



The World Bank Group

68901

June 2011

Demand-Led Transformation of the Livestock Sector in India

Achievements, Challenges, and Opportunities



South Asia Agriculture and Rural
Development

© 2011 The International Bank for Reconstruction and Development/The World Bank
1818 H Street, NW
Washington, DC 20433
Telephone 202-473-1000
Internet www.worldbank.org/rural
All rights reserved.

This volume is a product of the staff of the International Bank for Reconstruction and Development/The World Bank. The findings, interpretations, and conclusions expressed in this paper do not necessarily reflect the views of the executive directors of The World Bank or the governments they represent. The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

The material in this publication is copyrighted. Copying and/or transmitting portions or all of this work without permission may be a violation of applicable law. The International Bank for Reconstruction and Development/The World Bank encourages dissemination of its work and will normally grant permission to reproduce portions of the work promptly.

CONTENTS

Acknowledgements.....	x
Preface	xi
Executive Summary.....	xiii
Demand led-growth and poverty reduction Aspects	xiii
The Two Worlds of Indian Livestock.....	xiv
Challenges: Productivity, Services Delivery, Animal Health, and Public Expenditures	xiv
Market institutions and value chains	xvii
Rethinking The Optimal Public-Private Division of Roles in a Livestock Development Strategy For Leading and Lagging Regions.....	xix
Improving support services delivery	xix
Marketing Development for Livestock Products.....	xxii
1. Demand-led Growth and Poverty Reduction	1
Demand For Livestock Products is Growing	1
Livestock Can Be a Pro-poor Sector.....	5
There are at least Two Worlds of Livestock for Development in India	10
Summary of Key Points.....	12
2. Livestock Sector Performance: Diversity and Challenges.....	15
India's Livestock Population has Steadily Increased	15
The Livestock Population and Their Use Varies by Zone.....	16
Production and Productivity.....	17
Egg and meat production has grown over the past twenty years	21
Dairy production spurs other livestock production systems.....	22
Increasing Productivity Faces Many Challenges.....	25
Aggregate national expenditures have declined overall.....	27
Prioritization of public expenditure for provision of public goods	30
Summary of Key Points.....	30
3. Livestock Support Services.....	33
Breeding Programs Focus on Artificial Insemination	33
Feeds supply and Common Property Resources	38
Research on Livestock is Limited and Lacks Multi-dimensionality.....	45
Extension Does not Extend to Livestock.....	46
Access to Credit Remains Elusive	48
Summary Of Key Points	54
4. Animal Health and Veterinary services.....	56
Diseases Incidence And Economic Losses	56
Animal Health Infrastructure.....	58

Preventive health care infrastructure and services are underfunded	58
Disease reporting, surveillance, and diagnosis are plagued by under reporting	58
Immunization must be expanded to control diseases	60
Avian influenza outbreaks taught some lessons	62
Curative Health Care Services and Infrastructure	63
Veterinary Pharmaceuticals and Biologicals	67
Legislation for Disease Control.....	68
Summary of Key Points.....	69
5. Livestock Market Institutions and Value Chains.....	70
Milk and Dairy Dominate the Livestock Market.....	70
Dairy cooperatives prospered with public sector support and subsidies	72
Private dairies emerged as market restrictions relaxed	75
Cooperatives in the era of private sector emergence.....	78
Semi-formal and informal dairy value chains are changing	82
Improvement of Hygiene and Sanitary standards in dairy value chains	83
Dairy Value Chains in Leading Regions: the Case of Punjab and Haryana	83
Dairy Value Chains in Lagging Regions: the Case of Bihar and Orissa	90
Value chain analysis reveals challenges in lagging states	91
Poultry Value Chains Have Transformed Rapidly	94
Domestic Markets for Live Animals and Meat Vary Across States.....	98
Goat Processing, Slaughtering, and Marketing in Lagging Regions	102
Goat value chains produce low returns, but improvements are possible	102
Marketing and processing of hides and skins	104
Summary of Key Points.....	105
SWOT Analysis of Dairy, Poultry and Small Ruminants in Leading and Lagging States.....	108
Dairy sub-sector.....	108
Commercial poultry sub-sector.....	109
Small ruminant sub-sector in lagging states	110
6. Livestock Trade	111
Structure and Pattern of India Livestock Exports and Imports	111
Livestock Trade Policy Reforms	112
External Competitiveness of India's Livestock Products	115
Food Safety Standards.....	116
Summary and Policy Implications.....	116
7. Towards a Livestock Sector Development Strategy.....	118
Institutions, public expenditures, and public goods	118
Breeds and feeds	119
Animal health	120
Public and private roles in marketing.....	121
Summary of key policy problems and recommendations.....	123

Works Cited	129
Appendix 1. Characteristics of Different Models of Livestock Service Provision	137
Appendix 2. Provisions pertaining to animal health service delivery in the new livestock sector policy of Orissa	139
Provision of animal health and breeding services.....	139
Disease Control.....	140
Diagnostic Laboratories.....	141
Appendix 3. Comparative Analysis of Three Dairy Value Chains Models in Andhra Pradesh.....	143
Appendix 4. Qualitative Analysis of the Goat Value Chain	145
Appendix 5. AMUL: The Gujarat Cooperative Milk Marketing Federation Ltd. (GCMMF) (AMUL).....	147
The Genesis of GCMMF	147
Activities at a Glance:	148
System of Milk Collection	148
Value Added Milk Products	151

Tables

Table 1: Rural and urban household expenditure patterns have shifted away from cereals and towards livestock products.	2
Table 2: Changes in per capita consumption of livestock products by location and income group (kg/annum)	2
Table 3: Per capita annual consumption of milk, meat, and eggs varies across states	3
Table 4: India's per capita consumption of livestock products still trails that of other countries.....	4
Table 5: Alternative estimates project increasing demand for livestock products in 2020 and 2025.....	4
Table 6: Distribution of livestock numbers by land holding size (hectare), 2003	5
Table 7: Share of marginal farm households in land and livestock populations.....	6
Table 8: Employment in livestock sector by farm category	7
Table 9: The share of livestock in household income varies by ecozone and farm size	8
Table 10: Cooperative societies, membership, and dairy plants by state 2005-06	11
Table 11: India's livestock population is one of the largest in the world.....	15
Table 12: Livestock population in India has grown steadily from 1961 to 2003.....	16
Table 13: The livestock population varies across agro-climatic zones.....	17
Table 14: The structure of India's dairy production has changed since 1993/94	18
Table 15: Share of cattle and buffalo populations and milk output by state, 2003.....	20
Table 16: Small stock livestock population and share of improved breeds by state in 2003	22
Table 17: Average annual public expenditure (plan and non-plan) in the livestock sector.....	28
Table 18: Artificial Insemination infrastructure in India by State (2007-08).....	34
Table 19: Regional differences in availability of feed and fodder, 2004-05 (million tons)	38
Table 20: Production of manufactured concentrate feed in India (000 tons)	40
Table 21: Manpower and investment in animal science research in ICAR	45
Table 22: Percentage of farmers accessing information on animal husbandry and their sources by state.....	47
Table 23: Refinance disbursement by NABARD under dairy development to different credit institutions (Rs. million), 2003/04- 2006/07	50
Table 24: Outbreaks of selected viral and bacterial diseases 1991-2005 in select States	57

Table 25: Average cost incurred for veterinary services at doorstep (Rs. per visit)	65
Table 26: Distribution of public sector infrastructure for curative veterinary services by state	66
Table 27: Share of cooperative societies and membership, and dairy plants by state, 2005-06	74
Table 28: Selected indicators of growth of dairy cooperatives.....	78
Table 29: Comparative milk pricing and farmer share of retail price under selected value chains in Andhra Pradesh	81
Table 30: Important characteristics of different dairy value chains in the leading regions.....	84
Table 31: Key components of dairy cooperatives in Punjab and Haryana (2007-08)	85
Table 32: Change in Percentage of buffaloes in in-milk bovine stock per hundred rural households	87
Table 33: Prices of liquid milk at different states of organized dairy value chain in the region	87
Table 34: Effect of clean milk production in Roper Milk Union	89
Table 35: Commercial dairy farms in Punjab and Haryana	89
Table 36: Overview of COMFED & OMFED (2007-08).....	91
Table 37: Farm income from dairy enterprise (Bihar).....	91
Table 38: Dairy value chain analysis in lagging regions – summary of issues	92
Table 39: Extent of contract broiler production by state in India, 2004-05.....	95
Table 40: Producer share of retail price of live broiler and meat in selected states, 2006-07	97
Table 41: India's global export value for livestock and livestock products by broad commodity groups, 2001-2005, (US thousands)	111
Table 42: India: export of different meats in thousands of tonnes, 1995-2005	112
Table 43: Structure and pattern of India's livestock exports/imports and Applied MFN Tariffs for Livestock Products-Select Countries	113
Table 44: India's trade value to world for animal feed, 2001-2005 (US\$ million)	114
Table 45: Producer prices of livestock products: India and other competitive countries	115

Figures

Figure 1: Share of livestock and agriculture in India's GDP (in percent)	1
Figure 2: Relationship between income and employment shares of livestock in agricultural sector and rural poverty.....	8
Figure 3: Small landholders play a large role in dairy production, 2003	9
Figure 4: Rural poverty and share of the livestock in total agricultural output value in selected states in India	12
Figure 5: The value of milk output in relation to rice and wheat is on the rise, 1995-2006.....	18
Figure 6: Milk production and per capita availability varies across states (2007/08).....	19
Figure 7: Meat and egg production between 1988 and 2007	21
Figure 8: Attainable and actual milk yield by species in different regions, 2002-03	25
Figure 9: Public spending on livestock decreased as its value added to Ag-GDP went up	27
Figure 10: Public spending as percentage of livestock output.....	27
Figure 11: Common property resources in India (million ha)	43
Figure 12: Share of livestock in total credit disbursed to the agricultural sector	48
Figure 13: Disbursement of investment credit for animal husbandry to the states through refinance scheme by NABARD 2003/04 – 2005/06 (percent).....	51
Figure 14: Progress of Livestock Insurance Scheme.....	52
Figure 15: Number of outbreaks of major viral and bacterial diseases of animals in India, 1991- 2005... ..	57
Figure 16: Livestock units per veterinary institution- 2004 (thousands)	63
Figure 17: A general map of main dairy value chains in India.....	71
Figure 18: Percentage change in processing capacity of milk in Haryana, Punjab, and all India (1996-2006).....	86

Figure 19: Extent of milk processing capacity in comparison to milk production	86
Figure 20: General value chains for broilers and poultry meat in India.....	95
Figure 21: Seasonality in farm-gate price of broilers in Andhra Pradesh, 2004-06	96
Figure 22: Typical market chains for cattle and small ruminants in Bihar and Orissa	100
Figure 23: Domestic and World Prices of Livestock Products, 2001-03.....	115
Figure 24: AMUL's milk collection process.....	149
Figure 25: Village cooperative and union activities in AMUL.....	150

Boxes

Box 1: The Rajasthan Microfinance Initiative.....	7
Box 2: Kegg Farms – a better backyard chicken.....	24
Box 3: Artificial insemination services provided by BAIF	35
Box 4: Private breeding services in Bihar	36
Box 5: Compound Livestock Feed Manufacturers' Association of India (CLFMA).....	40
Box 6: Managing common property lands: an innovation from Karnataka.....	44
Box 7: Mongolia's index-based livestock insurance	53
Box 8: Use of Information technology for disease surveillance and monitoring	59
Box 9: Bovine Brucellosis Progressive Control Programme: Karnataka's experience (1998-2002)	61
Box 10: Examples of pro-poor animal health service delivery schemes	65
Box 11: Evolution of dairy marketing institutions in Andhra Pradesh	72
Box 12: Some features of the dairy value chain of Nestlé India, Punjab	77
Box 13: Some features of value chains of two private dairy chains in Bihar and Orissa	78
Box 14: Characteristics of Mutually Aided Co-operative Societies (MACS): an example from Mulukanoor	79
Box 15: Composition and function of the National Egg Coordination Committee	97
Box 16: Live animals marketing in Punjab and Orissa	99
Box 17: Meat processing plants in Punjab	101
Box 18: Building grassroots institutions to reach small ruminant markets in Rajasthan.....	104

CURRENCY EQUIVALENTS
US \$1.00 = Rs 44.9 (December 1, 2010)

FISCAL YEAR (FY)
July 1–June 30

UNITS OF MEASURE	
ac	acres
ha	hectares
kg	kilograms
li	liter
MT	metric tonnes

ADMAS	Animal Disease Monitoring and Surveillance
AGGDP	Agricultural Gross Domestic Product
AHD	Animal Husbandry Department
AI	Artificial Insemination
APDDC	Andhra Pradesh Dairy Development Corporation
ATMA	Agriculture Technology Management
BAIF	Bharatiya Agro Industries Foundation
BBPCP	Bovine Brucellosis Progressive Control Programme
BQ	Black Quarter
CLW	Community Link Workers
CMP	Clean Milk Production
CPR	Common Property Resources
DDD	Dairy Development Department
DDLs	Disease Diagnostic Laboratories
ET	Enterotoxaemia
FAO	Food and Agriculture Organization of the United Nations
FMD	Foot and Mouth Disease
GDP	Gross Domestic Product
GOI	Government of India
H5N1	Avian Influenza
HACCP	Hazard Analysis and Critical Control Points
HPAI	Highly Pathogenic Avian Influenza
HS	Haemorrhagic Septicemia
HSADL	High Security Animal Disease Laboratory
ICAR	Indian Council for Agricultural Research
IMP	Integrated Milk Project
IVRI	Indian Veterinary Research Institute
KVK	Krishi Vigyan Kendra
MACS	Mutually Aided Cooperative Societies
MFN	Most Favored Nation
MMPO	Milk and Milk Products Order
NABARD	National Bank for Agriculture and Rural Development
NATP	National Agricultural Technology Project
NCD	New Castle Disease

NDDB	National Dairy Development Board
NGO	Non-Governmental Organization
NSSO	National Sample Survey Organization
OF	Operation Flood
OIE	World Organization for Animal Health
PPLPI	Pro-poor Livestock Policy Initiative
PPR	Peste des Petits Ruminants
PPR	Peste des petits ruminants
RD	Ranikhet disease
SPS	Sanitary and Phyto-Sanitary
SWOT	Strengths, Weaknesses, Opportunities and Threats
TBT	Technical Barriers to Trade
WHO	World Health Organization

Vice President:	Isabel Guerreo, SARVP
Country Director:	Roberto Zagha, SACIN
Sector Director:	John Henry Stein, SASSD
Sector Manager:	Simeon Ehui, SASDA
Task Leader:	Rabih Karaky, EASER

ACKNOWLEDGEMENTS

This report has been prepared by a core team led by Rabih Karaky, and comprising Mohammad Jabbar, Animesh Shrivastava, Christopher Delgado, Saswati Bora, and Elliot Mghenyi. The work was conducted under the guidance of Adolfo Brizzi. Melissa Williams is the principal editor. Administrative assistance was provided by Nadia Islam, Vibhuti N. Khanna, and Deborah Ricks.

The team gratefully acknowledges the assistance of a number of organizations and individuals who provided background written inputs on various livestock related subject areas. These include Pratap Birthal from the National Centre for Agricultural Economics and Policy Research (NCAP, New Delhi); a team led by Iain Wright from the International Livestock Research Institute (ILRI- New Delhi) comprising Smita Sirohi, Anjani Kumar, Suresh Gokhale, K. Elumalai, Gitesh Sinha; a team led by Vinod Ahuja from the Indian Institute of Management (IIM-Ahmedabad) comprising M. Rajasekhar and Ramalinga Raju; a team from the National Dairy Research Institute (NDRI-Karnal) led by B.S. Chandel and comprising D.K. Jain and J.P. Dhaka; Vasant Gandhi (IIM-Ahmedabad); Rajesh Mehta; N.R. Bhasin, M.P.G. Kurup, Meeta Punjabi, B.S. Sathe, K.M.Singh, and R.K.P. Singh.

The team also wishes to acknowledge the valuable consultations and advice of P.K. Joshi (NCAP) and Lucy Maarse (FAO); Grahame Dixie, Grant Milne, Mark Cackler, and Brian Bedard (World Bank). Finally, the team extends its gratitude to the counterparts in the Department of Animal Husbandry, Ministry of Agriculture, GOI and the State Animal Husbandry Departments for their valuable comments, interaction, and assistance during the study.

PREFACE

The last World Bank assessment of the livestock sector in India was carried out in 1996. The study predicted that sustained economic growth and rising domestic incomes would generate rapid growth in the demand for livestock products, and provide significant opportunities for expansion in the sector. Given that rural households —mainly small and marginal farmers—owned livestock and earned a significant share of their household income from livestock, this growth could create opportunities for income generation and poverty alleviation. It all depended on whether small and marginal producers could increase the productivity of their livestock and be competitive (World Bank 1996)¹.

The study stressed that sustained growth in the livestock sector requires important policy reforms to promote increased productivity and efficiency, and recommended a set of policy measures to that end:

- increasing public expenditure in the livestock sector and shifting the focus of public expenditure from dairy to other areas of livestock;
- eliminating policies and regulations that hindered productivity growth on farms and in the processing sectors;
- improving marketing efficiency and reducing marketing margins in the dairy sector;
- creating a level playing field for all market participants in both output and input markets;
- phasing out remaining trade restrictions on feed and livestock products and continuing the restructuring of the domestic processing industry to expand exports; and
- integrating livestock development within a framework of environmental conservation.

Following more than a decade of activity, the Government of India approached the World Bank to undertake a new assessment of the livestock sector, which found that some of the original recommendations have been implemented to varying degrees while other initiatives demanded by the changing economic realities have also been taken up. Overall, there is a new dynamism in India's livestock sector that brings with it new opportunities and challenges which must be tackled squarely to keep the momentum of progress and guide new investments and policy. The key findings and recommendations of this assessment are presented in this report.

¹ A global study observed the same phenomenon throughout the developing world alongside or in some cases as a follow up of the cereal based ‘green revolution’ and dubbed it as the ‘livestock revolution’ and it also predicted similar livestock-based opportunities for the poor in the developing countries(C. Delgado, et al. 1999).

This report² is divided into seven chapters. It begins by examining the recent development of the livestock sector in India and highlighting its contribution to economic growth and rural poverty reduction within the overall policy and regulatory framework. It then examines the key instruments needed for the livestock sector to effectively play this role.

Chapter 1 examines the demand led transformation in the livestock sector and its contribution to national output, employment and rural poverty alleviation. The chapter also sheds the light on the existing dichotomy in the level of development of the livestock sector between different states.

Chapter 2 reviews the production and productivity landscape of key livestock products and examines the demand-supply relationship. It analyzes the growth in output and its sources, bringing out the differences among various livestock production systems and inter-state variability. It examines the level of public expenditures made in the sector and their effects on realizing its full potential. The chapter ends by identifying the key challenges facing livestock producers, primarily in the areas of support services, animal health, and marketing.

Chapter 3 looks at the gamut of livestock support services—breeding, feeding, research, extension, credit, and insurance—and highlights the challenges faced in delivering the services. It also studies the changing roles of the public sector, private sector, and community based organizations in providing these services.

Chapter 4 examines the incidence of livestock diseases and assesses the systems put in place to address them including surveillance systems, disease control programs, veterinary services delivery, infrastructure, and institutions. The analysis highlights the role of the various service providers in both the commercialized and livelihood-based production environments.

Chapter 5 discusses the marketing and market institutions of key livestock commodities, and the evolution of their value chains, building on case studies from different states.

Chapter 6 looks at the structure and pattern of trade of Indian livestock products and the policy environment under which it is taking place. It examines the level of competitiveness of Indian livestock commodities vis-a-vis other livestock producing countries, within the overall framework of WTO agreements and commitments.

Conclusions and recommendations are summarized in Chapter 7.

² A caveat of this study is that it doesn't consider in-depth the interaction between livestock and the environment. Due to the multiplicity of topics and the limited resources, it was determined that this important area is worthy of a separate study in itself.

EXECUTIVE SUMMARY

A “livestock revolution³” has taken place in India over the last couple of decades. Demand for major livestock commodities (milk, eggs, meat) increased rapidly, leading to unprecedented growth in the livestock sector. Today the livestock sector constitutes one of the major engines of agricultural growth in the country and continues to play a central role in rural poverty reduction. With growth and opportunity however come challenges and risks. These need to be tackled to keep the momentum of progress and guide new investments and policy reforms.

Some observers argue that existing production systems, support services delivery systems, and marketing systems (particularly for dairy), are ill-equipped to meet the increasing market pressures. Others are concerned that some states and population groups are missing out on the livestock revolution, perhaps as they missed out on some of the benefits of the Green Revolution before. With intensified production and proximity to large urban centers, dimensions of public health, food safety, and quality become more important, particularly with the increased risk of disease transmission from animals to humans. These questions raise the issue as to the respective roles of national and state governments, the private sector, and civil society groups faced with this changing environment.

DEMAND LED-GROWTH AND POVERTY REDUCTION ASPECTS

With one of the largest livestock population in the world, India has seen impressive demand-led growth of its livestock sector over the last two decades. Today livestock contributes to 26.5 percent of agriculture GDP. Structural transformation has gradually transformed the Indian economy from an agriculture-based to a more diversified economy, with a bigger role for industry and services, and a declining role for agriculture. Though the share of agriculture in total GDP decreased gradually, the share of the livestock sector in total GDP remained close to 5 percent over the same period, underlining the increasing relative importance of the sector in generating economic growth from agriculture.

Demand for livestock products increased across all household groups: rural, urban, rich and poor. This was largely driven by a rise in incomes, a higher urbanization rate, and changing dietary habits. Milk consumption increased by 70 percent and meat consumption by 30 percent, with the latter largely driven by the rise in poultry consumption. In 2005-06, consumers’ spending on livestock products accounted for 24 percent of total food expenditures. The rise in demand, however, has not been universal. For instance, per capita consumption level for milk ranges from as little as 12 liters/annum in Orissa to 146 liters/annum in Punjab.

³ “Livestock revolution” is the term used in Delgado et al (1999) to refer to the phenomenon of global demand-led livestock growth, with livestock based opportunities for poor producers in developing countries.

In response to the increased demand, the livestock sector grew at an annual rate of 4 percent during the last two decades. Milk output--the predominant livestock commodity accounting for 2/3 of the total value of output from livestock--increased by 58 percent between 1993-94 and 2005-06, driven not only by demand, but also associated with a change in the structure of the national dairy herd in favour of buffaloes. Today milk constitutes 18 percent of agriculture GDP. Meat production increased by 3 percent, primarily propelled by the high growth rate in the poultry meat's output (13 percent per annum). Egg production rose at the rate of 6 percent per annum.

Growth in the livestock sector has contributed to rural poverty reduction. The sector continues to play a central role in the livelihoods of the poor and the disadvantaged communities. Local growth in the demand for livestock products creates opportunities for activities they are already engaged in for subsistence or rural sales. Livestock constitutes a significant source of income for nearly 70 percent of rural households, who derive between 14 percent and 40 percent of their income from it. The livestock sector employs 9 percent of the total labor force. Women account for three-quarters of the work force in the livestock sector.

THE TWO WORLDS OF INDIAN LIVESTOCK

There has been uneven growth in the livestock sector in India, leading to unequal distribution of benefits, and the need for differentiated approaches for development. Operation Flood revolutionized smallholder dairy development in the country, and overtime laid the ground for private sector participation in the dairy industry. However, most of the investments, and consequently the impacts, occurred in only few states.

As a result, at least two conditions of livestock development are found in the country today. The first is observed in the “leading” livestock producing states, such as Punjab, Haryana, Gujarat, and Tamil Nadu, where livestock activity is increasingly a commercialized and market-driven enterprise. It is backed by relatively higher levels of animal productivity, and contributes significantly to agricultural output and rural poverty reduction in these states. In Punjab, for example, the share of livestock’s output in total agricultural output is 35 percent. The average dairy animal productivity in Punjab is nearly 2,000 kg/lactation compared to an all India average of 1306 kg/lactation.

The second state of Indian livestock development is found in the “lagging” livestock producing states, where livestock activity continues to be mainly subsistence driven and livelihood-based, characterized by low levels of animal productivity and low contribution to overall agricultural output. For instance, livestock contributes to less than 20 percent of agricultural output in Orissa. The level of rural poverty is significantly higher in Orissa (40 percent), compared to Punjab (9 percent). Promotion of livestock activities in the lagging regions that have potential but have hitherto been neglected is necessary to ensure more equitable and inclusive approach to livestock sector development across the country.

CHALLENGES: PRODUCTIVITY, SERVICES DELIVERY, ANIMAL HEALTH, AND PUBLIC EXPENDITURES

In addition to uneven regional development, the sector faces a number of challenges that are slowing down its further development and modernization in key areas such as productivity, support services delivery, and marketing among others. It is essential that necessary action to deal with these challenges is not further delayed, if the benefits of the livestock demand-led growth are to be sustained and improved.

Slowdown in milk production & low productivity levels The growth rate of milk production has slowed in recent years – from an average of 4.3 percent per annum in the 1990s to 3.8 percent per annum in the 2000s -- while domestic demand continues to grow spurred by rising per capita incomes and food preferences shifting towards milk and milk products. Over the next decade milk demand is projected to grow at 4-5% per annum.⁴ Improving productivity of dairy farmers to meet the projected demand is a key development challenge facing the Indian dairy sector. The average milk yield of Indian cows is about 4 kg per day which is very low when compared to other major milk producing countries. For instance, the average milk yield per cow is 7.8 Kg per day in China, and 25.6 kg per day in the US.

Trends in livestock production and consumption are creating tremendous pressure on support services delivery systems. Most livestock health and production services are in the public domain and continue to be of poor quality. Public good services such as disease surveillance and control, quarantine, sanitary control, and livestock extension remain weak. State governments bear primary responsibility for most livestock services, which tend to get low priority when they are faced with severe fiscal constraints. While required support services to the livestock sector include breeding, feeding, research, extension, credit, insurance and veterinary services, in most cases only breeding and veterinary services for large ruminants receive significant public attention.

In breeding, the emphasis has been on breed improvement through cross-breeding, with little attention to improvement of indigenous breeds. State Animal Husbandry Departments manage bull studs, semen collection centers and Artificial Insemination (AI) centers. Coverage is not uniformly distributed throughout the country, with over a third of the centers concentrated in four states which together have only 18 percent of the breedable dairy animals. Some success has been achieved through AI, particularly in the leading dairy states like Andhra Pradesh, Punjab, Tamil Nadu, Karnataka, and Kerala. However conception rates remain generally low (40-49 percent on average) with NGOs and privately run AI centers achieving higher rates than government run centers. Private AI centers charge higher rates than government centers suggesting that farmers are willing to pay for better conception results as the cost per calf becomes lower. Buffalo breeding has been neglected even though the contribution of buffalo in milk and meat production has been increasing. There is little breeding public support to small ruminants, pigs, and backyard poultry sectors, with many government schemes being ineffective. The commercial poultry sector receives breeding support from private sources, often linked with contract farming.

⁴ Estimates of projected demand vary depending on GDP growth assumptions and elasticities used.

Feed scarcity and feed quality continue to be a limiting factor to improve animal productivity. It is estimated that as a national average, there is an 11 percent shortfall in dry fodder, 28 percent in green fodder, and 35 percent in concentrates. Crop residues represent the largest feed component, but tend to be low in nutritive value and cannot on their own support high levels of production. The supply of roughages is inadequate. The use of concentrates remains low though it is slightly higher in the more commercialized oriented systems in the leading states. In the lagging states and in crop-livestock systems, as well as pastoral systems in which crop residues and green fodder from Common Property Resources (CPRs) are the main feeds, both spatial and temporal scarcity of feeds are quite high. The quality of CPRs has also degraded due to overgrazing, and due to legal and administrative procedures that reduced the role of traditional institutions leading to their poor management.

Both public and private sector support in development of green fodder resources are limited. Green fodder production is constrained by limited acreage and lack of availability of good quality fodder seeds. The production of compound animal feed is only about 10 million tons per year, of which only 35 percent is in the organized sector. In the commercial poultry industry, problems related to feed supply include poor quality of raw materials available in the domestic market, reduced import of maize and soybean, slow growth in domestic production of these crops, and larger increase in prices of feeds in relation to prices of products, which are important determinants of profitability and feed demand.

Public extension services have played a major role in technology and knowledge transfer in the crop sector, but in the livestock sector extension service delivery has been weak. Public extension activities by the state animal health departments (AHDs) suffer from inadequacy of resources and the lack of expertise to conceive and operate technology transfer packages. The services are mainly run by veterinarians who operate from veterinary dispensaries to treat animals, rather than educate and inform farmers about feed, fodder, management, and animal health issues. Some of the State Agricultural Universities, ICAR Institutes and Krishi Vigyan Kendras (KVKs) provide some form of extension, but this does not constitute a national extension service comparable to the nationwide extension support available for crop production. Only about 5 percent of households have ever accessed any kind of information on animal husbandry from formal extension services.

Research-extension linkages also remain weak. India has a large network of institutes under different organizations carrying out research in the livestock sector. Most research is disciplinary oriented while problems in the sector are multidimensional and multidisciplinary. Various kinds of data are regularly collected but there is often lack of coordination among the different agencies collecting data, creating unnecessary overlaps and gaps.

Access to credit is limited and disbursement is biased towards dairy and the leading states. Several new credit delivery schemes have been introduced making access procedure simpler, but the existing biases make it less likely for producers in the lagging states to benefit much from these schemes. The share of agricultural credit accounted for by the livestock sector is only 10 percent although its share in agricultural output value is about one-quarter. A large number of micro-credit institutions have emerged in recent years with the number of Self Help Group-bank linkage schemes increasing and a number of private banks entering the micro-credit sector.

Livestock insurance coverage for animals has increased from a relatively low base and is high in case of poultry. New insurance products are generally biased towards high yielding animals and commercial production systems. Private insurance providers are working with pro-poor development agencies in several states and have a sizeable number of clients, but face problems of high transaction costs, improper selection of clients, and moral hazard in settlement of claims.

Animal health and veterinary services need more funding to stem the tide of disease and limit losses to producers. The incidence of major livestock diseases is high throughout the country, with significant economic losses. Preventive veterinary service infrastructure and staff are very thin and highly inadequate in face of the needs. Moreover, available facilities are not effectively used for disease diagnosis, monitoring and surveillance, and for control measures through proper immunization. There is a weak disease reporting systems in many states, and most often outbreaks go unreported and/or improperly documented. Each state tries to produce all kinds of vaccines, so can't take advantage of economies of scale and specialization.

Public veterinary service infrastructure and staff are heavily biased towards curative services. These services are supposed to be free or heavily subsidized but in reality producers pay to access them, especially for home visits, and for purchase of drugs that are rarely in stock. Only about 28 percent of all households use any veterinary services, though the users' rate is much higher in the leading dairy states where a large proportion of home visits by government' veterinarians are done on personal contract basis. Where cooperatives and private sector service providers are present alongside government veterinarians, cooperatives charge the lowest cost for services, private sector fees are the highest but evidence suggest that users are willing to pay higher fees for quality service. In some lagging states and remote regions, pro-poor community based health services are being provided by various NGOs.

The nominal value of public expenditure on livestock sector support increased over time, but the share of the central government in total spending actually declined. Public expenditures on animal husbandry and dairying have been declining steadily from 5 percent of the value of output from the livestock sector in 1990-91 to 2.9 percent in 2004-05. There are large differences among states in the level of expenditures devoted to dairy development and other livestock activities. Expenditure on fodder development, veterinary training, research and education, which are priority areas, and essential for generation of new technologies, inputs and institutions to commercialize production systems is meager and has only increased marginally over time. It will be critical to refocus public expenditure on public goods (e.g. preventive public measures in disease control), and not on private goods (e.g. free curative veterinary medicine on specific animals).

MARKET INSTITUTIONS AND VALUE CHAINS

Markets for livestock products are by and large unorganized, traditional and fragmented, except for components of organized milk, meat and by-products sectors. About 60 percent of the milk produced is marketed with around one fourth of the marketed milk handled by the organized sector. The rest is sold through unorganized informal chains where the compliance with safety standards is usually limited, and

risks of contamination may be higher. Livestock products are highly perishable and require immediate processing, storage and preservation, to move them from production areas to demand centers. Processing and market linkages are therefore prerequisites for value creation and addition.

Dairy development has followed a well established organizational model producing a product for which local demand continues to grow. Successful adoption of the Anand model and the support from the National Dairy Development Board (NDDB) in training and capacity building, especially in the early years, have led to increased milk production and procurement. It has also contributed to increase outreach to the poorest sections of the population. In general dairy cooperatives have developed an integrated supply chain for liquid milk and other dairy products, provided support services, and increased income for their members. However the success was not universal. While some cooperatives in the leading states tend to be successful, others continue to suffer from a wide range of financial, governance, and management problems. Government interference in dairy cooperatives management and price determination has contributed to a number of cooperatives becoming dysfunctional in some states.

The economic reforms aimed at liberalizing milk marketing, implemented by GoI and some state governments provide opportunities for increased private sector participation in milk procurement and processing. This has led to improved competition, especially in the leading states, which reflects positively on all market participants, including the cooperatives. Competition helped coops to accept challenges and address some problems that had previously contributed to their inefficiency. The private sector has not however shown the same interest in the lagging states (with the exception of few individual initiatives) for various reasons, including poor infrastructure, weak producers' organizations, law and order issues, and other governance concerns.

Contract farming has become the dominant mode of production in the broiler industry, while independent enterprises remain dominant in the layer industry. There has been significant scaling up of production units in both broiler and layer industries, including contract production units. However, the higher degree of specialization and the increased economies of scale and size in poultry production, in addition to the concentration of both the dairy and poultry industries in few states have seriously limited the opportunities for creating wider geographical impact through participation of a larger number of smallholders, especially from the lagging states in the newly developed value chains. Regional inequality in development can stifle the overall development potential of the sector.

Meat processing is confined to slaughtering and dressing of carcasses for fresh meat output, used for direct consumption, and slaughtering and dressing are often carried out in the open air under highly unhygienic conditions. There are many slaughter houses throughout the country, owned by the local self governments, most of them dirty and dilapidated, just for rendering fresh meat. Value addition in meat is limited and includes small quantities of meat meant for export, poultry products and to a lesser extent, pork products.

Export is still a minor activity but has good potential. Export can be an alternative route to increase off-take rates to improve productivity and solve feed problems, but achievement of that will require

investment to improve quality of output. The hides and skin industry benefited from low wage and lax environmental regulations and enforcement in the country. There are opportunities for expansion in this industry subject to addressing the environmental impacts.

There is a perceived increase in the demand for quality, safety, variety and convenience along with increases in quantity demanded. But overall, quality and safety standards in all value chains – dairy, poultry, ruminant meat, hides and skins- are in need of improvement, though these issues have been receiving more attention in leading states and within private sector operations. The marketing of livestock products through unorganized channels tends to increase the products' safety risks and reduces its quality. Quality and safety standards in domestic and export value chains are managed through a number regulations and implementing authorities with little coordination amongst themselves.

RETHINKING THE OPTIMAL PUBLIC-PRIVATE DIVISION OF ROLES IN A LIVESTOCK DEVELOPMENT STRATEGY FOR LEADING AND LAGGING REGIONS

Public development efforts should be spread over larger geographical areas, rather than concentrated in few states. While the momentum of growth in the leading states should be maintained and increased, public good provision is needed to facilitate commercialization of production in the lagging states. Continued policy support for appropriate institutions and infrastructure development will be required for the leading states for further intensification and specialization of production systems to increase productivity, produce better quality and safer products to respond to domestic and international markets.

