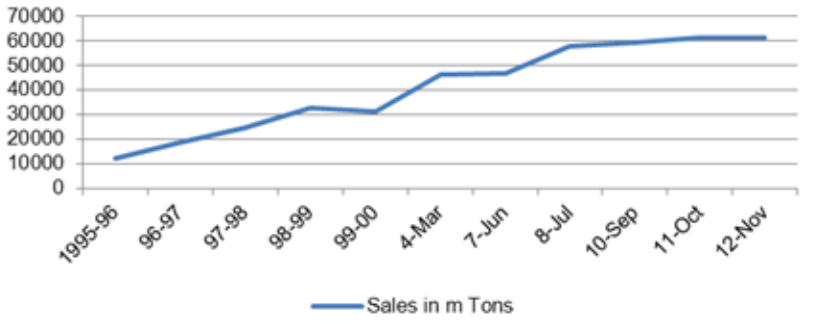
The Gangetic basin where COMFED works is better. Farmers supplying milk to COMFED purchase cattle feed mostly at milk collection centres, and there are several input suppliers located in small towns that also sell cattle feed.

Box 17. Feeding practices

Farmers in Kothatia village in Chandotia block of Gaya district said that they generally feed 2 kg of concentrate feed per day to animals in milk and 1 kg to dry animals. They either feed wheat flour or rice bran, and most feed chopped dry fodder. Farmers with crossbred animals that produce 10 LPD seem to provide feed and fodder worth Rs. 197/day, which includes 10 kg dry fodder (Rs. 5/kg), choked (Rs. 25), 1 kg mustard oil cake (Rs. 40), 2 kg rice bran (Rs. 32), 2 kg maize (Rs. 32), and 0.5 kg of molasses (Rs. 20). Most farmers are unaware of feeding practices related to balanced nutrition. No farmers reported using branded cattle feed, however, feeding concentrates was reported by some farmers associated with COMFED. They generally fed 1–2 kg of concentrate per animal, in addition to local ingredients.

Source: Intercooperation field study 2013.

Figure 24. Sales of cattle feed by COMFED.



The feed for lactating animals is mostly low quality and not appropriate for the animals' requirements. There is preference for feeding animals that are giving milk, and feed requirements are assessed based on a farmer's experience and affordability. Farmers lack the knowledge to assess feed requirements.

COMFED is producing cattle feed and supplying it to milk producers. Milk producers keeping good quality animals demand bypass[13] protein feed to enhance productivity of their animals. COMFED has one feed mixing plant at Patna and leases another one with a joint production capacity of 310 t/day and the plants operate at full capacity. Overall the demand for feed is increasing in the state and COMFED is not able to keep up with demand.

COMFED officials said they are not able to meet demand for concentrates even with all plants running at full capacity. For farmers, cost of concentrate feed and locally available feed ingredients have gone up, and they complain that increases in milk prices do not keep up higher prices for concentrate feeds and feed ingredients.

13 Bypass proteins have crude protein content more than 20%, with at least 50% of this protein escaping breakdown in the rumen. They are most suitable for the diet of high-producing, early-lactation dairy cows or rapidly growing starter beef cattle.

Concentrates fed to cows and buffaloes in the drought-prone area often do not meet nutritional requirements and therefore affect milk production and animal health. There is high incidence of milk fever among high yielders because the low quality of these feeds does not meet the animals' nutrition, which also indicates a lack of knowledge among farmers about preparing a balanced ration. Using branded feed to enhance milk production is expensive, yet the amount available on the market does not meet the emerging demand.

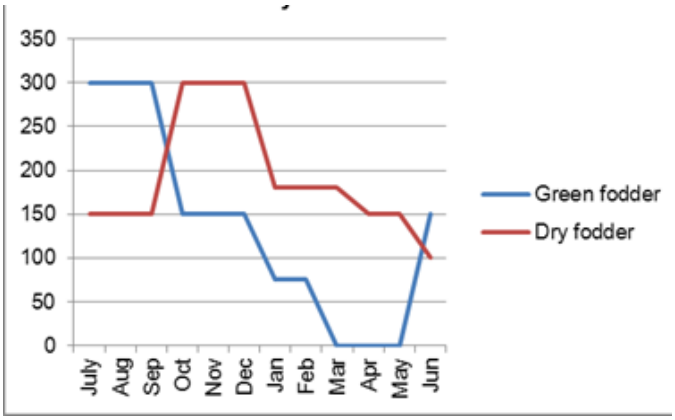
Fodder

Fodder cultivation is limited. Farmers generally collect green fodder that is grown on fields and bunds and animals are largely stall fed. Generally households do not possess land for grazing, but common property is available in many places, although those areas are often heavily overgrazed. Women and men who work as agricultural labourers often carry fodder from the fields at the end of the day. Landowners do not object to fodder cutting when it is available in abundant quantities. It is common for farmers to chaff[14] odder to avoid wastage.

There is a high demand for dry fodder in the region because green fodder is available only for a few months (Figure 25). Green fodder that is fed is mostly weeds and of low nutritive value. Some farmers cultivate green fodder on small pieces of land; generally local maize. Some farmers purchase dry fodder either from large-scale farmers in the village or from neighbouring villages when their own fodder is not adequate.

In south Bihar mainly rice straw is used as dry fodder, while both rice and wheat straw are fed in north Bihar. One or two farmers in a village with relatively more land cultivate maize as fodder. Villages near river banks with abundant fodder and available water prefer rearing crossbred buffaloes. Trade of dry fodder is more predominant in south Bihar within a village and with nearby villages. Trade becomes more prominent in a drought year.

Figure 25. Seasonality of fodder resources.



As a result of feeding low-quality paddy straw and local grasses that are low in minerals, animals suffer from mineral deficiencies. The major constraint for not producing fodder in addition to a lack of awareness is limited land, and the rapid conversion of grazing land to crops shrinks pastureland even further.

Mostly farmers do not want to dispose of unproductive animals due to local sentiments, although keeping unproductive animals until their death increases the overall demand for fodder.

14 Chopping fodder to a smaller size to improve digestibility

Box 18. Fodder feeding practices of farmers in Gaya district

Most farmers in Karhara village in Dobhi block of Gaya district take their animals to graze on grass. No fodder is cultivated. Grass available in nearby areas is able to meet only 10 percent of fodder requirements. Hence most families feed dry fodder. Smallholders do not have sufficient dry fodder, so they buy it from large-scale farmers. The price of dry fodder varies in the range of Rs. 2.50–3/per kg. During drought periods, fodder is bought from distant areas. There is a similar scenario in most rainfed low-surplus milk villages. Karhara village of 300 households produces surplus milk of 150 LPD during the flush season and 75 LPD during the lean season, which is sold in the village. Farmers are not turning to fodder cultivation. They often lack the land, but also do not see the economic benefit.

Source: Intercooperation field study 2013.

Credit

Subsidy-linked credit to purchase milk cattle is currently not available because banks are not interested in providing credit with no subsidies, nor are farmers willing to pay commercial rates of interest. However, there is a reasonable demand to purchase dairy animals. Farmer credit schemes such as kissan (farmer) credit cards are available to few farmers, but are mainly used for crop cultivation. Agricultural credit through cooperatives and banks is mainly for crop cultivation. Based on experience, most farmers perceive that dairy enterprises, including buying animals on credit, is profitable, but farmer experience is critical for success, however, credit for buying dairy animals is generally not available. Both bankers and farmers prefer government subsidy-linked credit to buy dairy animals.

Three percent of credit out of total agricultural lending at the district level is allocated for dairy. The SHG bank credit is inadequate for dairy animal loans due to its high costs. Finance institutions are reluctant to release milk cattle loans because repayment is irregular. Milk cattle loans linked through COMFED were repaid at a higher rate, so finance institutions prefer to sanction loans to COMFED members.

There are several cottage processing units operating in the state. These units are not able to access credit because banks consider them as informal units and not eligible for credit, so these units grow slowly.

The small financial allocation by the government for the livestock sector, especially dairying, is a constraint faced by many farmers. Lack of interest subsidies is another hindering factor, and the high unit cost of milk animals makes banks reluctant to extend credit. Dairy is not a priority sector for lending programs even though it is an important livelihood activity. The government of Bihar is considering a lending scheme for farmers not linked to bank credit.

Knowledge

Considering the high value of livestock, farmers would like to manage these assets to the best of their abilities, which requires knowledge and skills about good livestock practices. Farmers are interested in training and extension services—they seek training in animal health management, feeding, breeding, economics of dairy farming, and dairy processing. There is no formal mechanism to assess needs and demand for training. At times it relates to new technologies and improved rearing practices, and farmers are reluctant to pay for this training, which could be provided as an added service alongside AI, health and vaccination services, and sale of inputs, which farmers are already paying for.

Farmers have very limited access to training organized by the animal husbandry department. In COMFED areas the situation is better, with both residential and village-level training, but coverage is limited.

Good practices are disseminated to poor farmers through progressive farmers who have better knowledge and access to new practices promoted through mass media, input suppliers, research institutes and veterinary doctors.

Although few training programs take place in villages, they are often conducted without adequate training and extension materials. Farmers prefer to have training materials developed for them to refer to after each training program. The department is conducting resident courses for in-service training and farmer training, but capacity of the training centres is limited. COMFED has been conducting training for farmers at four residential training centres.

The Animal Husbandry Department puts little emphasis on training of their field staff. In 35 years of service, some veterinarians received only 10 days of training, making them unfit to face the challenges of a changing livestock and dairy sector. The Bihar Academy of Management on Extension Training Institute (BAMETI) started conducting training of trainers programs in coordination with the department, COMFED, Veterinary College and ICAR. About 25% of BAMETI's ToT curriculum is related to animal husbandry. In recent years efforts have been made to strengthen BAMETI.