At the same time appropriate policy and incentive structures need to be created to attract both public and private sector investment in the lagging states to reduce the gap with the leading states. In making policy and investment strategy, potential and comparative advantage of each lagging state in different commodities - dairy, poultry, ruminant meat, pork and hides and skins- should be objectively assessed and prioritized rather than trying to develop everything in each state. The objective should be to integrate better supply response in the lagging regions with growing demand in the leading regions.

Given the strong and growing demand in domestic and export markets, there is considerable scope to involve the commercial sector in production support, processing and marketing. Public programs need to focus a little more on the small animals sector, which plays a critical role in the livelihoods of the very poor, especially women farmers. Identification and facilitation of effective political and institutional change that addresses small ruminants and backyard poultry should constitute an important focus area, especially in lagging states. Development efforts in the livestock sector have largely focused on large ruminants (especially dairy cattle). The poultry sector has seen rapid growth in large scale commercial sector but the potential of backyard poultry sector remains untapped.

IMPROVING SUPPORT SERVICES DELIVERY

A program for genetic improvement of local breeds through selection and grading needs to be considered in parallel with the current crossbreeding program to improve disease resistance under smallholder conditions. The objective should be to harmonize and integrate the two. More attention also needs to be given to buffalo, small ruminants, and backyard poultry breeding. Furthermore, policy for provision of AI services should encourage competition among alternative suppliers- government, cooperatives, NGOs and the private sector- but choice of breeds should be guided by a national breeding policy and the quality of breeding materials (stock, semen) and other infrastructures need to be monitored properly. AI services should be delivered at famers' doorsteps as paid inputs. Moreover, the linkage between AI services and mainstream veterinary services should be strong to reduce incidence of reproductive diseases.

Strategies for packaging technology options for diffusion by extension services and marketing by feed manufacturers should consider potential demand for each technology option in different production systems. In the intensive commercial production systems, good forage varieties and good quality seeds supply are major constraints that need to be overcome. In the crop-livestock and pastoral systems, extension packages for feed technology diffusion should target producers who are likely to intensify and commercialize production. In these systems, many poor households depend on livestock for their livelihood, and they depend on common property resources for feeds. Strategies for better management of common property resources need to be developed through innovative ways of reconciling legal and administrative procedures with local practices, and by actively involving the stakeholders of these resources in the discussions on future actions.

More attention should be given to address problems of micronutrients deficiencies at local levels, and to enriching crop residues in the forms of blocks and pellets. Private compounding of feed should be encouraged and large scale investments in animal feed should be promoted with particular attention to quality. Import restrictions on feed ingredients should be removed.

Access to credit and insurance services should be enhanced significantly as finance is a major constraint for investment in improved technologies and risk is a deterrent for investment. The bias of credit and insurance programs towards larger farms and high yielding animals creates inherent disadvantage for the poor and smallholders. Such lending might reasonably be shifted to the private sector, and fresh approaches devised for using public funds to better support integration of the lagging regions.

More attention needs to be given to research and extension services. The Agricultural Technology Management Agency (ATMA) extension model has been successful in some states. It has mobilized farming communities and developed public-private partnership. Large numbers of Farmer Interest Group have been formed including self-help groups around specific crop or products. ATMA has improved interaction amongst farmers, extension workers and researchers. The ATMA model should be extended to livestock sector especially to small ruminants, backyard poultry and piggery farmers who constitute the poor and deprived section of the rural community.

Development of cost-effective disease control strategies and catalytic regional, national and international action for the control of trans-boundary diseases is needed. In order to reduce the threat of trans-boundary animal diseases like bird flu, disease investigation facilities should be modernized, where existing, and created where non existing. In all states, the public sector needs to provide oversight and enforcement with respect to control of major epizootic diseases (OIE List A diseases). Coordination and the capacity for rapid response by the federal government need reinforcement, in addition to the capacities of state governments in this regard. The latter are the first lines of defense. The capacity building of the public sector staff should also be given higher importance in matter of allocation of funds under state as well as central plans.

Government needs to re-examine its current strategy for services delivery. In the absence of good access to markets, the demand for livestock services is likely to remain low, requiring government presence in service delivery in many areas, especially the lagging regions. This blocks the resources required to provide much needed public health services and market access infrastructures for this sector. Both the input and output sides of livestock production must therefore be examined simultaneously.

Important criteria for new approaches in livestock service delivery are profitability of veterinary practice from the point of view of the private practitioner on one hand, and the need to reach all farmers on the other. A reform policy, therefore, needs to identify an appropriate targeting mechanism for the poor in marginal areas, as well as for those who live amongst better-off farmers in leading areas and who may not have access to these services due to their low financial capacity. Keeping small animals, such as goats, sheep and chickens is generally an essential part of the livelihood of this population.

In order to improve the quality of support services and make sure they reach their intended beneficiaries and be accountable to them, efforts should progressively make clinical Veterinary Care and AI, a mobile practice operating within their existing jurisdictions and delivering the service at the farmers' door-step as paid inputs. The alternative could be to permit the serving veterinarians and para-professionals of the department (livestock assistants/livestock inspectors) to become full time mobile practitioners, with their own arrangements for supplies and transport (motorcycles) for their practices, home delivering both Veterinary and AI services as paid inputs at market prices.

Leading states and better-off districts of lagging states—with relatively good access to markets and a relatively higher incidence of large dairy animals--appear to profitably support the private veterinary sector. The government should create a level playing field to enable the development of this sector. This will necessitate reducing public expenditure and subsidy on curative health services or other private goods and introducing measures of full cost recovery, especially in those areas where producers are already paying government veterinarians for services on contract basis. Producers are also showing willingness to pay for better quality services and drugs provided by private, NGO or cooperative service providers. The government should withdraw from the high potential areas, and develop a regulatory framework for private veterinary practice. Reducing government presence for curative service delivery would release significant resources for focusing on the lagging regions with higher incidence of poverty and poor market access.

In the marginal areas, where livelihoods depend primarily on subsistence agriculture and the marginal supplementary income derived from non-dairy animals, such as small ruminants and backyard chicken, a different approach will be required. Important factors that require attention in these areas are the development of awareness levels and the provision of primary veterinary care as well as extended services to avoid production loss and mortality of animals. The Government will have a much more direct role in these areas compared to relatively better-off areas. Even in these areas, however, the Government need not and should not be the only, or even the dominant, player. A desirable approach would involve working with NGOs and other stakeholders to sensitize poor communities towards creating a demand for these services, training community based health workers for minor treatments, providing drugs and supplies on cost in areas where the private distribution network is weak, providing extension advise related to animal husbandry including feeding practices and shelter innovations, etc.

Public expenditure in the livestock sector should increase in real terms to match the contribution of the sector to GDP. Also expenditure should be prioritized and rationalized for more effective utilization and impact. Policies on public expenditure should vary between leading and lagging states depending on the degree of development of the livestock sector and the degree of market orientation for livestock inputs, services and outputs. Public expenditure on research, education and training in the sector should be significantly increased and imbalances in research resource allocation between species should be corrected on the basis of careful assessment of the potential for development in each case.

The private sector should be encouraged to contribute to research and extension expenditure targeted to the poor, just as it did in the poultry industry. Both public and private expenditure should be increased for creating stronger linkage between science, industry and producers, i.e for generation and diffusion and application of technologies, inputs and institutions, as otherwise opportunities for growth cannot be fully exploited. Incentive structures should be created to encourage multidisciplinary systems research encompassing animal production and veterinary sciences, as well as economics, policy and other social sciences. Special attention needs to be given to research on livestock input and output markets. Scant data and few analytical studies characterize the policy research landscape in small animals and backyard poultry. Better coordination among various central and state government agencies collecting macro statistics should be increased to increase complementarities and compatibility of data, thus make better use of scarce resources.

MARKETING DEVELOPMENT FOR LIVESTOCK PRODUCTS

Demand for better livestock products in terms of quantity, quality and variety is thought to be likely to increase very rapidly in India in the future. At the same time, livestock production and marketing systems remain relatively unorganized, except for a few pockets of modernization. There is therefore great need to address several issues in the future development of marketing of livestock and livestock products. There is great need to promote use of scientific and modern practices by the smallholders in the production of livestock products. This is essential to deliver the necessary increase in the quantity of the raw products as well as ensure that they are of the quality required by the processors and marketers for the domestic and international markets.

The economics of production favor the use of relatively cheap labor and raw materials available in the rural areas. In order to tap this economy of production it is essential that new and durable systems such as modern co-operatives, efficient contracting and efficient procurement by private players for the local settings be developed. These arrangements should not be exploitative but should be in the model of win-win partnerships between the organizations and the primary producers of livestock products.

Investment in promoting access to growing urban markets and processing of dairy and meat products will be one of the critical elements for enhancing the competitiveness of small producers and poor households. Although India has emerged as a major producer and consumer of milk, a large proportion does not enter the organized sector. A large percentage of the marketable surplus is handled by the unorganized sector comprising of milk dealers and vendors. In the meat sector, most meat is sold without any sanitary inspection. Due to unsophisticated slaughtering practices, the recovery of various by-products is very low and the quality of meat is poor. This contributes to low overall prices for live animals. On the other hand, high transactions cost due to poor marketing and processing infrastructure leads to high cost of finished products.

There are significant economies of scale in collection, distribution and processing of livestock products. Given the very small marketable surplus with individual households it is necessary to build institutions that can vertically integrate small and scattered producers with livestock food processors. Strong marketing organizations can provide a viable vehicle for linking the small and poor producers with urban market centers. While successful experiences clearly demonstrate the potential of cooperatives in reaching out to the poor, it is important that cooperatives compete with the private sector on a level playing field. In order to achieve better performance, the cooperatives need to separate politics from business, insist on competent professionals in management, and avoid interference in technical and business decisions.

Increasing milk supply by improving animal productivity and deepening market penetration is needed, particularly in the lagging regions. Recommended actions to address these areas would include improving support services delivery, improving the infrastructure, increasing the investment in modernizing and upgrading old facilities, and developing the necessary market linkages between the milk cooperatives, other dairy companies, and milk producers; and on mobilizing producers into organizations to facilitate the linkages and minimize transaction costs. There is also great need to attract and expand the capacity of the private sector and modernize the sector involved in the manufacture of indigenous products.

Key areas for greater attention include improving the quality of the product produced and processed, improving the efficiency of transport, and increasing cooling and processing capacity with additional investments. First, improving infrastructure to reduce distances travelled by perishable products (e.g. milk) would decrease spoilage. Second, raise farmers' awareness about the importance of good quality product through extension and communication campaigns. Ideally, these campaigns would be coupled with price incentives for those who produce higher quality product.

The number of milk collection centers that are equipped with cooling and storage facilities and quality testing equipment must be increased. Increasing the numbers would reduce spoilage and allow for testing on site, while separating the good quality milk from the lower quality grades. Second, the risk of contamination at the processing plants in lagging areas can be reduced by following strict hygiene standards and replacing outdated equipment. Finally, the shelf life of milk products can be enhanced through flash (UHT) processing, investing in better packaging technologies, or engaging the research community and the private sector in joint research and development activity to do the same.

Meat processing and marketing offers great scope for private investment, but inducing this may require more public investment in key infrastructure, especially in the lagging regions. Modern slaughterhouses would be a case in point. Rearing of buffalo male calves and their processing and export can be highly profitable for private agents. Processing of sheep and goat meat would add value to the meat chain. Slaughter houses and meat processing plant for mutton should be set up for major producing areas for sheep and goat, particularly in the lagging states. There is an increasing realization of the desirability of improving the quality of the livestock products, and of following good hygienic practices. Investment is required in establishment of laboratories for quality testing, human resource development and building public awareness towards the quality of the products.

With rising demand for livestock products, other key areas that also need to be addressed are marketing efficiency, and the sanitary and environmental problems associated with livestock processing. The government's role should increasingly be not of direct involvement but one of promoting and ensuring fair competition in the market, and the establishment and enforcement of hygiene, sanitary and quality standards. Identification of real marketing bottlenecks and critical areas of market development through a good livestock market information and research system would be very helpful. Market information would be very important for promoting market competition. An information network on livestock production, marketing needs to be build up- Application of 'e' technology would be of great consideration for building up such an information network. Gujarat Milk Marketing Federation has already created an e-network covering their district milk producers' cooperative unions. The concept needs to be expanded to the other areas.

To improve the functioning of regulated markets, reforms are required in the State Agricultural Product Markets Acts. The draft model legislation on agricultural marketing has been discussed by the states at several levels and has already been adopted by several states. At present, markets are "set up" at the initiative of the state government alone. The reforms in the draft model legislation provides for the establishment of markets by private persons, farmers and consumers including more than one market in a market area. In the Model Act, provisions have been made for allowing and promoting direct marketing to consumers. The objective is to create and transmit incentives for quality and enhanced productivity, better technology and technology support, reduction of distribution losses and raising farmer income. The government's role should be that of a facilitator rather than that of having control over the management of the markets. Adoption of the Model Act by the states needs to be accelerated.

There is great need to ensure better standards of public health and safety, environmental protection, and quality in the poultry activity. The organized private sector has developed efficient production

systems for eggs and broilers. The model of poultry integrators has shown tremendous promise and progress, especially in south India. It has improved the efficiency of the production and marketing systems, brought down the retail prices, and is conducive to the adoption and benefit of large sections of the rural population. There is great need to encourage this model throughout the country through specific special schemes, finance and services.

There is great scope for improvement on the retail marketing as well. Dairy product marketing needs to change from door-to-door sale to supermarket sale in larger quantities, since large numbers of urban households have refrigeration facilities at home. Poultry product retailing needs to move from live/raw to the processed and frozen mode. The retailing of other meats also needs to be consolidated and modernized into scientifically managed outlets. The feed industry also needs to undergo tremendous growth to meet the requirement of a rapidly growing and modernizing livestock sector.

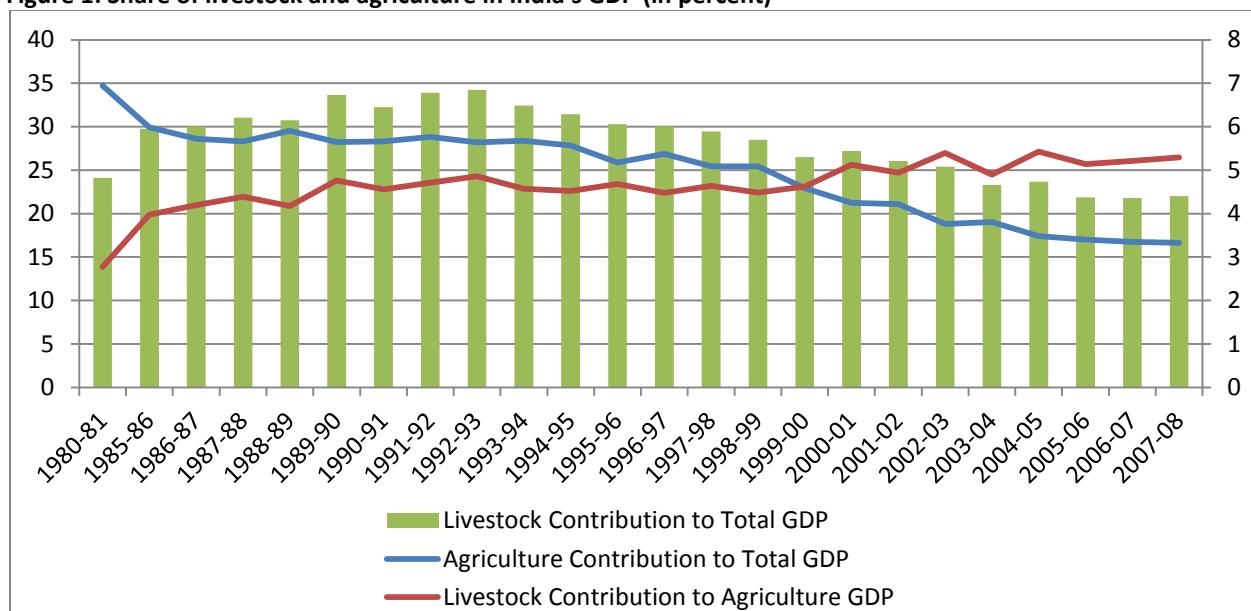
The potential for linking investment with export markets should be assessed. Quality and safety standards need to be significantly improved to exploit export potential. Investment for improving quality and safety standards in all the value chains – dairy, poultry, ruminant meat, hides and skins- should be increased to meet apparently rising domestic demand for quality and safety and also to expand export. An integrated systems approach to value chain management by harmonizing the multiplicity of regulations and institutions for hygiene, safety and quality management will be needed to improve hygiene and quality standards.

Finally, as demand is projected to continue growing, the capacity of livestock production systems to respond, should try to internalize the possible environmental externalities. For example, overgrazing tends to threaten the sustainability of common property resources (pastures, grasslands, forests) considered to be the primary source of feeding for smallholders' livestock. As productivity rises, animals will necessarily require additional supply of feed and fodder which would put increasing pressure on land and water resources. Larger bovine production inevitably contributes to green house gas emissions (methane) and pollution of water ways. Such threats, in addition to the effects of climate change, would necessitate a change in approach to reduce the adverse environmental impacts and ensure sustainable livestock development. Possible areas to explore would include improving feed diets, feed supply, and feed conversion ratios to reduce enteric fermentation and hence methane emission; managing manure to reduce pollution; increasing feed crops productivity through intensification; and reducing common property resources degradation, thus contributing to the mitigation of climate change impacts.

1. DEMAND-LED GROWTH AND POVERTY REDUCTION

India's economy has not only grown, it has transformed. Once an agriculture-based economy, both the industrial and service sectors gradually saw their shares in total GDP increase while the agriculture's sector share declined. In 1980, the share of agriculture sector in total GDP stood at 34 percent. It decreased to 16 percent in 2007-08 (GOI, 2008). Between 1991 and 2008, the country's total population increased by 1.6 percent annually, but the urban population grew at a faster rate of 2.4 percent. Real per capita income also rose by 4.8 percent annually. Throughout India's economic transformation, the livestock sector consistently contributed to about five percent of total economic output (figure 1). Between 1981 and 2006, the livestock sector grew at the rate of 3.9 percent annually much faster than crop sector growth of 2.8 percent. Both contributed to a growth rate of about three percent annually for agricultural value added during the same period (national accounts statistics). In 2007-08, the livestock sector contributed to 26.5 percent of agriculture GDP increasing from 14 percent in 1980-81 (GOI, 2008)

Figure 1: Share of livestock and agriculture in India's GDP (in percent)



Source: Basic Animal husbandry statistics, GoI (2008)

DEMAND FOR LIVESTOCK PRODUCTS IS GROWING

These changes were accompanied by a decline in the share of household expenditures on food, but a marginal increase in the share of food expenditures on livestock products. Between 1983 and 1994, the relative share of food in total household expenditure in urban areas declined by only four percent. It plummeted by 13 percent between 1994 and 2006 (Table 1). In rural areas, the decline was respectively by 2.4 percent and 8.2 percent for the corresponding decades. The share of animal products in total household expenditures in urban areas increased from 21.8 percent in 1983 to 25 percent in 2005-06,

and in rural areas the corresponding increase was from 16.1 percent to 22.6 percent. By 2006, livestock products accounted for 24 percent of total food expenditures in the country as a whole.

Table 1: Rural and urban household expenditure patterns have shifted away from cereals and towards livestock products.

Food Category	Rural (percent expenditure)			Urban (percent expenditure)		
	1983	1993-94	2005-06	1983	1993-94	2005-06
Share of food in total household expenditure	65.6	63.2	53.0	58.7	54.7	40.0
Allocation of food budget:						
Milk and milk products	11.5	15.0	15.1	15.7	17.9	17.5
Meat, egg and fish	4.6	5.3	7.5	6.1	6.2	7.5
Total animal products	16.1	20.3	22.6	21.8	24.1	25.0
Cereals	49.5	38.5	32.1	32.9	25.8	22.5
Other foods	34.4	41.3	45.3	45.4	50.2	52.5
All foods	100.0	100.0	100.0	100.0	100.0	100.0

Source: Birthal (2008) and NSSO survey (2005-06)

Per capita consumption of livestock products has increased. Between 1983 and 2000, per capita consumption of milk nearly doubled from 43 kg to 73.5 kg, and that of meat increased from 2.4 kg to 3.1 kg— largely driven by surging demand for poultry. Per capita poultry meat consumption increased by 122 percent over the same period to reach 0.71 kg/annum in 2000. There were also significant increases in per capita bovine meat consumption (30 percent) and pork consumption (50 percent). Per capita consumption of mutton and goat meat, on the other hand, showed a marginal decline, led primarily by trends in urban areas. Per capita consumption of eggs increased substantially during this period (111 percent) from 9.2 eggs to 19.5 eggs annually.

Changes in the food basket have been widespread. Between 1983 and 2000, both poor and rich households increased their per capita consumption of animal products (table 2). Changes in the per capita consumption for meat, eggs and fish were pronounced—increasing 120 percent in rich households and almost doubling in poor households. The proportionate increase in milk consumption was slightly higher for rural (71 percent) than urban households (63 percent). A proportionate increase in the per capita consumption of meat, eggs, and fish was similar (34-36 percent) for rural and urban consumers. Ravi and Roy (2006) observed faster growth in the consumption of animal products among the bottom 30 percent households compared to the upper 30 percent bracket.

Table 2: Changes in per capita consumption of livestock products by location and income group (kg/annum)

Income Group	Milk			Meat, egg and fish		
	1983	1999-00	% change	1983	1999-00	% change
Income class						
Poor	15.7	20.6	30.6	1.9	3.8	100.0
Rich	89.7	117.2	30.7	4.8	10.6	120.8
Location						
Rural	37.0	63.3	71.1	4.4	5.9	34.1
Urban	55.5	90.7	63.4	5.9	8.0	35.6
All	43.0	73.5	70.9	4.8 ^a -9.2 ^b	6.6-19.5	37.5-112.0

Notes: a. Meat and fish excluding eggs. b. Number of eggs.

Source: Kumar, Mruthyunjaya and Birthal, Changing consumption Pattern in South Asia (2007).

Aggregate consumption, however, hides wide variation among states in per capita consumption. Table 3 shows animal product consumption by state, listing the states in descending order by level of milk consumption since that product saw the greatest increase and it is the most important animal product consumed. In terms of milk consumption, there are three groups of states: the first group of six states consumes between 97 and 146 liters per capita per year; the second group of nine states consumes 40 to 67 liters per capita per annum and the remaining states, mainly in the east and hilly regions of the country, consume 20 liters or less. Among the first group, the northern states of Haryana and Punjab have the highest annual per capita consumption at 146 and 134 liters, respectively. In the west and south of the country, the per capita consumption of milk ranges from 40 liters in Andhra Pradesh to 67 liters in Gujarat. In the eastern and hilly regions of the country per capita milk consumption is much lower, ranging from 2.5 liters in Manipur to 36 liters in Bihar. Milk consumption is not an indicator of all animal products consumption, however. Some of the states in Group 1 consume less meat and eggs than the hilly and mountainous states, which also consume more meat, especially pork and beef.

Income, religion, and socio-cultural practices are important factors in determining consumption levels. The propensity to spend on livestock products is higher at higher income levels, and the data show that many states with higher income growth rates consume more animal products than others. Expenditure elasticity of demand for dairy and poultry products has been estimated by various studies to be 0.99–1.32 for urban areas and 1.15–1.96 for rural areas (Sharma, et al. 2008). About 40 percent of India's population is vegetarian; some consume dairy products while others do not (Kumar and Birthal, Changes 2004). The consumption of beef and pork is subject to religious restrictions in most states.

Table 3: Per capita annual consumption of milk, meat, and eggs varies across states

State	Liquid milk	Eggs	Mutton	Beef	Pork	Chicken	Others	Total meat
Haryana	146.2	5.27	0.36	0.20	0.05	0.17	0.00	1.62
Punjab	134.8	13.60	0.31	0.01	0.04	0.48	0.00	0.84
Rajasthan	108.3	2.84	1.05	0.06	0.00	0.03	0.01	1.15
Himachal Pradesh	104.0	10.56	1.43	0.06	0.01	0.17	0.01	1.68
Delhi	97.1	21.70	0.82	0.80	0.04	0.93	0.01	2.60
Jammu & Kashmir	97.1	25.55	1.97	1.76	0.00	0.84	0.01	4.58
Gujarat	66.8	6.35	0.44	0.23	0.00	0.18	0.00	0.85
Sikkim	65.9	20.34	0.54	2.79	1.56	1.88	0.01	6.78
Uttar Pradesh	56.7	7.32	1.08	0.95	0.05	0.12	0.01	2.21
Karnataka	45.4	21.21	1.74	0.41	0.05	0.72	0.01	2.93
Madhya Pradesh	43.5	6.02	0.44	0.09	0.01	0.30	0.01	0.85
Goa	41.6	41.40	0.86	1.02	0.24	1.97	0.06	4.15
Tamil Nadu	40.6	33.11	1.57	0.78	0.02	1.10	0.03	3.50
Maharashtra	40.8	17.19	1.24	0.64	0.01	0.42	0.01	2.32
Andhra Pradesh	40.7	26.93	1.25	0.61	0.04	1.28	0.03	3.21
Bihar	36.7	6.88	0.54	0.16	0.04	0.28	0.02	1.04
Kerala	36.2	33.39	0.35	1.97	0.03	1.09	0.00	3.44
West Bengal	20.8	40.36	0.47	0.82	0.06	0.86	0.02	2.23
Assam	16.5	19.87	0.42	0.45	0.56	0.94	0.24	2.61

State	Liquid milk	Eggs	Mutton	Beef	Pork	Chicken	Others	Total meat
Tripura	14.6	25.65	0.39	0.21	0.40	1.03	0.29	2.32
Orissa	11.8	8.33	0.47	0.24	0.04	0.35	0.08	1.18
Meghalaya	11.1	20.02	0.25	5.98	2.25	1.90	0.72	11.10
Mizoram	11.5	26.87	0.11	2.25	5.21	1.25	1.91	10.73
Arunachal Pradesh	8.8	23.40	1.07	5.61	1.34	1.80	0.58	10.4
Nagaland	5.5	55.29	0.37	7.93	7.90	1.74	0.62	18.56
Manipur	2.5	13.15	0.10	1.06	0.58	0.46	17.19	19.39

Note: Data reported is from 2004-05. Milk is reported in liters, eggs in number, and meat in kg.

Source: Gandhi and Zhou (2008) for milk, and authors' field work for eggs and meat.

Despite the rapid increase in consumer demand, India still ranks low among other countries in consumption of livestock products (table 4). While its consumption of milk outstrips other developing countries in Asia, it is still considerably lower than consumption in developed countries. The per capita annual milk consumption in India in 2003 was 68 kg, much less than that in many developed countries. India lags behind comparable Asian countries, such as China, Thailand and the Philippines in terms of consumption of poultry meat and eggs.

Table 4: India's per capita consumption of livestock products still trails that of other countries

Country	Milk ^a	Eggs	Bovine meat	Mutton and goat meat		Poultry meat
China	16.6	18.3	4.9	2.8		10.9
Philippines	18.7	6.5	3.8	0.4		8.6
Thailand	24.2	10.0	3.7	0.0		12.0
Japan	65.8	19.1	8.4	0.2		15.8
India	68.0	1.8	2.4	0.6		1.6
New Zealand	83.4	10.1	26.4	24.8		35.2
Saudi Arabia	95.8	4.4	3.8	6.3		35.8
Australia	248.7	6.2	46.1	14.4		35.6
USA	261.6	14.6	41.9	0.5		50.2

Notes: Data are from 2003 a. excludes butter.

Source: FAO (2009)

By 2020, the demand for livestock products is projected to increase substantially. If the per capita income were to grow at the same rate it did between 1991 and 2006, estimates put the demand for milk, meat, and eggs in 2020 at 153 million tons, 7.0 million tons, and 3.7 million tons, respectively. Demand projections vary widely depending on assumptions about income, population, urban growth, and expenditure elasticity parameters; however, alternative projections show that income growth and demographic changes will likely continue to propel demand growth for all kinds of livestock products, albeit at varying rates (table 5).

Table 5: Alternative estimates project increasing demand for livestock products in 2020 and 2025

Product	Demand in 2003 (actual) ^a	Projected demand in 2020			Projected demand in 2020 ^b	Projected demand in 2025 ^c
		with per capita annual income growth of ^a	4.3 percent	6.0 percent		
Milk (liquid)	83.8	151.7	175.8	132	138	
Total meat	5.0	7.0	7.4	9	9.6	

Product	Demand in 2003 (actual) ^a	Projected demand in 2020			Projected demand in 2020 ^b	Projected demand in 2025 ^c
		with per capita annual income growth of ^a 4.3 percent	6.0 percent			
Bovine meat	2.6	2.9	2.7	NA	NA	NA
Mutton & goat meat	0.7	1.0	1.1	NA	NA	NA
Poultry meat	1.7	3.1	3.6	NA	NA	NA
Eggs	1.9	3.6	4.3	NA	NA	NA

Note: Amounts are in million tons Source: a.. Kumar and Birthal, Changes, 2004; b. Delgado, Rosegrant and Meijer, 2001; c. Kumar, Mruthyunjaya and Birthal, Changing cosumption Pattern in South Asia (2007).

LIVESTOCK CAN BE A PRO-POOR SECTOR

The World Bank's last assessment of India's livestock sector posited that growth in the sector could be poverty alleviating by creating income and employment opportunities due to greater participation in production and the expanding markets by landless, marginal, and smallholders. The protagonists of the 'livestock revolution' made the same prediction for the wider developing world (C. Delgado, et al. 1999). But have the poor in India really benefited from the impressive increase in the demand for livestock products?

The share of landless households owning livestock has declined. In 1982, landless households constituted 26 percent of rural households and they owned 9.3 percent of the small ruminant population, a fairly similar proportion of poultry and pigs, and a smaller share of cattle. In 2003, the proportion of landless increased to 31 percent of rural households (though some may own small piece of homestead), but among the landless, only up to one percent owned any cattle or buffalo, 2.8 percent owned small ruminants, 0.2 percent owned pigs, and 4.7 percent owned poultry (table 6). Between 1961 and 2003, human and ruminant populations increased by 2.5 and 1.5 times, respectively; however, common grazing resources decreased by 35 percent due to (a) large scale privatization; (b) government redistribution of common land among the landless and poor; and (c) general encroachment by land owners for expanding crop production. The quality of common grazing resources also deteriorated due to over exploitation and improper management.

Table 6: Distribution of livestock numbers by land holding size (hectare), 2003

	Landless (<0.002)	Marginal (0.002-1)	Small (1-2)	Medium (2-4)	Large (>4)	All
No. of households, 000	47.2	73.3	16.6	9.2	5.1	151.4
percent households	31.2	48.4	11.0	6.1	3.4	100
Average size of land holding(ha)	0.0	0.37	1.37	2.62	7.53	1.08
percent distribution of population						
Cattle	0.6	53.4	20.8	14.4	10.8	100
Buffalo	0.6	50.4	20.5	15.1	13.5	100
Small ruminants	2.1	62.4	15.4	9.4	10.8	100
Poultry	4.3	63.8	16.8	6.6	8.4	100
Pig	3.1	76.8	11.8	5.3	3.0	100
percent households owning livestock						
Cattle	1.0	45.9	62.2	69.2	76.4	36
Buffalo	0.6	25.8	37.4	44.3	55.6	21
Small ruminants	2.8	21.4	20.3	18.9	20.4	15

	Landless (<0.002)	Marginal (0.002-1)	Small (1-2)	Medium (2-4)	Large (>4)	All
Poultry	4.7	20	18.6	15.6	9.3	14
Pig	0.2	1.7	1.5	1.1	0.9	1
Herd size (number/owning household)						
Cattle	2.0	2.5	3.2	3.6	4.3	2.9
Buffalo	1.5	2.1	2.6	2.9	3.7	2.4
Small ruminants	1.5	3.9	4.4	5.2	10.0	4.2
Poultry	3.7	8.2	10.2	8.7	33.1	8.6
Pig	1.8	3.1	2.3	2.6	3.1	2.9

Source: Birthal, Jha and Joseph, Livestock Production and the Poor in India (2006)

Livestock ownership is more equitable than land ownership among land owning households. The 1987 livestock census showed that 57 percent of the holdings owned less than one hectare of land, 18 percent owned 1-2 hectares, and only 2 percent owned over 10 hectares. Fifty-six percent of the cattle and buffalo population were raised on holdings of less than one hectare and only five percent were raised on farms larger than 10 hectares. The average herd size was 3.7 cattle and buffalo and 1.5 sheep and goats (World Bank, 1996). The share of marginal farm households (those with 1 hectare of land or less) among total rural households increased from 41 percent in 1981-82 to 48 percent in 2003. At the same time, their share of rural land increased from 12 to 24 percent and their share of livestock population increased by an average of 20 percent across various livestock categories (table 7). Between 1992 and 2003 their share in land area increased by 9 percent and in different livestock species by 15-27 percent (with the exception of cattle), while their share in rural households remained essentially unchanged.

Table 7: Share of marginal farm households in land and livestock populations

Marginal households' share in	1981-82	1991-92	2002-03
Rural households	41.2	48.3	48.4
Land ownership	11.7	15.5	24.1
Livestock population			
Cattle	30.0	47.3	53.4
Buffaloes	27.9	35.8	50.3
Small ruminants	38.6	46.2	62.4
Pigs	56.0	49.9	76.8
Poultry	48.8	54.9	63.8

Note: Figures presented are in percent.

Source: Birthal, Jha and Joseph, Livestock Production and the Poor in India (2006)

The livestock sector is an important source of employment for the rural population, especially women. The sector engaged 6.8 percent of the labor force in 1994 and 8.8 percent in 2005 (table 8). In these years women comprised 71 percent and 77 percent of the labor for livestock, respectively. The proportion of female labor is around 90 percent in some states. There is considerable regional variation in the share of livestock in agricultural employment, ranging from as low as three percent in eastern and northeastern states to as high as 40-48 percent in the northern states of Punjab and Haryana.

Table 8: Employment in livestock sector by farm category

Farm category	Agricultural employment in rural employment (percent)		Share of livestock in agricultural employment (percent)		Share of women in livestock employment (percent)	
	1993-94	2004-05	1993-94	2004-05	1993-94	2004-05
Landless	62.8	62.5	5.5	2.3	68.0	97.2
Marginal	73.0	65.2	7.1	9.2	69.4	73.4
Small	89.4	88.2	6.1	7.4	72.1	82.1
Medium	92.2	90.8	6.8	7.8	72.8	83.1
Large	93.1	91.4	7.7	8.6	76.7	82.0
All	78.4	72.7	6.8	8.8	70.5	76.6

Source: Birthal (2008) based on NSSO (2006).

Women are the primary care takers of livestock. They contribute the most to family labor in animal husbandry including feeding, breeding, and management care. It is therefore not surprising to find that one of the first investments that rural poor women groups choose to make under micro-credit schemes is in livestock. To them, a cow or a buffalo represents a source of nutrition, credit, draft power, natural fertilizer, and sustainable income for their families. Women also look after small ruminants, sheep and goat, and backyard poultry activities. Livestock empowers women by providing them the opportunity to contribute to family income, responsibilities and decision-making. Organizing women in Self Help Groups (SHG) around livestock activities has helped link them to input and support services providers and market buyers (e.g. Andhra Pradesh Rural Poverty Reduction Project, Rajasthan District Poverty Initiatives Project, etc.). Box 1 provides an example of such an intervention.

Box 1: The Rajasthan Microfinance Initiative

The Rajasthan Microfinance Initiative of the Sir Ratan Tata Trust (SRTT) was launched in March 2003 to demonstrate working of self-sustaining community-based microfinance and livelihoods development programs in Rajasthan. At present, the Trust is supporting 14 non-profit organizations (NPOs) under this initiative to promote, strengthen and upscale self-help groups of women and their community based institutions. Two of the organizations supported by the SRTT, PRADAN and SRIJAN have been implementing the World Bank-funded District Poverty Initiatives Project (DPIP) in 3 districts of Rajasthan since 2004-05; Dholpur and Dausa (PRADAN) and Tonk (SRIJAN). DPIP provides subsidy to groups of poor for undertaking income enhancement activities, dairy development and goat rearing being the two major activities that are being supported. The SRTT has provided a cumulative grant of Rs. 2.1 million for a three year duration to these organizations as plug gap funds for creating strong backward and forward linkages for innovations in livelihood cluster development around goat and dairying in approximately 230-250 villages spread across the three districts.

In the Tonk District, around 1250 women have been provided with a total of 1613 buffaloes from the DPIP. Eleven clusters have been organized to provide veterinary services, feed business and 24 milk collection centers. The members are given credit facility and the amount is adjusted against milk produced by them. Veterinary doctors undertake weekly visits to the cluster shops. A cadre of para-vets has also been selected and developed by the clusters. Marketing linkages have been established with a private dairy company. The intervention has successfully led to an increased return of Rs. 3-4 per liter for the members. Based on the impact of the dairy intervention, Maitree Mahla Mandal, the federation of these members has set up a 2000 liter per day capacity Bulk Cooling Unit to be able to cater to more villages and to supply milk to far off dairies located in Jaipur or Kota.

The model for empowering of the women's groups seems to be working well. Direct interaction with women group leaders showed that they were active and outspoken, though illiterate and members of very traditional households.

Source: Sirohi, et al. (2008)

The importance of livestock as a source of income varies across eco-zones. In the arid zone, the livestock's share of household income averages 36 percent and increases to 39 percent among households owning less than 0.5 hectare of land, but the importance of livestock in the livelihoods of the poor is significant even in well-endowed regions. In the highly irrigated states of Punjab and Haryana, the marginal farms earn 25-33 percent of their total income from livestock. In some rainfed states, like Gujarat, livestock contribute as much as one-third to the income of these households. Livestock's contribution in the eastern states of Orissa and West Bengal, however, is extremely low. Overall, the sector's importance as an income source is least in the coastal region. Nationwide, livestock contributes to 14 percent of household income, a proportion that is about the same across all land owning classes (table 9).

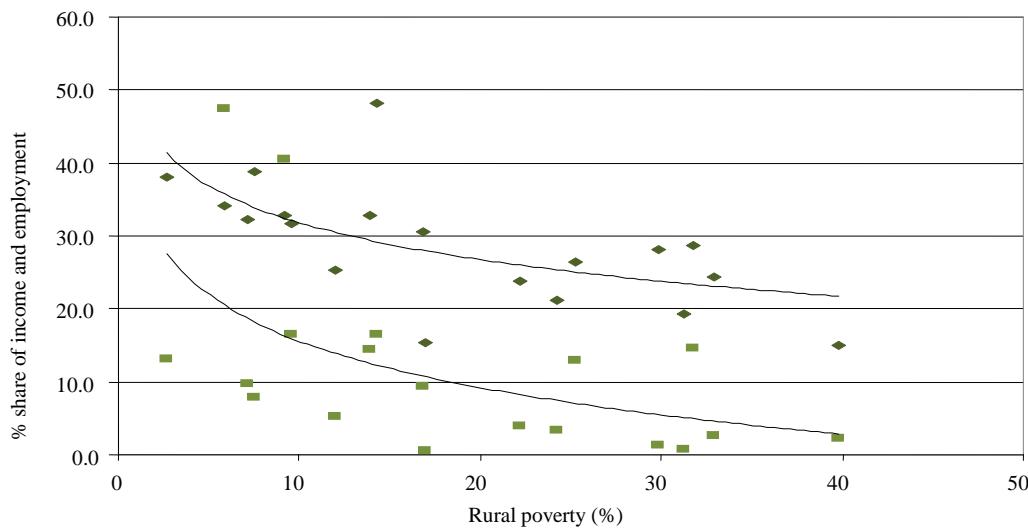
Table 9: The share of livestock in household income varies by ecozone and farm size

Farm size	All India	Arid	Rainfed	Irrigated	Coastal	Hill & Mountains
≤ 0.5 hectares	14.8	38.7	13.1	18.0	7.8	14.3
0.5-1.0 hectares	15.0	33.6	13.2	19.2	6.5	14.0
1.0-2.0 hectares	15.7	34.5	12.2	20.1	7.8	16.0
2.0-4.0 hectares	13.8	42.9	10.2	17.0	11.2	7.7
>4.0 hectares	12.2	32.7	8.8	14.7	5.7	9.7
All	14.4	36.0	11.4	18.0	7.6	13.6

Note: Data are from 2003. Source: Birthal, Overview (2008)

Livestock income and employment constitutes a path out of poverty for rural poor communities. Figure 2 shows that the higher the share of livestock in agricultural income, the lower the rural poverty index. Similarly, a higher share of livestock in agricultural employment is positively correlated with lower incidence of rural poverty. Birthal and Taneja (2006) found a stronger negative relationship between the growth in livestock sector and rural poverty reduction compared to the growth in crop sector and rural poverty alleviation efforts.

Figure 2: Relationship between income and employment shares of livestock in agricultural sector and rural poverty

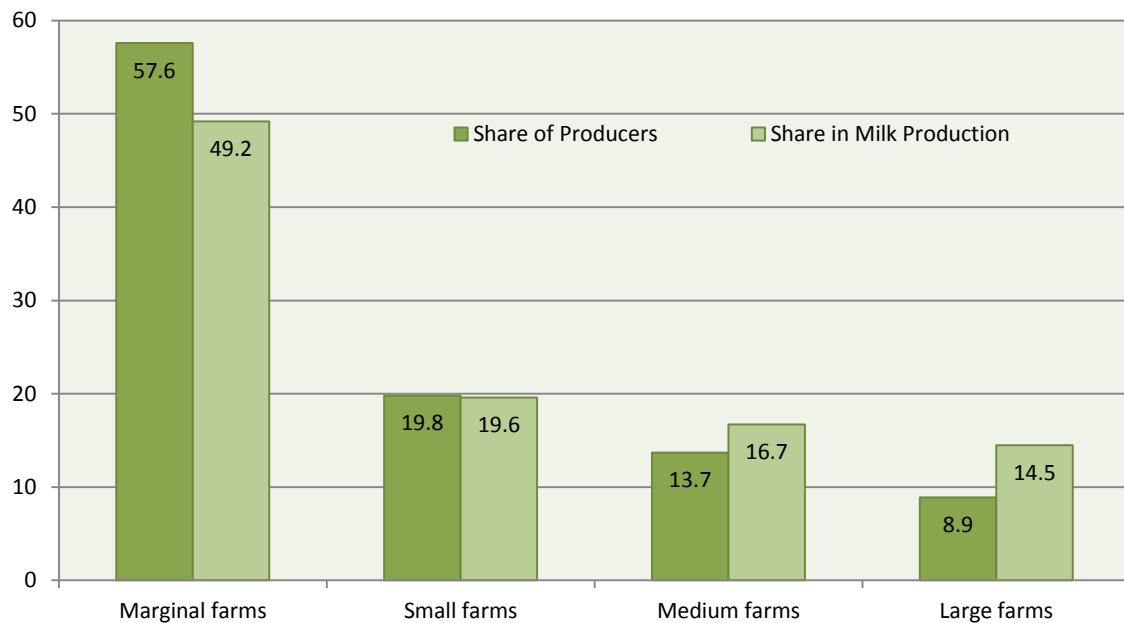


Source: Birthal, Overview (2008).

Though the share of livestock ownership among landless households has declined, dairying continues to be an important activity to landless households and more so to smallholders. In recent years dairying has provided about 12.5 percent of family income for landless households, who are impeded by limited resources to increase their income from this activity. On the other hand, small farmers derive the highest contribution to family income from dairying. They contribute in family labor and make use of their limited agriculture holding to support livestock farming. Crop production provides the major source of income for medium and large households, contributing to more than half of total household income.

Dairy activity is largely concentrated among small landholders, who also control about 78 percent of the small ruminant population in the country. Nationally, 44 percent of farm households are associated with dairy. Figure 3 shows that 58 percent of them are marginal farm households (≤ 1.0 hectare) and another 20 percent have land holdings between 1-2 hectares (Birthal, Linking 2008). Together they contribute to 70 percent of total milk produced in the country.

Figure 3: Small landholders play a large role in dairy production, 2003



Source: Birthal, Overview (2008)

In the sub-humid region—Bihar, Orissa, and West Bengal—small landholders (≤ 2 hectares) own more than 78 percent of the small ruminant population due to extremely small land holdings (Birthal, Jha and Joseph, Livestock Production and the Poor in India 2006). In the dry regions of Rajasthan and Maharashtra, large farmers (> 4 hectares) control 35-40 percent of the small ruminant population. The herd size is also larger in these states. Small ruminants contribute 20-25 percent to the household income in the Eastern region, and 50-75 percent in the Western region (Birthal, Deoghare, et al. 2003). For marginal farmers, small ruminants often represent the single largest source of income. In Bihar, goats are mainly reared by landless and marginal farmers in smaller flocks. Holding size is generally 1-3 goats per family depending on availability of surplus labor in the family. Field work in Orissa has shown

that larger flocks of goat and sheep are maintained by the small and marginal farmers as a means of livelihood.

Backyard poultry is an important livelihood activity, particularly for poor and disadvantaged communities. A vast majority of these birds are owned by the landless and marginal farm households and households belonging to scheduled castes and scheduled tribes (e.g. 90% in Orissa). Backyard poultry is, however, managed in an unorganized manner considerably undermining its potential to contribute to household income and to family nutrition. Flock holdings vary widely from as low as 2 to as high as 30 birds. Backyard poultry systems suffer from a number of problems which limit their potential of being a viable and profitable livelihood generating activity. These problems include: lack of skills in aspects of feeding and management, lack of genetic inputs to improve the local stock, heavy losses due to diseases, and general lack of extension support.

THERE ARE AT LEAST TWO WORLDS OF LIVESTOCK FOR DEVELOPMENT IN INDIA

Green revolution successes created a platform for livestock development in some states. High yielding cereals, irrigation, fertilizers, pesticides, tractors, and other mechanical equipments played a major role in transforming the livestock sector from both the supply and the demand side. On the demand side, higher crop productivity increased rural household incomes, which increased the demand for milk and other dairy products. Higher crop productivity also reduced real prices of cereal for urban consumers, which freed income to buy livestock and dairy products. On the supply side, promotion of irrigation and mechanization of farm operations released many draft animals from field work that made way for increased number of dairy cows and buffaloes to be used for milk production. In general, the development in input markets, agricultural services, and mechanization resulted in substantial cereal crop productivity and output gains. The rise in cereal productivity—which continued beyond the mid-1980s—allowed relatively more land to be used to produce green fodder for dairy animals in the most successful states. Physical infrastructure—such as, roads and electricity—developed to support the green revolution technology also provided a sound basis for the development of livestock, particularly dairy (Staal, Nin Pratt and Jabbar 2008).

Operation Flood scales up a dairying success. Operation Flood was launched in 1970 to replicate the farmer-owned cooperative organizations of the Anand cooperative model. The program revolutionized dairy development all over India and over time laid the groundwork for private sector participation in the dairy industry; the western and southern states received most of the investment and saw most of the impacts. By 2005-06, there were about 12.4 million farmer members, including 3.4 million women, spread over 117,575 village cooperative societies in 346 districts. These societies were federated into 170 milk unions and further federated at the state level. One of the most successful examples is the Gujarat milk producers' federation (see Appendix 5).

The benefits of the Green Revolution and programs like Operation Flood were not captured by all states equally. States like Punjab, Haryana, and Gujarat (hereafter referred to as leading states) exemplify the potential that can be achieved from significant investment, while states like Bihar and Orissa (hereafter referred to as lagging states) were largely by-passed. Over 60 percent of the dairy

cooperative societies and farmer members of such societies are located in few selected states (table 10). Fifty four percent of the cooperative dairy processing plants and 65 percent of cooperative dairy processing capacities are located in the group of states with highest milk consumption. Only Maharashtra and Karnataka have sizeable number of cooperative societies, members, and processing capacity outside of the high consumption group of states. Even the private sector and the government parastatals established 96 percent of their processing capacity in the states belonging to the first consumption group.

Table 10: Cooperative societies, membership, and dairy plants by state 2005-06

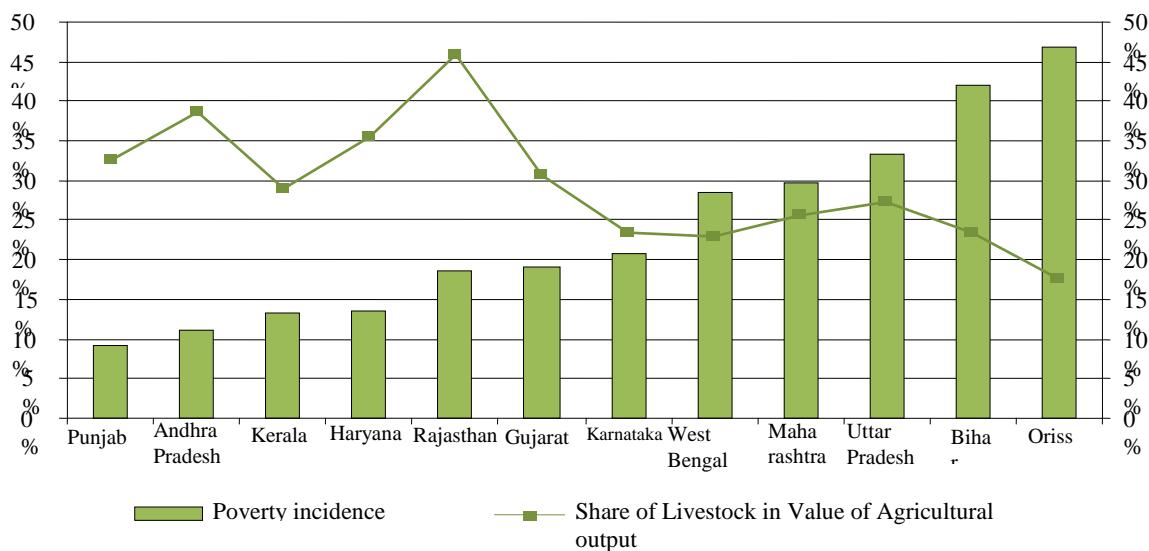
State	Percent Cooperative societies	Percent Farmer members	Cooperative dairy plants		Total dairy plants	
			Number	Capacity ^a	Number	Capacity
Punjab	5.7	3.7	13	1580	50	5,272
Haryana	4.6	1.9	5	865	39	5,740
Kerala	2.8	6.0	9	565	19	898
Tamil Nadu	6.7	15.1	25	4365	45	7,040
Gujarat	10.2	19.8	16	9870	33	11,045
Rajasthan	10.8	4.8	18	1887	27	2,632
Uttar Pradesh	16	6.9	33	2326	232	19,079
Andhra Pradesh	3.9	6.3	14	2930	39	5,237
Delhi	-	-	0	0	7	10,000
Sub-total	60.7	64.5	133	23848	491	66,943
Maharashtra	16.6	13.2	62	7801	185	19,360
Karnataka	8.6	14.8	16	2213	38	4,243
Bihar	4.5	2.1	7	491	9	691
Madhya Pradesh	4.7	2.2	10	1070	28	3,747
West Bengal	2.1	1.5	2	216	17	2,081
Orissa	1.8	1.1	8	212	9	262
Sub-total	38.3	34.9	105	12003	286	30,384
Other states	0.9	0.6	6	99	10	644
Total	100	100	246	36570	789	98,051

a. Capacity of all dairy plants in 000 litres per day;

Source: NDB Annual Report, (2006-07)

Today some of the states with the lowest rural poverty incidence have a very vibrant and dynamic livestock sector contributing significantly to their agricultural output and growth. For instance, more than a third of the agricultural output in Punjab, Andhra Pradesh, and Haryana is generated by the livestock sector. The rural poverty rates in these states are among the lowest in the country at 9 percent, 11 percent, and 14 percent, respectively (figure 4). On the other hand, despite the importance of the livestock sector to poverty reduction, states with high rural poverty incidence have yet to capitalize on their livestock resources to help them generate higher output and income. For instance, Bihar and Orissa, which are the two most impoverished states in India, receive little contribution from the livestock sector to their total agricultural output, despite the increased dependence of the poor on livestock. The livestock sector contributes to less than 20 percent of agricultural output in Orissa and less than 25 percent of agricultural output in Bihar.

Figure 4: Rural poverty and share of the livestock in total agricultural output value in selected states in India



Source: Planning Commission, 2008 for poverty data (2004-05); (Central Statistical Organization n.d.)

SUMMARY OF KEY POINTS

- Rapid economic growth during the last decade and a half has been accompanied by a large increase in per capita consumption of milk and meat. The largest increase in consumption occurred in case of poultry meat followed by pork and bovine meat. Consumption of mutton and goat meat declined.
- The proportionate increase in consumption of milk and meat was similar across rural and urban areas and across income classes, but there are wide variations among states in consumption growth.
- The opportunities for participation in sector development activities and their distributional impact through employment and income generation could not be enjoyed by people in wider geographical areas.
- Increase in consumption by state followed growth in production. Leading states experienced higher milk and meat output and consumption growth while lagging states experienced lower output and consumption growth.
- Livestock has contributed to poverty reduction. Among land owning households, livestock ownership was more equitable than land ownership, and small and marginal farmers generate a significant share of income and employment through livestock. The contribution of livestock in income and employment appeared higher in leading states than in lagging states, due to lower marketed surplus and market participation in the lagging states.

- The Green Revolution and Operation Flood created a platform for livestock sector development in some states, but not all. To meet the expected large demand increase, different strategies for leading and lagging states have to be developed.

2. LIVESTOCK SECTOR PERFORMANCE: DIVERSITY AND CHALLENGES

India has one of the largest livestock sectors in the world and the largest livestock population with 520.6 million heads. Table 11 provides a breakdown of the major livestock population in relation to the world livestock population (FAOSTAT, 2008).

Livestock products meet more than income needs. Milk is an important source of protein for the large vegetarian population, and animal dung is extensively used as organic fertilizer and household fuel. Despite the increasing mechanization of agricultural operations, animal draft power continues to be an important source of energy for many farmers. In addition, livestock constitutes a natural asset for the poor that can be liquidated when required. Hence, it is a store of wealth and an insurance substitute during times of crisis.

Table 11: India's livestock population is one of the largest in the world

Animal	Percent of world population
Cattle	12.7
Buffalo	56.7
Goats	14.5
Sheep	5.9

INDIA'S LIVESTOCK POPULATION HAS STEADILY INCREASED

The population of crossbred cows and buffaloes has increased rapidly in recent years. Crossbred cows accounted for one-fifth of the total cows in 2003 (19.7 million), up from 5 percent in 1982. During this period, the buffalo population increased by 40 percent, from 70 million to 98 million (table 12).

The goat population has also rapidly increased. Between 1961 and 2003, the goat population more than doubled from 61 million to 124 million, but its growth has decelerated in recent years. During 1997-2003, annual growth in the goat population was 0.7 percent, compared to 1.9 percent during 1982-1992. The slowing may be attributed to the decline in the quantity and quality of grazing resources.

The poultry population more than quadrupled, from 114 million to 483 million, between 1961 and 2003. Chickens account for about 99 percent of the total poultry population. Other domesticated species include ducks, guinea fowls, geese, and quail. Robust growth in the poultry population was triggered by increasing market demand and substantial private investment in this sector. The population of pigs also grew, but stagnated after 1992.

Table 12: Livestock population in India has grown steadily from 1961 to 2003

Livestock Category	1961	1972	1982	1992	1997	2003
Cattle	175.6	178.3	192.5	204.6	198.9	185.1
Buffalo	51.2	57.4	69.8	84.2	89.9	97.9
Sheep	40.2	40	48.7	50.8	57.5	61.5
Goats	60.9	67.5	95.3	115.3	122.7	124.4
Pigs	5.2	6.9	10.1	12.8	13.3	13.5
Poultry	114.2	138.5	207.7	307.1	347.6	482.6

Source: Basic Animal Husbandry Statistics, GOI (2006)

THE LIVESTOCK POPULATION AND THEIR USE VARIES BY ZONE

India has widely varying agro-climatic and socio-economic conditions that directly influence livestock production systems and their performance. Broadly, the geography of India can be categorized into five zones—arid, rainfed, irrigated, coastal, and hills and mountains—which cut across the state boundaries (table 13).

Cattle dominate in the rainfed zone, but only about one-third are used for dairy production. The rainfed zone is spread over 53 percent of the country's area and supports 45 percent of the human population. Cattle are the dominant livestock species in this zone, and about 11 percent of the cattle are crossbred varieties. Cattle are an important source of draught power in this zone; roughly one-third of male cattle are used for this purpose. Only 31 percent of the total cattle are raised for milk production in the rainfed zone. The goat and sheep population is also considerable in the rainfed zone because of the availability of common grazing lands, which cover 15 percent of the geographical area. Poultry has also emerged as important activity in this zone, mainly in the southern and western rainfed areas. About half of country's poultry population is concentrated in this zone.

The irrigated zone is densely populated with all species. The irrigated zone falls largely in the Indo-Gangetic plains of Bihar, West Bengal, Punjab, Haryana, and Uttar Pradesh, and is one of the most densely populated and intensively cultivated zones in the country. It has one of the highest densities of different livestock species, accounting for 41 percent of the country's buffaloes, 26 percent of the cattle, 30 percent of the goats and 28 percent of the pig population. Cattle outnumber buffaloes in this region, particularly in the Indo-Gangetic plains of Bihar and West Bengal, which account for 45 percent of all cattle in the irrigated zone. About 15 percent of the total cattle are crossbred varieties. The buffalo population is concentrated in Punjab, Haryana, and Uttar Pradesh, where nearly 87 percent of the buffaloes in this zone are concentrated in the irrigated districts of these states. Goats are another important species in irrigated areas, particularly in the lower Indo-Gangetic plains, which hold about 57 percent of the total goat population in the irrigated zone. Poultry is becoming popular in the irrigated zone, particularly in the lower Gangetic plains in Bihar, West Bengal, and Orissa. Fifty-seven percent of total poultry population in the irrigated zone is found here.

Poultry is a major commercial activity in the coastal zone. This zone suffers from a dense population, much like the irrigated zone. Cattle are the main livestock species here, and goats are also found in sizeable number. Common grazing lands comprise 13 percent of the total land area. Poultry is an

important commercial activity here; about a quarter of the country's poultry population is found in this zone. An important feature of livestock in this zone is the high adoption of improved breeds of cattle as well as poultry; 26 percent of the cattle and 70 percent of the poultry are crossbred/improved breeds.

The hills and mountains and the arid zones have extreme climatic conditions and are sparsely populated. In both of these zones, about one-third of the land area is under common grazing lands/pastures, and livestock systems are largely grazing based. The structure of the livestock population, however, differs significantly within the regions. Cattle and goats are more prominent in the hills, while the livestock production system in the arid zone is quite diversified, and small ruminants outnumber other species. Poultry and pigs are rare in the arid zone but are found in considerable number in the hills. Adoption of improved animals, except poultry, is higher in the hills than in any other zone of the country.

Table 13: The livestock population varies across agro-climatic zones

	Arid	Coastal	Hill and Mountain	Irrigated	Rainfed	Total
Share in human population (percent)	2.8	13.3	4.3	35.0	44.6	100
Share in geographical area (percent)	8.7	8.3	14.5	15.2	53.4	100
Cattle Population (percent)	2.9	9.8	11.4	26.0	49.9	100
Buffalo Population (percent)	5.1	6.1	4.0	41.4	43.4	100
Sheep Population (percent)	11.9	16.1	8.0	7.0	57.1	100
Goat Population (percent)	7.2	8.4	9.0	30.0	45.5	100
Pig Population (percent)	1.5	7.4	34.6	28.7	27.9	100
Poultry Population (percent)	0.2	24.6	9.0	16.5	49.7	100

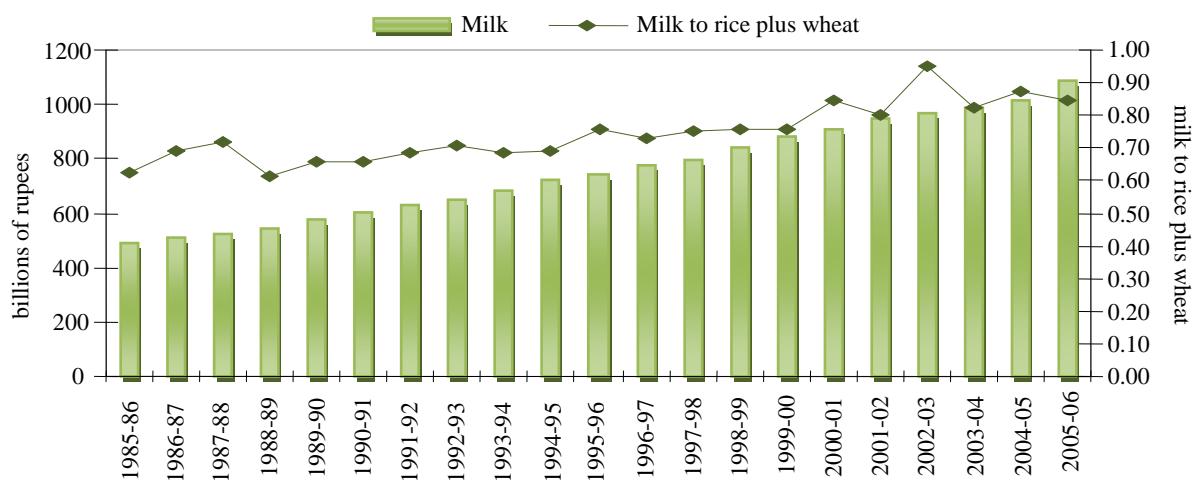
Note: Data are for 2003

Source: Birthal, Overview (2008)

PRODUCTION AND PRODUCTIVITY

Since 1990-91, milk is the single largest agricultural commodity produced in the country, and India is now the largest aggregate producer of milk in the world. Milk output has shown the most impressive growth in response to high consumer demand and changes in the structure of the national dairy herd and its yields. Between 1993/94 and 2005/06, milk output increased by 58 percent compared to a 23 percent increase in the population of bovine animals. The level of milk production reached 96 million tons in 2005/06, equivalent to 15 percent of global production. In the same year, the value of output from milk—Rs 1088 billion in 1999/00 prices—was equivalent to 85 percent of the value of rice and wheat put together (figure 5). In 2007/08, milk accounted for two-thirds of the total value of output in livestock. The shares of meat, eggs, wool, and dung were 17.5 percent, 3.7 percent, 0.2 percent, and 7.7 percent, respectively.

Figure 5: The value of milk output in relation to rice and wheat is on the rise, 1995-2006



Source: Central Statistical Organization (2007) as reported in Birthal, (2008)

Between 1993/94 and 2007/08, the number of crossbred milk cows more than doubled and their proportion in the producing stock (excluding dairy goats), increased from 7.3 percent to 12.6 percent. At the same time, the number of buffaloes increased by 38 percent and their share in producing stock rose from 43.9 to 48 percent. Accordingly, the share in total milk production increased from 15 percent to 22 percent for crossbred cows, and from 56.1 percent to 56.3 percent for buffaloes. The indigenous cow population increased by only 2.1 percent over the same period (table 14), and their share of total milk production declined accordingly from 29 percent to 22 percent. The share of goat in milk production stood at 3.7 percent in 2007-08.

The marginal increase of indigenous cow numbers is due to the fact that these are dual purpose animals. Males are used for draught power and females for milk and herd replacement. With increased mechanization of crop production and declining farm size making many marginal farmers unable to keep draught cattle, the utility of indigenous cattle has been decreasing. The contribution of draught animals in total energy use in crop production declined from 46 percent in 1971/72 to 10 percent in 2000/01 (Kulkarni 2005). These changes occurred more rapidly in the states where green revolution technologies have been in use for a longer period. Moreover, indigenous cattle produce lower milk yield than buffaloes, so there is a tendency to replace indigenous cattle with dairy buffaloes and crossbred cattle once the need for draught power is gone.

Table 14: The structure of India's dairy production has changed since 1993/94

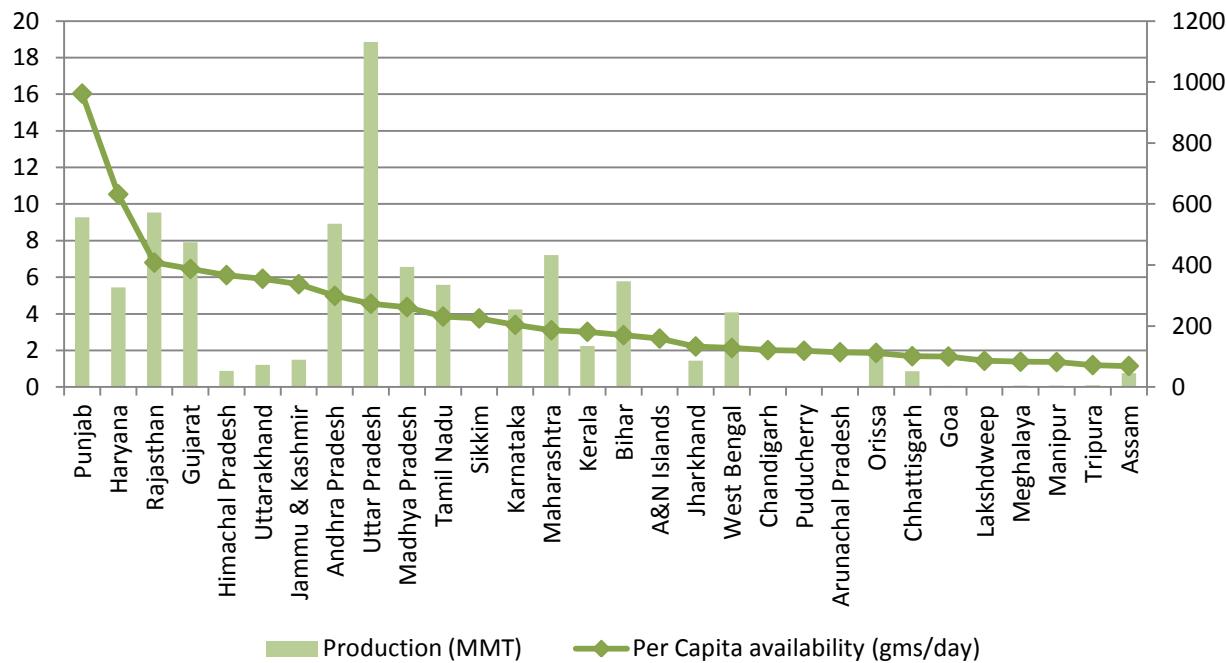
Milk Source	In-milk population (million)		Production (million t)	
	1993-94	2007-08	1993-94	2007-08
Crossbred cows	4.2	9.09	8.6	21.7
Indigenous cows	27.7	28.3	16.8	21.7
Buffalo	24.9	34.4	32.5	55.9
Total bovine	56.8	71.79	57.9	99.3

Source: Basic Animal Husbandry Statistics, GoI (2008)

There are significant inter-state differences in the structure of dairying that affect animal productivity. Buffalo is more prominent in Haryana, Punjab, Rajasthan, Gujarat, Madhya Pradesh, Andhra Pradesh, Uttar Pradesh, and Uttarakhand, where they contribute between 54-85 percent to total milk produced. On the other hand, in other states like Kerala and Tamil Nadu, crossbred cows account for the bulk of milk output. States like Punjab, Haryana, Himachal Pradesh and Jammu & Kashmir also have sizeable proportion of crossbreds in their cattle herds.

Milk production per buffalo per day ranges from as low as 2kg in Assam to a high of 7.8 kg in Punjab. Only a few states (Punjab, Haryana, Jharkhand, Kerala, and West Bengal) have a milk yield from buffaloes above the national average of 4.4 kg per day. Crossbred cows, on average yield 6.5 kg per day—ranging from 3.3 kg per day in Assam to 9 kg per day in Punjab. However, their yield in most states hovers around the national average of 6.5 kg per day. Milk yield of an indigenous cow is much lower at about 2 kg per day and ranging from 1.1 kg per day in Orissa to 4.6 kg per day in Haryana⁵. The growth rate of milk production nationwide has slowed in recent years, from an average of 4.3 percent per annum in the 1990s to 3.8 percent per annum in the 2000s.

Figure 6: Milk production and per capita availability varies across states (2007/08)



Source: Calculated based on data from Basic Animal husbandry statistics, GoI (2008).

Growth in milk production has been concentrated in a few states. The states of India are again arranged in descending order of the share of milk output in relation to the share of dairy population, assuming that a larger share of output in relation to the share of dairy population signifies higher technical efficiency in production (table 15). Three groups of states emerge.

⁵ Yield figures in this paragraph are based on Basic Animal Husbandry Statistics, GOI (2008)

Table 15: Share of cattle and buffalo populations and milk output by state, 2003

State	Milk Output (percent)	Population Percentage			Yield (kg/animal/day)			
		Cattle	Buffalo	Cattle & Buffalo	Crossbred Cattle	Crossbred cows	Indigenous cows	Buffalo
Punjab	9.2	1.1	6.1	2.9	75.8	8.9	2.8	7.0
Haryana	5.5	0.8	6.2	2.7	38.4	6.9	4.4	6.2
Kerala	2.1	1.2	0.07	0.8	82.6	7.1	2.6	6.4
Tamil Nadu	5.7	5.0	1.7	3.8	57.4	6.3	2.7	4.2
Gujarat	7.2	4.0	7.3	5.2	8.9	8.3	3.3	4.3
Rajasthan	9.0	5.8	10.7	7.5	4.4	7.0	3.0	4.5
Uttar Pradesh	18.0	11.2	24.7	16.0	9.3	6.9	2.5	4.3
Andhra Pradesh	7.9	5.0	10.9	7.1	12.3	7.3	1.9	4.0
<i>Sub total</i>	<i>64.6</i>	<i>34.1</i>	<i>67.7</i>	<i>46.0</i>	-	-	-	-
Maharashtra	7.0	8.9	6.3	8.0	17.3	6.5	1.5	3.6
Karnataka	4.2	5.1	4.1	4.8	17.4	5.8	2.2	2.5
Bihar	5.2	10.0	7.3	9.0	7.9	5.6	2.0	3.4
Madhya Pradesh	6.5	15.1	9.4	13.1	2.1	5.9	1.8	3.3
West Bengal	4.0	10.2	1.1	7.0	6.1	5.4	2.0	5.4
Orissa	1.4	7.5	1.4	5.3	7.9	5.1	0.9	2.5
<i>Sub total</i>	<i>28.3</i>	<i>56.8</i>	<i>29.6</i>	<i>47.2</i>	-	-	-	-
Jammu & Kashmir	1.4	1.7	1.1	1.5	43.6	-	-	-
Himachal Pradesh	0.9	1.2	0.8	1.1	30.9	3.2	2.0	2.7
Assam	0.8	4.5	0.7	3.2	5.4	3.5	0.9	1.7
Tripura	0.09	0.4	0.01	0.3	7.7	4.1	1.2	2.7
Manipur	0.08	0.2	0.08	0.2	17.4	7.5	1.4	2.9
Meghalaya	0.08	0.4	0.02	0.3	3.3	8.9	0.7	1.9
Nagaland	0.08	0.2	0.03	0.2	56.4	6.4	2.2	2.5
Arunachal Pradesh	0.05	0.2	0.01	0.2	3.2	6.0	1.2	-
Sikkim	0.05	0.08	-	0.06	51.0	-	-	-
Mizoram	0.01	0.02	0.01	0.01	26.2	8.1	1.1	1.8
<i>Sub total</i>	<i>3.5</i>	<i>8.9</i>	<i>2.7</i>	<i>7.1</i>	-	-	-	-

Note: Bihar includes Jharkhand, Madhya Pradesh includes Chhattisgarh and Uttar Pradesh includes Uttarkhand. In all subsequent tables where states have been shown, this definition has been applied.