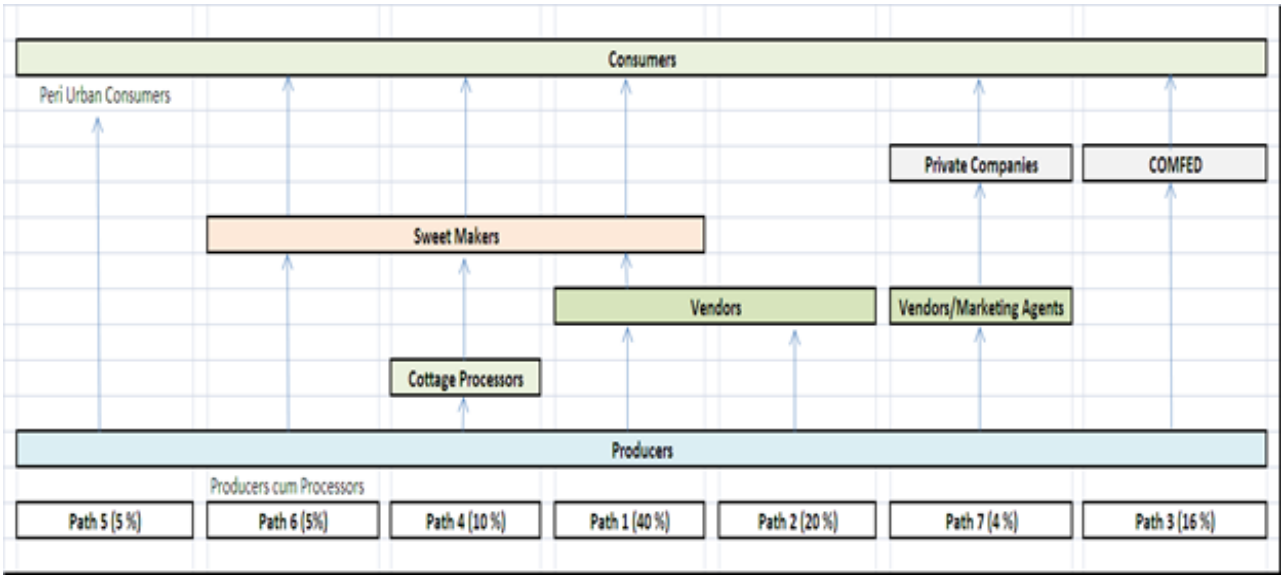
A major problem is lack of human resources. Of the total 2200 positions for veterinary doctors, only 1200 are filled, which is not sufficient to render effective livestock and dairy services.

Value chains

The following seven dairy value chain paths have been identified in Bihar. The structure along with volume handled for each path includes:

- Path 1 (40%): Producers–vendors–sweet makers–consumers
- Path 2 (20%): Producer–vendors–consumers
- Path 3 (16%): Producers–COMFED–consumers
- Path 4 (10%): Producers–cottage processors–sweet makers–consumers
- Path 5 (5%): Producer–consumer (peri-urban)
- Path 6 (5%): Producer cum processors–sweet makers–consumers
- Path 7 (4%): Producers–vendors/marketing agents–private companies–consumers

Figure 26. Value chain flow diagram for Bihar.



Path 1: Producers–vendors–sweet makers–consumers

Nearly 40 percent of the milk produced in rural areas follows this path.[15] Vendors usually collect milk from producers in the morning. Often farmers remove cream from the evening milk before selling the milk to vendors the next morning. The scale of operation by vendors collecting milk from this channel is about 40 LPD/vendor. Procurement is linked to daily demand from the sweet makers to whom vendors sell their milk. Vendors often have close links with one or a few sweet makers. Vendors collect milk from the farmer's doorstep and pay monthly. Sweet makers pay the vendors based on the yield of khoa they get from the milk. Sweet makers mostly sell sweets in the local market but occasionally they also sell to distant markets. In COMFED's operational area vendors pay higher prices to producers to fight competition from COMFED.

Box 19. Livelihood by selling milk

For 15 years, Maheswar Ray has been working as a milk vendor. He collects milk from 30 households in Kalyanpur village and sells it to sweet shops. Out of the 30 farmers, 15 have been supplying milk for 15 years. He collects milk atthe doorstep of producers, tests milk quality visually, and at times uses a lactometer to detect any adulteration. He collects as much milk as he is able to sell to two sweet shops. He is paid at the rate of Rs. 150/ kg chhana. The sweet shops in turn sell sweets locally, and also send their sweets to cities such as Muzafferpur, Hazipur and Patna. During the flush season, his collection rises to 160 LPD and in the lean season (March–May) it drops to 80 LPD. He has been able to develop trust with his producers by providing credit to purchase animals and for feed and medicines. He has invested about Rs. 9600towards purchase of seven milk cans of Rs. 800each and a bicycle atRs. 4000).

Source: Intercooperation field study, 2013.

Both procurement and sales prices offered by COMFED are considered benchmarks for other players to follow. Vendors generally have oral agreements with producers and consumers. Milk quality in the organized sector relates to fat and SNF content, while in the unorganized sector it is yield ofchhena. Quality control in terms of microbial load is still not functional even with COMFED. Progress has been made toward clean milk production, however, a food analyst reports poor quality milk in both organized and unorganized sectors. There has not been a major concern (except for one large-scale rumour in Patna city) related to milk quality.

Path 2: Producer–vendor–consumer

About 20 percent of milk produced in rural areas is channelled through this path. Milk is adulterated at the vendor level, but not so much at the producer level. This path is mainly found in non-COMFED villages that do not have a large volume of surplus milk. Producers prefer selling milk to vendors mainly because they receive credit from them. This path primarily leads to consumers in small towns. Consumers buying milk from vendors are aware of adulteration because the consumer price often depends on the amount of water added.

Path 3: Producers–COMFED–consumers

COMFED is the single largest organized formal dairy sector that procures milk in rural Bihar. The federation procures milk from 31 districts through nine milk unions. COMFED manages surpluses and deficits in the state through inter-union transfers, and has an installed capacity of 2.0 million LPD and currently operates at 85%% capacity utilization. As reported by COMFED, about 16% of the surplus milk produced in villages is marketed through this channel. Milk-producing households prefer this channel because of its regular procurement of milk, regular payments, and supply of cattle feed. COMFED generates 80% of its revenue through sale of liquid milk. In urban markets such as

15 Traditionally, Bihar is sweet consuming state. The sale of sweets has increased with a rise in purchasing power. Sweets are sold to cities outside the state, including Jamshedpur and Kolkata.

Patna, the demand for COMFED products is high and increasing. With its operation at high capacity, it is not able to procure all the surplus milk available in its areas of operation. At times it declares milk holidays, hence, some producers in COMFED cooperatives prefer to have links with vendors. With new units being installed and expansion of existing plant capacity, the issue of milk holidays may be resolved. With support from the state government and GOI, COMFED is trying to upgrade its processing capacity for liquid milk, including production of UHT milk, but also milk powder and other dairy products. Current milk powder production is used to reconstitute milk during the lean season. Over the past 10 years there has been a gradual increase in liquid milk marketed by COMFED.

With great efforts to improve cold chain management and farmer training, the overall quality of milk has improved—fat and SNF contents increased, while microbial load decreased. In addition to expanding its processing infrastructure, COMFED plans to expand its geographical area to improve milk procurement, expand its service network to3400 centres, establish150 BMCUs with automatic milk collection units for clean milk production, and strengthen its cattle feed production.

Path 4: Producers–cottage processors–sweet makers–consumers

About 10 percent of the milk produced in rural areas is channelled through cottage processors which are from villages that are often located along highways and main roads. Producers supplying milk to cottage processors do not adulterate it because they receive a higher price for whole milk. The producer price is based on yield of paneer, chhena and khoa obtained from the milk. Cottage processors find it difficult to meet consumer demand during the lean season, but may find it difficult to purchase all the milk supplied by producers during the flush season.

Cottage industries as a traditional occupation are likely to continue in traditional milk surplus villages that are already linked to sweet shops in towns and cities. Economy of scale does not assume importance because they operate in the informal economy.

Firewood is the predominant fuel used to boil milk. Preparation of cottage milk products also sees a high incidence of spoilage, making operations at times uneconomic. A lack of storage facilities affects milk and finished products, causing further losses for processors.

Box 20. Cottage production as a livelihood

In Bihar, cottage dairy processing is widely practiced in villages with a significant milk surplus and good transport links to nearby towns and cities. For the last 25 years, Laxmi Ray of Arai block in Muzafferpur district has been into cottage processing. He collects0.30 t of milk from 50 farmers in the village at a rate of Rs. 30/litre. Because he offers a good price, most farmers deliver milk to his processing facility. He is happy with the milk quality and is the leading processor in his village, although there are about 10. Using traditional technology, he generally makes paneer and sends it to shops in Muzafferpur. He employs six people, one full-time and five part-time. Cost for milk is Rs. 9000 (300 litres×Rs. 30) and spends Rs. 2/litre on fuel and labour, which is Rs. 600/day. Selling about 90 kg of paneer at Rs. 150/kg yields a gross income of Rs. 13,500/day.

However, because his technology is traditional and rudimentary, he experiences milk spoilage for about 20 days during the summer with a lost income of about Rs.3000/day. Milk spoilage is a key constraint for cottage processors such as Laxmi. In addition to spoilage, his milk supply shrinks during festival seasons when there is high demand, so he tries to obtain milk from other places. He also faces a similar situation during the lean season (June–July), when his milk collection drops to 150 LPD.

Source: Intercooperation field study 2013.

Path 5: Producer–consumer (peri-urban)

About 5% of milk in Bihar is produced and marketed in peri-urban areas. Villages in this path are generally located 5–8 km from urban centres, and producers sell raw milk directly to urban consumers. Urban consumers demand quality milk and are prepared to pay higher prices, but some consumers who do not want to pay higher prices buy milk adulterated with water. Producers carry different containers with different levels of adulteration (water added) for different consumers. Direct sale of milk is an add-on activity to their primary occupation (working for wages) and other activities in urban areas. This pattern is limited to certain milk producing households and there is limited scope for expansion because doorstep milk collection in other paths is working.

During the last years there has been a steady decline in direct sales from smallholder producers. Either farmers gave up dairying because there was increased scope to earn wages, or they stopped time-consuming sales in town and let vendors collect milk at their farms.

Path 6: Producer cum processors–sweet makers–consumers

About 4% of the milk in Bihar is marketed through this path, mainly rainfed areas of south Bihar, which is a low milk-producing area. In this path, families that own dairy animals and produce some milk convert the milk directly into milk sweets in their households. When the household is unable to meet the local demand for dairy products, it may source some additional milk from neighbouring producers. Such a situation normally arises during the festival season. Producer-processors mainly sell in local markets.

Path 7: Producers–vendors/marketing agents–private companies–consumers

About 4 percent of milk produced in the state is marketed through this path. These villages are in high surplus milk pockets where COMFED already operates. Private players located at Begusarai collect milk from these villages through local agents. Many times existing vendors become market agents for private dairies. Producers supplying milk to the private sector generally receive a higher price compared to the price offered by COMFED. The private sector competes with COMFED, but unlike the cooperative body, private dairies do not provide services such as AI and sell cattle feed. The private players mostly convert milk to milk powder and supply milk powder to milk-deficit states

Summarizing the dairy paths

COMFED's share in the state is steadily increasing, and with the current pace of growth it can reach 25%of the liquid milk market by 2015.This assumption is based on data provided by COMFED and discussions with the Directorate of Dairy Development. With a new processing plant and enhanced chilling and processing, COMFED may be able to reduce milk holidays and add to its position.

The government of Bihar is not actively encouraging more private players to enter the dairy business in view of the growth of COMFED. To improve milk quality, COMFED has been establishing Bulk Milk Chilling Units (BMCU), which has significantly improved raw milk quality, and shortly COMFED will be in a position to produce UHT milk and may be able to market it in other deficit states such as Assam.