Source: Author based on data in Birthal, Overview (2008)

First, there are eight states located in the northwest and south of the country in which the share of milk production is larger than the share of the cattle and buffalo population. Together they contain 46 percent of the cattle and buffalo population but produce 64.6 percent of the total national milk output. Among these states, Punjab, Haryana and Kerala rank the highest in relative production efficiency. Punjab's share of output is more than three times its share of dairy population, Haryana's share of output is twice the share of its dairy population and Kerala's share of milk outputs is two and half times its dairy population. These are also the states with the highest level of milk consumption.

Second, there is a group of six states in the centre, south and east of the country which contain 47 percent of the dairy population—about the same as the previous group- but produce only 28 percent of the national milk output. Each of the state in this group produces a smaller share of the national output in relation to its share of the dairy population. They have a small proportion of crossbred cattle in their herds and the average yield of all types of animals- crossbred, indigenous cattle and buffaloes- is much lower than the first group. Most of these states fall in the medium level of consumption of milk.

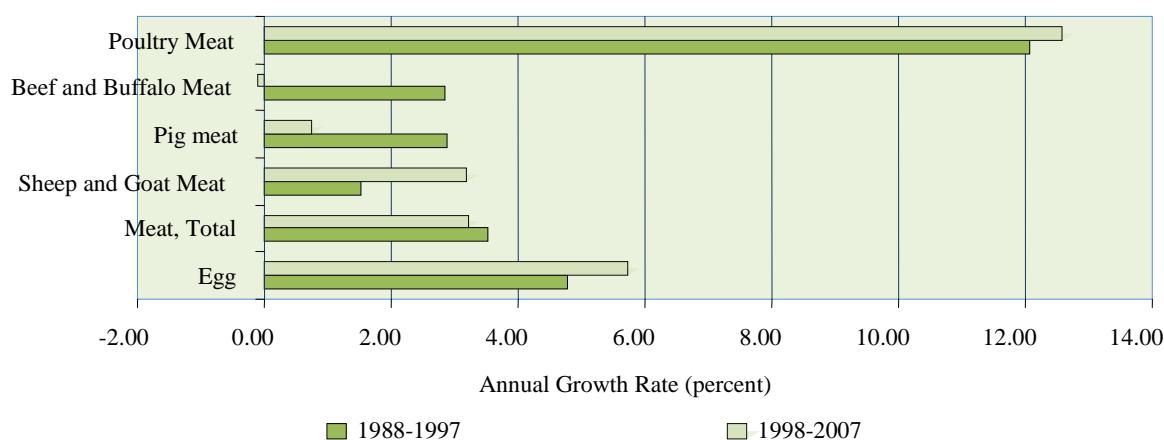
Third, there is a group of 10 states mostly located in the north and east of the country encompassing the hills and mountains, which together contain 7.1 percent of the dairy population and produce 3.5 percent of the national output. Some of these states have high proportion of crossbred cattle in their small herds but yields of all kinds of animals are quite low. These are also the states with the lowest level of milk consumption.

EGG AND MEAT PRODUCTION HAS GROWN OVER THE PAST TWENTY YEARS

Poultry drove the growth in meat production over the past two decades. Total meat production grew at an annual rate of three percent over the period, while poultry grew at a higher rate, maintaining double digit annual growth (12.6 percent) during the period between 1998 and 2007 (figure 7). Like poultry meat, egg production grew at a significant rate of 5.7 percent per year over the last decade. The value of both poultry meat and eggs, at 1999-2000 prices, increased from Rs 69 billion in 1985-86 to Rs 169 billion in 2005-06. In 2005-06, the poultry sector contributed to 11 percent of the value of the livestock sector output, and two-thirds of this share was accounted for by meat. Sheep and goat meat production also grew, albeit at a lower rate of 3.2 percent/year between 1998 and 2007, twice as fast their growth rate in the decade before. Pork production grew, but at a low rate (2.9 percent) between 1988 and 1997, and that rate dropped to less than one percent in the following decade (1998/2007).

Buffalo and beef production declined by 0.11 percent per year over the last ten years, after growing at 2.8 percent between 1988 and 1997. This meat is derived primarily from animals culled by mixed crop-livestock farmers, once they have finished their productive life as dairy and draught animals. Unlike specialized dairy farming observed in leading dairy states and in peri-urban areas, specialized buffalo and cattle rearing for meat is extremely rare—there are few examples of fattening culled animals for short periods to add bodyweight and value, especially targeting some festival seasons. This production behavior largely explains the low growth rates in the output of buffalo and cattle meat.

Figure 7: Meat and egg production between 1988 and 2007



Source: calculated based on FAOSTAT data.

Sheep and goats account for about 10 percent of the total value of livestock sector output. Goats are valued for milk and meat and sheep for meat and wool. Sheep production is largely concentrated in the

southern plateaus of Andhra Pradesh, Tamil Nadu, and Karnataka and the dry western parts of Rajasthan, Maharashtra, and Gujarat. In the southern states, sheep are valued primarily for meat, while in the west and in the Himalayan foothills they are reared for both wool and meat.

Goats are spread across a wider geography than sheep, but are concentrated in the eastern sub-humid regions of West Bengal, Bihar, Uttar Pradesh, and Orissa (43 percent) and the dry western parts of Rajasthan, Maharashtra, Madhya Pradesh, and Gujarat (35 percent). One important difference between the two regions is that dry regions value goats for both milk and meat, while the sub-humid regions rear goats mainly for meat production.

Small ruminant production systems are largely based on grazing on common lands and harvested fields. States like Rajasthan, Gujarat, and Madhya Pradesh have one-fifth to one-third of their geographical area under common lands. Being dry/rainfed, seasonal migration is a common phenomenon in these states, particularly in Rajasthan. During summers when the local feed resources are scarce, herders migrate to the irrigated regions of Haryana, Punjab, and Uttar Pradesh, and return during the rainy season when the fodder supplies improve. In the western Himalayas too, herders from high hills migrate to low hills during winter. Sedentary production systems predominate in the southern plateau and the sub-humid eastern regions. An intensive feedlot system has yet to be developed.

Pig production is more widespread in the hills and mountain regions, but some pigs are also raised in the rainfed and irrigated areas. Overall growth in pig meat output has been very small. Much of the increase in poultry occurred in the coastal and rainfed ecozones, perhaps because of the proximity to feed supply sources and output markets.

DAIRY PRODUCTION SPURS OTHER LIVESTOCK PRODUCTION SYSTEMS

Successful dairy states are not only moving ahead with dairy, they are also improving the quality and productivity of various small stock animals and poultry, which are important for poorer households. In many production systems and ecosystems, such complementarities occur due to synergy in feed supply and feeding systems. The grouping of states according to relative efficiency or success in dairy production discussed earlier also shows their relative shares of sheep, goat, pig, and poultry populations in 2003, and the proportion of crossbred or improved animals and poultry birds in the states' flocks (table 16).

Table 16: Small stock livestock population and share of improved breeds by state in 2003

State	Population (000)				Percent crossbred/improved		
	Sheep	Goats	Pigs	Poultry	Sheep	Pigs	Poultry
Punjab	220	278	29	10,779	32.3	41.1	90.9
Haryana	633	460	120	13,618	11.1	29.3	93.5
Kerala	4	1,213	76	12,143	0.0	66.6	28.1
Tamil Nadu	5,593	8,177	321	86,490	13.7	15.4	46.0
Gujarat	2,062	4,541	351	8,147	85.9	10.4	58.2
Rajasthan	10,054	16,809	338	6,190	0.7	8.2	54.2
Uttar Pradesh	1,733	14,099	2,317	13,569	7.4	8.3	48.2
Andhra Pradesh	21,376	6,277	570	102,244	1.8	8.5	72.4
<i>Sub-total</i>	<i>41,675</i>	<i>51,854</i>	<i>4,122</i>	<i>253,180</i>			

State	Population (000)				Percent crossbred/improved		
	Sheep	Goats	Pigs	Poultry	Sheep	Pigs	Poultry
(percent of total)	(67.8)	(41.8)	(30.9)	(52.8)			
Maharashtra	3,094	10,684	439	37,961	1.7	5.3	40.3
Karnataka	7,256	4,484	312	25,591	0.2	7.4	62.4
Bihar	1,062	14,521	1,780	27,706	9.4	2.7	13.9
Madhya Pradesh	667	10,478	910	19,844	18.4	5.2	35.7
West Bengal	1,525	18,774	1,301	57,338	1.5	4.7	17.8
Orissa	1,620	5,803	662	17,421	0.7	14.6	22.9
<i>Sub-total</i> (percent of total)	<i>15,224</i> (24.8)	<i>64,744</i> (52.2)	<i>5,404</i> (40.5)	<i>185,861</i> (38.7)			
Arunachal Pradesh	19	231	330	1,717	0.1	2.4	11.3
Assam	170	2,987	1,543	20,135	0.8	31.8	18.3
Himachal Pradesh	926	1,125	3	767	15.4	38.6	72.9
Jammu & Kashmir	3,411	2,055	2	5,505	58.7	36.6	33.1
Manipur	6	33	415	2,860	2.0	50.1	42.6
Meghalaya	18	327	419	2,810	3.5	6.8	5.0
Mizoram	1	17	218	1,124	58.0	90.0	29.4
Nagaland	4	175	644	2,772	50.9	56.1	35.9
Sikkim	6	124	38	322	0.7	8.2	54.2
Tripura	3	472	209	2,915	1.5	45.4	13.2
<i>Sub-total</i> (percent of total)	<i>4,564</i> (7.4)	<i>7,546</i> (6.0)	<i>3,821</i> (28.6)	<i>40,927</i> (8.5)			
Total (percent)	61,463 (100)	124,144 (100)	13,347 (100)	479,968 (100)			

Source: based on data from Birthal, Overview (2008)

Table 16 shows that the eight higher-producing dairy states (Group 1) contain 68 percent of the national sheep population, 42 percent of the goat population, 31 percent of the pig population and 53 percent of the poultry population. Moreover, in Gujarat and Punjab, for instance, a high proportion of the sheep population is crossbred. In several states, a sizeable proportion of the pigs are crossbred, and nearly all the states in this group (except Kerala) have between 46 and 94 percent of their poultry populations as improved birds.

The second group of six states (Group 2) contains 25 percent of the national sheep population, 50 percent of the goat population, about 40 percent each of the pig and poultry populations. However, they have a small proportion of crossbred sheep and pigs and only a moderate proportion of improved poultry birds.

Group 3, which encompasses the hill and mountain areas, has a sizeable pig population, and, in some states, the proportion of crossbreeds in the herds is reasonably good. A fewer number of these states have improved poultry. However, it is not clear if the production potential of these animals and birds is adequately exploited to compensate for the small population size.

In 2005-06, the leading dairy producing states (Group 1) produced 71 percent of total eggs in the country—84 percent improved bird eggs and 29 percent of indigenous bird eggs. Group 2 produced 27 percent of total eggs, but these come largely from indigenous birds (15 improved, compared to 65 percent indigenous). The states in Group 3 produced only marginal quantities. For improved birds, average yield of eggs per layer was the highest for the Group 1 (249 eggs/layer/year), followed by the

Group 2 (236 eggs/layer/year) and lowest for Group 3 (198 eggs/layer/year). On the other hand, average yield of indigenous layer was highest for the Group 2 (127 eggs/layer/year) and much lower for Group 1 (107 eggs/layer/year) and the Group 3 (108 eggs/layer/year).

The scale of commercial poultry enterprises has increased rapidly in recent years. About three decades ago, average flock size hardly ever exceeded 500 birds per cycle per farm, but such small-scale units are now rare (Mehta, Nambiar, et al., Broiler and Egg 2003). There are over 100,000 layer farmers and an equal number of broiler farmers in the country. About 70 percent of the poultry units have a flock size ranging 3000-50,000 birds, and 10 percent varying from 50,000 to 400,000 birds. The remaining units have less than 3000 birds.

Egg production is concentrated in the southern region; Andhra Pradesh and Tamil Nadu together account for 60 percent of all eggs produced in the country. Punjab and Maharashtra are other major egg producing states. Southern states also account for 33 percent of total poultry meat production. Northern states, on the other hand, contribute to 23 percent of total poultry meat. Poultry for meat is also picking up in the eastern states, particularly in West Bengal, which contributed 12 percent of the total poultry meat production. In states like Andhra Pradesh, Tamil Nadu, Haryana, and Punjab almost the entire egg output comes from improved layers. This transformation of the poultry sector was triggered by private investment in technology (breeding, hatching, and feeding), marketing and processing (Landes, Persaud and Dyck, India's Poultry Sector: Development and Prospects 2004) (Landes, Persaud and Dyck, India's Poultry Sector: Development and Prospects 2004). Farmers now grow internationally-recognized breeds with better feed conversion efficiency. Production coefficients under commercial systems are at par with the best international standards.

Contract farming, especially in broilers, is spreading throughout the country. About 40 percent of broiler production in the country is done under contract. In Tamil Nadu, Karnataka, Maharashtra, and Andhra Pradesh, 60-90 percent of broiler production takes place under contracts. Even units of contract producers have grown in size due to economies of scale. Small scale producers are also rearing improved birds in some cases under (semi)-confinement but apparently with high degree of feed conversion efficiency as in the case of larger commercial farms.

Notwithstanding this rapid transformation, the backyard poultry system remains in many parts of the country and is practiced by socially and economically disadvantaged groups (Subrahmanyam and Murthy 2006). In general, a backyard unit comprises less than 20 birds, which are free range, rarely receive external inputs, and low productivity (producing 40-80 eggs/year). In general, most backyard poultry operations are small and meet the subsistence needs of households; however, some recent studies have indicated that backyard poultry could be profitable (see for example Subrahmanyam and Murthy 2006). By and large, the forward and backward linkages are absent from this system. Nonetheless, some new models of backyard poultry production have emerged (box 2) and appear to be achieving good results that are worthy of further analysis and replication.

Box 2: Kegg Farms – a better backyard chicken

Kegg Farms have bred a robust and improved dual purpose backyard chicken, called a Kuroiler, which lays 100 – 150 eggs per year (as opposed to around 40 for a Desi Chicken) and grows to 2 1/2 kilos in about half the time for a

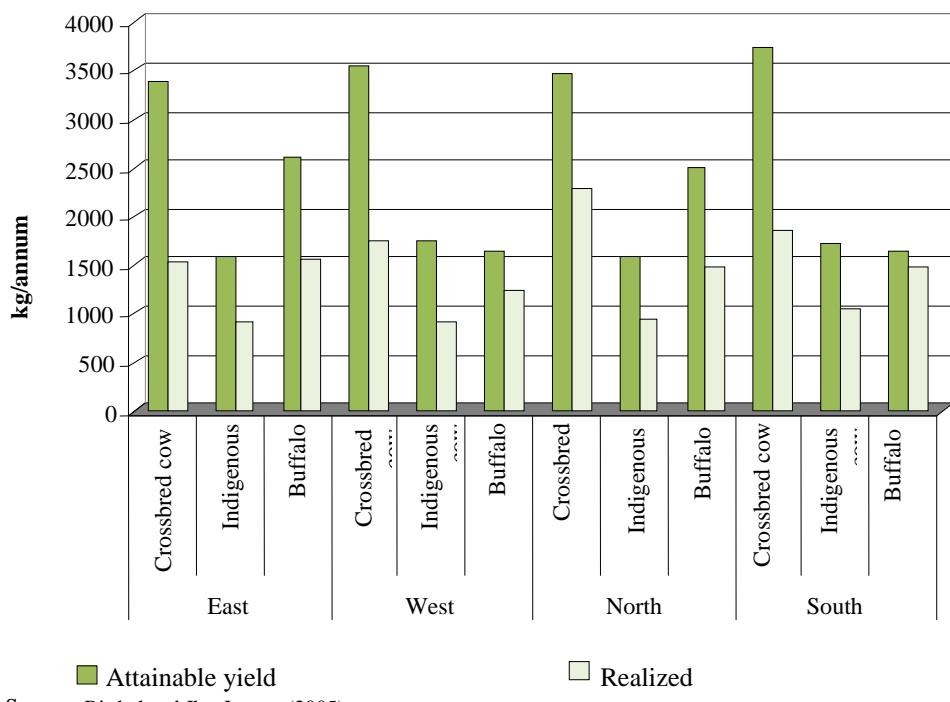
Desi chicken to reach one kilo. The company produces around 16 million day-old chicks. These are sold to 1,500 mother units who grow on the chicks for about two weeks before inoculating them and selling them to approximately 6,500 bicycle salesmen (pheriwallas), who sell them mainly to individual women in villages. Sales are made to some 800,000 farmers, often located in some of the remotest parts of the country. The turnover in sales of chicks is some US\$5 million a year with another US\$5 million turnover for the thousands of small rurally-based businesses that grow and sell the chicks.

Source: (Dixie 2008)

INCREASING PRODUCTIVITY FACES MANY CHALLENGES

Slow down in milk production & low productivity levels. The growth rate of milk production has slowed in recent years – from an average of 4.3 percent per annum in the 1990s to 3.8 percent per annum in the 2000s. Enhancing dairy productivity is constrained by a number of limiting factors, and would require an integrated strategy for intervention. Figure 8 shows that different species in different parts of the country only realize 26-54 percent of their attainable yield (Birthal and Jha, Losses 2005). The difference between the attainable and the realized yield is due to a number of factors, of which feed and fodder scarcity is the most limiting. Poor animal health, poor delivery of veterinary and breeding services, and low quality inputs also play an important role. Extension services are extremely poor. It is also argued that India's large livestock population itself is a constraint to raising productivity because of the imbalance with the availability of feed-fodder resources. When compared to the world's average, India's cow milk yield is about half. It also represents one-fifth of average yield in the developed countries. In 2008, the average yield of cow milk in India was 1148 Kg/year. This compared to 2615 Kg/year for China, 3714 Kg/year for South Africa, and 9050 Kg/year for the United States in the same year (FAOSTAT)

Figure 8: Attainable and actual milk yield by species in different regions, 2002-03



Source: Birthal and Jha, Losses (2005)

The small ruminant production system is also hampered by a number of factors. The small ruminant production system is largely dependent on increasingly deteriorating grazing lands and low yields partly because of the poor genetic potential. Only 9.3 percent of the sheep are improved breeds, and mortality rates are high (30-40 percent) due to diseases such as Peste des Petits Ruminants (Subrahmanyam and Murthy 2006). Small ruminants remain largely ignored in livestock development programs because of the increasing bias for dairy animals. Credit, insurance, and extension support is weak. Marketing facilities for small ruminants—live animals and their products and by-products—are poor. A majority of the households throw or bury dead animals for want of marketing facilities (Subrahmanyam and Murthy 2006).

Lack of feed supplies is the most growth-limiting factor in the poultry sector. Lack of feed supplies is the most limiting factor impacting the poultry sector. Issues such as high and volatile feed ingredient prices, and decline in imports, as well as high tariffs are concerns affecting poultry producers. Diseases are another major problem in poultry. Outbreaks of various poultry diseases and more recently avian flu have caused considerable losses to the poultry industry. Furthermore, though poultry farming is a part of the agricultural sector, poultry enterprises are deprived of the benefits of income tax exemption, as is the case with other agricultural enterprises tax.

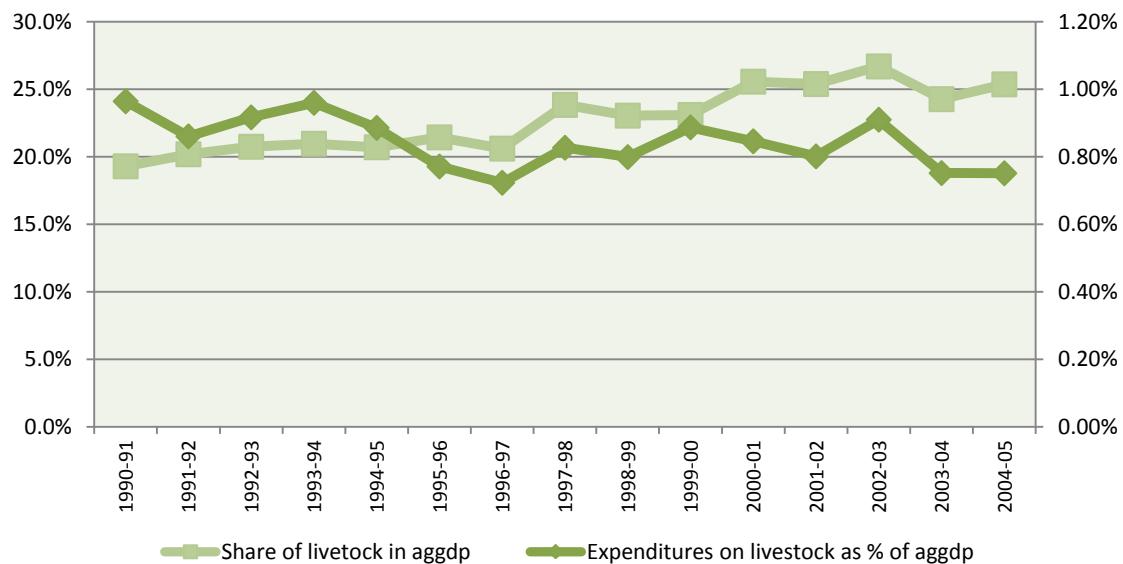
Strategies for growing the livestock sector must recognize the uneven development among states. The situation in the relatively leading states indicate that traditional ways of production under subsistence and mixed farming systems based on poor genetic material, scavenging and poor quality feed resources, poor veterinary and institutional support services have to gradually give way for scientific based technologies, better management, institutional innovations and investment by both private and public sectors. The development challenge in the lagging states is to capitalize on this potential for livestock

sector growth and its capacity to significantly impact upon the livelihoods of the vast majority of the rural population, especially the smallholders. This entails elaborating a strategic framework for livestock sector development that would encourage movement towards a broad-based and market-oriented production system in the lagging states.

AGGREGATE NATIONAL EXPENDITURES HAVE DECLINED OVERALL

During the 1990s, India's public expenditure on livestock as percentage of agricultural GDP declined significantly despite the sector's rising contribution to agricultural output. In 1990/91, the level of public expenditure on livestock, as percentage of agricultural GDP stood at 1.0 percent. At the time, livestock contributed to 22.8 percent of agricultural output. In 2004/05, public expenditures on livestock dropped to 0.75 percent of agricultural output, while livestock's share in total agricultural GDP increased to 24.7 percent (figure 9).

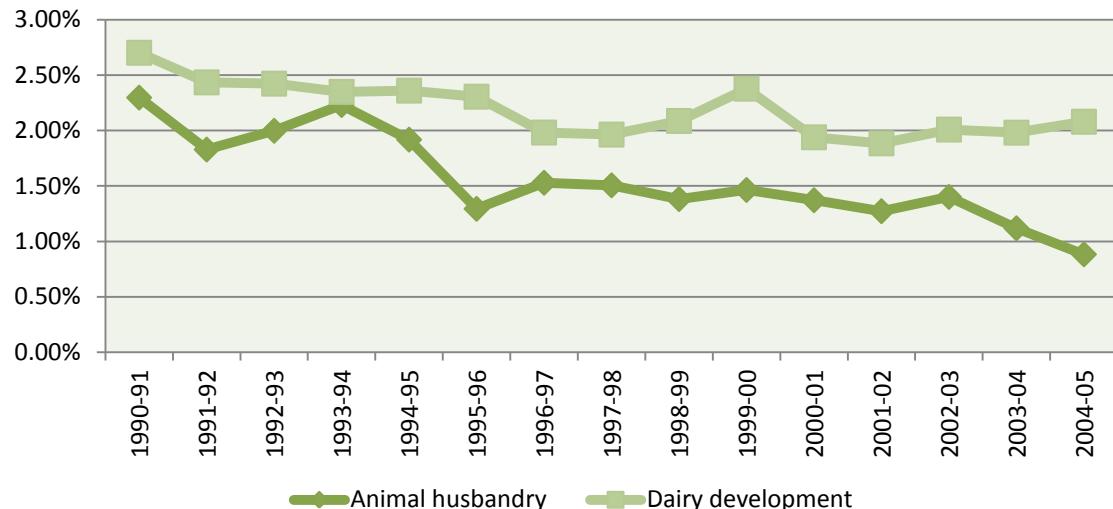
Figure 9: Public spending on livestock decreased as its value added to Ag-GDP went up



Source: Sirohi, et al. (2008) and GOI (2006)

The share of total livestock spending as percentage of livestock GDP has also declined from five percent in 1990-91 to 2.7 percent in 2007-08. This was primarily driven by a rapid decline in the spending share of animal husbandry as percentage of livestock output—from 2.3 percent to 0.9 percent—while the relative share of spending on dairy development declined only from 2.7 percent to 2.1 percent of livestock GDP, underlining the continuous bias towards dairy activities. In fact in real terms (1993-94), the rate of spending on dairy development grew at an annual rate of 1.3 percent per annum during this period, while the rate of spending on animal husbandry shrank by 1.9 percent per annum (figure 10).

Figure 10: Public spending as percentage of livestock output



Source: Author calculations.

In nominal terms, public expenditure in the livestock sector more than doubled between 1990-91 and 2004-05 but the share of the central government in total expenditure declined from 14.6 percent to 8.5 percent between the two periods (table 17). The share of livestock sector in total expenditure on agriculture and allied activities declined from 19.6 percent in 1990/91 to 16.2 percent in 2004-05.

Table 17: Average annual public expenditure (plan and non-plan) in the livestock sector

	1990/91- 92/93	1996/97- 98/99	2002/03- 04/05
Total spending (Rs million)	14,009	22,559	29,435
Share of central government (percent)	14.6	8.3	8.5
Expenditure per standard livestock unit	45.40	73.20	96.40
Composition of public spending (percent)			
Dairy development	43.8	39.6	36.7
Veterinary services & animal health	21.0	24.4	21.5
Cattle and buffalo development	12.5	12.0	11.7
Sheep and wool development	2.8	2.3	2.1
Poultry development	3.1	2.3	2.2
Piggery development	1.5	0.5	0.4
Fodder development	0.4	0.5	1.1
Direction and administration	3.8	5.9	15.8
Research, education and training	1.9	2.3	2.9
Others	8.7	9.5	7.5

Source: Birthal, Overview (2008)

State level expenditures have favoured animal husbandry over dairy development. An examination of aggregate state public expenditures for selected years indicates that animal husbandry accounts for the largest share of total expenditures on livestock. In 2007-08, nearly 75 percent of public expenditures on livestock, across all states, were for animal husbandry compared to 25 percent for dairy development. After the third phase of the Operation Flood Program, most of the states pruned expenditure on dairy development, with the exception of Maharashtra and to a lesser extent West Bengal.

Veterinary services and animal health receive, on average, the highest share of spending on animal husbandry across most states, followed by spending on Direction and Administration. The percentage of spending on veterinary services and animal health varies from 5.5 percent in Orissa to 68.6 percent in Punjab, with high percentages also observed in Bihar (54.3 percent), Andhra Pradesh (43.1 percent) and Gujarat (27.9 percent). The percentage of spending on Direction and Administration varies from 1.6 percent in Bihar to 91.9 percent in Mizoram, with high percentages also in Orissa (87.7 percent), Tamil Nadu (76 percent) and West Bengal (64.3 percent). Although there is a common procedure for classifying the various items of expenditure, in practice State Governments have flexibility in putting items of expenditure under different heads. This may explain the high variation. Cattle and buffalo development was generally the third most important item for public spending on animal husbandry in most states.⁶

Public spending on other livestock sub-sectors is relatively small and varies widely across states. The share of public expenditure in the poultry sector ranged from 0.6 percent in Orissa to 10.5 percent in Manipur. In recent years, private investment activities in the poultry sector have increased greatly. However, this private investment is in commercially-oriented activities and investment in backyard poultry production remains almost negligible. In Gujarat, sheep and wool development received top priority and accounted for about 28.4 percent of total public expenditure. In the hill state of Himachal Pradesh, the ratio was also considerable at 15.3 percent. Development of piggery and goats —continue to get little share of total public investment across most states, despite their importance for poor and disadvantaged communities. Even in the North East States, where over 25 percent of the pig population is located and where pig rearing is an important livelihood source, expenditure on piggery development is extremely low.

Feed development and veterinary training remain largely neglected. Public spending on fodder and feed development and veterinary education and training also remains low despite the high priority of these two activities, particularly the former. Most Indian states are deficient in green and dry fodder production. Fodder and feed development programs are considered to be one of the top priority activities for accelerated public investment, but in reality the expenditure on this activity, as percentage of total spending on animal husbandry, is quite low. The highest proportion was observed in Maharashtra at 8.9 percent, followed by Tripura at 7.6 percent, and Uttar Pradesh at 7.3 percent. Veterinary education and training also received very low shares of public spending within animal husbandry. Karnataka allocated the highest share (8.9 percent) followed by Madhya Pradesh (8.2 percent), but many states allocated less than one percent.

Expenditures under the ‘Others’ category include assistance to animal husbandry cooperatives, public sector and other undertakings, local bodies and corporations. The spending on the ‘Others’ category was highest in Haryana (48.4 percent) followed by 24.4 percent in Jammu & Kashmir. In recent years,

⁶ This includes expenditure on cattle breeding farms schemes, semen laboratories, liquid nitrogen plants, heifer rearing projects in Panchayat unions, supply of stud bulls to remote villages, cross breeding of cattle with exotic breeds, improvement of buffaloes using frozen semen techniques etc.

these governments spent relatively high amounts of resources to strengthen local bodies and corporations to ensure effective input delivery mechanisms for livestock keepers.

PRIORITIZATION OF PUBLIC EXPENDITURE FOR PROVISION OF PUBLIC GOODS

Given fund limitations and ineffective use of budget allocations, prioritization and rationalization of public expenditures, especially for provision of public versus private goods, need urgent consideration. Public expenditures and services provided by the public sector generate public goods as well as private goods or benefits. Given that limited public funds do not allow adequate allocation to all kinds of activities undertaken in the livestock sector, which then leads to ineffective utilization of the allocated funds, rationalization and prioritization of public expenditures are necessary to make public expenditures more effective for development of the sector. This brings up the issue about the balance between the provision of public and private goods through public expenditure, especially in the case of expenditure on animal health and extension services as it accounts for a fairly considerable proportion of the livestock sector budget.

SUMMARY OF KEY POINTS

- Milk is the predominant livestock commodity in India. The growth rate of milk production has slowed in recent years – from an average of 4.3 percent per annum in the 1990s to 3.8 percent per annum in the 2000s
- Meat production increased by three percent over the last decade, driven primarily by the high growth rates in poultry production (13 percent per year).
- Growth in output was concentrated in a few states, while majority of the states lagged behind. Consequently, the opportunities for participation in livestock development and to benefit from its distributional impact through employment and income generation could not be enjoyed by people in wider geographical areas.
- Leading dairy states experienced higher milk and meat output while lagging states experienced lower output.
- Bovine production systems face a number of constraints including slow productivity growth, feed scarcity, breeding problems, diseases, large population of low producing indigenous cattle, poor extension services.
- Small ruminant production systems have come under stress because of deteriorating quality and quantity of grazing resources, low yielding animals, high mortality rates due to diseases, bias in favor of large animals, and lack of marketing facilities.
- Despite its huge success, the poultry sector growth is still impeded by a number of factors including lack of feed supplies and diseases.

- To meet the expected large future increase in demand, different strategies for leading and lagging states have to be designed and implemented taking into account their specific needs and challenges.
- In nominal terms, public expenditure increased over time, but the share of the central government spending declined. Dairy and animal health are the two most important areas for public expenditure.
- Expenditure on fodder development is inadequate given the high priority for this area.
- Expenditure on research, education and training—which is essential for generating new technologies, inputs and institutions to commercialize production systems—is meager and has increased only marginally over time.
- Public expenditures generate both public and private goods, The government needs to rationalize its expenditures that generate private goods. This is particularly important for the provision of health services, where gradual reform is required to allow an increasingly larger role for the private sector in the provision of services that primarily generate private goods.
- A ‘one-size-fits-all’ strategy for the process of transformation will not work; separate mechanisms and options suitable for leading and lagging states need to be considered carefully.

3. LIVESTOCK SUPPORT SERVICES

A vast gamut of livestock support services is required for harnessing the potential of livestock production in India. These services have been typically classified into, (a) production services including breeding, feeding, research, extension, credit, and insurance etc.; (b) health services: curative and preventive veterinary care, disease surveillance, etc.; and market services market information and output marketing (Ahuja and Redmond, 2004). This chapter reviews the current institutional infrastructure for delivering support services and the regional dimensions of their availability, outreach, and efficiency. The focus is on production services. Animal health and marketing services will be treated in subsequent chapters.

BREEDING PROGRAMS FOCUS ON ARTIFICIAL INSEMINATION

Cross-breeding has largely been the strategy followed for breed improvement, with little attention given to selecting and grading from within the best performing local breeds. Introducing exotic breeds and crossing them with local breeds started before independence and continues today with mixed results. Various foreign breeds have been introduced under all climatic conditions in pure form or crossed with native breeds; however, their performance varied due to lack of adaptation to local conditions, feed shortages, and disease. Experiences from other countries show that crossbreeding is usually coupled with a process of natural selection and grading from within local breeds to maximize effectiveness. For instance, South Africa has developed fully stable high performing breeds for their local environment through systematic selection and grading over about 40-50 years. Unfortunately, India has not followed this path. Nonetheless, with the various biotechnological tools available today, the time required to develop stable breeds may be much shorter.

A few states have created extensive infrastructure to implement crossbreeding through artificial insemination. Initially, improved bulls were distributed for natural service in the crossbreeding strategy. This approach was later replaced by artificial insemination (AI), which has become the main focus of infrastructural development for breed improvement. AI service centers have spread throughout the country; however, they are concentrated in a few states where dairy production has already shown progress. Over one-third of the AI service centers are concentrated in Andhra Pradesh, Karnataka, Tamil Nadu, and Kerala, even though these four states together account for only 18 percent of the breedable dairy population. Furthermore, there is a large discrepancy in the number of animals served between states. For instance, an AI service center in Punjab serves, on average, 1,359 animals compared to 2968 animals served by one AI service center in Bihar. Even in the under-served states, the distribution of the AI centers is skewed in favor of better performing districts.

Table 18: Artificial Insemination infrastructure in India by State (2007-08)

State	Breedable bovine population (millions)	No. of Semen Stations	Frozen Semen Banks	No of AI Centers	No of adult dairy animal population per AI Center	Total number of AI done (millions)	No of Cattle Breeding Farms	No of Buffalo Breeding Farms	No of Bull Semen Stations	No of Liquid Nitrogen Plants
Punjab	4.21	3	3	3095	1359	2.98	2	1	108	0
Haryana	3.57	3	7	2876	1242	1.37	5	0	7	11
Kerala	1.04	3	7	3024	342	1.52	3	0	3	4
Tamil Nadu	4.92	4	37	6280	782	4.85	9	3	3	6
Gujarat	6.8	4	1	4458	1525	3.21	16	1	4	4
Rajasthan	10.54	1	6	3662	2878	1.98	4	3	1	0
Uttar Pradesh	17.08	5	8	5679	3008	2.62	6	6	0	17
Uttaranchal	1.48	1	20	878	1680	0.23				
Andhra Pradesh	8.47	4	19	7242	1169	3.97	9	0	0	12
<i>Subtotal (percent by AHD)</i>	<i>58.1</i>	<i>28(50)</i>	<i>108(31)</i>	<i>37194(78)</i>	<i>1554</i>	<i>22.73</i>	<i>54(62)</i>	<i>14(93)</i>	<i>126(94)</i>	<i>54(70)</i>
Maharashtra	8.93	5	6	4873	1832	2.26	9	1	5	10
Karnataka	6.04	5	6	6252	967	4.69	11	1	5	4
Bihar	6.47	2	4	2181	2968	0.63	6	0	0	1
Jharkhand	2.46	0		453	5424	0.03				
Madhya Pradesh	10.06	1	7	3230	3114	0.99	12	0	1	5
Chattisgarh	3.05	1	3	1471	2073	0.61				
West Bengal	6.75	3	0	5511	1226	1.9	8	5	3	3
Orissa	4.42	1	5	5288	835	0.89	8	0	2	13
<i>Subtotal (percent by AHD)</i>	<i>48.18</i>	<i>18(73)</i>	<i>31(95)</i>	<i>29259(80)</i>	<i>2305</i>	<i>12.01</i>	<i>54(93)</i>	<i>7(100)</i>	<i>16(75)</i>	<i>36(89)</i>
Jammu & Kashmir	1.79	2	10	1107	1615	0.47	3	0	1	8
Himachal Pradesh	1.37	1	6	1705	802	0.53	5	0	0	7
Assam	2.68	1	7	598	4476	0.12	1	1	0	11
Tripura	0.26	0	4	876	292	0.09	1	0	3	2
Manipur	0.15	0	2	255	584	0.01	1	1	0	2
Meghalaya	0.38	1	2	43	8884	0.02	4	1	2	1
Mizoram	0.02	0	2	70	228	0	7	1	0	2
Nagaland	0.2	0	3	131	1550	0.03	7	1	2	0
Sikkim	0.07	0	3	76	855	0.01	0	0	1	2
Arunchal Pradesh	0.14	0	3	50	2880	0	27	0	1	1
Other Union Territories	0.3	2	23	177	5072	0.19	0	1	7	4
<i>Subtotal (percent by AHD)</i>	<i>7.34</i>	<i>7(100)</i>	<i>65(90)</i>	<i>5088(54)</i>	<i>2476</i>	<i>1.47</i>	<i>56(75)</i>	<i>6(86)</i>	<i>17(100)</i>	<i>40(90)</i>
<i>India (percent by AHD)</i>	<i>113.63</i>	<i>53(69)</i>	<i>204(65)</i>	<i>71541(74)</i>	<i>2008</i>	<i>36.2</i>	<i>164(77)</i>	<i>27(93)</i>	<i>159(92)</i>	<i>130(82)</i>

Source: Department of Animal husbandry & Sirohi et al. (2008)

State Animal Husbandry Departments are the dominant institutions for providing AI services, running most of the approximately 72,000 AI centers in the country. However in recent years, a significant increase in the AI centers run by other organizations—like cooperative and NGOs—has taken place. In 2007-08, there were about 15,000 AI centers functioning under the ambit of cooperatives performing 10 million AIs, about one quarter of the total AIs done in the country. NGOs and private AI centers together accounted for nearly 11,500 AI centers and performed around 12 percent of the total AIs in the country. Along with AI, one of the NGOs, BAIF, provides extension services and inputs and currently operates in 187 districts across ten states (box 3).

Box 3: Artificial insemination services provided by BAIF

BAIF was established in 1967 with the mission of creating opportunities for gainful self-employment among rural families—especially the disadvantaged—ensuring sustainable livelihood, enriched environment, improved quality of life, and good human values. From the beginning, BAIF adopted livestock, especially cattle, as a vehicle to achieve its goals. The major focus of BAIF's cattle development program is to deliver AI services at farmers' door steps. By 2006-07, its program reached 2.5 million families through over 1600 cattle development centers in 45,000 villages in 187 districts across ten states.

BAIF is responsible for producing around 5 percent of the India's cross-bred dairy cattle. Conception rates from AI registered by BAIF is around 45 percent, ranging from 26 percent in Rajasthan to 57 percent in Madhya Pradesh, higher than government rates. Other than AI, BAIF also provides veterinary care, vaccination, training for fodder production, and extension advice.

Source: Sirohi, et al. (2008)

The coverage of AI services is low countrywide. In total all the agencies in the country carried out about 36 million artificial inseminations in 2007-08, covering only 24 percent of the breedable bovine population. About 90 percent of the inseminations are done in cows and only 10 percent in buffaloes. In 2007-08, no more than 10-15 percent of the Indian national cattle herd was crossbred, though this rate varies across states from as low as 7.6 percent and 11 percent in Orissa and Bihar, respectively, to as high as 56 percent in Tamil Nadu and 75 percent in Punjab.

Conception rates (CR) by state AI centers are generally low. Even in leading states, conception rates (CR) are relatively low at around 40-49 percent on average, though some NGOs and other private suppliers generally achieve higher rates. CRs are much lower in lagging states—e.g., 20 percent in Orissa and 38 percent in Uttar Pradesh—while in some areas of Andhra Pradesh and Gujarat the CR is over 50 percent. In Gujarat, cooperatives perform more AIs than the government and other providers. The success rate of AI in buffaloes is about 10 percent lower than in cows, even on organized farms. Studies on factors affecting CR in cattle indicate that with 90 percent or more efficiency in four important factors namely, cow fertility, estrous detection accuracy, semen fertility and AI techniques, the CR can be between 65-70 percent (Smith, undated). NGOs such as BAIF and the private sector suppliers have reportedly achieved relatively higher conception rates of more than 50 percent.

Several factors have contributed to the low success of AI. First, most of the AI centers are stationary and do not provide services at the farmer's door step, particularly for government- run AI centers, leading to a reduction in their utilization rate. AI services rendered by NGOs and private inseminators tend to be mobile, though within limited geographical area. Second, there is little effort to effectively monitor and record the performance of AI services. Third, there is no regulatory mechanism in place to oversee the breeding activity, particularly semen production and AI delivery. Fourth, the existing supporting infrastructure (e.g. semen centers and stations, liquid nitrogen plants, frozen semen stations and banks) remains inadequate to ensure timely availability of quality semen at AI centers⁷. Inadequate quantity and quality semen doses and poorly trained inseminators have been widely reported as serious limiting factors (Singh and Chauhan 2006; Singh, et al. 2006). Finally, the high incidence of reproductive disorders in crossbred animals (Repeated breeding, anoestrus condition) contributes to poor AI performance.

Pricing for AI services is also an important dimension of efficiency and varies across states and service providers. Official fees charged for government AI service per insemination range from Rs. 5 in Gujarat and Haryana to Rs. 16 in Rajasthan and Rs. 25 in Kerala. These official charges are grossly inadequate to cover the actual costs that range from Rs. 150-250, so the government service is heavily subsidized. However, farmers' transaction costs for accessing services provided by the state are high due to additional incentives to be paid to AI personnel for timely service. The cooperatives, NGOs and private AI centers generally charge higher fees but have few, if any, hidden transaction costs. With lower repeat services required, higher conception rates, and service usually provided at the farmers' doorstep, their effective cost per calf born is much lower than the cost of government AI services. Their approach has yielded better results, and studies suggest that farmers are willing to pay higher rates for better conception rates as the cost per calf is lower (Sirohi, et al. 2008). Successful examples (box 4) suggest that privatization of private goods services, like AI, can make the services more attentive and demand driven and therefore sustainable.

Box 4: Private breeding services in Bihar

Patna Animal Development Pvt. Limited: This organization works through a network and provides materials and equipment for AI services, namely liquid nitrogen, semen, containers, health, etc. All this is done through well-trained veterinarians and para-veterinarians. This organization is now supplying these materials to 1200 AI centers (700 in Bihar and 500 in other states). It sells semen straws to AI centers at Rs. 20.

Dr Vijay Krishna Animal Development Trust: This organization provides training on AI and first aid to animals. They organize two types of training: a 6 month full time intensive training and a part-time refresher course lasting three months. The latter is generally given to new veterinary graduates. The fee for the first type of training is Rs. 28,000, which also includes room and board, while the fee for the refresher course training is Rs. 4,000 without boarding and lodging. To date, 700 students have been trained under this initiative and the trained personnel are practicing AI and allied services in different locations. These trained youths are on average earning about Rs. 10,000 per month, which is considered a substantial income in the rural areas of the state, in view of other available opportunities. They impart training to women free of cost to enable women to become self reliant, although in

⁷ For instance, in May 2004, a Committee constituted by the Department of Animal Husbandry, Dairying and Fisheries for the evaluation of semen stations observed that out of the 54 functional semen stations in the country, only 29 stations were considered satisfactory (Government of India 2006).

practice very few women have received training from them to date. This organization publishes a quarterly magazine, Pasupalan Sandesh, to disseminate information and create awareness among the people engaged in this work.

Livestock Fertility Centre: This centre was established for collection and preservation of frozen cattle semen of Holstein Friesian, Jersey and Haryana breeds and frozen goat semen of Sannam and Jamunapari breeds. It maintains its own bull stud, collects semen from the bulls, processes it in its laboratory and sells and distributes it to different centers. It is now starting to produce semen from pigs, yaks, and horses.

Source: Sirohi et al., 2008

Buffaloes get inadequate attention in breed development programs. Although buffaloes are playing an increasingly larger role in milk output, buffalo breeding has so far received marginal attention. There is anecdotal evidence that dairy farmers themselves are selecting good buffalo breeds, but like its indigenous cattle counterpart, formal sector breeding policy and research has given little support to such farmers to exploit the genetic potential of the local breeds.

Concerned over the poor status of breeding services in the country, GoI initiated the National Project for Cattle and Buffalo Breeding (NPCBB) in October 2000 to strengthen the coverage and efficacy of breeding services. Unfortunately, NPCBB also suffers from a variety of problems—including, lack of quality bulls for semen production, inability to provide uninterrupted supply of liquid nitrogen, etc. Hence, seven years into a 10-year programme, progress is very slow in light of its targets (Government of India 2007), particularly in terms of converting fixed government AI centres into mobile ones. (Ahuja, et al. 2000).

Breeding support for small ruminants and pigs is limited and ineffective. Central and State Government efforts to improve the genetic stock of small ruminants have focused on the All-India Coordinated Research Projects under the aegis of the Indian Council of Agricultural Research and the State Agricultural Universities. The program seeks to set up breeding farms, breeding centers, and promote and finance crossbreeding programs for the evolution of superior animals. However, the status of related infrastructure shows that there are only 59 and 52 sheep and goat breeding farms, respectively, in the entire country.

The private sector leads commercial poultry breeding and development. There are 4569 poultry breeding farms and hatcheries in the country, of which only five percent are government owned. The rest are privately owned; most were established during the last 10-15 years. Out of 4,355 private poultry breeding farms and hatcheries, 2,921 are located in Punjab and 1,394 in Gujarat alone. Government farms used to support commercial poultry but this sector now receives breeding support almost fully from private sources, often linked to contract farming, and they are doing quite well. The Cobb 100 breed developed by Venkateshwara Hatcheries (VH) currently accounts for 60-70 percent of all broilers in India. VH has a nationwide infrastructure that supplies its breed to broiler operators, either as grandparents, parents, or day old chicks (DOCs), and it provides comprehensive veterinary services to its growers.

The support services for backyard poultry on the other hand, are largely neglected. More than 95 percent of the poultry breeding farms and hatcheries are under non-government institutions. The crosses and grades of exotic breeds of poultry that are maintained by the commercial hatcheries and poultry integrators are of little use to backyard poultry farmer as the exotic crosses do not have brooding instincts (Rao 2006). Even in states such as Orissa, where the government farms (state and central) reportedly play a significant role in poultry breeding through production and supply of Day old Chicks (DOCs), there has not been the effective provision of breeding services in a sustained manner as per the conditions and requirement of the rural areas (Kurup, Socioeconomic Perspective 2003). The hatchability rates are also quite low in the field. A study by (Conroy, Sparks, et al. 2005), in the villages of Udaipur, Rajasthan found that 25-30 percent of the eggs failed to produce chicks due to factors such as egg sterility, bacterial contamination, and embryos dying during embryogenesis due to improper storage of eggs.

FEEDS SUPPLY AND COMMON PROPERTY RESOURCES

Estimates of feed supply and availability vary widely. The National Institute of Animal Nutrition and Physiology (2005) estimates that out of the 890 million tons of feed produced in India in 2005, 44 percent came from crop residues; 34 percent from planted fodder; 18 percent from forests, fallow land, common property and wastelands; and less than four percent in concentrates. Other sources have estimated that in 2004-05, 527 million tons of feed were available, of which 69 percent was dry fodder, 24 percent was green fodder, and seven percent were concentrates (Ramachandra, et al. 2007). However the feed deficit problem persists. It is estimated that there is 11 percent shortfall in dry fodder, 28 percent in green fodder, and 35 percent in concentrates. (GOI, 2007).

Feed availability varies across agro-ecological zones. Feed availability per adult cattle unit equivalent is the highest in the irrigated zone followed by rainfed, arid, hill, and coastal zones. Despite the variation, feed availability did increase from 385 million tons in 1985-86 mainly driven by the increase in the production of rice and wheat resulting in higher straw and bran output, and by the increase in concentrates. Crop residues, such as rice and wheat straw and sorghum stover, represent the largest feed component but tend to be low in nutritive value and cannot support high levels of production on their own. Rice and wheat straws account for half of the dry fodder supply, and coarse cereals and sugarcane tops contribute 38 percent.

Table 19: Regional differences in availability of feed and fodder, 2004-05 (million tons)

Ecosystem	Dry fodder	Green fodder	Concentrates	Total	Per adult cattle unit (kg/day)
Arid	9.8	5.9	2.0	17.7	5.26
Coastal	21.8	4.9	1.6	28.3	3.93
Hill and mountain	23.6	10.3	1.5	35.4	4.99
Irrigated	155.4	41.9	11.3	208.6	8.33
Rainfed	155.2	63.5	17.9	236.6	5.77
Total (percent)	365.8 (69)	126.5 (24)	34.3 (7)	526.6 (100)	6.29

Source: Ramachandra, et al.(2007)

Interestingly, in parts of the Northwest Indo-Gangetic plain rice straw is not regarded as a valued feed and is regularly burned, while it is fed to livestock in Bihar and West Bengal (Erenstein, et al. 2007). For example, Punjab burns *in situ* some 81 percent of rice straw and 48 percent of wheat straw produced in the state annually, as a matter of disposal. Shredded wheat straw left behind by harvesters can be pulverized (hammer mill) and palletized in a feed mill, with or without enrichment (urea, molasses, other feed ingredients), which enhances its universality as a ruminant feed, as it can be stored, transported and utilized. Though rice straw cannot be handled in the same manner because of its high silicon content, it can still be briquetted along with molasses and urea on factory sale in the place of origin, which can render a large quantity of rice straw safe for animal consumption, particularly in fodder deficit/drought affected areas of the country.

Green fodder and concentrates are essential to realize the genetic potential of animals. The area under fodder crops in India has stagnated at about 8.5-9.0 million hectares during the past decade and accounts for only about 4.6 percent of the total cultivated area (Birthal 2008). Fodder cultivation for livestock is a common practice only in selected regions that are more advanced in milk production such as Punjab, Haryana, Western Uttar Pradesh, and parts of Gujarat and Rajasthan. The land used for green fodder production is around 10 percent or more in these states. Sorghum and berseem are cultivated in 50 percent of the land under fodder, followed in lesser amounts by Lucerne (alfalfa), maize, bajra (pearl millet), and oats.

Both public and private sector support for the development of green fodder resources is limited. The central fodder feed production farm in Karnataka, seven regional stations in different agro-climatic zones, and about 80 state fodder seed production farms have the mandate to produce high yielding varieties of fodder and fodder seeds and to transfer of scientific fodder production technology by training field officers, demonstrating fodder agronomy practices, and organizing farmers' training. Government services also include distributing fodder seed mini-kits, testing their performance in the field, establishing fodder banks, and providing assistance to fodder block making units; however, the production of fodder seeds meets only 15-20 percent of the requirement. The impact of these activities on the farming community is not very significant, especially when compared to the resources spent. The R&D to identify and develop new varieties and develop packages of practices suitable to the region remains neglected. Very few varieties were introduced in the recent past and the extension service failed to popularize the existing high yielding varieties of fodder. The distribution of the mini-kits also did not create any tangible impact on the mandated objectives of popularizing high yielding fodders, attracting new entrants to the fodder development activities and bridging the gap in demand and supply of fodder, mainly due to organizational and operational constraints. In some states, despite farmers' interest in expanding green fodder area, little support is provided with constraints cited about availability of gap area.

Most of concentrate cattle feeds are used in the form of feed ingredients rather than as manufactured feed. Out of 35 million tons of concentrate feeds available in the country in 2005, 45 percent was groundnut, mustard, and other oil cakes; 38 percent was bran; and 17 percent were grains, mainly maize. Nearly 90 percent of the concentrate feeds were used as feed ingredients by producers and only 3.7 million tons (10.6 percent) was manufactured as compound feed.

The private sector plays an important role in the compound feed segment. Animal feed production in the country is carried out both in the organized and the unorganized sector. The organized sector comprises commercial feed and integrators' feed. The unorganized sector includes the customary feed preparations made by the farmers for their own use and production in unregistered feed factories. Although the product of the unorganized sector suffers from many deficiencies and imbalances, it still accounts for nearly 80 percent of all feeds consumed by the entire animal population in India (Vaidya 1999; Pathak and Garg 1999) The production of compound animal feed is only about 10 million tons per year, of which only 35 percent is in the organized sector. About 55 percent of manufactured concentrate is used in the poultry sector, 44 percent in dairy sector, and one percent in fisheries (table 20). Most of the compound poultry feed manufacture takes place in the South, where industrial poultry production increased more rapidly and most of the compound cattle feed manufacture takes place in the West and the South where dairy production has expanded (box 5).

Table 20: Production of manufactured concentrate feed in India (000 tons)

Year	Cattle feed	Poultry feed	Fish feed and others	Total
1990	1325	834	0	2158
1995	1513	1268	30	2811
2000	1241	1519	34	2794
2004	1278	1636	59	2972
2005 (percent)	1610 (44)	2004 (55)	45 (1)	3659 (100)
2005 by region (percent)				
North	6.5	1.5	0	3.7
South	25.8	48.0	77.8	31.4
West	44.3	16.9	2.2	28.8
East	1.8	16.8	0	10.0
Others	21.6	16.8	20.0	26.1

Source: Birthal, Overview (2008)

Until a few years ago, almost all products of the feed sector fell in the special category for *exclusive manufacture in the small-scale sector*. In other words, the sector was not open for higher investments, and the industry was unable to benefit from large-scale operations, which limited its ability to compete with external markets. This explains why the Indian animal feed industry, though quite old, is still in a very primitive stage. The sector supplies only about five percent of cattle feed and 30 percent of poultry feed requirements in India. The rest of the feed is being produced by the unorganized sector comprising home and custom mixers. In 1997, the Indian animal feed industry was removed from the Small Scale Industry List, which opened it for larger operations.

Box 5: Compound Livestock Feed Manufacturers' Association of India (CLFMA)

CLFMA is the sole representative, national body of the Compound Livestock Feed Industry. Its members include all sectors of the livestock industry. They have a total installed capacity of around 6 million tonnes, and produce over 3 million tonnes of Compound animal feeds per annum. CLFMA is recognized not only by livestock farmers, Central and State Governments, Government Departments, Agricultural Universities, Veterinary Colleges and National Research Institutes in the country, but also by related sectors outside the country.

The prime objective of CLFMA is to help the promotion of overall animal husbandry, by promoting the concept of balanced feeding of animals in accordance with their nutritional requirements for deriving the maximum output from them through productivity improvement. It is fully committed to manufacturing and supplying high quality; safe and conversion-efficient animal feeds to livestock farmers at prices affordable to them.

For attaining the above objectives CLFMA persevere (a) to promote the concept of nutritionally balanced livestock feed as an imperative requisite of Animal Husbandry Development on scientific lines, (b) to promote and organize, scientific research and design to advance the industry—i.e. manufacture, trade and commerce of compound livestock feed, and (c) to formulate constructive policies and sound business principles for bringing about over all livestock industry growth, (d) to take steps for the removal of obstacles to the healthy progress of the industry by making collective representation to the Central and State Governments, etc. and (e) to impart training to livestock farmers, animal feed mill personnel, veterinarians, scientists and students of animal nutrition and any other veterinary aspect.

CLFMA represents to Central and state governments, to get following problems faced by the livestock feed industry: (a) Exemption of Animal Feed, Concentrates, and Feed supplements from Central Excise duty, (b) Exemption / Reduction from Sales Tax on animal feed in different states, (c) Substantial Reduction in Import duty and Customs duty on Amino Acids, Molasses, Feed Supplements and Additives, and (d) De-Reservation of Poultry Feed Manufacture.

Source: ([CLMFA] Compound Livestock Feed Manufacturers Association n.d.)

Change in relative prices of raw materials and products, is a major concern among commercial producers, and is impacting the demand for manufactured animal feed. Overall, the weighted index of input material used in the feed industry has increased from 51.3 in 1980-81 (base 1993-94) to 174.7 in 1999-2000 (Sirohi, et al. 2008). The sharp increase in the wholesale prices of major feed ingredients (maize, rape and mustard cake, ground nut cake and cereal bran) after the 1990s caused further increases in feed prices. This is also reflected in rapidly rising prices of cattle feed, far in excess of fodder and milk prices. Between 1990/91 and 2005/06, the ratio of chicken price to maize price declined to half and that of egg price to maize price fell from 0.33 to 0.26. The falling price ratios are due to sharp a decline in the prices of poultry products on the one hand, and an increase in the prices of grain feeds on the other. Although domestic production of maize and its use as feed has been increasing, imports have been decreasing. Commodities' price volatility and supply constraint are likely to remain considerable limiting factors in the coming years.

In emerging market-oriented livestock production systems, feed technology and markets are increasingly playing key roles in mitigating feed deficit problems. In crop-livestock systems that are intensifying and moving towards specialization, increasing marketable output requires increased feed supply either from home production or from the market. This is why feed technology adoption has been increasing with market orientation of production. This is reflected in the increased production of planted fodder and manufactured concentrate cattle feed in leading dairy states, and manufactured concentrate poultry feed in states where poultry production is concentrated. In the leading dairy states where 6-10 percent of gross cropped area is devoted to planted fodder, acreage of fodder is sometimes constrained by lack of good varieties of fodder, limited supply of good quality fodder seeds on a sustained basis, and

an increasingly shrinking gap area. Private sector investment in seed production has increased in recent times, but it is not yet adequate.

The strategies for addressing feed problems need more attention for the benefit of the poor livestock keepers, especially after severe climatic events such as floods and/or droughts. One of the spatial and temporal issues related to feed scarcity is the after-effects of floods which frequently affect eastern states like Assam, Bihar, and West Bengal, and droughts that affect some central and southern states. High morbidity and mortality and destocking of livestock are observed in these situations due to feed scarcity. After natural disasters—e.g., floods or droughts—problems of food security are frequently studied and strategies are developed to address them; however, little attention is given to the problem of feed security and its possible solutions under similar conditions. Feed markets may play a key role in resolving feed scarcity in disaster prone areas.

Where peri-urban commercial dairy systems are important, there is a strong demand for roughage feeds, so there is room for developing alternative supply chains and feed technologies to respond to that demand. Due to bulkiness, roughage feeds are traded locally in varying degrees depending on production systems and their evolution trend, nature and extent of feed scarcity, market orientation of producers, quality of transport infrastructure and its consequences on cost. For example, urban/peri-urban dairy based on buffaloes is a major economic activity in and around Hyderabad, Andhra Pradesh. These dairies depend on feed supplies, primarily sorghum fodder, from a large hinterland supply about 80-500 km from Hyderabad and extending beyond Andhra Pradesh through several channels involving transportation of un-chopped sorghum straw to Hyderabad, chopping and retailing, and transportation of sorghum straw chopped at source for retailing, (Blümmel and Parthasarathy Rao 2008). Over time, the relative importance of the channels linking distant places has increased due to increased demand, but also due to shortages in the nearby supply hinterlands.

This kind of urban/peri-urban dairies will eventually face the same fate as their developed-country counterparts. They will move away from the cities due to higher opportunity cost of land and labor in urban/peri-urban areas, cheaper increased supply of milk from rural areas, and greater market orientation of producers. Improved road infrastructure, and the higher cost of transportation of feed from rural areas, and that of manure out of towns and suburbs (due to municipal and public health regulations) will also speed up the transition. However, until such time, feed markets will continue to play a key role in the supply of feed to distant dairy producers. In such evolving systems and markets, demand for processing technology options such as simple chopping, baling, and making blocks with urea molasses or other such ingredients to improve quality may be examined.

Common Property Resources are degrading and diminishing. Feed markets have limited role in addressing feed problems of landless and smallholders who primarily depend on common property resources (CPRs), which continue to deteriorate in quantity and quality. For the landless and smallholders, livestock are more often valued for their non-market functions—as food, an asset, savings, and a vehicle for risk management in time of crisis. While livestock plays a critical role in the livelihoods of poor people, efficient utilization of feed may not be expected in these systems as a significant proportion of the feed is used primarily for maintenance of the stock and less for adding market value to

generate income. They depend largely on CPRs for much of the feed, and rarely, if at all, purchase concentrate or better quality roughage feeds. A study in 1999, showed that 35 percent of livestock keepers in the country reported grazing on CPRs, 23 percent reported collecting fodder from such lands, and 3 percent cultivated fodder on such lands. The feeds they derive from CPRs are generally non-tradable even though occasionally users may have to pay some rents or fees—in cash or kind—to get access to specific resources.

These resources being ‘common access’ rather than ‘common ownership’, so there is more incentive for each individual livestock keeper to exploit them to their limit, and little incentive to conserve and improve their productivity by increasing off take and reducing flock/herd size. The over exploitation and degradation of CPRs was exacerbated due to weakening of the role of traditional institutions that managed them through the introduction of formal administrative structures and legal procedures that were rarely enforceable. These measures marginalized local people’s initiative and alienated them from the management of CPRs, and rather encouraged dependence on government grants or relief and discouraged mobilization of local resources for better upkeep of the CPRs.

Between 1960-61 and 2004-05 permanent pastures and grazing lands have squeezed by 25 percent and of barren and cultivable waste lands by 51 percent (figure 11). The decline in common property land resources affects the entire country, but more so in the coastal and irrigated areas (Ramachandra, et al. 2007). Some important factors behind the deterioration of CPRs include large-scale distribution of common lands under poverty alleviation programs and increasing population pressure on land. The population of ruminants has increased by 150 percent since 1961, while the grazing resources declined by 35 percent. Increasing demand for fuel wood and fodder has put common lands under stress, leading to a decline in their vegetative cover.

Figure 11: Common property resources in India (million ha)



1. includes area under permanent pastures and grazing, cultivable wastes, fallow other than current fallow and barren and un-cultivable wastes.
Source: Directorate of Economics and Statistics, Ministry of Agriculture, Government of India

Better management of CPRs through alternative institutional arrangements is the most viable alternative for landless and smallholders, especially in pastoral systems. The poor conditions of CPRs are expected to worsen further, so landless and marginal farmers' livestock ownership and the traditional multi-functional role of livestock as a source of livelihood for the poor will come under serious challenge with increasing land pressure. Schemes to settle herders have rarely been successful as a solution to degraded CPRs anywhere including India. The long term solution lies in reducing the stocking rate, increasing off-take by culling unproductive animals, and better management of CPRs. The Government of India started implementing a number of programs for better management of CPRs—e.g., the Desert Development Program, the Watershed Development Program, the Drought Prone area Program, but little is known about the performance of these programs (box 6).

Box 6: Managing common property lands: an innovation from Karnataka

The World Bank-supported Karnataka Watershed Development Project (Sujala) recognized the critical need to manage common lands, which underpin the livelihoods of the poorest in the community who use them for grazing, fuelwood, and non-timber forest products. Sujala commissioned an exhaustive legal study and collaborated with the State Legal Ministry, to clearly define benefit-sharing rules, roles, and responsibilities. This led to the development of a Memorandum of Understanding (MOU) to be signed by local government agencies managing state land and community based organizations wanting to use these common lands.

Studies and observations show that these benefit sharing mechanisms have, in some cases, developed into sustained common land management mechanisms. There are now a few good examples of CPR management on revenue lands (and Forest Reserve areas), by community institutions, including women's SHGs, using community based mechanisms to maintenance the lands and to share benefits. Interestingly, mainly women's SHGs from poorer households have endured and a considerable number of them engage in CPR management. These areas are managed for communal grazing, often in combination with intermixed forestry plantations to provide additional fodder and fuelwood.

In other cases, the long-term sustainability of treated revenue land is likely to be weak. This is where MOUs were signed after the common land interventions were established, and so they largely remained agreements on paper only. Participation in common revenue land treatments was partly motivated by the direct employment generated. In these cases the communities have not had full trust that the agreements would actually result in assured benefit sharing.

Sujala demonstrated an innovative approach to common land management that while producing mixed results, has produced many lessons for future efforts. It underscores the need for a strong tenure arrangement, with legal backing, with respect to benefit sharing between the community and government. More important, it also indicates that many communities require further efforts by government agencies owning common lands to build trust for long-term benefit sharing and management arrangements.

Source: Milne (2009)

Notwithstanding these interventions, the future conditions of such resources may change through different pathways. For example, if due to net migration of rural population to urban areas or to non-agricultural occupations, pressure on CPRs is reduced, they may remain as viable sources of feed for landless and poor livestock keepers for a longer period. If on the other hand, population pressure actually increases and more CPRs are privatized or converted to crop land—considered to be a likely

scenario—degradation of remaining CPRs may continue until sustainable livelihoods from livestock based on these resources become impossible and leading to the abandonment of these resources permanently or temporarily depending on the level of degradation. Another possibility is that degradation may continue until collective self interest for present and future survival will induce users of CPRs to revitalize their traditional management and conservation strategies for better utilization of these resources over a longer period. Development of such strategies will require innovations in reconciling the administrative and legal procedures in place with traditional institutions.

RESEARCH ON LIVESTOCK IS LIMITED AND LACKS MULTI-DIMENSIONALITY

Commercialization and development of the livestock sector requires adequate investment in research, education, and training to generate and disseminate new technology, inputs, services, and institutional options. Between 1990/91 and 2004/05, expenditure on animal science research as percentage of total spending on livestock increased slightly from 1.9 percent to 2.9 percent. However, this remains quite low in relation to the challenges of livestock development in the country and given the important role of livestock in overall agricultural output. This includes national level expenditure through the Indian Council of Agricultural Research (ICAR) and its affiliated institutions, which account for over 90 percent of the research done in the country. The share of animal sciences in total agricultural research staff and expenditure at ICAR remained at around 17 percent (table 21). More than 95 percent of the scientists are in public institutions and they operate at low capital intensity and often not backed up with adequate operational resources, especially at the state level. Raising investment in livestock research especially at the state level, and its efficient deployment is critical. Rapid growth in private R&D is also needed.

Table 21: Manpower and investment in animal science research in ICAR

	1991	1996	2000	2003
Researchers (full-time equivalent)				
Total agricultural research	6380	7188	7476	7200
Percent share of animal sciences	17.1	17.1	17.0	17.3
Spending (Million US\$ in 2000 prices)				
Total agricultural research	486	579	867	951
Percent share of animal sciences	18.9	19.2	17.5	17.5

Source: Birthal (2008)

Most research is disciplinary while problems are multidimensional. Different central and state government and autonomous agencies collect regular national and state level statistics on various aspects of the economy, including livestock. However, most research is disciplinary oriented while most problems are multidimensional requiring multidisciplinary systems-oriented research encompassing veterinary and animal sciences as well as economics, policy, and other social sciences. Also there is lack of adequate coordination among various agencies collecting statistics, so there are unnecessary overlaps and gaps.

Research-extension linkage remains poor. The link between research and extension is also very weak so the research outputs generated by the research systems are not adequately and properly packaged and

disseminated for the benefit of the producers, processors, market agents and consumers. Lack of multidisciplinary research is one of the reasons for the weak research-extension linkage.

EXTENSION DOES NOT EXTEND TO LIVESTOCK

The public extension services have played a major role in technology and knowledge transfer in the crop sector, but in the livestock sector, extension services delivery has been very weak. The extension activities related to the livestock sector are by and large entrusted to the State Animal Husbandry Departments (AHDs), which have neither the resources nor the expertise to conceive and operate technology transfer packages. The institutional arrangement in the AHDs are mainly run by veterinarians who operate from veterinary dispensaries to treat animals rather than approaching farmers to educate and inform them about feed, fodder, and animal health. Thus, the delivery of breeding and health services gradually became the sole extension support to the livestock sector, and the evolution of a comprehensive nationwide extension service in the livestock sector has not been attempted.

There are, however, attempts by cooperatives; non-governmental/voluntary organizations; and institutions under the National Agricultural Research System, like the animal science institutes of the Indian Council for Agricultural Research, State Agricultural Universities, Krishi Vigyan Kendras (KVKs), etc. to provide some measure of extension support to livestock producers. But the coverage of, and access to, these agencies is limited, both in area and content and these do not measure up to a purposive national extension service comparable to the nationwide extension support available for crop production.

The Agricultural Technology Management Agency (ATMA) approach to coordinated agricultural extension was piloted in a number of districts throughout India under the National Agricultural Technology Project (NATP) and has now been adopted in more than half of the country's districts. ATMA involves establishing a society of key stakeholders associated with agricultural development in the district, including line departments, research organizations, non-governmental organizations, and other agencies. Under this model the public sector operates down to block level with front line services below that level being provided by private service providers, community-based organizations, farmers' cooperatives, agri-businesses, and agro-clinics. Unfortunately, very few of the ATMAs have embraced livestock extension activity.