COMFED is a public sector organization and is supported by GOB. All other dairy stakeholders do not receive any support related to processing, manufacturing, or marketing, so in this sense, government interference in the dairy sector in Bihar is still very significant. With government support and professional management, COMFED is efficient and operating at an optimal capacity, but if similar support is offered to the private sector given the overall growth of the diary sector, COMFED may have some concerns.

Waste management

COMFED handles an average 1.8million LPD through its dairy plants located in different unions. All dairy plants are provided with an effluent treatment plant (ETP) to properly dispose of waste, in particular to clean water used during processing. In addition, COMFED developed a system to collect consumer milk packets (poly packs) that can be recycled at the supplier plant.

Climate change

Impact from climate change. Milk production—keeping dairy animals—is highly water intensive. With an increase in the dairy population, in particular high-yielding buffaloes and crossbred animals and increased dairy intensity, the demand for water will increase further, especially if farmers increasingly resort to partially irrigated fodder cultivation.

Farmers feel that climate change has reduced the period when green grass is available. Some natural fodder species that were once abundant are now gradually declining. Overall yield of green grass has declined. Dairy farmers are also concerned about heat stress for their animals, especially crossbred cows. Higher temperatures reduce productivity and increases incidence of diseases such as theileriosis and babesosis.

Adaptation strategies. Farmers have developed coping mechanisms to adapt to climate change, for example, animals previously kept in open places in front of their houses are now kept in sheds during peak temperatures, or immediately after harvest, farmers collect crop residues and store them in a proper way for feeding during the lean period.

Departmental breeding policy aims to conserve indigenous breeds that are better adapted to harsh local conditions. In addition, the breeding policy is to restrict the exotic blood level in crossbreds to 50% to ensure their heat tolerance. However, AI workers and farmers do not adhere to this policy because crossbred animals continue to be inseminated with pure exotic bull semen, further increasing the exotic blood level, which ultimately leads to heat stress, low productivity and increased incidence of diseases.

Public health concerns

The Food Safety Department reported no food safety incidents in the organized dairy sector during the last 15–20 years. However, there are growing concerns about the production of synthetic milk and paneer by the informal sector in some pockets of the state. The department is unable to initiate preventive measures due to a lack of human resources and lack of clear roles and responsibilities for local bodies. However, the Government is serious about implementing FSSA, which is gradually becoming operational at different levels.

The department made it compulsory for milk cooperatives to register with the department and adhere to food safety standards. Currently the department has nine designated officers at the divisional level,14 food safety officers at the block level and one laboratory at Patna. The laboratory has facilities to test fat, SNF, and microbial load, but for detailed tests samples are sent to Mitra laboratories at Kolkata. Food safety officers collect fresh milk samples from vendors, cooperative milk collection centres and processed milk from COMFED.

To enforce FSSA the department is planning to create 38 district officers, 1400 block-level officers and one laboratory per division. The Patna laboratory will be strengthened to conduct detailed tests such as presence of toxic materials, heavy metals and pesticides. The divisional officer will be the licensing authority, while the food safety officer will be the registering authority. The department has established an adjudicate court with an assistant district magistrate and one special court. Once all positions are filled, the department will make it mandatory for all micro-entrepreneurs, milk collection centres, milk vans and milk booths to register with the department.

As per the act, the department will charge a Rs. 500 registration fee for the smallest entrepreneurs lasting for five years. The entrepreneur is required to renew the registration by paying Rs. 100 each year. It may be desirable to register activities related to handling milk beyond the small-scale producer level. It has yet to be seen if regulation of micro-enterprises will affect, positively or negatively, the functioning of these businesses. There is inadequate knowledge among officials about CODEX standards.

Research and development

The Indian Council of Agricultural Research established its eastern region research station at Patna. The ICAR identifies its research priorities through multi-stakeholder consultative fora which include progressive farmers. Currently the unit is conducting adaptive research with a focus on a farming systems approach. So far it has developed farmer-friendly low-cost feed formulations that have yet to be popularized in the field with support from the department. ICAR also conducts farmer training jointly with BAMETI and the department and has been collaborating with IRRI and ILRI. The centre is keen to collaborate with other organizations on mutually agreed projects. Bihar has one veterinary college at Patna that provides veterinary education.

Development strategies of the government

Economic development

To improve the income of poor households, the state has been focusing more on milk pockets where the poor rear crossbred animals and follow similar (at times better because of access to labour)practices of higher economy groups.

In potential milk pockets, COMFED established MPCS and provides some key services. Economic development through dairying has become slightly biased because the focus has been on milk surplus pockets, and the government has not offered much to support private dairies.

The government has a provision to support the poor when they purchase dairy animals with a subsidy. However, the number of beneficiaries is very limited. Besides support for purchasing dairy animals, the government focuses on strengthening the cooperative dairy sector in the state.

Technical support and assistance include:

Privatization of AI services: Improvement of the crossbred population and efforts for better buffalo breeds are assigned high importance. However, this will not achieve the desired level due to limitations of the department. To increase breeding coverage the government has initiated privatization of AI services with support from BAIF and JK Trust, which increased coverage and improved AI performance due to doorstep services.

Mobile clinic: The department intended to provide quality livestock health services to farmers at the doorstep through mobile clinics, and for that purpose purchased 12 vans with disease diagnostic and preventive health care equipment for emergency cases. However, the program could not be launched due to administrative constraints.

Disease diagnostic facilities at the subdivision level: Currently, the department is establishing disease diagnostic facilities at the subdivision level to allow field staff quick access to diagnoses and provide evidence-based treatment.

- Strengthening COMFED infrastructure: The government is providing this support to CMOFED:
- Strengthening cold chain management at retailers,
- Mechanization and automation for packing fresh milk products,
- Establishing a 1-t capacity cheese plant at Patna, and
- Establishing new feed plants and expanding the capacity at Patna and Tirhut.

JIVIKA and COMFED collaboration: JIVIKA, a World Bank project to improve livelihoods of the poor has entered into an agreement with COMFED to promote dairying as a livelihood option. COMFED will organize milk collection centres by involving Joint Livelihood Group (JLG) members, collect milk regularly and provide livestock services. Credit support is also extended to JLG women by JIVIKA for purchase of dairy animals. The collaboration did not develop as well as anticipated mainly because of balancing 'business principles' with 'development/empowerment initiatives'. There may be limited appreciation by JIVIKA about business viability such as collection of minimum quantities. It is more of a public private partnership (PPP) that can be strengthened based on experience, such as introducing performance-linked subsidy supports until the business is viable. This would intensify dairy activity involving poor households in rain-fed areas.

COMFED was unable to collect milk from JLG because it was not able to collect minimum volumes of milk, so COMFED closed several milk routes. On the other hand, during the flush season COMFED was forced to declare some milk holidays that frustrated JLG members. COMFED could also not extend livestock services to JLG groups.

Opportunities

Research and development: There are 4500 private AI cum health workers in the state that provide breeding and health services to milk producing farmers in different locations. Institutionalizing this system with ongoing welfare schemes under dairy development to provide professional support and ethical supervision could enhance performance of these workers.

Most farmers face recurrence of FMD even after vaccination. The department could not resolve the issue, maintaining that the cold chain is perfectly managed, no gaps were identified with vaccinations and no new FMD strains were identified. However, there is a need to study the issue in a systematic way, including vaccine production, procedures, and storage, as well as re-examination of the FMD strain typology and analysis of efficacy.

Infertility and repeat breeding problems are on the rise. Several contributing factors were reported and may need further examination:

- Increased exotic blood level due to non-adherence of breeding policy coupled with poor management of animals by farmers;
- Increased heat stress that changes the reproductive physiology of the animal, including an in-depth study to analyse heat tolerance levels of crossbreds with different blood levels;
- Mineral deficiency;
- Unhygienic procedures and adoption of poor techniques by AI workers; and
- Frequent attacks of FMD and theileriosis as predisposing factors for infertility.

Scope for ILRI: Considering the high cost of feed there is a need to develop a participatory technology development (PTD) approach to develop low-cost feeding strategies and try them in the field. Except for a few households in a village that cultivate fodder, most farmers feed local grasses at a level of 95%. If dry fodder is included, it may be 5–30% but varies with animal and conditions—pregnant or milk-giving stage, agroclimatic condition, etc. Understanding the importance of these local grass species in feeding dairy animals is important to identify potential and further use as fodder.

Large numbers of small-scale processors produce different cottage products that can be supported through promotion of technologies that enhance product quality. Support can be planned in partnership with other institutions and private companies, including local fabricators. The local fabricator may be able to support decentralized processing equipment, including best practices related to hygienic processing. This would enhance the quality of milk products and also reduce losses from spoilage often encountered by village-based cottage processors.

Conclusions

An increasing population and higher consumption are combining to boost the demand for milk in India. The rise in consumption is attributed to an increase in consumer purchasing power. Demand for milk products such as paneer and ice cream has also increased.

Steady growth in milk production rose to 127 million tonnesin 2010–11, with per capita availability at 267 g/day. Most milk (90%) is produced in rural areas, small-scale and marginal farmers produce 70% of the nation's milk, and are 80% of all dairy farmers.Womenare71% of the dairy labour force.

India is able to meet its requirement for milk and milk products, but with liberalization (removal of quantitative restrictions), there is an emerging trend for exports, while imports are driven by demand for milk products. Nonetheless, there is always a concern if India will be able to meet future demand for milk and milk products.

The increase in milk production is attributed to breeding programs and institutional efforts in cooperatives. Artificial insemination increased the share of milk from crossbred cows from 14.2% in 1991–92 to 22.9% in 2009–10. However, low productivity continues to be key concern that could be addressed by:

- Further strengthening institutions related to breeding, including partnerships with private agencies and doorstep delivery of AI services;
- Emphasising both research and extension related to production and use of feed and fodder;
- Regulating and institutionalizing veterinary health services provided by individuals;
- Supporting educated youth belonging poor families to take up dairy as an enterprise activity; and
- Encouraging both cooperatives and the private sector to focus on rainfed areas.

In addition to these initiatives, there is a need for production sanitation at the farmer level and support forthe informal milk sector.

Key Issues related to dairying in India include:

- Increasing cost of milk production due to the high cost of concentrate feeds and lack of fodder;
- Concern for milk quality;
- Lack of veterinary knowledge and services as well as wrong prescriptions and use of antibiotics and hormones by private practitioners;
- Reported incidence of foot and mouth disease (FMD) and mastitis in crossbred animals;
- Inability of the government extension system to reach farmers;
- Inadequate access to credit and insurance services;

- Negative effects of climate change on total milk production has been estimated at 1.6 million tonnes of milk annually by 2020;
- Decline in milk production and reproductive efficiency will be highest in cattle, then buffaloes; and
- Global warming is likely to increase the incidence of animal diseases, particularly viral and protozoal diseases, especially in crossbred cattle.

Further attempts to enhance productivity would be affected by availability of water, fodder, and feeds, climate change; control of animal diseases; and food safety measures. The National Livestock Policy 2013 emphasises a focus on developing indigenous milk breeds to benefit smallholder milk-producing farmers.