The National Sample Survey Organization (2003-04) found that only five percent of the households were able to access any information on animal husbandry compared with 40 percent of households accessing information on modern technology for crop farming (NSSO [National Sample Survey Organization] 2005). Progressive farmers and electronic and print media are the most important sources of information for users of extension services. Analysis of the sources from where information was sought, revealed that among the few seekers of information, 29 percent accessed from neighboring progressive farmers, 14 percent from radio, 13 percent from TV, and 10 percent from newspapers (table 22). It has been reported that progressive farmers themselves receive information from government extension workers for further transmission to other farmers (Saha 2001; Conroy 2004), in which case they seem to be performing their job somewhat well. Extension workers, cooperatives, input dealers,

credit agencies, village fairs, government demonstrations, para-technicians, NGOs, Krishi Vigyan Kendra, etc.—all of which could serve the purpose of a line extension department—have been used by a tiny proportion of the information seekers almost everywhere. Even in Gujarat, where dairy cooperatives have been disseminating information on improved dairy production, a meager five percent of the information seekers mentioned primary cooperative as a source.

Table 22: Percentage of farmers accessing information on animal husbandry and their sources by state

State	Percent w/access information	Percentage of users by source of information							
		Progressive Farmers	Radio	TV	Newspaper	Extension Worker	Input Dealer	Credit Agency	Others ^a
Punjab	6.5	2.8	18.6	32.0	11.7	0.0	2.6	10.7	21.6
Haryana	3.4	21.0	15.4	20.4	19.6	0.0	0.0	2.8	20.8
Kerala	23.1	16.2	22.5	7.3	29.8	1.8	2.9	2.3	17.2
Tamil Nadu	18.0	28.5	8.5	10.1	5.1	11.1	3.6	5.1	28.0
Gujarat	8.5	21.8	0.3	15.5	3.7	11.0	4.2	0.6	42.9
Rajasthan	0.9	75.6	8.7	3.2	8.6	0.0	0.0	1.6	2.3
Uttar Pradesh	1.4	80.5	12.2	3.4	1.8	0.3	0.3	0.3	1.2
Andhra Pradesh	5.1	54.3	0.4	12.8	4.6	2.5	9.8	1.3	14.3
Maharashtra	4.5	19.9	10.8	15.1	15.8	1.2	1.2	10.2	25.8
Karnataka	3.6	14.7	10.6	22.9	12.4	0.0	2.0	13.2	24.2
Bihar	2.3	10.2	21.8	7.8	11.8	0.3	20.5	0.0	27.6
Madhya Pradesh	0.8	5.9	8.6	13.4	0.4	50.0	0.0	9.8	1.9
West Bengal	1.2	36.3	11.6	14.0	2.6	0.2	5.8	0.0	29.5
Orissa	2.2	0.0	14.4	16.3	16.3	0.7	3.0	26.1	23.2
Jammu & Kashmir	2.2	0.0	42.7	16.4	2.8	4.7	0.0	0.0	33.4
Himachal Pradesh	1.0	35.8	0.0	30.3	22.7	0.0	0.0	0.0	11.2
Assam	6.9	8.1	27.3	14.6	18.3	0.0	6.1	5.7	26.0
Tripura	0.2	0.0	0.0	0.0	48.4	0.0	0.0	0.0	51.6
Manipur	5.3	53.1	22.3	0.0	3.4	0.0	8.2	0.0	13.0
Meghalaya	20.5	38.0	20.5	29.8	4.8	0.0	0.2	0.0	6.7
Mizoram	0.7	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Nagaland	13.7	0.0	29.8	29.4	19.1	0.0	0.0	0.0	21.7
Arunchal Pradesh	11.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	57.3
Sikkim	8.9	0.0	0.0	0.0	0.0	97.9	0.0	0.5	1.6
Total	4.2	28.7	14.3	12.9	9.8	4.2	3.9	4.0	22.2

a. Includes village fair (2.9 percent), village primary cooperative (2.8 percent), para technician, NGO, private (2.6 percent), govt demonstration (2.2 percent), output buyer, food processor (2.2 percent), participation in training (1.3 percent), Krishi Vigyan Kendra and study tour (0.4 percent), unspecified (7.8 percent);

Source: Sirohi et al. (2008)

A large number of NGOs are active in delivering livestock services especially to the poor. The main NGOs working in the livestock sector are Bharatiya Agro Industries Foundation (BAIF), J.K. Trust Gram Vikas Yogana, and ANTHRA. PRADAN and BASIX have also started dissemination activities more recently. BAIF provides extension services and inputs in addition to their AI services. Other NGOs operate in localized areas and have in some cases dissemination of information on livestock technology as a complement to their other activities.

Conroy (2004) characterized five biases in India's extension services: (a) top-down transfer of technology with heavy reliance on interaction with progressive farmers; (b) emphasis on large ruminants

and other species of livestock are ignored; (c) services primarily focused on milk production, neglecting other roles of livestock; (d) services are concentrated in higher potential areas⁸—but here also it is by and large on the health care and breeding aspects; and (e) gender issues are neglected—i.e. services are provided by men to men, despite the vital role that women play in livestock production. Except for some examples like the Malabar Regional Coop Milk Producer's Union, which has initiated a dairy extension program exclusively run by women, extension workers are by and large men.

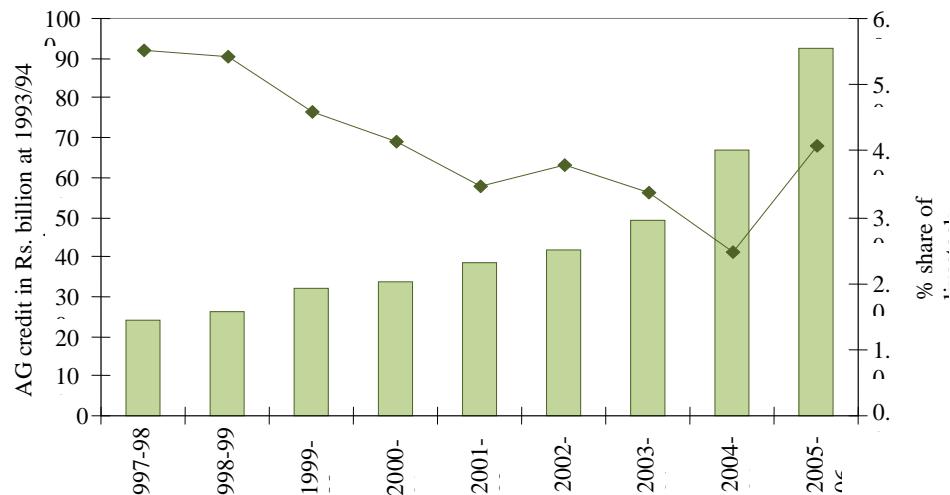
Demand for extension services and information may be low due to low market orientation of production systems. Information on profiles of the users of information is not available but a plausible hypothesis is that more market oriented producers sought information as market orientation exposes one to the need for improved inputs, technology and information and their economic use to maximize profit. This is evident in case of dairy farmers in the leading dairy states who seek technology and knowledge from available sources, even if some of the sources may not be the most ideal or efficient ones. More clear evidence can be found in the commercial poultry sector where contract producers are provided with technology and information by the contractors. Independent poultry producers also seek such knowledge and information from available sources based on needs. On the other hand, the majority of the livestock producers in the country belong to mixed crop-livestock and pastoral systems in which few external inputs are used so they have little demand for external knowledge and technology. They may not seek much advice on how best to use on-farm inputs or resources, even though there are opportunities for productivity improvement through better use of existing resources. For example, better management of fragile grazing areas to improve their productivity can contribute significantly to increase productivity and income.

ACCESS TO CREDIT REMAINS ELUSIVE

The share of the livestock sector in total agricultural term loans is less than 10 percent, although livestock contributes to about a quarter of the total agricultural output. Between 1998 and 2006, it varied from 2.5 to 5.5 percent (figure 12). Formal credit—from cooperative societies, banks and government—still eludes livestock holders. Instead, livestock producers must turn to non-institutional sources, such as traditional moneylenders, quasi-government, and non-government organizations.

Figure 12: Share of livestock in total credit disbursed to the agricultural sector

⁸ The access of information by the farmers is somewhat better in Kerala (23 percent), Tamil Nadu (18 percent), Gujarat (8.5 percent), and Punjab (6.5 percent)



Source: Birthal, Overview (2008) based on Annual report, 2002-03 and 2006-07- National Bank for Agriculture and Rural Development (NABARD)

Banks and other financial institutions provide credit facilities in the form of term loans for various livestock activities—including dairy, poultry, sheep and goat rearing, piggery, etc. Financial assistance is given to purchase animals, construct animal sheds, purchase equipment, and meet other expenses in setting up a farm. The working capital for the initial period of operation (the time period depends upon the nature and size of livestock activity) can also be capitalized and given as a term loan.

If the livestock activity also involves expenditure on land development, fencing, digging of wells, electricity connections, go-downs, transport/vehicle, etc., these items can be considered for a loan. Besides the purchase of livestock, post-production activities, such as establishing milk collection centers, bulk milk coolers, livestock product processing units, cold chain, storage and marketing infrastructure, vehicles for transporting livestock products, retail outlets for sale of livestock products, etc. and feed and fodder development activities are also eligible for financing.

However, the wide range of dairy development activities that can be financed through bank loans are of limited relevance from the perspective of small-scale livestock holders who require capital for rearing a small herd of 1-3 animals. According to bank norms, a two-animal unit is considered to be the minimum viable unit size for financing and the banks usually finance only the purchase of animals for such small units, while in the case of larger commercial units credit is advanced to meeting the working capital requirement and other capital investments. Empirical evidence suggests that the amount of loan is often inadequate for farmers to meet the cost of the animal and about 10-11 percent of the loan amount is spent in meeting non-interest credit costs (Krishnan and Krishnan 1989; Singh, Nanda and Dahiya 1995; Sinha 2001). Further, due to lack of support services for purchasing/selecting good quality animals, poor availability of physical support, and cash constraints in adopting scientific dairy farming practices, the income accruing to farmers from bank borrowing is often low, which results in poor repayment performance by borrowers (Gupta, Singh and Patel 1983).

The absence of an integrated approach to providing credit and other relevant support services works to the disadvantage of not only the smallholders but also for potential entrepreneurs, particularly those in

the rural areas who are interested in setting up livestock farms on a commercial scale. The banks require a systematic project report showing detailed financial calculations on a yearly basis for financing any commercial project. Without an institutional mechanism for providing ready availability of technical advice to prepare techno-feasibility reports and other required support services at the time of loan application and later during the course of operation, the uptake of institutional credit for livestock activities is likely to remain low.

The composition of refinance disbursements by NABARD show that an increasing proportion of the credit services for animal husbandry are going to dairy development. The share of advances for poultry, sheep and piggery have declined sharply from 50 percent in the early 1990s to 32 percent in the late 1990s and further to less than 22 percent in triennium ending 2005-06.

Cooperative banks have the dominant share in refinance disbursement by NABARD under dairy development (table 23) indicating that the credit assistance to dairy farmers is provided largely by the cooperative banks. The RRBs that are mandated to cater to the credit needs of the socially and economically weaker sections have a very small share in refinance disbursements. These banks usually handle the credit associated with specific government schemes for assistance to the economically and socially weaker sections e.g., advances under Integrated Rural Development Program (IRDP), now renamed Swarnjayanti Gramin Swarozgar Yojna (SGSY).

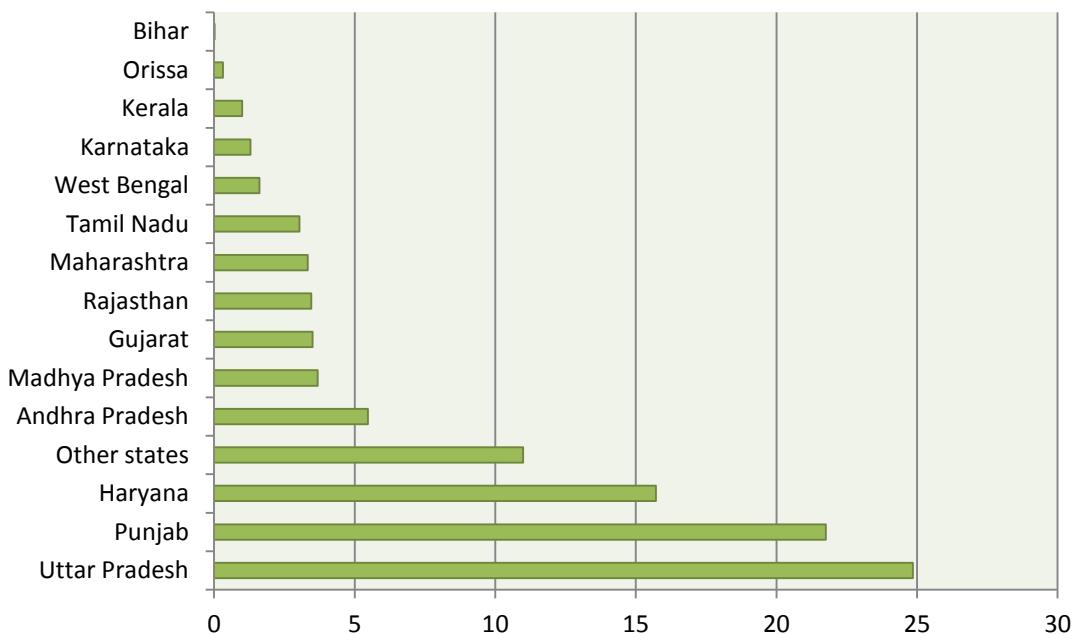
Table 23: Refinance disbursement by NABARD under dairy development to different credit institutions (Rs. million), 2003/04- 2006/07

Year	Commercial Banks	RRBs	SCBs	SCARDBs	Total
2003-04	22.9	301.7	1382.1	4984.8	6691.5
2004-05	1483.3	488.5	900.0	4669.3	7541.1
2005-06	2235.6	313.4	782.6	3615.7	6947.3
2006-07	1368.3	371.7	986.7	2313.5	5040.2

Source: NABARD (2007)

The inter-state variations in access to credit services as captured through the share of the state in all-India animal husbandry investment credit indicates that Assam, Bihar, Chhattisgarh, are Orissa are very poorly served, while the northern states of Haryana, Punjab and Uttar Pradesh receive 62 percent of the share (figure 13).

Figure 13: Disbursement of investment credit for animal husbandry to the states through refinance scheme by NABARD 2003/04 – 2005/06 (percent)



Source: NABARD (2007)

Several measures have been taken in recent years to boost agricultural credit including livestock. In 1998 the Kisan credit card scheme was introduced to simplify procedures for obtaining institutional credit. Instead of taking the sanctioned amount in one installment and following a rigid repayment schedule, the card enables farmers to obtain credit up to their sanctioned limit in installments according to need and to repay any amount at any time. From 1998 to March 2007, a total of 67 million Kisan credit cards have been issued. In 2003, the interest rate on agricultural credit was reduced from 14-18 percent to 7-9 percent. In recent years, a few new models of delivering credit services to the animal husbandry sector have been initiated, such as financing under the Rural Infrastructure Development Fund (RIDF) to establish veterinary dispensaries and livestock aid centers, the Venture Capital Fund for the dairy and poultry sector to promote new entrepreneurs in these two areas, and the National Credit Fund for Women.

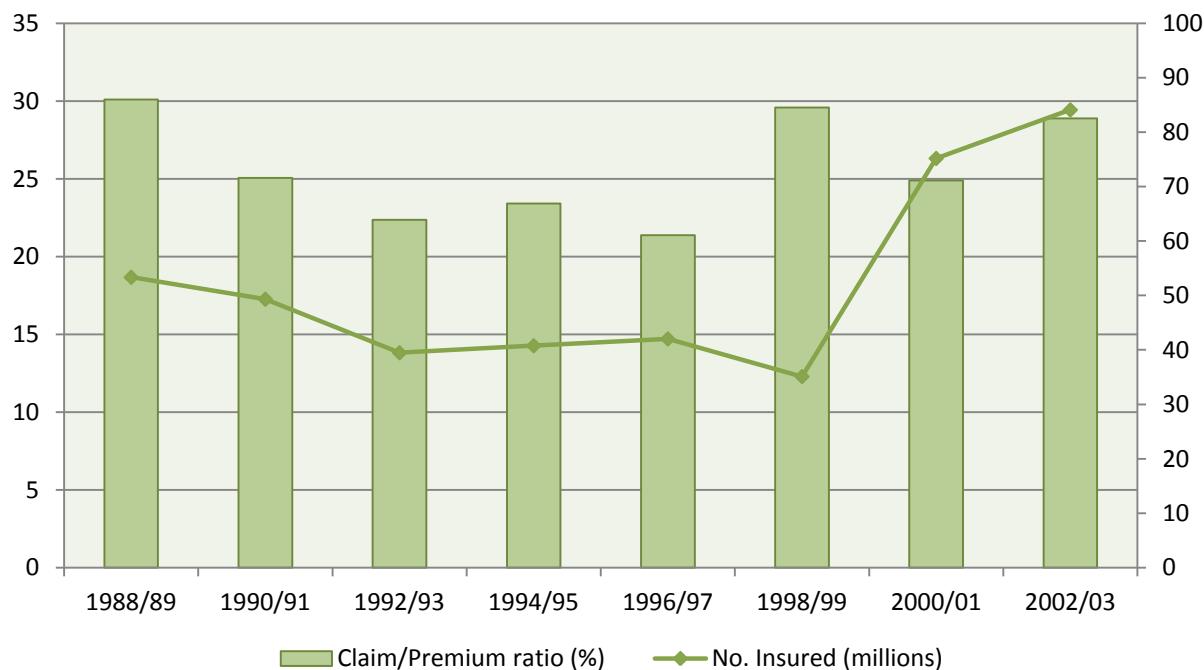
There are also a large number of micro credit institutions that have emerged, but there is no umbrella scheme to promote microfinance in the livestock sector. However, the importance of micro-finance and the self help group (SHG)-bank linkage program has been increasing at a faster rate. The cumulative number of SHG-bank linkage programs was 263,825 in 2000-01 and rose to 2,238,565 by 31 March 2006, about a nine-fold increase in five years. A number of private sector banks are entering the micro-credit sector with several innovative products.

Progress of Livestock Insurance Schemes has been very slow. The outreach of livestock insurance schemes' outside of the commercial poultry section is extremely low (figure 14). In 2002-03, approximately six percent animals, excluding poultry (29.4 million)—were insured. In contrast, commercial poultry farmers readily seek insurance coverage due to the high risk of mass mortality. In

1999, about 80 percent (60 million birds) were insured (Chawla, Kurup and Sharma, Animal Husbandry: State of the Indian Farmer 2004). There are a number of potential reasons for the low coverage of livestock insurance outside the commercial poultry sector—lack of awareness, affordability, delivery channels, problems in settlement of claims, etc. Furthermore, the heavy claim ratio (above 80 percent) in the case of livestock makes the transaction and service costs very high for the insurance industry and deters extension of schemes (Raju and Chand 2008).

In recent years, a few state governments launched schemes for the benefit of certain sectors to ensure protection of their livestock assets—such as, Avikavach in Rajasthan for sheep flock owners. Although such schemes have laudable objectives, they have not been implemented effectively, mainly due to lack of awareness among the potential beneficiaries.

Figure 14: Progress of Livestock Insurance Scheme



Source: Birthal (2008)

The Department of Animal Husbandry and Dairying, Government of India has also formulated a new pilot scheme in 100 districts of the country, where the National Project for Cattle and Buffaloes Breeding (NPCBB) is in operation. The scheme is restricted to high yielding cows and buffaloes (yielding at least 1500 liters of milk per lactation). Half of the premium cost is borne by the farmers and the remaining 50 premium amount and the administrative charges—including the cost of the ear tags—is borne by the Government of India. The subsidy is to be restricted to two animals per beneficiary and is to be given for one-time insurance of an animal up to a maximum period of three years. The farmers are encouraged to go for a three-year policy, which is likely to be more economical and useful for getting the real benefit of insurance in the event of natural calamities, like flood and drought. However, if a livestock owner prefers to have an insurance policy for less than three years for valid reasons, the subsidy is still available, with the restriction that no subsidy would be available for further extension of the policy. The

State Implementing Agency (SIA) and livestock development boards (LDB) will be implementing the private scheme, to bring about synergy between NPCBB and livestock insurance. Where there are no SIAs the livestock insurance scheme will be implemented through State Animal Husbandry Departments. The Gram Panchayats are to assist the insurance companies in identifying the beneficiaries.

Until recently livestock insurance was provided solely by the public agencies, but now private players have entered the market. In 2002, BASIX, a livelihood promotion institution working in several arid and backward districts spread over seven states, collaborated with Royal Sundaram to provide livestock insurance to poor livestock keepers.⁹ They have distributed about 35,000 insurance products up to 2006-07 and have initiated efforts to simplify the product and policy issuance procedures. They have also implemented control measures to reduce adverse selection and moral hazards in claims. These measures have allowed the insurance company to reduce the premium rate in livestock insurance from 4.5 percent to 3.9 percent in subsequent years. The rapid scaling up by BASIX and product replication by other insurance companies proves the viability of such a product as well as existence of demand. The entry of an increasing number of private players to provide risk management tools to the rural poor indicates financial sustainability of these services. These types of initiatives need to be replicated on a wider scale and micro-financial institutions and private sector players should be encouraged to increase the outreach of livestock insurance.

The problems faced by insurance products in India—like the costly claims adjustments and monitoring required for moral hazard and adverse selection—may also be addressed to a large extent by offering index-based insurance products. Index insurance and carefully layering of risks can offer an excellent beginning to getting the big risk out of the local community or country. For example, in Mongolia an Index Based Livestock Insurance where the choice of insuring runs from 30 percent to 100 percent of the value of herds, the vast majority of herders select 30 percent with a lower premium cost (box 7). In this project, there is a clear separation of the commercial and the social base on the willingness to pay for risk (Skees and Enkh-Amgalan 2002). Pooling and transfer of risk takes place whereby the government facilitates risk pooling among companies within the country and then sells the tail risk to the global reinsurance markets. The government subsidizes only the most extreme risks and premium subsidies are avoided due to high costs and poor incentives.

Box 7: Mongolia's index-based livestock insurance

Since 2005, Mongolia has piloted index-based livestock insurance to share risks among herders, insurance companies, and the government. The project combines self-insurance, market-based insurance, and social insurance. Herders retain small losses that do not affect the viability of their business (self-insurance), while larger losses are transferred to the private insurance industry (market insurance through a base insurance product). This is not a purely commercial program, however. The government bears the final layer of catastrophic losses (social insurance through a disaster-response product).

Herders pay a market premium rate for the base insurance product, which pays out to individual herders whenever the livestock mortality rate in a local region exceeds a threshold. As excess mortality reflects a combination of dry, windy summers and cold, high-snowfall winters, the insurance index is linked not to a weather

⁹ India's first private non-life insurance company, backed by Sundaram Finance, India's leading financial services company and Royal & Sun Alliance, UK.

event, but to historical livestock mortality data. Insurance payments are thus not directly linked to individual herders' livestock losses; payments are instead based on local mortality. This should avoid or reduce moral hazard and adverse selection, and reduce costs.

A key to the approach is having good data to develop the livestock mortality index. Mongolia has a 33-year time series on adult animal mortality for all regions and for the four major species of animals (cattle and yak, horse, sheep, and goat). The mortality index provides the basis for determining the specific mortality rates that would trigger indemnity payments.

Source: World Bank (2008)

SUMMARY OF KEY POINTS

- Artificial insemination using exotic blood has been adopted as the strategy to upgrade local cattle and increase yield. To that end, facilities have been created by the public sector, cooperatives, NGOs and the private sector, more in the leading dairy states than in the lagging states. Buffalo breeding has been neglected.
- Performance of AI programs in terms of conception rates and cost per calf born is better for services administered by some of the NGOs and the private sector compared to those provided by the government agencies and the cooperatives.
- A proper breeding policy for selection and grading of improved local breeds of cattle and buffalo need careful consideration for long term development of breeds.
- Feed scarcity in terms of quantity and quality has been a long standing constraint to improve productivity. However, in leading dairy states feed market is playing a prominent role in mitigating temporal and spatial differences in availability of roughages, and planted fodder production and use of concentrates are increasing.
- In the lagging states and in crop-livestock systems where crop residues are the main feeds, the role of planted fodder or better feed technology and markets is limited because the producers are not adequately market oriented. In pastoral and crop-livestock systems where dependence on CPRs is high, the role of improved feed technology and markets is also limited. However, given that many poor livestock keepers are involved in these systems for their livelihood, strategies for better management of CPRs need to be designed through innovative ways of reconciling legal and administrative procedures and traditional institutions.
- In per-urban dairy systems, strong demand for roughage feeds is met by feed supply chains linking these systems with distant feed supply hinterlands. In some of these systems, concentrate feed use is very low, the rationale for which is unclear.
- In the commercial poultry industry, concentrate feed use has been increasing rapidly and the feed industries are mostly located where the poultry production units are concentrated. Poor quality of raw materials and inadequate supply of maize due to reduced import and inadequate

domestic production are major problems. Relative prices of feeds and products are important determinants of profitability and feed demand in commercial production systems. Both the domestic and world markets for feeds and products are volatile at present so price movements in the market will need careful monitoring for choosing supplies from alternative sources.

- The issue of feed scarcity, particularly after floods and droughts, in states where these occur frequently should receive priority attention. Feed markets may play a key role in resolving feed scarcity in disaster prone areas.
- Most research is disciplinary while problems are multidimensional requiring multidisciplinary systems research. Research-policy-extension linkage is also weak.
- There is no separate extension service as in the crop sector. Livestock extension is the responsibility of the State Animal Husbandry Departments, who apparently give little time to extension. Some large and small NGOs also provide packages of services—some in several states and others in localized areas- but these are apparently more focused and efficient.
- Those who seek livestock information do so mainly from progressive neighboring farmers, TV, radio and newspapers; this indicates less preference for conventional sources, such as a livestock extension department.
- Low overall market orientation of production is the main reason for low demand for technology and information. In designing content of extension packages and institutional arrangements for the delivery of extension services, the guiding principle should be that demand for improved technology and information usually increase with commercialization of production. Extension service needs to respond to that demand.
- Access to livestock credit is limited and disbursement is biased towards dairy animals in leading dairy states. Several new credit delivery approaches and schemes have been introduced making access procedures simpler but the biases mentioned above are still present so lagging states are unlikely to benefit much from these schemes.
- Livestock insurance coverage for animals has increased from a low base and is very high in case of poultry. New insurance products are generally biased towards high yielding animals and commercial production systems. Claim ratio is quite high for livestock insurance.
- Some private insurance providers are working with pro-poor development agencies in several states and have a sizeable number of clients, but they face problems of high transaction costs, improper selection of clients, and moral hazard in settlement of claims. More innovative approaches need to be tested to deal with these problems to expand insurance coverage.

4. ANIMAL HEALTH AND VETERINARY SERVICES

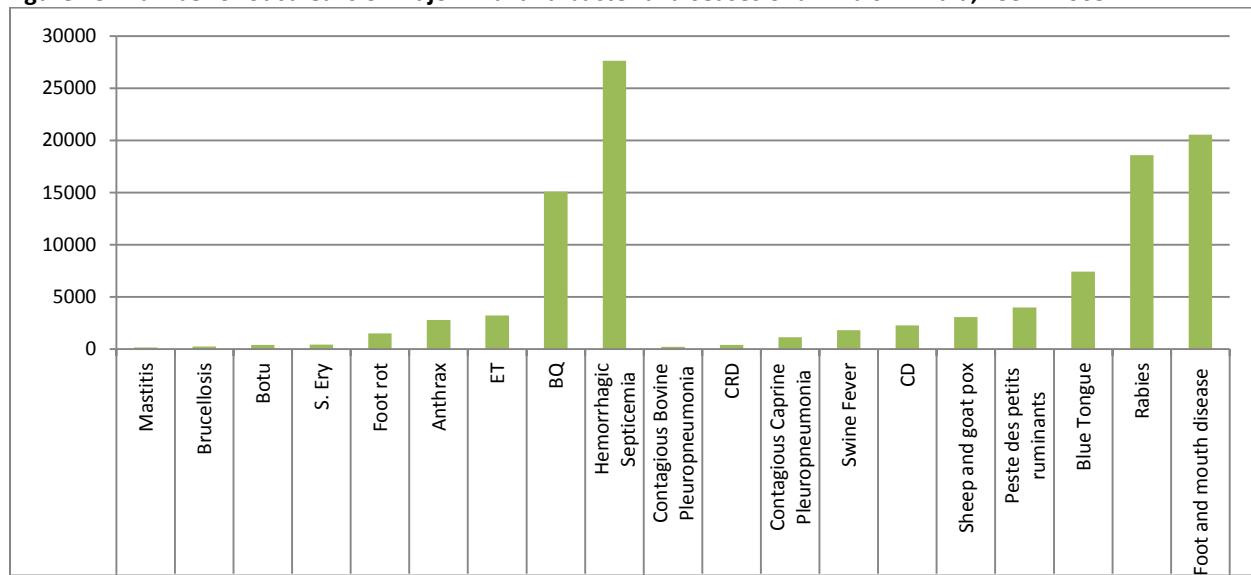
Animal health is crucial to the productivity and profitability of the livestock sector, and as several past events have illustrated, it also impacts human health. This chapter explores key issues related to animal health in India. More specifically, it attempts to (a) identify the major animal diseases affecting livestock; (b) review the surveillance, prevention, and control systems that are in place; (c) examine the existing institutional infrastructure dealing with animal health including institutions that are responsible for delivering animal health and veterinary services (diagnostics, vaccines, drugs, etc.); (d) explore the role of the private sector and opportunities for public private partnerships in animal health activities in leading and lagging states; and (e) review animal health policy and regulation in the country.

DISEASES INCIDENCE AND ECONOMIC LOSSES

Animal diseases continue to inflict considerable economic losses on all livestock-owning households, particularly the poor and marginal farming community. Losses arise through high levels of animal morbidity, mortality, declines in production levels, reduced fertility, inefficient feed conversion resulting in poor weight gain, and impaired draught power. Furthermore some of the diseases are zoonotic and have significant impact on public health, especially among women who traditionally handle livestock. While the country has been declared free from rinderpest, a number of other diseases like Foot and Mouth Disease (FMD), Black quarter (BQ), Hemorragic Septicemia (HS), Blue Tongue, Peste des Petits Ruminants (PPR) and sheep and goat pox continue to persist and sometimes in growing intensity. Direct losses due to FMD alone were estimated at Rs. 40 billion per year between 1990 and 2001, as shown in figure 15 (Government of India 2002).

In addition, diseases like New Castle (NC), infectious bursal disease, chronic respiratory diseases, and highly pathogenic avian influenza (hereafter referred to as H5N1) also affect the poultry sector. H5N1 alone has lead to severe losses resulting from animal deaths and the costs of controlling it through mass culling to reduce outbreaks. While there is no accurate available data on the total financial and economic losses caused by animal diseases, various estimates put the losses between Rs. 50 billion to Rs. 132 billion annually (Chawla, Kurup and Sharma 2004; Ahuja, Rajasekhar and Raju 2008).

Figure 15: Number of outbreaks of major viral and bacterial diseases of animals in India, 1991- 2005



Source: Government of India (2002) and Ahuja, Rajasekhar and Raju (2008).

State wise data on disease incidence are difficult to obtain; however, available data have shown that Andhra Pradesh, Karnataka, Gujarat, and Jammu & Kashmir have experienced a large number of outbreaks of four major diseases—FMD, HS, BQ, and Anthrax—during the period 1991-2005 (Table 24). The appearance of larger outbreaks in these states could be due to under reporting in the rest of the country. For instance, Andhra Pradesh is one of the few states where veterinarians are encouraged to report disease information, which is compiled and shared with national laboratories. FMD, BQ, and Anthrax outbreaks also occurred in Kerala, West Bengal, and Bihar over the same period, while Maharashtra and Rajasthan appear to have suffered from a number of HS outbreaks. Several other states suffered from one or more outbreaks of the four major diseases.

Table 24: Outbreaks of selected viral and bacterial diseases 1991-2005 in select States

State	FMD	Number of outbreaks of diseases		
		Hemorrhagic septicemia	Black Quarter	Anthrax
Karnataka	4482	5384	7139	354
Andhra Pradesh	3053	9782	3540	1141
Gujarat	1509	2984	316	97
Jammu & Kashmir	1017	506	493	73
Kerala	2458		491	200
West Bengal	1343		926	433
Bihar/ Jharkhand	781	851	288	
Maharashtra		667	528	129
Madhya Pradesh/Chhattisgarh		1387	374	
Rajasthan		4641		
Meghalaya	1522			34
Maharashtra	809			
Assam	638			95
Tamil Nadu				219
Manipur			240	

Source: Ahuja, Rajasekhar and Raju (2008)

ANIMAL HEALTH INFRASTRUCTURE

The high incidence of disease outbreaks, and the resulting losses, occurs despite having an extensive infrastructure and a large number of personnel to provide veterinary services, disease surveillance, and disease reporting. A significant share of public expenditure in the livestock sector is allocated to provide these services. However, very little attention is given to preventive veterinary health care, vaccination coverage of animals is unsystematic and ineffective, and the disease reporting and surveillance system is not used efficiently, all of which undermines efforts and results in the poor state of animal health. There is also an unbalanced distribution of infrastructure and inefficient delivery of curative services, which are used by only a small proportion of the producers.

PREVENTIVE HEALTH CARE INFRASTRUCTURE AND SERVICES ARE UNDERFUNDDED

There are two broad categories of activities under preventive health care program—(a) disease diagnosis and surveillance; and (b) control and immunization against endemic diseases. These activities are supported by about 250 disease diagnostic laboratories, 26 veterinary vaccine production units (including seven in the private sector), one National Veterinary Biological Products Quality Control Center, and animal quarantine stations at the four metropolitan cities. GOI has established one central and five regional Disease Diagnostic Laboratories (DDLs) to provide referral diagnostic services, and they have initiated a network linking the DDLs with other State Government laboratories, ICAR and universities for better coordination, efficient disease diagnosis, monitoring, and reporting. However, out of a total of about 27,000 veterinarians (about 90 percent of which are veterinary graduates) and 61,000 para-veterinary staff (stock assistants and technicians) working in the livestock health institutions throughout the country, only a meager 3.5 percent are engaged in disease investigation and control (Ahuja, McConnell, et al. 2003).

DISEASE REPORTING, SURVEILLANCE, AND DIAGNOSIS ARE PLAGUED BY UNDER REPORTING

Under reporting and lack of reporting diseases is common. Organized national surveys of endemic diseases are needed to properly assess incidence and prevalence. In most cases, disease reports are based on clinical symptoms and subjective assessment, but they lack laboratory confirmation. Disease outbreak reports are consolidated manually at the block, district, and state levels, which cause lots of the information to get diluted at every stage of consolidation and transmission; vital detailed information is often permanently lost. The information flowing through the system is incomplete, and lacks information from non-government agencies, private practitioners, and universities. There is little or no cohesiveness in handling livestock diseases as a national phenomenon and each state acts with little interaction with its neighbors.

Disease reporting formats need simplification. Lengthy and complicated formats dissuade functionaries from actively reporting diseases. A simple ‘Disease Outbreak Report’ should be developed and deployed nationwide. The required epidemiological data collection should be the responsibility of the

epidemiologist investigating specific outbreaks, using more detailed formats. Use of information technology can greatly facilitate quick and effortless data collection and transfer (box 8).