On the other hand, due to the rise in per capita income levels and shifts in food preferences, milk has become one of the most important commodities in the human food chain. TheGOI projects that milk demand is likely to be 180 million tonnes by 2021.To meet projected requirements, productivity needs to grow at 5.5% annually over the next decade. If India fails to achieve this growth, significant imports will be inevitable. Increased production can be achieved by increasing the number of quality animals and improving productivity.

This situation could be a severe setback to rural families who derive income and employment from the livestock sector. To face these emerging challenges India created the NDP.

Assam

In Assam, milk is mostly produced in integrated crop–livestock systems. Per capita availability is low (76 grams/day), and most of the demand is met from Bihar and West Bengal. Dairy is an important activity, although small. Supporting milk production in the state fits into a pro-poor livestock development component. In Assam these small producers can be integrated with informal stakeholders such as processors and vendors along the diary value chain. Considering inadequate surplus milk in rural areas, there is limited scope for intervention by the organized sector, but more opportunities for the private sector.

Bihar

Bihar is in the ninth position in national milk production. Traditionally, farmers rear dairy animals for self-consumption (49% retained in villages). Surplus milk pockets are mostly concentrated in irrigated and flood-prone areas. In Bihar there is enormous scope for smallholders with quality animals and some green fodder (cultivation) for viable dairy enterprises.

COMFED has demonstrated market opportunities and facilitates related input supplies and capacity building for its producers. But despite these accomplishments, 80% of the marketable surplus is marketed through informal channels. There is an enormous scope to organize these informal channels with COMFED.

There is a need to reform the informal sector, which can be achieved by promoting decentralized technologies (including equipment) related to processing and promoting best practices related to quality improvement in vending and cottage processing.

Annexes

Annex 1. Literature reviewed

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Annex 2. Key informants

Bihar State

1. Farmers (individual and group), Vendors, Traditional Processor, Input Suppliers, Small Hotels/Sweet Shops,Private AI cum Health Service Providers—linked to 4 clusters in 2 districts
2. COMFED—State and District level
3. Animal Husbandry Department

a. BLDA, District Officials,

4. Dairy Development Department
5. Veterinary College—Extension Department
6. Dairy Science College
7. Private Dairy
8. Department of Health—Food Safety
9. NRLM/Jeevika
10. NABARD—State and District level
11. SAMETI
12. BAIF, JK Trust
13. ICAR—Eastern Region Centre

Assam state

1. AAU; Director Research
2. Director, Dairy Development; AACP;
3. Animal Husbandry Department; ALDA; NE Disease Diagnostic Laboratory; Veterinary Biological Institute
4. Public Health Department; Food Safety Analyst
5. Producers Association Representative

6. NABARD
7. Nutrition Department; Veterinary College
8. Animal Genetics; Veterinary College
9. Livestock Corporation
10. Cattle Feed Manufacturing Unit—Delux
11. Prthvi Dairy
12. Purabi Dairy/WAMUL

Annex 3. Household demographics (all-India)

Estimated number of households and persons by sex, and average monthly per capita expenditure for each decile

Decile class ofMPCE (URP)	Estimated no. (00)						Sex ratio	Average MPCE (Rs.)	Sample households	Sample Persons
	Households	Adults		Children		Persons				
		Male	Female	Male	Female					
All-India										Rural
1	133558	217990	223106	165031	155023	761150	987	377.06	3153	18234
2	135892	225592	228392	159718	147506	761207	976	495.82	3439	19642
3	144802	241452	233244	148281	138067	761043	953	575.69	3974	21851
4	148923	246648	244908	140788	128842	761186	965	649.25	4310	23249
5	157828	259421	253957	131549	116238	761165	947	724.02	5033	26210
6	161690	263187	256598	132894	108550	761229	922	808.34	5239	26620
7	167374	271872	266395	119723	103921	761910	946	910.15	6396	31721
8	172424	278817	268454	112930	99877	760078	940	1053.30	7121	34137
9	185614	295269	276893	105026	84173	761361	902	1288.78	8665	38990
10	216831	318721	287749	88397	66327	761194	870	2394.66	11789	46485
All classes	1624934	2618968	2539696	1304335	1148524	7611523	940	927.70	59119	287139
Sample no.	59119	101156	98413	46543	41027	287139	–	–	–	–
All-India										Urban
1	48570	87556	86203	54606	53835	282201	985	521.32	4537	26017
2	53851	94731	90914	48693	48007	282345	969	722.31	3521	18848
3	55358	99060	95375	45969	41708	282113	945	869.62	3381	17566
4	59766	100984	99171	42310	39708	282173	969	1027.93	3593	17693
5	63087	104635	100456	42982	34193	282266	912	1207.69	3622	16838
6	66144	110117	102664	37246	32097	282123	914	1420.07	3934	17251
7	71658	114004	102921	36853	28403	282180	871	1687.74	4014	16482
8	78076	119413	103715	32434	26727	282289	859	2051.45	4703	17851
9	83124	119661	107404	30857	24503	282424	876	2680.52	5190	17913
10	101823	127899	108919	23642	21435	281894	860	5673.16	5241	14953
All classes	681457	1078059	997742	395591	350617	2822009	915	1785.81	41736	181412
Sample no.	41736	67873	64803	25705	23031	181412	–	–	–	–

Annex 3a. Household demographics (Assam and Bihar, rural)

Estimated number of rural households and persons by sex, and average monthly per capita expenditure for each decile

Decile class ofMPCE (URP)	Estimated no. (00)						Sex ratio	Average MPCE (Rs.)	Sample households	Sample Persons
	Households	Adults		Children		Persons				
		Male	Female	Male	Female					
Assam										
1	4375	7307	7629	5232	5054	25222	1011	432.46	184	1054
2	4475	8302	7573	5086	4376	25338	892	522.78	212	1207
3	4396	7627	7107	6859	3784	25377	752	585.82	209	1162
4	4908	8946	8835	4375	2968	25124	886	641.44	236	1252
5	4774	9354	8230	4302	3474	25358	857	704.28	254	1346
6	4646	9072	8726	3523	3836	25158	997	772.05	237	1296
7	5003	8714	8730	4427	3406	25277	923	866.41	237	1233
8	4947	9091	8330	4530	2996	24947	831	970.54	278	1428
9	5257	9266	9463	3411	3483	25624	1021	1154.36	349	1767
10	5967	9951	9582	3124	2581	25238	930	1983.42	420	1895
All classes	48748	87630	84205	44870	35957	252662	907	863.47	2616	13640
Sample no.	2616	4894	4551	2350	1845	13640	–	–	–	–
Bihar										
1	10517	19250	17020	20301	18960	75531	910	327.22	171	1193
2	12439	20982	18649	17567	18166	75364	955	420.33	214	1318
3	11783	19909	19582	20397	15440	75327	869	470.32	200	1242
4	14146	21852	21186	16890	15783	75711	954	526.21	303	1714
5	13827	24475	19482	17567	13769	75292	791	588.81	318	1822
6	14556	23536	22862	14589	14555	75542	981	646.82	282	1591
7	15349	22558	22180	16066	14545	75349	951	715.84	368	1983
8	14624	25054	21792	17152	12033	76030	801	803.76	314	1714
9	16560	26212	22814	13282	12639	74947	898	928.72	455	2254
10	19202	28798	24012	12336	10294	75439	834	1383.22	674	2785
All classes	143004	232625	209578	166147	146184	754533	892	681.03	3299	17616
Sample no.	3299	5565	5052	3774	3225	17616	–	–	–	–

Annex 3b. Household demographics (Assam and Bihar, urban)

Estimated number of urban households and persons by sex, and average monthly per capita expenditure

Decile class of MPCE (URP)	Estimated no. (00)						Sex ratio	Average MPCE (Rs.)	Sample households	Sample persons
	Households	Adults		Children		Persons				
		Male	Female	Male	Female					
Assam										Urban
1	587	821	872	857	338	2888	721	511.05	128	670
2	579	1009	930	527	417	2884	877	694.04	77	377
3	620	1141	875	481	416	2913	796	820.29	67	333
4	556	1119	1014	407	316	2855	872	966.58	78	383
5	611	1114	1064	448	270	2895	854	1167.74	82	384
6	668	1188	1031	411	244	2874	798	1393.54	98	428
7	686	866	1347	406	239	2858	1246	1654.65	63	256
8	807	1315	996	363	257	2930	747	1933.07	76	280
9	638	1390	973	268	228	2859	724	2428.62	94	309
10	1076	1710	741	202	238	2891	512	3833.78	69	182
All classes	6826	11673	9841	4369	2964	28847	798	1540.27	832	3602
Sample no.	832	1311	1273	564	454	3602	–	–	–	–
Bihar										Urban
1	1263	2698	2234	1933	1739	8604	858	396.13	155	1096
2	1353	2302	1931	2168	2015	8416	883	500.06	79	492
3	1611	2517	2315	1999	1731	8562	896	591.27	124	690
4	1573	3087	2580	1179	1582	8428	976	712.82	83	474
5	1564	2680	2824	1715	1386	8605	958	788.40	112	595
6	1567	3317	2721	1255	1150	8442	847	903.23	86	420
7	1708	3301	2932	1189	1089	8510	895	1048.17	121	574
8	1941	3027	2865	1435	1351	8678	945	1261.35	123	508
9	2364	3351	2825	633	1337	8146	1045	1629.74	129	498
10	3145	4364	2689	1045	807	8905	646	3024.60	260	797
All classes	18089	30644	25916	14550	14186	85295	887	1092.33	1272	6144
Sample no.	1272	2142	1837	1168	997	6144	–	–	–	–

Annex 4. Value of consumption (all-India)

All-India (rural)—Value of consumption (Rs.) of broad groups of food and non-food items per person for a period of 30 days for each decile of monthly per capita expenditures using a reference period of 30 days for all items

item	Decile class of MPCE (URP)											no. Of hhs reporting consumption	
	1	2	3	4	5	6	7	8	9	10	all classes	per 1000hhs	Insample
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Food													
cereal	104.69	121.26	130.76	135.26	141.99	145.61	155.89	159.48	171.50	184.51	145.09	985	58788
gram	0.54	0.93	1.04	1.09	1.26	1.40	1.55	1.54	2.16	3.30	1.48	217	14695
Cereal substitutes	0.06	0.19	0.23	0.30	0.47	0.63	0.65	1.06	1.21	1.83	0.66	81	5290
pulses and pulse products	18.89	24.20	26.65	28.32	32.42	33.86	36.45	41.25	45.32	54.91	34.23	969	57510
milkand milk products	15.35	25.76	38.78	50.00	60.63	73.49	87.56	108.74	136.50	204.78	80.16	797	48679
sugar	9.71	13.98	16.14	18.24	20.42	22.51	24.87	27.38	32.01	41.05	22.63	959	57544
salt	1.58	1.73	1.79	1.82	1.98	2.02	2.14	2.28	2.46	2.74	2.05	982	58671
Edibleoil	20.18	25.43	27.64	30.29	32.94	34.81	37.52	39.25	43.41	49.99	34.15	982	58384
eggfish and meat	10.75	16.60	19.88	24.20	27.22	30.86	35.52	38.88	46.12	72.57	32.26	619	39790
vegetables	34.34	42.66	47.29	49.87	54.60	57.29	61.38	65.73	72.64	86.19	57.20	984	58733
Fruits(fresh)	2.23	4.00	5.32	6.42	7.49	10.04	11.75	14.89	19.39	36.04	11.76	729	46115
Fruits(dry)	0.54	0.98	1.41	1.93	2.03	2.67	2.93	4.69	5.01	8.95	3.12	300	17653
spices	11.62	14.55	16.08	17.54	19.46	20.25	21.91	24.03	26.12	31.20	20.28	983	58582
Beveragesetc.	20.08	30.09	33.97	38.37	42.79	47.12	49.11	56.03	68.18	134.53	52.03	984	58533
total:food	250.56	322.36	366.97	403.65	445.69	482.53	529.25	585.25	672.03	912.60	497.09	1000	59113
Non-food													
Pan	1.02	1.65	2.28	2.74	3.30	2.93	4.07	3.49	4.20	4.59	3.03	249	16811
tobacco	5.10	6.75	7.81	9.21	10.54	11.32	11.89	12.77	14.87	17.39	10.76	592	33892
intoxicants	3.17	3.35	3.38	4.29	5.47	4.94	7.10	8.71	9.94	17.69	6.80	165	10751
pan,tobacco and intoxicants	9.28	11.75	13.47	16.23	19.31	19.20	23.06	24.98	29.01	39.67	20.60	676	39860
Fuel and light	50.20	60.69	68.20	73.41	80.40	86.90	94.39	103.26	116.27	144.20	87.79	998	59072
clothing	8.74	14.66	18.86	24.78	26.54	37.04	40.83	56.25	73.67	153.71	45.51	455	29180
footwear	1.92	3.41	3.49	5.05	5.71	8.06	8.28	12.28	14.52	29.78	9.25	291	19427
education	3.58	6.38	9.20	11.39	12.90	16.20	21.42	27.13	40.98	115.88	26.51	448	29809
Medical(inst.)	0.08	0.39	0.15	1.02	0.66	0.98	2.23	5.12	8.96	120.13	13.97	18	1486
Medical(non-inst.)	9.92	14.70	18.91	21.53	25.23	29.11	38.64	44.03	66.43	124.13	39.26	678	40577
entertainment	0.96	2.36	3.25	4.00	5.09	6.51	8.07	11.61	15.10	25.00	8.20	352	24875
Minor durable goods	0.74	0.94	1.17	1.57	1.84	2.26	2.05	3.36	4.18	7.32	2.54	181	12485
Toiletarticles	11.22	14.03	16.39	17.91	20.50	21.84	24.89	28.07	32.51	44.28	23.16	995	58926
Otherhh. consumables	9.02	11.80	13.77	15.13	17.46	19.38	21.52	24.85	29.16	41.17	20.33	993	58812
Consumer services	12.24	17.96	22.30	26.77	31.75	37.81	43.07	54.30	70.33	128.16	44.47	975	57500
conveyance	5.57	9.29	12.68	16.33	20.00	26.19	32.59	43.88	66.40	142.66	37.56	804	50034

Rent	0.14	0.15	0.60	0.74	1.00	0.90	1.92	3.88	6.33	32.24	4.79	71	4971
Taxes and cesses	0.47	0.70	1.00	1.24	1.57	1.94	2.27	3.09	3.98	6.41	2.27	385	23887
Durable goods	2.41	4.25	5.27	8.50	8.38	11.50	15.66	21.99	38.90	327.31	44.42	351	20572
total non-food	126.50	173.46	208.72	245.60	278.34	325.81	380.91	468.05	616.74	1482.05	430.62	1000	59118
Total expenditure	377.06	495.82	575.69	649.25	724.02	808.34	910.15	1053.30	1288.78	2394.66	927.70	1000	59119
Cooked meals received asassistance or payment*	8.65	12.85	13.10	13.57	14.12	14.09	12.38	11.44	11.22	15.00	12.64	242	13013
clothing:2nd hand$	0.24	0.14	0.13	0.17	0.21	0.30	0.28	0.22	0.31	0.30	0.23	8	1110
footware:2nd hand@	0.00	0.02	0.11	0.01	0.02	0.04	0.10	0.04	0.10	0.10	0.05	2	167
Booksetc:2nd hand**	0.08	0.03	0.06	0.09	0.14	0.06	0.21	0.35	0.30	0.43	0.18	6	446
Durablegoods: 2nd hand#	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.20	0.02	4	173

*included nthe'beveragesetc.'component of total food

$included in the'clothing' component of total non-food

@included in the'footwear'component of tota lnon-food

**included in the'education'component of total non-food

#included in the'durable goods'component of total non-food

Annex 5. Value of consumption (rural Assam)

Assam (rural)—Value of consumption (Rs.) of broad groups of food and non-food items per person for a period of 30 days for each decile of monthly per capita expenditures using a reference period of 30 days for all items

item	Decile class of MPCE (URP)											no.of hhs reporting consumption	
	1	2	3	4	5	6	7	8	9	10	All classes	per 1000hhs	In sample
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Food													
cereal	143.03	173.13	174.85	195.00	206.56	207.05	209.02	230.96	239.75	252.08	203.15	1000	2616
gram	0.37	0.53	0.32	0.52	0.39	0.46	0.39	0.36	0.60	3.46	0.74	110	310
Cereal substitutes	0.00	0.00	0.00	0.00	0.00	0.14	0.28	0.08	0.00	0.03	0.05	5	8
pulses and pulse products	18.60	17.76	24.07	22.49	25.13	27.28	31.57	39.16	41.60	51.90	29.96	977	2557
Milk and milk products	6.35	13.00	10.15	21.32	31.28	42.17	41.13	49.00	53.72	82.57	35.06	719	2013
sugar	7.49	8.22	8.48	10.35	11.93	12.43	13.12	14.61	16.40	20.11	12.32	989	2589
salt	2.46	2.30	2.42	2.49	2.38	2.70	2.49	2.84	3.03	3.67	2.68	998	2613
Edible oil	20.30	22.51	24.11	26.19	28.57	27.90	30.07	33.59	36.98	44.67	29.49	999	2611
Egg fish and meat	33.59	47.28	45.16	57.60	62.42	76.27	92.16	102.67	119.34	178.88	81.54	994	2606
vegetables	45.46	48.65	52.61	57.21	57.54	59.95	61.50	69.58	81.82	120.15	65.46	999	2611
Fruits(fresh)	1.84	3.58	3.50	4.92	5.80	7.91	8.78	11.16	14.51	28.16	9.02	775	2077
Fruits(dry)	0.10	0.17	0.27	0.43	0.28	0.22	0.44	0.53	0.64	2.20	0.53	120	366
spices	8.89	10.11	10.64	12.11	14.29	13.57	13.16	15.92	16.44	20.62	13.58	999	2611
Beverages etc.	17.84	26.47	32.13	31.37	33.24	47.23	45.60	48.11	60.74	82.37	42.52	997	2608
Total food	306.33	373.71	388.71	441.98	479.82	525.28	549.73	618.57	685.56	890.85	526.09	1000	2616
Non-food													
Pan	5.85	7.24	9.17	9.66	11.29	15.98	18.47	25.66	20.70	20.56	14.45	903	2347
tobacco	3.46	4.88	6.05	5.75	6.64	6.82	7.98	7.27	8.43	12.77	7.01	798	2005
intoxicants	2.62	2.63	3.92	3.10	4.40	4.48	5.10	5.26	9.21	18.99	5.98	257	663
Pan, tobacco and intoxicants	11.94	14.75	19.15	18.51	22.32	27.28	31.55	38.20	38.35	52.32	27.43	957	2489
Fuel and light	56.08	59.21	70.55	67.93	72.42	74.60	89.44	92.81	107.34	126.25	81.68	1000	2615
Clothing	10.17	13.64	25.70	24.57	24.93	27.07	48.66	36.19	70.02	157.66	43.90	599	1615
footwear	1.95	1.63	3.95	3.57	5.16	5.61	7.84	8.52	14.07	33.82	8.62	288	772
education	2.47	2.83	4.07	5.35	6.76	7.87	7.83	11.28	24.36	52.28	12.52	514	1406
Medical(inst.)	0.19	0.16	1.38	0.25	0.28	0.40	0.69	0.29	1.32	8.82	1.38	13	40
Medical(non-inst.)	6.39	9.74	6.30	8.14	9.30	11.09	18.73	22.70	27.75	30.01	15.02	684	1849
entertainment	1.70	1.84	1.90	2.37	2.89	2.68	3.49	8.19	14.11	30.22	6.95	325	1035

Minor durable goods	0.76	1.37	2.17	1.71	2.09	2.44	2.76	3.57	7.37	18.76	4.30	251	673
Toilet articles	9.10	11.20	10.77	15.15	15.93	17.02	17.38	21.86	24.54	37.89	18.08	994	2611
Other hh.consumables	8.67	9.27	9.73	12.88	13.89	14.67	16.40	17.67	20.90	31.50	15.56	991	2607
Consumer services	7.38	10.30	14.82	17.20	20.14	25.84	33.88	42.36	49.35	91.07	31.24	955	2533
Conveyance	6.56	7.96	10.36	13.97	15.97	20.33	26.65	28.62	39.94	77.32	24.78	905	2405
Rent	0.31	0.49	0.47	0.81	0.49	0.56	0.30	0.93	0.56	1.42	0.63	347	957
Taxes and cesses	0.18	0.18	0.08	0.29	0.38	0.42	0.19	0.38	0.36	0.89	0.33	179	555
Durable goods	2.30	4.51	15.69	6.75	11.50	8.88	10.88	18.39	28.46	342.33	44.95	350	903
Total non-food	126.13	149.07	197.10	199.46	224.46	246.77	316.68	351.97	468.81	1092.56	337.38	1000	2616
Total expenditure	432.46	522.78	585.82	641.44	704.28	772.05	866.41	970.54	1154.36	1983.42	863.47	1000	2616
Cooked meals received as asstance or payment*	2.78	8.38	8.31	5.16	6.72	9.96	5.62	4.81	11.83	7.46	7.12	141	352
clothing:2nd hand$	0.22	0.59	0.30	0.85	0.90	0.44	4.25	0.35	0.68	0.19	0.88	26	61
footware:2nd hand@	0.00	0.00	0.00	0.11	0.37	0.10	0.08	0.18	0.12	0.20	0.12	5	10
booksetc:2nd hand**	0.06	0.14	0.73	0.47	0.01	0.04	0.01	0.00	0.06	0.14	0.17	12	29
Durablegoods: 2nd hand#	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	3