Box 8: Use of Information technology for disease surveillance and monitoring

The rapid growth of information technology can make the task of disease monitoring and surveillance easier and faster with built-in checks that increase the reliability of information. With fairly well developed telecommunication in India, the following options have been suggested for enhancing the effectiveness and efficiency of disease monitoring and surveillance:

Interactive Voice Response System (IVRS) - The IVRS is an automated interface with telephone callers (disease informers / reporters) that can enable instant delivery of time-critical information. It can also be routed through operators (preferably retired vets working in shifts) to provide person-to-person direct interaction that helps to elucidate disease related information from farmers, the epidemiology units, or any business service providers.

IVRS can provide almost foolproof voice-to-data-to-voice conversions and all the details of the call—phone number, time, and duration—can be stored for any length of time for traceability. The system can also receive emails or SMS and convert voice mails to data for delivery to a pre-designated phone/mobile/SMS/e-mail/fax. It can receive voice mails in any language and respond in the same way, which is very useful to illiterate villagers. A disease outbreak message can then be distributed or conveyed through voice/SMS/e-mail/fax instantaneously to vet service providers at all levels. Pre-recorded messages through IVRS can also help extension education efforts by AHDs. If linked to GPS, it can display disease outbreaks reports on maps and the data can be stored for epidemiological analysis. The details of costing and maintenance need to be worked out if IVRS is to be put in use for national disease reporting system.

SMS through mobile/cell phones- This is useful in its own way for disease reporting for people with mobile phones and who are literate enough to write an SMS. It is not automated for redistribution of messages and requires manual intervention for this purpose. It is difficult to organize a national network for the simple reason that no one knows when and where the disease is going to strike and access to cell phone for sending SMS and in particular to find person willing to SMS for a poor villager. Voluntary networks in endemic areas can be attempted as good public relations effort by local vets. On the other hand, in most places public land line telephony is feasible and its use for disease reporting is seen as more pragmatic than SMS.

Toll free land line phones- This can perhaps provide the most easily accessible, simple, user friendly system even in most remote places for disease reporting. If the government provides toll-free numbers, the system can encourage farmers to report diseases and interact with vets at various levels of the administration. These toll-free numbers can be directly linked to various animal health functionaries with a separate response cell at epidemiology unit for follow up action.

Source: Ahuja, Rajasekhar and Raju, Poverty Alleviation (2008)

Disease diagnosis remains inaccurate because few samples are tested in laboratories. When an animal shows signs of a disease, the incident is normally reported by villagers, or the village *sarpanch*, to the nearest veterinarian. The veterinarian initially diagnoses the disease based on symptoms identified by the villagers because, in most cases, the animal is already dead by the time the veterinarian reaches the village. Pathological samples are rarely collected to confirm any disease because the animal has already been disposed of or the veterinarian lacks the proper equipment for collection, preservation and transportation to nearest laboratory for confirmation. Consequently, only dung samples are collected and examined at most of the veterinary hospitals to identify parasitic infestation. In many cases, diseases are not reported and the affected animals are sold at bargain prices.

Animal health centers, which are usually located at district headquarters, are responsible for confirming the disease and supplying the required preventive vaccinations. Diseases are confirmed based on reported symptoms and examination of dung, urine, blood samples, when available, and by conducting a postmortem of the dead animal. For further confirmation, samples are sent to the state laboratory because diagnostic kits are not available at the field or district levels. At the state level, final diagnoses are rarely made for many viral diseases due to lack of equipment and reagents, so samples are sent to regional or central government laboratories. Currently, culture and biological tests are conducted at state level laboratories. Facilities and trained manpower need to be provided at the district level so that most of the diseases can be diagnosed and effective control measures can be taken up without delay. In most cases, by the time the disease is confirmed, the affected livestock is no longer available to undertake remedial measures.

IMMUNIZATION MUST BE EXPANDED TO CONTROL DISEASES

The central and state governments share responsibility for disease control. The central government directly implements programs to control specific diseases—like Rinderpest and FMD—that are endemic and cross state boundaries, requiring more than the efforts of affected individual states. The central government also makes financial allocation to state governments to undertake disease control activities through their own programs. State and Central Plan budgets annually provide for vaccinating animals against all major diseases; however, vaccinations are often distributed as a share of the planned budget due to each district, with little planning based on area specific control plans and sound epidemiological surveillance systems, resulting in low effectiveness in containing the disease.

Disease control programs and vaccinations are sporadic, unsystematic, and have limited coverage. GOI successfully implemented a program to eradicate Rinderpest during the last decade, after which FMD became the most important contagious disease. New control programs are now being implemented in eight selected states—the leading dairy production states—to address FMD. Between 2003/04 and 2006/07, the central government spent Rs. 102 million annually on the FMD program, but control is particularly complicated by several factors:

- there are many serotypes of FMD virus causing the disease;
- there is no systematic vaccination of susceptible livestock;

- there is unrestricted and seasonal livestock movement;
- there are “carrier animals” that transport virus following infections and outbreaks; and
- symptom-free infection in small ruminants often goes undetected.

Over 25 million vaccinations against FMD are carried out each year, but this is only six percent of the 420 million animals that are at risk. FMD is a contagious disease, and until more than 85 percent of the animal population in an area is vaccinated, herd immunity cannot be established (Chawla, Kurup and Sharma, Animal Husbandry: State of the Indian Farmer 2004). The situation is further complicated because the movement of diseased animals across state boundaries is not controlled, dead animals are not disposed of properly (carcasses are discarded in tank beds or on common grazing lands), and the states do not coordinate their efforts to control viral diseases.

Recently, FAO’s Pro-poor Livestock Policy Initiative (PPLPI) attempted to develop an action plan to control animal diseases that are economically important to the poor. A total of five diseases—Haemorrhagic septicaemia (HS), Peste des Petits Ruminants (PPR), Black quarter (BQ), Enterotoxaemia (ET) and Ranikhet disease (RD)—were identified for this purpose. A focused, retrospective epidemiological analysis of disease outbreak data between 1998 and 2004 in Andhra Pradesh attempted to delineate the long-term trends in these diseases. In addition, need-based collateral information on the number of outbreaks, attacks and deaths, villages affected, weather parameters, migration profiles, livestock population density per km², infectivity and habitat aspects of the associated pathogens were reviewed to substantiate their impact on long-term disease trends. This was done with a view to understand specific temporal and spatial parameters associated with the long-term disease trends in the population and their usefulness in evolving control strategies and action plans.

Box 9: Bovine Brucellosis Progressive Control Programme: Karnataka’s experience (1998-2002)

Karnataka state, which has 13 milk producers’ unions representing 17,093 villages and 1.5 million farmers, was taken as a model to initiation the Bovine Brucellosis Progressive Control Program (BBPCP). In all, pooled milk samples from 6,767 village level milk co-operative societies from 13 milk unions with a turnover of 1.8 million liters of milk/day were used in this study. The first round of milk enzyme-linked-immunosorbent serologic assay (ELISA) results indicated that 5 out of 27 districts are free from brucellosis and in the remaining infected districts, 284 villages (3.8 percent) were positive for brucellosis. The maximum number of calves that required annual vaccination in these 284 villages was about 30,000 for 3-5 years. The estimated cost of vaccine was Rs. 300,000 per year and operational costs of another Rs. 200,000 per year.

This survey showed low or marginal infection in these five infected districts. This low prevalence is perhaps due to small herd structure (5-7 animals per herd) and natural self-limiting tendency of the disease under such conditions. These findings gave strong credence for the use of calf-hood vaccination in the infected villages and that the disease can be controlled at low cost. This Karnataka experience is an excellent example to initiate brucellosis control strategies at village level in India, through the concept of BBPCP.

AVIAN INFLUENZA OUTBREAKS TAUGHT SOME LESSONS

Management of recent outbreaks of H5N1 revealed weaknesses and lessons for designing future control measures. The outbreaks in both West Bengal and Tripura were eventually successfully contained by the state governments with administrative, financial, and scientific/technical support from the central government. Successful containment of the first outbreaks of bird flu in three states during 2006 provided India with practical experience in handling outbreaks in real time situations. However, the experiences also pointed to the possibilities of defaults at state and local levels and the need for effective center-state coordination and collaboration to successfully contain the disease.

The Government of India has developed a Country Program for Preparedness, Control and Containment of Avian Influenza (H5N1), covering both animal and public health dimensions. The strategy emphasizes the need for adequate bio-security measures, increased country capacity for surveillance and detection, strengthening the early warning system, reducing opportunities for human infection from birds, efficient control measures in case of an outbreak, and an effective communication strategy. Diagnostic support is enhanced with establishment of additional high security laboratories (e.g., Pune). The High Security Animal Disease Laboratory (HSADL) in Bhopal has been designated as the National Level Laboratory for HPAI. The four Regional DDLs of GOI have been strengthened to provide special training to field veterinarians from their constituent states in handling bird flu outbreaks. There is an effective top-down administrative action plan and support to state governments with full costs borne by the central government. Also, coordination with the WHO, FAO and OIE is taking place.

An initiative to develop a regional approach to control H5N1 is required given the risks of spreading the disease across borders. Although India has rigorously followed global standards set out by the WHO, FAO, and OIE to meet its international obligation to mitigate pandemic human infection, the country's long and porous international borders with neighboring countries require GOI to develop a regional strategy with its neighbors. West Bengal and other north-eastern states have high risk of contracting H5N1 from neighboring Bangladesh, which is densely populated with poultry, duck, and migratory birds. Long-term, pragmatic, and results-oriented intensive transboundary surveillance strategies to prevent incursions are needed. Massive culling of infected and in-contact poultry as a control strategy results in the loss of a valuable indigenous genetic pool. Compensation paid for such culling does not adequately protect the resources and livelihoods of poor farmers.

The system of H5N1 monitoring needs extensive community participation and integration with the system of general disease reporting and diagnosis, especially in the case of backyard poultry. India has some 270 million fowl and duck in the backyards of rural households. They are constantly exposed to risk of infection from migratory birds, particularly in the large land corridors along flyways. Large scale mortality among the backyard poultry annually due to NCD is common, and there is a risk that villages might confuse an outbreak of H5N1 with an outbreak of NCD and fail to report the problem. Human disease outbreaks running concurrently with large scale bird mortality are also likely to be ignored in this

scenario. Effective handling of such situations requires awareness and extensive community participation, particularly among village women because they are the primary managers of backyard poultry, in the disease information campaign against HPAI.

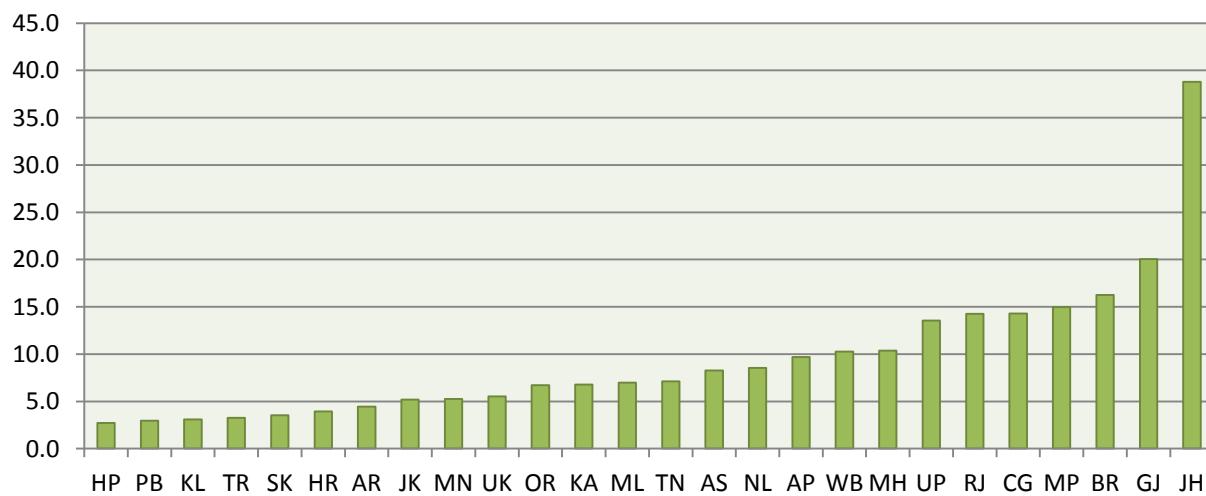
CURATIVE HEALTH CARE SERVICES AND INFRASTRUCTURE

The role of State AHDs is to provide services related to animal breeding, veterinary service delivery, disease control, feed and fodder development, and to liaise with other state governments and central departments and institutions in matters related to livestock development. Information on disease incidence is collected from animal health centers, veterinary institutions, and others, and sent to animal disease monitoring and surveillance (ADMAS), Bangalore and the Animal Husbandry Commissioner, GOI.

Overall, public infrastructure for animal health has grown significantly. In 1951, the available infrastructure providing animal health services consisted of 2,000 veterinary dispensaries. By 2006, the number of veterinary institutions had grown to more than 52,000 units comprising 8,700 veterinary polyclinics, 18,830 dispensaries, and more than 25,000 veterinary aid centers. All these institutions belong to the state/union territory governments and are manned by government employees—some 27,000 veterinarians and 61,000 para-veterinary staff .

There is a significant inter-state variation in the density of veterinary institutions. While there is significant correlation between the proportion of veterinary institutions in each state and the livestock population, there is substantial variation among states in the density of veterinary institutions. The number of livestock per veterinary institution is among the highest in some of the poorest states (figure 16). States such as Jharkhand, Bihar, Madhya Pradesh, Chhattisgarh, and Rajasthan have very high number of livestock units per veterinary institution. High income states such as Punjab and Haryana, on the other hand, have relatively lower number of livestock units per veterinary institutions.

Figure 16: Livestock units per veterinary institution- 2004 (thousands)



Source: Government of India (2006)

The inter-state variation reflects a continuing bias towards large animals. In general, the high potential areas for production of large ruminants, especially dairy—e.g., Punjab and Haryana—are better endowed with these facilities compared to states with medium to low dairy development. For example, eight states classified earlier as leading dairy states contain 70 percent of hospitals and polyclinics with best quality curative service facilities, even though they contain only 46 percent of the cattle and buffalo population. On the other hand, Andhra Pradesh, Rajasthan, West Bengal, Uttar Pradesh, and Maharashtra, which account for over 55 percent of India's small ruminant population, have less than 40 percent of the veterinary institutions. Even the institutions that exist in these states cater primarily to large animals. Gujarat, one of the leading dairy states, has one of the lowest numbers of government veterinary institutions on a per animal basis. This is due to the strong veterinary service delivery support provided by the dairy cooperative network.

Despite a vast institutional network both at the central and state level, the animal health service delivery system is facing many difficulties. The government continues to be the primary provider of veterinary services, but current budgetary resources cover mainly the salaries and benefits of full-time staff in a vast network of veterinary dispensaries, hospitals, first aid centers, and H5N1 centers (85 percent of the state non-plan budget in most states), leaving few funds for other recurrent needs—such as, drugs and veterinary supplies.

Recommendations to involve the private sector are met with resistance. Efforts to involve the private sector in order to mobilize financial and managerial resources continue to be met with resistance and suspicion on the grounds that this will restrict the access to services by the poor. The number of private providers is quite small and they generally operate in areas where there is unmet residual demand. Some cooperative unions and NGOs also provide these services, but they limit their operations to their procurement zone and near their base of operations, respectively. Most non-government service providers deliver the services at farmers' homes. In Gujarat, for instance, most cooperative services go to the farmer and nearly all services are paid for by the farmer. Government-owned (AHD) institutions require farmers to bring their animals to the institution to receive service. In Andhra Pradesh, some NGOs like BAIF and JK Trust provide minor veterinary services in a limited number of delivery centers. Private veterinary practices contribute a tiny share to veterinary services delivery in some parts of the country, especially in urban/peri-urban areas of leading dairy states. Private practice is becoming important in the commercial poultry industry, especially under contract farming arrangements, but remains nascent in other livestock sectors.

Public veterinary services and drugs are intended to be delivered with significant subsidies or free, but in reality they are not. Veterinary services provided in dispensaries and other centers are supposed to include prescription and basic drugs and vaccines free of charge or at nominal or subsidized cost; however, most of this subsidy does not reach the intended beneficiaries. Centers may also charge a nominal fee for home visits, especially to cover transport costs. In such cases, the basic drugs are still supposed to be free or at nominal cost. In reality, the free services provided by the veterinary centers are limited to prescription by veterinarians. Farmers must bear the cost medicines and vaccines most of the time because dispensaries and service centers lack the budget to have drugs on stock. In the case of home visits, in addition to the cost of medicine and the transport fee, government veterinarians charge

visit fees, which are not substantially different from those charged by private veterinarians. In some of the leading dairy states like Punjab and Haryana, over 70 percent of farm-gate services are provided by public sector veterinarians on a 'private contract' basis charging commercial rates, which the larger commercial producers are willing to pay, as they get satisfactory service.

Fees for home visits by public and private veterinarians differ across states. A study showed that fees for home visit charged by government and private veterinarians are about the same or only slightly different in Rajasthan and Kerala but in Gujarat, where cooperatives are also alternative suppliers, government and private veterinarians charge respectively 2.5 and 4.1 times more than cooperative veterinarians (table 25). There are differences in charges for drugs provided during these visits but these can't be easily compared as the severity of the problem treated and the types of drugs prescribed might be quite different from one another. However, a 2003 study reported that the level of farmer satisfaction in government veterinary services was lower than that of private vets and cooperative vets where they operate (Ahuja, McConnell, et al. 2003).

Table 25: Average cost incurred for veterinary services at doorstep (Rs. per visit)

Cost items	Gujarat			Rajasthan		Kerala	
	Gov	Coop	Private	Gov	Private	Gov	Private
Visit fee	110	44	184	227	206	94	98
Drugs	57	8	18	11	80	84	106
Total cost	167	52	202	238	286	178	204

Source: Ahuja, McConnell, et al.(2003)

Community based health services are emerging. The absence or poor accessibility to public veterinary services encouraged development agencies working on livestock as a means to alleviate poverty to develop different modes of community based animal health service delivery mechanisms (box 10). In these alternative models, the animal health workers earn supplementary income by providing services. While they provide useful and beneficial services as long as projects or schemes under which they work remain active, continuation of their services in the absence of project backing has not yet been established.

Box 10: Examples of pro-poor animal health service delivery schemes

Community Link Workers (CLW), Orissa: One male and one female worker are recruited from a village or locality with minimum eighth standard education and trained in animal health and production technology. They are working in about 100 villages and mainly provide vaccination for back yard poultry, de-worming and breeding service for small ruminants. CLWs work under the direct supervision of a veterinarian and a para-veterinarian who is part of a multidisciplinary block extension team (BET). Vaccines and medicines are supplied by the BET. Initially CLWs were paid a monthly stipend and the vaccines and medicines were supplied free of cost by the project. However, since December 2001, free supplies have been stopped and service charges introduced.

Gopal Mitra, Orissa: Vishaka Livestock Development Association recruits local youth from families below the poverty line and trains them in AI, veterinary first aid, and inoculation, then gives them the title of Gopal Mitra (livestock health attendant). They operate in their own localities providing services at the doorstep of the farmers for a fee. Over 250 such workers have been trained and they earn from Rs 25,000-75,000 per annum, which is quite high by local standards. Their incomes also indicate a high demand for their services.

Barefoot extension worker, Orissa: The recruitment, training and working mechanisms are about the same as in the case of Gopal Mitra except that emphasis is given on tribal youth for recruitment. In the areas they operate, poultry, pig and small ruminants are all important and they have been found to provide productive services at reasonable cost. Annual average income of a BEW was estimated at Rs. 6,618.

Patna Agricultural Development Private Ltd., Bihar: A private company that, as a part of its social work, recruits unemployed youth and train them on H5N1 and veterinary first aid for self-employment. They are given an initial kit to provide services in their local areas for a fee. Over 500 persons have been trained and many of them are earning over Rs.10, 000 per month. Because of them, H5N1 spread widely in Bihar in spite collapse of government H5N1 service. The work has been expanded to Jharkhand, Uttar Pradesh, West Bengal and Nagaland.

Link Workers Couple (LWC) Tamil Nadu: The Tamil Nadu Livestock Development Project trains couples in basic skills to providing veterinary first aid, fodder production, and low cost easy-to-adopt technologies. The services provided by LWCs include vaccination of poultry, de-worming, delousing and de-ticking, first aid and promotion of improved feeding practice. They charge a fee and have been found to provide productive services and earn a reasonable supplementary income.

Source: Pradhan, Ahuja and Venkatramaiyah (2003)

Use of curative veterinary services is generally low nationwide, somewhat higher in some of the leading dairy states. According to NSSO (2005) revealed that only 28 percent of livestock producers used veterinary services, but usage rates were much higher in some of the leading dairy states compared to lagging dairy states, although there are some exceptions to this general pattern (table 26). Proximity to service providers appears to be an important determining factor in usage, according to the survey. The two findings taken together imply that leading dairy states have a higher density of service providers than lagging dairy states.

Table 26: Distribution of public sector infrastructure for curative veterinary services by state

States	Veterinary Hospitals/ Polyclinics	Veterinary Dispensaries	Vet Aid Centers	Total units	Percent HH used vet services	Percent users by distance		
						<2 km	2-10 km	>10 km
Punjab	1362	1486	12	2860	70	64	35	1
Haryana	673	999	745	2417	41	72	27	1
Kerala	213	880	26	1119	21	64	33	3
Tamil Nadu	167	1156	1854	3177	47	54	42	4
Gujarat	14	487	587	1088	37	52	38	10
Rajasthan	1439	285	1733	3457	16	35	46	19
Uttar Pradesh	2058	279	2901	5238	30	35	60	5
Andhra Pradesh	303	1794	2879	4976	37	51	41	8
<i>Sub total (percent of total)</i>	<i>5926 (70)</i>	<i>7366 (39)</i>	<i>10737 (43)</i>	<i>24029 (46)</i>				
Maharashtra	43	1382	2056	3481	36	52	42	6
Karnataka	294	1451	2029	3774	31	42	49	9
Bihar	444	788	1435	2667	12	32	56	12
Madhya Pradesh	773	2450	364	3587	15	32	52	16
West Bengal	111	612	3248	3971	34	53	43	4
Orissa	0	540	2939	3479	23	38	56	7
<i>Sub-total (percent of total)</i>	<i>1665 (20)</i>	<i>7223 (38)</i>	<i>12061 (48)</i>	<i>20949 (40)</i>				
Jammu & Kashmir	303	1585	14	1902	43	61	39	

Himachal Pradesh	335	1721	14	2088	39	63	33	4
Assam	29	428	1213	1670	19	24	67	9
Tripura	15	56	396	467	37	90	10	-
Manipur	55	109	34	198	7	52	20	28
Meghalaya	4	70	151	225	9	17	57	26
Mizoram	5	35	103	143	7	95	-	5
Nagaland	4	27	127	158	33	27	41	32
Arunchal Pradesh	1	93	189	283	22	15	31	54
Goa	5	21	52	78	20	63	37	-
Sikkim	12	25	58	95	13	77	22	1
Others	70	71	38	179	na			
<i>Sub total (percent of total)</i>	<i>838 (10)</i>	<i>4241 (23)</i>	<i>2389 (9)</i>	<i>7486 (14)</i>				
Total	8429	18830	25187	52757	28	47	46	7

Source: Ahuja, Rajasekhar and Raju, Poverty Alleviation (2008)

New approaches are necessary to rationalize and reform the animal health sector. Given the lack of progress in reforming the animal health service sector, the government should consider devolving the responsibility of delivering curative veterinary services to the private and other providers (cooperatives, NGOs, etc.). Curative services are private goods that can be delivered much more efficiently by non-state actors. The government should focus its efforts on providing the public goods—such as disease surveillance and monitoring, regulation, and creating an enabling environment for private sector and other players to participate. This would be particularly desirable because the government is facing continuing budget shortfalls for free or subsidized services and the farmers are not getting the services at free or reduced rates, anyway. There is evidence that livestock producers, are willing to pay for quality services, so there is an objective basis for cost recovery or private provision of such services alongside government and other providers, such as NGOs and cooperatives (Ahuja, McConnell, et al. 2003).

Complete privatization of government service delivery in the immediate future may not be feasible, especially in relatively remote and marginal areas. Even in these areas, however, the government need not be the only or the dominant player. It will be desirable to work with non-government organizations and other stakeholders for sensitizing the poor communities towards creating the demand for these services, training community-based health workers for minor treatments, providing drugs and supplies on cost in areas where the private distribution network is weak, providing extension advice related to animal husbandry including feeding practices and shelter innovations, etc. Given the current concentration of government veterinary centers in relatively better-off areas, reducing government presence in curative service delivery in these areas can release significant resources to focus on marginal areas.

VETERINARY PHARMACEUTICALS AND BIOLOGICALS

Pharmaceuticals are mainly a private sector concern, but the production of vaccines is shared by the public and private sectors. India has 26 biological production units—19 public sector (owned by the state governments) and 7 private sector. In all, 21 viral vaccines, 14 bacterial vaccines, and 13 diagnostic reagents are now produced in the country. Each state tries to produce its own requirements of various

vaccines rather than specialize based on comparative advantage and go into inter-state trade. Rapid expansion of the commercial poultry industry and a large project on FMD control has expanded the market for vaccines in the last decade. Though some state vaccine production units have excellent, state of the art facilities, most are that are ill equipped and have outdated technology and inadequately trained staff. Continued presence of the public sector in vaccine manufacture results in wasteful utilization of resources while raising the costs of production due to poor economies of scale and unnecessary public sector overheads. The government should gradually move out of vaccine production and shift its own demand to private sector.

The pharmaceutical industry consists of a large number of firms, many of which are small-scale. Larger units are owned by larger companies and have modern and up-to-date facilities and skills. Small-scale firms are often ill equipped and ill conceived. Quality assurance and control in both the public and private sectors is weak. Most of the public sector units do not follow good manufacturing practices and the private sector units, barring a few, often cut short the procedures to avoid expensive quality control procedures

There is inadequate monitoring and quality control of the vaccines produced. Standards for veterinary vaccines followed in India are outdated and need to be revised. Some vaccines produced in the country are found ineffective in the field. Regulation of production of veterinary vaccines and biologicals is governed by the Drugs and Cosmetic Act of 1940 and administered by the Drug Controller of India, assisted State Drug Control Departments. The Indian Veterinary Research Institute is responsible for monitoring the quality of vaccines and biologicals produced in the country. In addition, a separate National Veterinary Biological Quality Control Center has been established at Baghpat, Uttar Pradesh to monitor and assure the quality of veterinary biologicals produced at home and imported.

LEGISLATION FOR DISEASE CONTROL

The states issue animal disease control acts, and there is considerable variation from state to state. For a national campaign on disease containment and control, uniformity in the entire operational area, spread out in several states is an essential prerequisite. Further the existing acts have many loopholes and lack force and authority. A model disease control bill was drafted under the auspices of the Technology Mission on Dairy Development (TMDD) in consultation with all states, but it has not yet been adopted.

Necessary legislation needs to be enacted to regulate the control program of infectious and contagious diseases of animals. There is a need to make infectious and contagious disease reporting mandatory and to strengthen border check posts for inter-state and international borders to control the movement of animals. Import of livestock into the country is regulated under provisions of the Livestock Importation Act of 1898, as amended by the Livestock Importation (Amendment) Act of 1953. This is a national act that is administered by the Animal Husbandry Commissioner, Government of India. There is no separate act regulating import of products of animal origin, though import of some food products of animal origin is controlled under the provisions of the Prevention of the Food Adulteration Act of 1954 and applied with the Sea Customs Act of 1978.

Existing statutes are not effective, and new legislation to safeguard the country from the ingress of pathogens is long overdue. What little legislation that exists is seldom enforced, enabling new animal diseases to enter the country. The rules for the inspection, detention, disinfection, and destruction of imported animals are framed by the state governments. It is necessary to structure effective quarantine at the ports of embarkation and to subject all livestock, birds, and products of livestock/poultry origin to strict Zoo Sanitary and Quarantine procedures. There had been some move in the national AHD to strengthen the quarantine its wing and to set up expensive quarantine laboratories in the four cities—Bombay, Delhi, Chennai, and Kolkata—and a cadre of staff and professionals to enforce regulations. A quarantine lab is a very expensive proposition and the current levels of import and export of livestock and products may not justify such investments. In practice, the inspection of animals on arrival and laboratory tests, if required, would be far easier if the GOI entrusted the state governments with the task on a cost reimbursements basis and with national oversight. There are already well equipped laboratories in the State Agricultural Universities and these labs can carry out the required tests.

SUMMARY OF KEY POINTS

- Nationally, only about 28 percent of households use any veterinary service and only about 4 percent of households seek livestock-related technology or information, though the rates in both cases are higher in leading dairy states.
- Incidences of some major livestock diseases are high throughout the country. Some of the leading or medium dairy development states suffer from high incidence of some endemic diseases. Estimated losses due to disease are very high and justify public expenditure to control the major diseases.
- Preventive veterinary service infrastructure and staff are very small and highly inadequate relative to current and projected future needs. Moreover, available facilities are not effectively used for disease diagnosis, monitoring and surveillance, and for control measures through proper immunization. Most state-owned vaccine production enterprises run at losses.
- Public veterinary service infrastructure and staff are heavily biased towards curative services, which are supposed to be free or heavily subsidized, but in reality are not. Where cooperatives and private sector service providers are present, producers have shown a willingness to pay for quality service. Cooperatives charge the least for services and private companies the highest, but apparently some users are willing to pay higher fees for quality service.
- In some lagging states and remote regions, pro-poor community-based health services are provided by various NGOs, but the sustainability of these service schemes are yet to be established.

5. LIVESTOCK MARKET INSTITUTIONS AND VALUE CHAINS

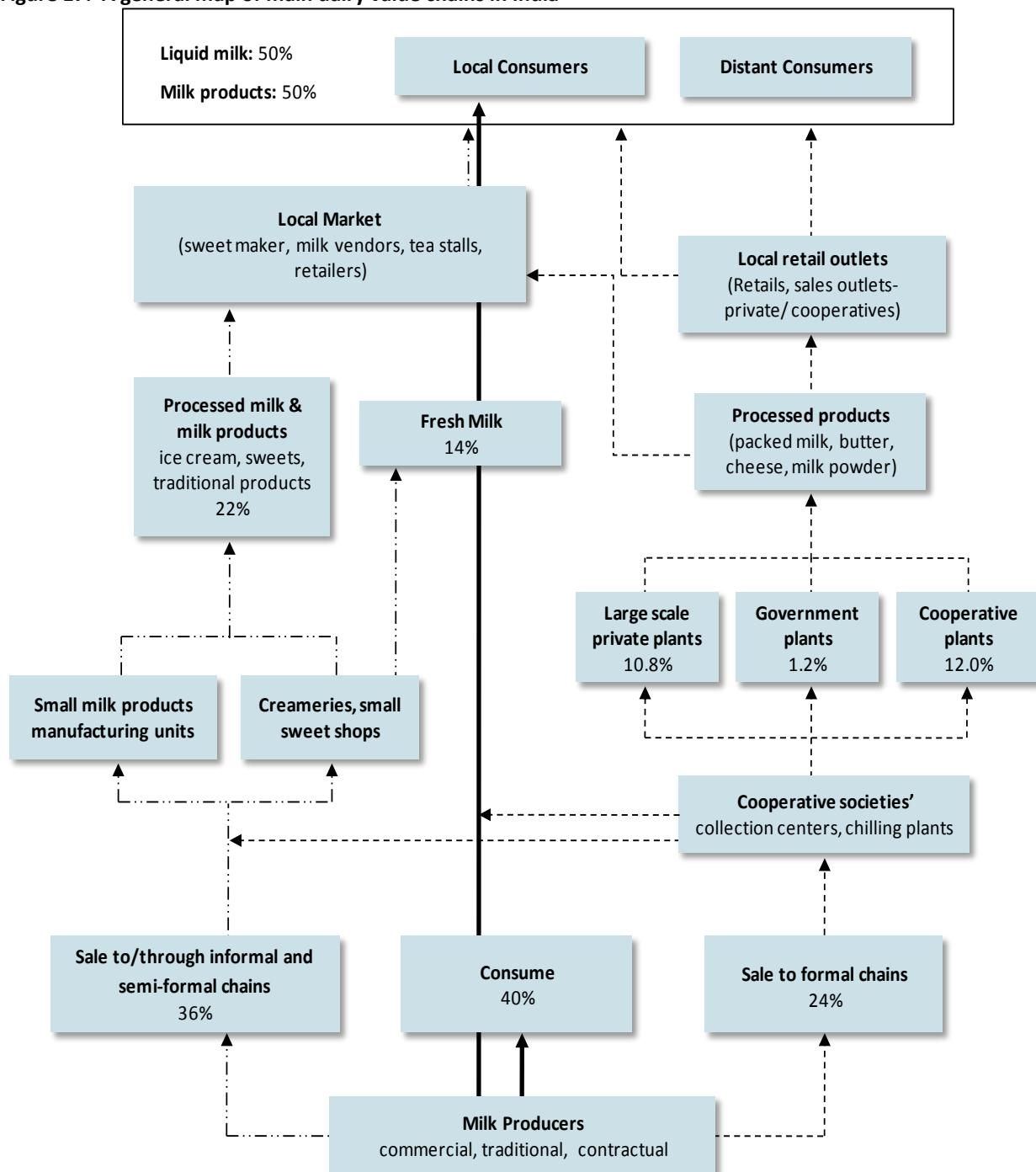
Livestock products have highly distributed production systems located far from consumer markets and they are, highly perishable. Thus, they require highly efficient marketing and processing along their entire value chain—from production to consumption—to realize their best value. Marketing and processing activities are even more critical in India since most livestock producers are small, resource poor, and often unable to establish their own linkages with markets, processors, and consumers; . Even after decades of economic development in India, the marketing of livestock and livestock products remains largely unorganized, traditional, and fragmented, with a few exceptions.

MILK AND DAIRY DOMINATE THE LIVESTOCK MARKET

The milk and dairy products are, by far, the largest constituent of the livestock sector in India. India has now become the world's largest milk producing nation, and its dairy market today is worth Rs 2500 billion (Gandhi and Zhou 2008). In 2004-05, liquid milk comprised about 92 percent of consumer expenditures on dairy products. It is broadly estimated that over 50 percent of milk production is consumed as fluid milk, about 25 percent is converted into butter or *ghee* (clarified melted butter), ten percent into milk powder, seven percent into *paneer* (cottage cheese) and other cheeses. The rest goes to other dairy-based products such as *dahi* (yogurt), sweet meats, and in recent years, ice cream (Gandhi and Zhou 2008).

Milk moves from producers to consumers through various value chains that vary depending on the state and the production system. Figure 17 gives a general map of the main value chains through which milk flows from producers through processing and value addition to consumers. Informal and semi-formal chains are generally short and primarily serve local markets, while formal chains are longer and link producers with local and distant consumers. It is estimated that nationally about 40 percent of milk output is consumed by producers themselves and 60 percent is marketed—36 percent through informal chains and 24 percent through formal chains managed by cooperatives, the private sector, and government parastatals.

Figure 17: A general map of main dairy value chains in India



Note: 50 percent of total milk output is consumed in liquid form and 50 percent in processed from. On-farm consumption is 40 percent of output- assumed 20 percent in liquid form and 20 percent in processed form. Of the 60 percent of output marketed, 36 percent goes through informal channels and 24 percent through formal channels. In informal channel 14 percent is supplied in liquid form and 22 percent in the form of milk products. In the formal channels 16 percent is supplied in liquid (pasteurized) form and 8 percent in processed form.