*includedinthe'beverages,etc.'componentoftotalfood

$included int he'clothing'component of total non-food

@included in the'footwear'component of total non-food

**included in the 'education'component of total non-food

#includedinthe'durable goods'component of total non-food

Annex 6. Value of consumption (rural Bihar)

Bihar (rural)—Value of consumption (Rs.) of broad groups of food and non-food items per person for a period of 30 days for each decile of monthly per capita expenditures using a reference period of30 days for all items

item	Decile class of MPCE (URP)											no. Of hhs reporting consumption	
	1	2	3	4	5	6	7	8	9	10	All classes	per 1000hhs	In sample
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Food													
cereal	124.25	151.79	149.71	156.88	166.26	162.70	178.87	171.16	191.62	204.42	165.75	999	3291
Gram	0.54	1.10	1.91	1.96	2.05	2.02	2.27	3.10	2.28	3.24	2.05	266	903
Cereal substitutes	0.01	0.01	0.00	0.00	0.00	0.04	0.07	0.00	0.06	0.10	0.03	9	17
pulses and pulse products	13.64	17.39	20.08	21.29	23.14	23.62	29.20	29.21	33.25	40.99	25.18	988	3253
Milk and milk products	11.53	12.44	21.87	29.10	37.66	48.76	62.37	79.37	86.96	134.75	52.48	775	2751
Sugar	5.19	6.49	8.21	9.92	10.06	10.41	13.60	15.40	17.25	22.41	11.89	954	3179
Salt	1.56	1.73	1.94	1.93	2.05	1.97	2.28	2.45	2.43	2.85	2.12	997	3286
Edible oil	17.64	20.93	25.83	27.68	26.81	27.41	33.51	37.24	38.04	44.19	29.93	999	3286
Egg, fish and meat	7.14	9.23	11.95	14.79	17.80	18.50	19.76	24.66	26.25	33.18	18.32	710	2286
vegetables	31.13	39.37	44.79	48.78	55.02	54.38	62.61	62.96	68.77	87.16	55.49	997	3286
Fruits(fresh)	0.95	1.76	3.11	3.03	5.08	4.88	5.28	11.64	10.16	19.44	6.53	586	2124
Fruits(dry)	0.03	0.06	0.28	0.38	0.54	1.11	0.68	1.24	1.62	5.29	1.12	155	725
Spices	7.97	10.86	13.61	14.10	15.73	15.82	17.23	17.76	20.08	24.40	15.75	997	3285
Beverages etc.	7.62	12.84	18.03	16.16	22.34	23.15	27.52	26.69	32.79	57.11	24.42	942	3179
Total food	229.19	286.01	321.31	346.00	384.53	394.79	455.23	482.87	531.56	679.54	411.06	1000	3299
Non-food													
Pan	0.30	0.40	0.71	1.44	1.48	3.09	1.48	2.88	3.45	8.35	2.36	225	864
Tobacco	2.92	3.02	4.97	3.89	4.93	5.19	5.65	4.33	6.10	6.22	4.72	745	2307
intoxicants	1.94	3.24	2.59	2.80	2.97	3.60	2.36	2.03	1.97	3.25	2.67	169	510
pan, tobacco and intoxicants	5.17	6.66	8.27	8.13	9.38	11.88	9.50	9.24	11.52	17.82	9.75	805	2557
Fuel and light	43.49	55.58	58.79	63.85	67.18	66.29	76.63	73.99	85.42	109.10	70.02	999	3296
Clothing	10.36	15.29	15.43	29.18	32.71	47.95	39.46	74.12	80.91	133.08	47.85	596	1978
Footwear	2.37	2.37	3.58	4.65	3.99	5.75	5.22	10.55	12.68	23.83	7.50	349	1153
education	3.02	3.36	4.64	6.04	7.10	14.42	12.97	17.00	21.31	48.14	13.80	480	1765
Medical(inst.)	0.01	0.00	0.00	0.00	0.04	2.46	0.28	0.59	8.45	22.58	3.44	10	44
Medical(non-inst.)	7.21	11.35	11.84	14.37	17.10	22.95	26.94	24.02	37.56	56.29	22.95	732	2487
entertainment	0.33	0.38	0.82	0.71	1.38	2.02	1.62	2.15	3.49	12.72	2.56	235	956
Minor durable goods	0.82	1.40	1.78	1.96	2.70	3.12	2.95	4.76	4.53	11.52	3.55	303	1079

Toilet articles	6.50	9.81	10.89	12.96	15.34	15.79	19.24	18.41	25.76	33.88	16.85	997	3287
Other hh.consumables	5.53	8.02	8.63	10.72	12.58	12.60	15.64	15.25	18.30	25.03	13.23	995	3282
Consumer services	9.81	14.81	16.03	18.21	23.69	29.09	34.79	37.25	52.33	93.27	32.92	984	3257
conveyance	2.52	3.39	4.18	4.53	5.52	6.40	8.55	15.55	18.57	50.65	11.98	619	2226
Rent	0.00	0.02	0.01	0.05	0.17	0.00	0.00	0.01	0.16	4.08	0.45	16	46
Taxes and cesses	0.01	0.00	0.00	0.01	0.00	0.02	0.00	0.02	0.00	0.32	0.04	5	26
Durable goods	0.87	1.90	4.12	4.84	5.40	11.27	6.80	17.98	16.18	61.37	13.07	360	1277
Total non-food	98.03	134.32	149.00	180.20	204.28	252.03	260.61	320.88	397.16	703.69	269.97	1000	3299
Total expenditure	327.22	420.33	470.32	526.21	588.81	646.82	715.84	803.76	928.72	1383.22	681.03	1000	3299
Cooked meals received as assistance or payment*	0.64	3.86	4.61	3.16	7.23	6.61	7.20	6.70	9.23	21.05	7.03	143	432
clothing:2nd hand$	0.92	0.00	0.00	0.00	0.03	0.07	0.00	0.00	0.02	0.07	0.11	5	10
footware:2nd hand@	0.00	0.01	0.00	0.00	0.46	0.00	0.00	0.00	0.06	0.16	0.07	4	9
Booksetc:2nd hand**	0.00	0.62	0.03	0.00	0.01	0.00	0.18	0.00	0.13	0.48	0.15	6	22
Durablegoods: 2nd hand#	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	1	5

*included in the'beveragesetc.'component of total food

$included in the 'clothing'component of total non-food

@included in the 'footwear'component of total non-food

**included in the' education'component of total non-food

#included in the 'durable goods'component of total non-food

Annex 7. Value of consumption (all-India, urban)

All-India (urban) —Value of consumption (Rs.) of broad groups of food and non-food items per person for a period of30 days for each decile of monthly per capita expenditures using a reference period of 30 days for all items.

Item	Decile class of MPCE (MMRP)											no.of hhs reporting consumption	
	1	2	3	4	5	6	7	8	9	10	all classes	per 1000hhs	in sample
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Food													
Cereal	110.86	128.73	138.25	145.52	153.57	166.93	171.84	188.09	196.30	211.62	161.17	935	40155
Gram	0.79	1.10	1.45	1.68	1.64	2.15	2.51	2.69	3.05	3.57	2.06	275	11456
Cereal substitutes	0.18	0.29	0.47	0.61	0.78	0.88	1.15	0.87	1.20	1.22	0.77	88	3280
pulses and pulse products	24.38	30.70	35.46	39.70	45.28	48.91	52.70	58.68	64.19	70.55	47.06	926	39520
milk and milk products	35.59	57.63	72.67	97.62	115.48	131.02	158.88	179.98	226.78	294.48	137.01	880	36320
Sugar	15.80	19.68	22.27	24.51	26.38	28.06	30.14	31.31	35.43	38.05	27.16	924	39459
Salt	1.61	1.92	2.00	2.11	2.26	2.47	2.57	2.68	2.76	2.96	2.33	931	40010
Edibleoil	27.42	35.10	41.72	45.54	49.08	53.19	57.38	63.66	74.94	80.51	52.85	930	39850
Egg, fish and meat	21.38	35.07	50.12	55.33	62.43	76.18	82.91	89.94	103.11	143.37	71.98	514	24272
vegetables	59.68	74.81	85.92	94.09	101.72	112.44	120.10	132.34	157.13	186.10	112.44	932	40030
Fruits(fresh)	6.85	13.67	20.10	24.67	34.10	41.51	51.02	63.74	90.55	157.06	50.33	777	31590
Fruits(dry)	1.45	3.04	4.53	5.58	8.09	9.35	11.59	15.36	22.92	42.41	12.43	344	12899
spices	24.73	31.67	35.61	39.67	42.32	46.44	48.27	51.85	56.01	62.01	43.86	929	39848
Beveragesetc.	39.37	57.42	72.68	82.64	97.93	115.60	147.96	178.14	250.80	551.17	159.37	996	41412
total:food	370.11	490.83	583.25	659.27	741.06	835.11	939.01	1059.33	1285.18	1845.08	880.83	1000	41690
Non-food													
Pan	2.26	3.30	3.64	4.75	3.91	4.76	4.00	3.59	4.94	5.55	4.07	140	8192
tobacco	8.92	10.13	12.22	12.95	13.61	15.02	16.02	16.01	17.96	27.75	15.06	344	16025
intoxicants	2.89	5.09	5.49	7.75	9.65	8.00	9.42	12.08	13.95	38.91	11.32	77	3860
Pantobacco and intoxicants	14.07	18.52	21.35	25.45	27.16	27.77	29.44	31.67	36.86	72.21	30.45	425	20074
Fuelandlight	63.58	82.23	93.68	105.55	114.23	129.81	142.52	160.80	197.49	287.27	137.72	991	41518
Clothing	35.78	46.99	55.75	65.39	73.73	83.16	97.31	115.14	144.53	244.22	96.20	997	41547
Footwear	6.19	8.03	9.73	11.74	14.12	15.77	19.04	23.41	29.93	52.61	19.06	989	41151
education	14.60	27.36	33.23	50.96	74.27	87.44	132.29	173.01	265.17	746.69	160.51	729	30854
Medical(inst.)	2.68	5.81	7.90	12.28	15.02	20.57	25.45	33.13	50.56	190.28	36.37	144	6456
Medical(non-inst.)	14.27	21.97	28.98	37.60	39.76	51.24	56.15	79.49	100.03	197.37	62.69	646	27535
entertainment	4.48	9.75	13.89	17.71	22.98	27.18	32.90	40.32	53.57	94.25	31.70	678	27669
Minordurablegoods	0.63	1.05	1.30	1.91	2.17	2.98	3.77	4.71	8.28	15.43	4.22	135	7581
Toiletarticles	15.23	20.98	25.30	29.64	34.85	39.01	45.44	52.94	65.91	96.07	42.54	996	41571

Other hh.consumables	12.18	16.74	20.30	24.05	27.55	31.25	36.25	43.86	55.87	75.57	34.36	992	41395
Consumer services	19.65	30.47	40.38	52.26	64.62	78.14	102.98	138.84	208.60	504.97	124.09	987	40858
conveyance	8.86	19.50	27.54	39.97	59.37	73.99	108.91	139.78	209.90	429.62	111.75	874	35576
Rent	6.55	15.26	25.66	33.13	50.06	75.42	93.04	141.77	180.28	528.57	114.98	373	13336
Taxesandcesses	2.99	4.38	6.12	8.51	10.50	12.32	15.22	19.17	25.69	51.48	15.64	583	24605
Durablegoods	7.41	11.09	17.48	20.67	26.54	42.24	51.22	72.50	132.85	431.54	81.36	784	32558
total:non-food	229.16	340.13	428.59	536.81	656.93	798.31	991.94	1270.54	1765.52	4018.17	1103.63	1000	41694
Total expenditure	599.27	830.963.42	1011.84	1196.08	1397.99	163	1930.96	2329.87	3050.69	5863.25	1984.46	1000	41697
Cooked meals received asassistance or payment*	9.42	10.48	10.51	8.03	6.90	7.23	7.44	9.76	12.24	17.86	9.99	83	3837
clothing:2nd hand$	0.49	0.32	0.68	0.26	0.31	0.28	0.18	0.28	0.17	0.13	0.31	33	2991
footware:2nd hand@	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	6	526
Booksetc:2nd hand**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	2392
Durablegoods:2nd hand#	0.20	0.25	0.37	0.52	0.82	1.00	2.18	2.16	2.57	30.75	4.08	18	683
imputed rent***	98.06	129.58	150.95	202.10	233.30	269.13	348.42	416.39	658.07	1363.08	386.92	644	28590

Annex8. Value of consumption (urban Assam)

Assam (urban)—Valueof consumption (Rs.) of broad groups of food and non-food items per person for a period of 30 days for each decile of monthly per capita expenditures using a reference period of 30 days for all items

item	Decile class of MPCE (URP)											no.of hhs reporting consumption	
	1	2	3	4	5	6	7	8	9	10	All classes	per 1000hhs	In sample
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Food													
cereal	166.43	189.23	191.59	206.14	236.20	226.69	230.26	219.44	269.33	294.37	222.91	993	821
gram	0.29	0.72	0.62	0.51	0.75	0.29	0.48	0.84	2.17	0.97	0.76	166	121
Cereal substitutes	–	–	–	——			–	–	–	–	–	–	0
pulses and pulse products	17.15	24.38	28.63	34.36	36.08	45.89	50.16	57.98	60.36	84.62	43.96	971	811
milk and milk products	5.66	14.70	25.29	32.67	48.03	62.57	70.76	97.18	96.62	143.42	59.71	815	662
sugar	8.84	9.97	10.48	13.22	14.84	16.07	15.35	18.95	20.61	21.68	15.00	969	810
salt	2.22	2.47	2.71	3.07	3.00	3.31	3.88	3.51	3.65	4.25	3.21	992	819
Edibleoil	19.87	28.38	30.10	38.43	42.33	46.78	46.73	50.59	62.66	69.37	43.51	990	819
Egg, fish and meat	39.11	76.64	74.33	82.30	103.49	124.66	195.22	171.13	325.08	367.10	155.77	975	801
vegetables	48.52	62.54	65.32	74.39	80.28	97.67	110.69	107.31	147.25	165.19	95.87	991	818
Fruits(fresh)	3.18	6.56	5.75	11.89	15.34	26.87	26.64	38.89	60.33	90.85	28.62	854	682
Fruits(dry)	0.11	0.18	0.37	0.73	1.57	2.79	4.30	7.62	4.28	33.78	5.58	339	197
Spices	9.37	15.00	14.66	13.65	16.92	19.19	22.63	24.39	29.01	38.67	20.35	991	818
Beveragesetc.	24.93	29.27	39.06	45.83	60.33	70.42	72.95	99.93	119.83	252.86	81.57	992	828
Total food	345.69	460.06	488.91	557.21	659.17	743.19	850.05	897.76	1201.18	1567.10	776.82	1000	832
Non-food													
Pan	6.69	8.06	9.08	11.91	14.54	17.55	13.37	13.89	21.37	33.33	14.97	735	638
Tobacco	3.31	5.35	5.59	8.06	15.08	16.16	11.41	11.78	26.12	46.76	14.95	637	544
intoxicants	0.52	1.44	0.70	3.92	4.43	3.77	6.78	3.67	5.75	3.92	3.48	113	104
pan,tobacco and intoxicants	10.52	14.84	15.37	23.89	34.04	37.48	31.56	29.34	53.24	84.01	33.41	895	739
Fuelandlight	53.18	76.00	90.96	108.15	113.83	130.05	132.00	140.01	158.47	244.43	124.69	994	823
Clothing	18.92	20.52	29.93	37.57	43.42	44.92	92.10	86.34	164.48	136.67	67.41	632	515
Footwear	2.63	2.80	5.53	8.08	6.85	7.41	13.42	20.05	21.85	50.82	13.95	291	227
education	5.96	9.96	15.73	22.83	30.51	70.65	101.03	135.90	92.02	274.41	75.98	709	543
Medical(inst.)	0.00	0.00	0.01	1.24	0.45	2.44	5.26	0.22	7.77	2.46	1.97	16	13
Medical(non-inst.)	5.76	14.29	7.94	12.36	17.91	19.38	35.37	38.00	39.84	103.29	29.42	738	562
entertainment	2.95	7.91	17.17	20.60	39.44	40.64	42.81	49.31	58.42	95.20	37.45	658	512

Minor durable goods	1.85	3.56	1.24	4.26	8.07	5.33	6.39	3.79	17.15	12.37	6.39	243	225
Toiletarticles	12.83	15.33	18.79	23.86	27.05	28.64	46.83	57.31	56.41	123.89	41.11	1000	832
Other hh.consumables	10.52	11.79	19.06	20.88	21.11	25.01	31.65	37.02	47.75	75.56	30.03	1000	832
Consumer services	15.98	18.31	35.54	47.66	76.33	93.97	106.70	135.76	183.95	407.97	112.24	976	812
conveyance	7.85	13.21	19.23	28.91	44.92	55.95	62.48	87.82	133.72	277.74	73.19	919	751
Rent	11.94	19.10	32.53	27.98	26.45	56.86	61.14	119.44	25.30	200.80	58.30	554	395
taxesandcesses	1.85	1.75	3.92	2.36	9.68	10.93	6.23	8.83	7.11	24.04	7.68	392	367
Durablegoods	2.63	4.61	18.44	18.74	8.51	20.69	29.64	86.17	159.95	153.00	50.23	365	283
Total non-food	165.36	233.98	331.38	409.37	508.57	650.35	804.60	1035.31	1227.44	2266.67	763.45	1000	832
Total expenditure	511.05	694.04	820.29	966.58	1167.74	1393.54	1654.65	1933.07	2428.62	3833.78	1540.27	1000	832
Cooked meals received asassistance or payment*	6.72	4.67	3.68	4.05	2.91	0.43	3.08	1.71	0.45	0.00	2.77	40	48
clothing:2nd hand$	0.08	0.04	0.08	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2	5
footware:2nd hand@	–	–	–	——			–	–	–	–	–	–	0
Booksetc:2nd hand**	0.02	0.00	0.00	0.00	0.00	1.18	0.05	0.00	0.85	0.15	0.22	7	10
Durablegoods: 2nd hand#	–	–	–	——			–	–	–	–	–	–	0
Imputedrent***	79.88	100.64	130.98	151.20	256.71	232.56	176.56	188.34	316.97	287.08	191.99	459	483

Annex 9. Value of consumption (urban Bihar)

Bihar (urban)—Value of consumption (Rs.) of broad groups of food and non-food items per person for a period of 30 days for each decile of monthly per capita expenditures using a reference period of 30 days for all items

item	DecileclassofMPCE(MMRP)											no.of hhs reporting consumption	
	1	2	3	4	5	6	7	8	9	10	all classes	per 1000hhs	In sample
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Food													
cereal	144.31	161.93	161.56	180.31	186.78	186.28	186.92	193.85	207.74	225.39	183.49	966	1241
gram	0.72	1.11	2.67	1.84	2.19	1.10	4.38	4.58	3.23	3.29	2.52	255	370
cereal substitutes	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.14	0.02	2	6
pulses and pulse products	15.93	22.47	23.99	25.88	24.25	30.10	32.67	40.04	46.87	59.00	32.07	945	1214
milk and milk products	16.38	35.44	45.67	63.44	49.71	61.45	93.31	122.31	163.33	250.89	90.03	833	1048
sugar	6.78	9.75	11.69	14.75	13.10	14.18	17.42	21.99	29.84	33.63	17.29	927	1187
salt	1.55	1.58	1.74	2.09	2.43	2.08	2.40	2.45	2.73	3.07	2.21	956	1228
edibleoil	20.60	30.30	31.30	39.03	31.45	37.76	51.57	54.56	58.04	86.56	44.07	959	1229
egg fish and meat	8.28	25.10	25.97	28.63	44.71	47.92	59.75	43.22	65.64	111.96	46.06	505	654
vegetables	50.04	61.96	72.07	77.97	93.26	102.25	109.38	111.10	128.08	172.60	97.76	958	1227
fruits(fresh)	1.16	4.85	9.03	4.18	15.43	25.65	22.13	32.98	25.59	88.13	22.81	550	753
fruits(dry)	0.21	0.11	0.25	0.36	0.45	4.28	4.28	12.62	5.23	32.62	6.00	131	274
spices	19.14	25.40	26.70	28.73	33.19	34.38	39.77	35.33	41.66	48.05	33.22	957	1225
Beveragesetc.	22.49	24.70	37.79	37.97	45.32	49.82	71.65	85.66	153.51	246.83	77.42	971	1218
Total food	307.58	404.69	450.43	505.18	542.27	597.28	695.63	760.68	931.50	1362.19	654.97	1000	1270
Non-food													
pan	0.71	1.49	2.86	3.32	3.34	5.82	5.71	5.79	3.50	38.99	7.12	206	331
tobacco	5.13	5.40	7.35	8.07	8.32	7.77	10.14	10.87	9.49	27.14	9.96	569	709
intoxicants	1.16	6.75	2.45	4.52	0.33	1.97	6.91	5.65	6.72	53.93	9.02	99	110
pan,tobacco and intoxicants	7.01	13.64	12.67	15.91	11.98	15.56	22.75	22.32	19.71	120.07	26.11	649	821
Fuel and light	45.84	58.04	65.01	76.82	80.79	90.54	96.00	104.49	133.13	187.03	93.64	993	1254
clothing	24.62	31.24	46.72	41.62	49.03	63.44	71.45	82.76	102.93	178.07	69.01	999	1266
footwear	3.16	4.73	5.43	5.07	6.37	8.12	10.16	14.89	16.97	33.30	10.80	983	1232
education	4.55	11.64	23.23	39.40	44.52	55.52	71.47	99.42	241.15	219.85	80.85	794	969
Medical(inst.)	0.53	1.77	4.55	1.51	5.00	6.93	20.49	7.70	6.26	103.16	15.75	108	112
Medical(non-inst.)	14.43	12.83	20.64	29.20	20.96	32.12	40.73	55.44	38.94	126.43	39.07	738	952
entertainment	0.40	1.58	2.64	2.74	6.29	8.51	10.19	11.58	17.83	47.46	10.89	430	598

Minor durable goods	0.96	1.81	2.80	2.97	2.17	3.90	3.45	3.79	2.85	8.72	3.33	219	385
Toilet articles	7.77	12.48	13.57	15.30	17.30	23.78	23.60	32.73	40.57	58.46	24.49	995	1258
Other hh.consumables	6.36	9.84	13.89	13.08	14.57	19.01	21.56	21.58	27.44	43.04	18.99	993	1258
Consumer services	10.44	24.71	27.13	26.88	39.95	47.68	62.33	67.63	85.08	227.51	61.80	978	1257
conveyance	2.59	3.09	6.18	9.79	12.41	21.26	21.77	45.49	54.70	195.17	37.10	704	866
rent	0.76	1.72	2.46	6.83	40.73	19.19	22.49	49.19	128.97	175.59	44.81	272	237
Taxes and cesses	0.83	0.71	0.49	0.63	0.80	1.40	1.65	1.06	4.16	3.63	1.53	201	264
Durable goods	5.78	6.53	15.17	10.61	12.04	18.65	26.82	31.12	34.35	284.47	44.40	742	979
Total non-food	136.03	196.36	262.58	298.35	364.92	435.60	526.92	651.17	955.03	2011.97	582.57	1000	1270
Total expenditure	443.61	601.05	713.02	803.53	907.19	1032.88	1222.54	1411.85	1886.53	3374.17	1237.54	1000	1270
Cooked meals received asassistance or payment*	1.66	4.55	7.34	3.14	2.48	0.04	5.30	6.22	1.12	5.08	3.71	47	71
clothing:2nd hand$	0.60	0.44	0.08	0.20	0.00	0.03	0.00	0.02	0.00	0.00	0.14	27	52
footware:2nd hand@	0.01	0.02	0.00	0.03	0.00	0.02	0.06	0.01	0.00	0.01	0.02	7	12
Books etc:2nd hand**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	86
Durable goods:2nd hand#	0.07	0.44	0.00	0.10	0.07	0.00	0.04	0.20	0.42	0.24	0.16	16	19
Imputedrent***	70.97	96.96	97.92	128.31	117.61	158.25	205.81	197.44	247.06	462.69	177.93	641	883

Annex 10. India's dairy exports

Composition of India's dairy exports, 2010-11

HSCode	Product	Qty. (in t)	Value (Lacs Rs.)
4021010	Skimmed milk in powder, granules and other sold forms (Fat <1.5%)	11345	15467
4051000	Butter	5497	9649
4059020	Other Ghee	4391	9125
4021090	Other milk powder (Fat < 1.5%)	3287	4161
4059010	Other Butter Oil	1862	3887
4022910	WHOLE MILKÂ (Fat>1.5%)	1371	2276
4059090	Other	1029	1915
4061000	Fresh (unripened/uncured) cheese, incl. whey cheese, and curd	1084	1372
4063000	Processed cheese, not grated/powdered	805	1281
4069000	Other Cheese	594	990
4022990	Other	581	895
4022920	Other Milk for babies	433	796
4012000	Milk and Cream of a fat content, by weight, exceeding 1% .	2653	780
4041020	Whey, dry, blocks and powdered	915	758
4041010	Whey, concentrated, evaporated or condensed, liquid or semi-solid	245	269
4039090	Other	218	256
4011000	Milk and Cream of a fat content, by weight, not exceeding 1% .	478	199
4029990	Other	168	152
4039010	Other Butter Milk	127	147
4021020	Milk food for babies (Fat < 1.5%)	106	142
4029190	Other Condensed Milk (Fat>1.5%)	65	65
4013000	Milk and Cream of a fat content, by weight, exceeding 6% .	70	45
4062000	Grated/powdered cheese, of all kinds	22	41
4022100	Not containing added sugar or other sweetening matter (>1.5%)	20	31
4049000	Other (Excl. 04041010, 04041020, 04041090)	15	26
4029920	Other Condensed Milk	16	16
4029110	CONDENSED MILKÂ(Fat>1.5%)	9	15
4064000	Blue-veined cheese	6	12
4041090	Other Whey	15	12
4052000	Dairy spreads	7	12
4031000	Yogurt	2	2
4029910	Other Whole Milk	2	2
	Total	37436	54797

Source: DGCIS.

Composition of India's dairy exports, 2012–13

HSCode	Product	Qty. (in t)	Value (Lacs Rs.)
4021010	Skimmed milk in powder, granules and other sold forms (Fat <1.5%)	69633.55	108554.59
4059020	Other Ghee	5052.63	14225.58
4069000	Other Cheese	1650.09	3820.16
4021090	Other milk powder (Fat < 1.5%)	1846.2	3061.04
4051000	Butter	988.27	2487.77
4061000	Fresh (unripened/uncured) cheese, incl. whey cheese, and curd	910.91	2060.83
4012000	Milk and Cream of a fat content, by weight, exceeding 1%	4627.31	1940.71
4063000	Processed cheese, not grated/powdered	950.38	1724.92
4059090	Other	326.12	598.18
4022990	Other	237.53	470.83
4041090	Other Whey	212.53	430.38
4052000	Dairy spreads	132.7	276.52
4039090	Other	174.21	264.42
4021020	Milk food for babies (Fat < 1.5%)	117.46	213.65
4049000	Other (Excl. 04041010, 04041020, 04041090)	240.13	193.52
4013000	Milk and Cream of a fat content, by weight, exceeding 6% .	112.49	156.27
4041020	Whey, dry, blocks and powdered	110.34	125.53
4011000	Milk and Cream of a fat content, by weight, not exceeding 1% .	146.41	93.74
4022910	WHOLE MILKÂ (Fat>1.5%)	83.24	86.87
4039010	Other Butter Milk	82.02	80.32
4022920	Other Milk for babies	32.4	74.22
4041010	Whey, concentrated, evaporated or condensed, liquid or semi-solid	46.51	61.49
4022100	Not containing added sugar or other sweetening matter (>1.5%)	28.64	58
4029990	Other	14.47	47.54
4062000	Grated/powdered cheese, of all kinds	10.7	36.45
4029190	Other Condensed Milk (Fat>1.5%)	19.07	23.17
4029920	Other Condensed Milk	14.62	18.02
4031000	Yogurt	8.22	10.8
4064000	Blue-veined cheese	3.52	5.86
4029910	Other Whole Milk	10.1	5
4029110	CONDENSED MILKÂ(Fat>1.5%)	1.04	2.87
4059010	Other Butter Oil	0.37	0.58
	Total	87824.18	141209.83

Source: DGCIS

Annex 11. Artificial insemination

Status of AI Delivery (2008–09)

Type of Institution	Inseminators			AI done in millions and share of agencies (%)
	Stationary	Mobile	Total	
Cooperatives		15,576	15,576	10.37 (23.59%)
Government	46,141		46,191	26.83(61.03%)
Gopalmitra/LDB		6430	6430	3.10 (7.05%)
NGOs		5006	5006	2.15(4.89%)
IndiaGen		1455	1455	0.76 (1.73%)
Private/others		2383	2383	0.75(1.71%)
Total	46,141	30,850	76,991	43.96 (100%)

Through project interventions semen production has increased from 50.5 million to 62 million and AI number from 50 million to 52 million between 2009–10 and 2010–11. Conception rate increased from 20to 35% (Source: GOI / NPCBB).

The project facilitated the conversion of 36,000 Government Stationary AI centres into mobile AI centres; At the same time, 21,000 private AI centres were established and 4000 private AI workers were trained.

To enable natural service facility 21,700 breeding bulls with high genetic merit were planned to be inducted, whereas 3000 breeding bulls have been inducted between 2009–10 and 2010–11 at field level. Furthermore:

- 50,000 existing AI workers have been trained in all the aspects of frozen semen technology and artificial insemination
- 1800 professionals have been trained outside the State at reputed training centres.
- In order to improve quality of semen production in the country a Minimum Standard Protocol (MSP) for semen production has been formulated and introduced at all semen station in the country
- 49 frozen semen bull stations were strengthened as per MSP for semen production;
- 22 semen stations are graded as 'A', 17 as 'B' and 3 as 'C' during 2010–11 against 11 as 'A', 16 as 'B' and 7 as 'C' during 2007–08. The number of A and B graded semen station has increased to 37 against 27 in earlier evaluation.

Bulls and semen production in government and private sectors

Agency	Semen station	No. Of bulls	Semen production (millions)	Bulls/station	Doses produced/ station in lakhs
Government	37	2029	31.59	54	8.54
NDDB/Cooperatives/NGO/Private	11	1292	30.37	117	27.60

Source: Annual report, 2011–12, Department of AHD, GOI

Annex 12. Diseases and deaths

Type of disease cases and deaths during 1997–2006

	1997		2001		2003		2005		2006	
Disease	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
FMD	46022	589	69329	1396	123560	2066	67237	2315	19660	360
Anthrax	230	153	735	460	319	239	323	242	504	196
Rabies									159	159
Anaplasmosis									97	8
Babesiosis									1781	33
Brucellosis									15	0
HS	6751	3594	8679	3767	4522	1411	4753	2229	5309	1000
BQ	2592	1351	3125	1326	6527	2864	2396	956		
Fascioliasis	9341	105	49119	4	21993	10				
Trypanosomiasis									1622	28

Source: Vinod Ahuja (2007) Animal health for poverty alleviation, a review of key issues for India

Annex 13. Animal feed

Production of compound animal feed by CLFMA members 1964–2000

Year	Cattle Feed	Poultry Feed	Other Feeds	Total (million tonnes)
1964	25.0	14.4		39.4
1974	275.4	164.6		440.0
1984	750.0	406.7		11572.2
1990	1324.5	833.7		2161.2
1994	1446.2	1074.6	18.9	2539.7
1995	1512.9	1267.8	29.9	2810.6
1999–2000	1278.7	1600.7	23.6	2903.0
2000–01	1240.0	1519.3	33.9	2794.1
2001–02	1163.0	1362.0	35.0	2561.0
2002–03	1123.4	1477.0	53.0	2654.0
2003–04	1114.0	1457.0	61.0	2632.0

Source: Vaidya etal. 2004; Indian livestock industry document

Share of major players in feed production

Company	Production in tonnes
Godrej Agrovet Limited	200,000
Gold Mohur Foods and Feeds	75,000
KSE Limited	175,000
Khaira District Cooperative Milk Union	150,000
Kolhapur ZillaSahakari DudhUtpadakSangh	800,000
Surat District Cooperative Milk Producers Union Limited	800,000

Source: Dairy India 2007

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