Source: Adapted from Gandhi and Zhou (2008) and Birthal, Linking (2008).

DAIRY COOPERATIVES PROSPERED WITH PUBLIC SECTOR SUPPORT AND SUBSIDIES

Dairy cooperatives first started in Gujarat and spread throughout the country with the Operation Flood (OF) program. OF promoted the creation of farmer-owned and controlled cooperatives to (a) provide members an assured market for a perishable commodity by creating a network of milk collection points, then transporting the milk to chilling and processing centres, and finally distributing it to retail outlets; (b) supply members with inputs and services—like feeds, veterinary care, and breeding, at reasonable prices to improve productivity and increase marketable surplus; and (c) enable members to directly share benefits profit-sharing. These factors contributed to the initial success of cooperative value chains, as did the support from the public sector. OF received regulatory protection through the Industries Development and Regulation Act 1951, which used licensing requirement to restrict entry to the market. Channelling dairy imports through NDDB to shield the sector from competition from cheaper imports and allowing dairy products to only be imported in the form of food aid, the proceeds of which were used by NDDB to finance its cooperative development efforts and create infrastructure, also protected the market.

Dairy cooperatives played a significant role over the years in increasing the production, marketing, and processing of dairy products. Each cooperative adopted a dairy brand. They also evolved, adapted and created a platform for private sector involvement in dairy processing at a later stage, when market reforms were undertaken. The evolution of dairy marketing institutions including cooperatives in Andhra Pradesh is a typical example of such adaptation (box 11).

Box 11: Evolution of dairy marketing institutions in Andhra Pradesh

1960-61: AHD introduces pilot scheme to organize milk marketing.

1964: AHD introduces Integrated Milk Project (IMP) around Hyderabad and Vijayawad to organize milk supplier cooperative societies for procurement through collection centers, processing through chilling centers, and supply to consumers in half liter glass bottles in the two cities.

1969-1970: To conserve surplus milk, particularly in flush season, a Milk Powder Factory with capacity of 150,000 liters/day was established with UNICEF assistance at Vijayawada. Milk supply to Hyderabad and Chennai by rail in refrigerated tanks started. The Dairy Development Department (DDD) was created to expand activities under the IMP, and chilling and cooling centers were established in several districts to supply milk to three major dairy plants.

1974-76: DDD was converted into the Andhra Pradesh Dairy Development Corporation (APDDC), which was given more responsibilities and working capital. Milk producer's cooperative unions started under OF program. More chilling capacities created.

1981: To access assistance under OF Programs and develop the dairy industry in the 'Anand Pattern', APDDC was converted into the Andhra Pradesh Dairy Development Cooperative Federation APDDCF. More districts were added to the program, management was transferred to the district unions in 1985.

1989-90: Steps taken for applying modern technologies to improve production and optimal use of infrastructure. IMP was taken up in 3 districts with 70 percent outlay as a loan from National Cooperative Development Corporation and 30 percent subsidy/share capital from the state government.

1997-2002: Various cooperative dairy plants and their village societies were re-registered under the Mutually Aided Cooperative Union Act. All the milk union's major infrastructures were created with government funds.

1995-2006: Following de-licensing of the dairy sector, private dairy processing plants were established.

Currently there are 14 cooperative, 24 private, and one government dairy plant in the state with total processing capacity of 2930, 2107 and 200 liters/day, respectively.

Source: Raju (2008)

Cooperatives' investments and benefits have been concentrated in a few states in the west and south of the country. By 2005-06, cooperatives had about 12.4 million farmer members, including 3.4 million women, spread over 117,575 village cooperative societies (VCS) in 346 districts. VCSs federated into unions at the district level and further into federations at the state level. However, over 60 percent of the VCSs and their members, 54 percent of the cooperative dairy processing plants (and 65 percent of processing capacity) are located in the leading dairy states (table 27). Maharashtra and Karnataka are the only two states to have a sizeable number of cooperative societies, members, and processing capacity outside this group. Even the government and parastatals established 96 percent of their processing capacity in the leading dairy states.

Protection and monopoly led to inefficiency and eventually the demand for cooperative reforms. Lack of competition in the industry, and deviation from the 'Anand' principles in the organization and management of cooperative societies bred inefficiency leading to losses in many cooperatives. Lack of transparency in decision making due to inadequate member participation, setting prices arbitrarily without testing quality, and poor delivery of inputs and services—e.g., veterinary care, AI and credit—were most common problems having negative effects on financial and operational performance. More recently, there have been calls for dairy cooperatives' reforms, particularly in key areas such as conducting regular and timely elections; setting clear criteria for Board membership; autonomy in deciding milk procurement prices and sales prices; autonomy in staffing; appointing search committees for Chief Executive Officers (CEO); and periodic audits by independent and certified auditors, etc.

Table 27: Share of cooperative societies and membership, and dairy plants by state, 2005-06

State	Percent Cooperative societies	Percent Farmer members	Percent of all women members	Percent of output procured by coop	Cooperative dairy plants		Private dairy plants		Government/parastatal dairy plants		Total dairy plants	
	No.	Capacity ^a	No.	Capacity	No.	Capacity	No.	Capacity	No.	Capacity	No.	Capacity
Punjab	5.7	3.7	1	3.2	13	1580	37	3692	0	0	50	5272
Haryana	4.6	1.9	2	2.8	5	865	32	4745	2	130	39	5740
Kerala	2.8	6	4	13.5	9	565	8	298	2	35	19	898
Tamil Nadu	6.7	15.1	23	13.9	25	4365	20	2675	0	0	45	7040
Gujarat	10.2	19.8	19	33.8	16	9870	11	605	6	570	33	11045
Rajasthan	10.8	4.8	5	6.5	18	1887	9	745	0	0	27	2632
Uttar Pradesh	16	6.9	7	1.7	33	2326	198	16453	1	300	232	19079
Andhra Pradesh	3.9	6.3	4	5.2	14	2930	24	2107	1	200	39	5237
Delhi	-	-		-	0	0	0	0	3	10000	7	10000
Sub-total	60.7	64.5	65		133	23848	339	31320	15	11235	491	66943
Maharashtra	16.6	13.2	11	15.1	62	7801	90	8398	33	3161	185	19360
Karnataka	8.6	14.8	16	26.9	16	2213	21	1630	1	400	38	4243
Bihar	4.5	2.1	1	4.1	7	491	2	200	0	0	9	691
Madhya Pradesh	4.7	2.2	1	3.8	10	1070	18	2677	0	0	28	3747
West Bengal	2.1	1.5	2	3.1	2	216	14	1265	1	600	17	2081
Orissa	1.8	1.1	2	5.5	8	212	1	50	0	0	9	262
Sub-total	38.3	34.9	34		105	12003	146	14220	35	4161	286	30384
Other states	0.9	0.6	1		6	99	4	545	0	0	10	644
Total	100	100	100		246	36570	493	46085	50	15396	789	98051

a. Capacity of all dairy plants in 000 liters per day

Source: Birthal (2008), NDDB (1999-2009)

PRIVATE DAIRIES EMERGED AS MARKET RESTRICTIONS RELAXED

The licensing requirements under the 1951 Act were first removed in 1991, but some aspects were reintroduced in 1992 under the Milk and Milk Products Order (MMPO). Important features of the MMPO include:

- All plants handling more than 10,000 liters or producing milk products containing more than 500 kg of milk solids per day need to obtain a license from the MMPO controller.
- Those processing between 10,000 liters and 75,000 liters per day or more than 500 kg but less than 3,750 kg of milk solids per day require state permission, while enterprises processing more than 75,000 liters per day or greater than 3,750 kg a day of milk solids require central government approval, with the license renewable every three years.
- New processors must develop their own milk shed or milk collection area and cannot encroach on cooperative milk sheds. If a shortage of milk occurs in one area and milk needs to be procured from other areas, it can only be sourced through cooperative unions or the cooperative federation at prices set by the union or federation.
- The processing of milk into higher-value products is banned during the lean summer months.

The MMPO was further amended in 1993 so that the licensing requirement for plants over 75,000 liters/day or 3,750 kg milk solids per day was retained and the renewal requirement was increased to five years.

These amendments were criticized on the grounds that the licensing requirements would restrict competition and production growth, limit the opportunities to take advantage of economies of scale and to modernize the technology in order to increase competitiveness in domestic and export markets, and thus reduce both producer and consumer welfare. The requirement of private enterprises to create their own milk sheds would create *de facto* monopolies for cooperatives, increase costs, reduce the viability of private plants, and deprive producers from the benefits of competition. The zoning of milk sheds was also questioned on the ground that these were built with public sector subsidy so cooperatives should not monopolize their uses for indefinite period.

Private sector investment increased rapidly creating new value chains. By 1996, the private sector accounted for 44 percent of processing capacity nationwide, but in some of the leading dairy states like Punjab and Haryana, private sector capacity was 67 and 88 percent of the state totals, respectively (Chandel, Jain and Dhaka 2008). In 2002, the MMPO was further revised to remove both the conditions for licensing and milk shed creation, which facilitated establishment of some larger units. In 2005-06, 68 percent of total accumulated private sector dairy processing capacity was located in the eight leading dairy states; this increases to 90 percent if Maharashtra and Karnataka are added to that group. Thus, once the private sector was allowed to enter the industry, it also established most of its plants in the

already leading dairy states to take advantage of larger milk supply and better pre-existing infrastructure created to support development of cooperatives.

Characteristics of newly created private value chains differ widely among states. In order to compete with the already established cooperative value chains, private enterprises established physical facilities—such as, collection points, chilling and processing plants and chain governance mechanism, system of price fixation and collection of milk, and provision of services to producers. However, there was no uniformity among enterprises within or across states in these respects. A few large private dairies—like Nestlé India in Punjab and Dynamix in Maharashtra—have developed some variant of contract farming through which they get an assured supply of milk for their processing facilities. They also provide producers an assured market for milk, reduced price uncertainty, lower marketing and transaction costs, and easy access to inputs, technology, credit, and other services. Nestlé India has been operating since 1961, so it competed with cooperatives throughout the 1970s and 1980s. It adapted many of the principles of cooperatives in its management of contract farming arrangements and has become the single largest private dairy enterprise in Punjab (box 12).

Most private enterprises compete with cooperatives in the same milk sheds for supply of milk. Two major types of milk collection mechanisms operate in milk producing areas. In some cases, traditional milk traders and powerful village leaders, who may be heads of village cooperative societies, are contracted to supply milk. Leaders of cooperative societies may divide available milk between the cooperative and the private enterprise. In other cases, cooperatives and private companies pay collection agents to collect milk, paying them a base salary plus a commission based on the volume of milk delivered as an incentive. Where they compete with cooperatives, they use the price fixed by the cooperatives as the benchmark, then add an incremental amount to attract delivery. Mode, regularity and frequency of payment vary to some extent.

Despite the low presence of the private sector in the lagging states, few enterprises have emerged recently though on a small scale. They remain however hampered by the lack of infrastructure (mainly roads and electricity) which increases their costs. Nonetheless these enterprises try to provide inputs and support services to their members either directly or through facilitation from other sources. Other enterprises provide inputs and services like AI, veterinary care, and credit, but the mode of delivery, pricing, and cost recovery methods vary. Some of these features can be observed in the two private value chains in Bihar and Orissa (box 13).

Box 12: Some features of the dairy value chain of Nestlé India, Punjab

Nestlé, an international company, started operating in India as a trading company in 1912. In response to government policy to increase domestic milk production, it started a factory in 1961 at Moga, Punjab, a backward area on the desert margin with no irrigation or tube wells. The company invested in extension services and helped farmers accessing bank loans to buy animals and inputs. It also established milk collection centers at various points in the region to ensure prompt collection and payment to instill confidence among farmers in the dairy business. Over the years, the company expanded its operation by:

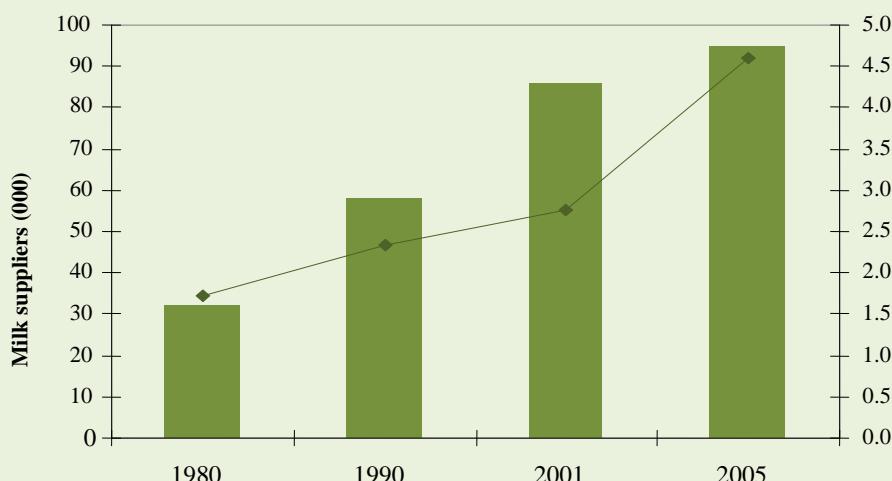
- developing a comprehensive extension system and continuously adding new knowledge and technology; over 30,000 women in 550 villages have been covered by a special program because they perform most of the dairy activities;
- providing high quality feeds and good quality fodder seeds at reasonable prices—about 10 percent of gross cropped area in Punjab is devoted to planted fodder, to which Nestlé contributed significantly;
- providing breeding services free and veterinary services and drugs at cost;
- helping farmers access bank loans and including mandatory insurance to cover risk; and
- collecting milk through commission agents and paying regularly in a transparent manner based on quality.

Nestlé is a major infant food producer, which requires strong quality control throughout the supply chain. Since 1995, it has invested significantly in infrastructure and education throughout the supply chain to improve the supply of quality milk.

These activities led Nestlé to become the largest private dairy in the state. In 2005-06, it collected from nearly 100,000 farmers through 1700 collection centers compared to 4 collection centers and 184 farmers in 1961. In 2005-06, Nestlé collected 0.79 million liters/day compared to 0.5-1.2 million liters/day by cooperatives with 3.5 times more members.

There has been general scaling up of dairy farms in the state, but more so in case of Nestlé's contract farms. In 1980-81, three percent of milk collection came from 0.2 percent of the suppliers; in 2005-06, 18 percent of collection came from 1.7 percent of the suppliers. Between 1980 and 2005, the number of milk suppliers to Nestle increased 3-fold and milk sale/supplier increased from 1.7 to 4.6 tons/year. These changes have occurred due to its special support for larger farms. In addition to management techniques, it provided milk cans to large farmers, chilling tanks at the farm gate and milking machines at low cost and credit for even larger ones. Since 1995, it gave more emphasis on cow rather than buffalo milk production, and supported larger specialized farms to produce cow milk with crossbreeds and exotic breeds to increase yield.

Growth in number of milk suppliers and volume per supplier to Nestlé (ton/year)



Source: Punjabi (2008), Birthal (2008)

Box 13: Some features of value chains of two private dairy chains in Bihar and Orissa

Raj Dairy in Bihar

Started operation in 1996-97 by a wholesale business of ghee and butter. Currently collects about 60,000 liters of milk per day, of which 66 percent is pasteurized and 34 percent is processed into ice cream, ghee, chana, and other products.

Milk is collected through village agents; some are cooperative society presidents, who divide village milk between the cooperative and this firm. Farmers are paid without testing for quality at flat rate of Rs. 12 for cow milk and Rs. 14 for buffalo milk, same as paid by cooperatives. Agents are paid based on fat content at company rate which is slightly higher than farmer price, but not always regularly.

Agents sometimes extend loan to farmers when required to ensure milk supply but the company does not provide any input or service to farmers.

Main problems for the company are lack of roads and electricity that increase collection time and cost, and makes quality maintenance of milk very difficult.

Prithwiraj Dairy in Orissa

Started operation in 2000. Currently collects about 20,000 liters of milk per day from ±4000 farmers in 350 village in five districts. 80 percent of milk is pasteurized and 20 percent processed into various products.

Milk is procured through village agents. Farmer price is Rs 0.50 - Rs.1 higher than the price paid by co-operatives. Agents are supervised by route officers who are paid a base salary, plus a commission per liter as an incentive to maximize collection.

To compete with cooperatives for milk supply, provides health service through an NGO run by the same company. Hold monthly health camps in 80-90 villages, provides service at Rs 10/animal, and drugs at 10 percent discount. The firm helped ±400 farmers access loan from SBI, but milk procurement did not increase because many farmers sold their animals after purchase.

Main problems of the company are lack of regular electricity, which significantly increases costs and inadequate milk supply in the lean season due to low milk yield and competition among processors.

Source: Authors field work (2008)

COOPERATIVES IN THE ERA OF PRIVATE SECTOR EMERGENCE

Cooperatives continued to expand along with the expansion of private sector dairies but its relative market share declined. Between 1990/91 and 2005/06, the period of growth of private dairies, number of cooperative societies increased by 85 percent, membership by 66 percent, and milk procurement by 121 percent (table 28). Currently, the formal processing sector has a total installed capacity of 98 million liters/day, of which cooperatives, private and government/parastatal dairies respectively share 37, 47, and 16 percent (Birthal, Overview 2008). Cooperatives still command a good share of the market in some states—e.g., in Gujarat, where one third of the state's milk output is procured by cooperatives, followed by 27 percent in Karnataka, 15 percent in Maharashtra, and 14 percent each in Tamil Nadu, and Kerala 14 percent. These shares were much higher in the past. However, in general market shares of cooperative dairies have declined in many states, especially in some of the leading dairy states like Punjab, Haryana, Maharashtra and Uttar Pradesh.

Table 28: Selected indicators of growth of dairy cooperatives

	1990-91	2005-06	Percent change
No. of dairy cooperative societies	63,415	117,575	85
Members, million	7.48	12.42	66
Milk procured, million tons	3.54	7.83	121
Milk procured, percent of output	6.6	8.2	24

Source: Birthal, Overview (2008)

NDDB pursued new approaches to address problems of inefficiency in cooperatives. NDDB implemented a program during 1997-2005 with funding from the European Union to strengthen cooperatives at the grass root level in aspects like governance, management and economic viability. In order to address problem of inefficiency of cooperative organizations and plants in various states and improve competitiveness with the private sector, NDDB offered help and advice to willing state cooperative unions to improve management through a new arrangement under the Mutually Aided Cooperative Union Act (box 14). Under this arrangement, bureaucratic interference in management was supposed to decline and member participation in decision making increase. However, participation of cooperative unions in this scheme was voluntary so not everyone chose to get involved and where agreements with NDDB were made, implementation of the act proved rather difficult because of long standing built-in norms and practices.

Box 14: Characteristics of Mutually Aided Co-operative Societies (MACS): an example from Mulukanoor

With the financial support from the women's thrift cooperatives and their associates, and with technical support from NDDB, The women's mutually aided cooperative dairy union was registered in January 2000. Actual dairy activates started in August 2002. The area of operation was limited to 25 kilometers. In one example, Mulukanoor Women's Mutually-aided Dairy Cooperative Union features:

- Two tier, village level and union level
- No government control in administration
- Democracy at the village and union level
- Freedom in setting prices
- Accountability and ownership at the village/union level
- Strong governance and internal audit system
- More freedom to village level societies (more than 1 soc/village)

So far, this approach has only been implemented on the ground in Andhra Pradesh. Today there are 107 village level primary cooperatives with 18,000 producers procuring 17,000 liters of milk every day. The milk is sold as liquid milk at Warangal town at slightly higher price than all other branded milk because of its quality. The special feature of this society is all the activities from procurement of milk, processing and marketing are done by the women members only.

Source: S. Raju (2008)

NDDB has also been pursuing the idea of setting up producer companies to improve the management efficiency and transparency in the cooperative sector. The idea is to transform the three-tier system of cooperatives to be replaced with a simpler structure that would enable a larger participation. NDDB plans to roll out its blueprint for what could become the new structure in the dairy industry and give a corporate color to the dairy industry. While the producer institutions are likely to be self-help groups instead of cooperative societies, the producer companies will be parallel to the cooperative unions. . Infrastructure such as milk cooling plants and chillers will come from NDDB. The aim is to bring regions uncovered by Operation Flood under a cold chain, strengthen weak cooperatives, and increase the share of milk marketed through the organized sector.

Performance of some cooperative chains improved as a result of increased competition. There is no objective assessment of the overall outcome of the new NDDB initiatives, but some indicators suggest that the cooperatives' performance has improved to some extent due to competition with the private

sector. First, current capacity utilization in the sector seems to be on par with the private sector and much better than in the government/parastatal units. Cooperatives, private, and government dairies process 50, 45, and 5 percent, respectively, of the total volume handled by the formal sector even though they share 37, 47, and 16 percent, respectively, of formal sector installed capacity (Chawla, Kurup and Sharma, Animal Husbandry: State of the Indian Farmer 2004). The higher share of actual processing by the cooperative plants is apparently the result of a lower share of government/parasratal plants due to their lower capacity utilization. Although cooperatives in Bihar and Orissa generally show poor performance, 837 womens' dairy cooperative societies (DCSs) formed under a special project in Orissa and comprising 60,287 members in 17 districts were found to be performing relatively well. Second, evidence form Andhra Pradesh shows that farmers' share of retail price, an indicator of distribution of benefits in a chain, is higher under different forms of cooperative chains than under one of the largest private sector chains (table 29).

Table 29: Comparative milk pricing and farmer share of retail price under selected value chains in Andhra Pradesh

APDDCF Cooperative			Vishaka Dairy Cooperative		Mulkanoor Women Cooperative		MACU Cooperative		Private Dairy	
	Cow	Buffalo	Cow	Buffalo	Cow	Buffalo	Cow	Buffalo	Cow	Buffalo
Farm level milk testing	Almost none		Price based on testing		Price based on testing		Price based on testing		Hardly any testing	
Farmer price	Discretion of village society president	Discretion of village society president	102/kg total solids	260/kg fat***	102/kg total solids	260/kg fat	102/kg total solids	260/kg fat	Coop price + Rs. 0.50-1.00 based on agent discretion	Coop price + Rs. 0.50-1.00 based on agent discretion
Agent price/remuneration*	Rs.102/kg total solids +salary and bonus	225/kg fat** +salary and bonus	Salary and incentive bonus	Salary and incentive bonus	Salary and incentive bonus	Salary and incentive bonus	Salary and incentive bonus	Salary and incentive bonus	102/kg Total solids + Rs 5/kg solids as commission	260/kg fat + Rs 5/kg fat as commission
Consumer price	Rs. 20 – 24 per liter for double toned to full cream		Rs. 1-2 higher than co-op price		Rs. 1-2 higher than co-op price		Rs. 1-2 higher than co-op price		Rs. 2-3 higher than co-op price	
Farmer price as percent of consumer price	60 to 63 percent		Approx. 70 percent		Approx 70 percent		Approx 70 percent		< 60 percent	

* In theory, APDDCF declares farmer prices and the village society president works on commission basis. In practice, farmer prices are based on the discretion of the village society president because milk prices are not based on testing of milk

** Has been recently increased to Rs. 255/kg to meet the increasing competition from other players.

*** Buffalo milk prices are decided on per kg fat. Average fat content is 7 percent, this amounts to $260 \times 7 / 100 = 18.2/\text{kg} = 17.7/\text{liter}$

Source: Raju (2008)

SEMI-FORMAL AND INFORMAL DAIRY VALUE CHAINS ARE CHANGING

Informal and semi-formal value chains are still important to the sector, currently handling 60 percent of marketed milk output. In Bihar, more than 85 percent of marketable surplus in milk is sold through informal channels, especially private traders in the unorganized sector, and through direct sale to other farmers. These informal chains are generally short and serve mostly local markets. The chain may involve the supply of fresh milk directly from producer to consumer households or to tea and sweet shops, restaurants, and other institutions in the locality or a nearby market or town. Sometimes one or more intermediaries are involved if the chain covers a longer distance connecting villages with towns.

In informal chains, processing involves preparing traditional products mostly using manually-operated technology. Generally, milk vendors extract cream before selling liquid milk and the cream is converted into ghee or butter. The remaining milk is used to prepare sweets or other drinks like tea, shakes, lassi, etc. Most tea and sweet shops have a single outlet and serve mostly the local community. In larger cities, some such shops with a good reputation and a local brand name may have multiple outlets. In such cases, they collect milk from a number of suppliers. Adulteration with water is a common problem in the fluid milk market, but processors usually pay on the basis of quality in terms of fat and solid, so water addition does not pay. Some of the processors use mixed powdered milk with solids from fresh milk in the preparation of some products instead of using only fresh milk as raw material.

Better rural roads and transportation facilities and increased access to electricity in many rural areas, particularly in the leading states, has been changing the nature of these chains in terms of governance, products produced, technology used, and distribution of benefits. For example, new technology can reduce spoilage so that traders pay a higher price to farmers than in the past. Even rudimentary semi-automatic or automatic technology may reduce the drudgery of labor and save time, and can be used by shops that may use refrigerators to store products to increase shelf life.

Semi-formal chains usually function in urban and peri-urban areas serving niche markets. These chains usually involve larger dairy farms and they deliver milk directly or through agents to urban consumer households, shops, institutions or small processing units—especially creameries—that produce various dairy products. A creamery is an establishment where some cream is extracted from fresh, high-fat milk using automatic or semi-automatic technology to produce butter, cheese, ice cream and other products. The remaining low fat milk is sold for consumption. For example, about 50 percent of milk consumed in Patna, Bihar, is supplied by urban *dudhiyas* or dairy farmers. A good proportion of them have 8-10 dairy animals (cows plus buffaloes) producing 30-50 liters of milk per day. They deliver milk to households at Rs 15.0 and 20.0 per liter for cow and buffalo milk, respectively. For shops and institutions, the price is Rs 16 and 18 per liter, respectively, for cow and buffalo milk. In Bhubaneswar, Orissa, larger peri-urban farms have an average of 20 cows giving 60 liters of milk per day. They sell to households at Rs 13.5 per liter and to hotels, tea shops, and restaurants at Rs 12.5 per liter. In Punjab, the larger peri-urban farms are much bigger with average number of animal in 100-200 animals and high productivity. For instance, the average selling price around Lundhiana in Punjab is Rs. 24.1

Some chains may have their own dairy farms and processing units. Some processing units may collect milk from nearby rural areas through milk agents or traders, who are paid on commission. Chilling is not required because the distance covered for supply is generally short. This group also includes enterprises producing traditional sweets and other milk based snacks, including ice cream, using modern technology and marketing techniques like western fast food chains. Such enterprises may market products through multiple retail outlets in one or more cities.

IMPROVEMENT OF HYGIENE AND SANITARY STANDARDS IN DAIRY VALUE CHAINS

Demand for quality and safety has increased in both formal and informal value chains. Along with growth in demand for processed milk and milk products supplied by the various value chains, demand for their quality, safety, variety, and convenience has become increasingly important due to rising incomes and urban growth and greater awareness among consumers about the risks from contaminated food. However, hygiene standards and food safety in formal chains have not yet reached desired levels. With increased demand and the expansion of market participants, hygiene and food safety in addition to quality standards, become more critical and will eventually fetch higher market premiums.

In 2003, the Government of India started a scheme to educate dairy producers about clean milk production, and to strengthen the existing milk testing laboratories to enforce quality in chilling and processing plants. In 2005, this scheme was merged with the Integrated Dairy Development Project. However, much more needs to be done to upgrade hygiene and safety standards throughout the industry, not just among dairy producers, but throughout the value chain. In recent years, some large-scale plants in the formal chains have voluntarily established some quality control measures. Quality of feeds, quality of medicines, sale of milk from treated animals, chemical properties of milk at different stages in the chain are being monitored comprehensively in some cases and sporadically in others. In order to improve quality, hygiene, and safety standards, both technological and regulatory steps need to be taken with effective enforcement.

Demand for quality, safety, variety, and convenience has also increased in the case of raw fresh milk and traditional processed dairy products. The share of informal and semi-formal value chains in the overall milk market may continue to remain fairly large in the short to medium term if these chains properly respond to increasing demand for quality, safety, convenience, and variety in fresh milk and milk products. Some innovative milk processors, especially those with established brand names in the traditional products market, are already combining modern processing and marketing techniques to satisfy the changing or emerging demand for such products. The system of monitoring and enforcement of hygiene standards in both informal and semi-formal chains still needs to be strengthened systematically.

DAIRY VALUE CHAINS IN LEADING REGIONS: THE CASE OF PUNJAB AND HARYANA

Of the leading states, Punjab and Haryana provide good exemplary dairy value chains. The dairy value chains in this region are divided into organized, semi-organized (semi-informal), and unorganized (informal). The salient characteristics of these three categories are presented in table 30.

Table 30: Important characteristics of different dairy value chains in the leading regions

Characteristics	Dairy Value Chains		
	Organized	Semi-organized	Unorganized
Actors/ players	Producer, cooperative society, supplier, contractor, processing plant, distributor, retailer, consumer	Producer, milk vendor, contractor, small manufacturing units, retailer/ vendors, consumer	Producer, milk vendor, creameries, sweat shops, consumer
Kind of milk procured	Low fat milk High fat milk	High fat milk	Fresh milk High fat milk
Important dairy products	Packed/flavored milk, ice-cream, SMP, Paneer, Cheese, dairy whitener, butter, ghee, etc	Ice-cream, paneer, ghee, butter, etc.	Low fat milk, cream, paneer, khoa, curd, milk based sweets, butter, ghee, etc
Scale of processing	Large scale	Small Scale	Very small scale
Type of Business	Commercial and Cooperative	Commercial	Traditional
Type of markets served	Local, national and international	Local and national	Local and Niche
Value addition ¹ (times)*	> 1 and < 15	> 5 and < 15	> 2 and < 100
Margin	Low	Medium	High
Governance	High	Medium	Low
Average Time taken (hours) by liquid milk from cow to consumer	36-60	-	6-12

* Complied from studies conducted in the Division of Dairy Economics, Statistics & Management, NDRI, Karnal (Chauhan *et al.*, 2005 & 2007)

Cooperatives are the largest players in the organized value chains. The Haryana Dairy Development Cooperative Federation (HDDCF) was established in 1977, and the Punjab Milk Producer's cooperative federation, Milkfed, was established in 1978. They represent the states' apex bodies of their corresponding District milk producers' cooperative unions and the thousands of village dairy cooperative societies affiliated with them (table 32). Today Milkfed is the largest liquid milk supplier to the cities and towns in Punjab and the brand leader for milk and milk products ("Verka") consumed in the state with over 409,000 producer members state-wide, 6893 village Dairy Cooperative Societies (DCS), 11 District Unions, and 13 Dairy Plants. Similarly, HDDCF comprises more than 293,000 producer members state-wide with 6515 village Dairy cooperative societies, District unions, and five dairy plants. HCCDF is brand leader of dairy products ("Vita") consumed throughout the state and beyond. They both have a strong marketing network and well established distribution channels. It is reported that Verka products have also been exported to foreign markets—such as the UAE, Saudi Arabia, Australia, Japan, New Zealand, and Malaysia. Punjab and Haryana also have excellent processing and value addition facilities for milk and milk products both in the cooperative and the private sector. These include milk chilling plants in rural areas, liquid milk plants, milk product plants, and milk powder plants. Total installed milk processing capacity in Punjab is 5.8 million liters per day (LPD), 30 percent of which is in the cooperative sector and 70 percent in the private sector. The marketable surplus of milk represents 55 percent of total milk production. The total milk handled by the organized dairy sector is some 30 percent of the total marketable surplus. Nearly 70 percent of the milk trade is still in the traditional, unorganized

sector. While many dairy processing companies operate in Punjab- 50 of them between large and small-the two major players are the Punjab Milk producers' cooperative federation (Milkfed), and Nestle India in Moga.

Table 31: Key components of dairy cooperatives in Punjab and Haryana (2007-08)

	Punjab	Haryana	All India
No. of DCS Organized (Cumulative)	6432	6515	128799
Farmer Members ('000)	378	293	13411
Average # of farmers per Society (000)	59	45	104
Women Members ('000)	51	67	3697
Percent Women members in DCS	13	23	28
Milk Procured (TKgPD)	824	516	22874
Average Milk Procured per Society	128	79	178
Average milk procured per farm member liter/ day	2	2	2
Milk Marketing (TLPD)	576	317	18921

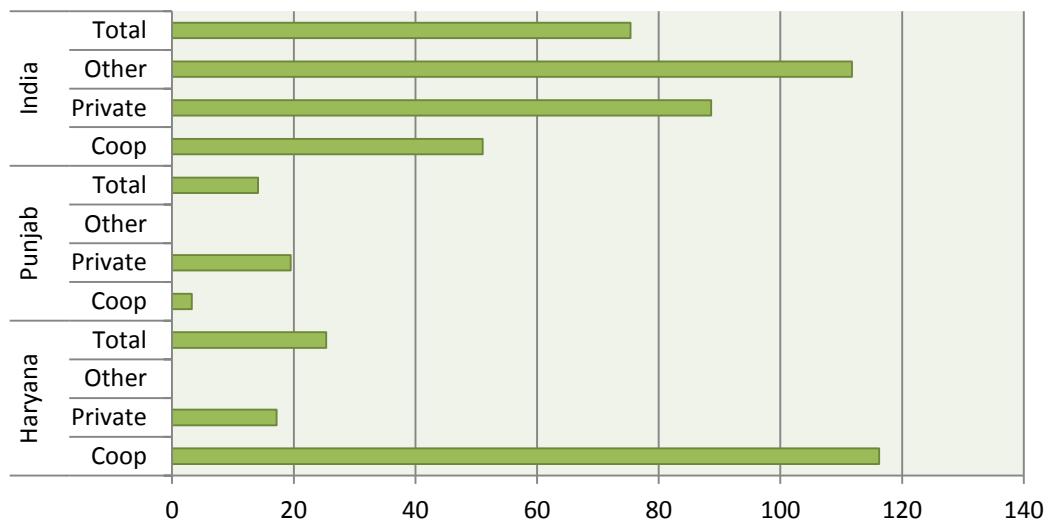
Source: NDBB Website and Authors' calculations

There are five milk plants operating in the cooperative sector in Haryana with a total handling capacity of 470 thousands liters per day.

Price of the milk paid to the farmer is based on fat and solid non-fat (SNF) percentage. While buffalo milk is being priced on fat basis only, two axis pricing policy was followed in case of cow milk giving SNF two-thirds of the weightage. Nevertheless, the price of milk paid to farmers in this chain is generally lower than the unorganized value chain. Still, milk producers remain attached to this chain because of supporting services like supply of feed, veterinary treatments, artificial insemination services, and a reliable payment system.

Overall, there is a shift in milk processing from the cooperative sector to the private sector. The overall trend in India that was observed between 1996 and 2006 was the shift from cooperatives to the corporate sector in milk processing. A similar trend has been observed in Punjab, but to a lesser extent. The reason being that the share of private plants in total processing capacity in the state was already high (about 67 percent) to begin with. After GOI removed the licensing policy in the dairy industry through MMPO, the private companies have overtaken the cooperative sector in terms of share in processing capacity (figure 18). However, Haryana, has recorded a slight decrease in the number of private plants (by about 6 percent), and at the same time, the capacity of cooperative plants has more than doubled.

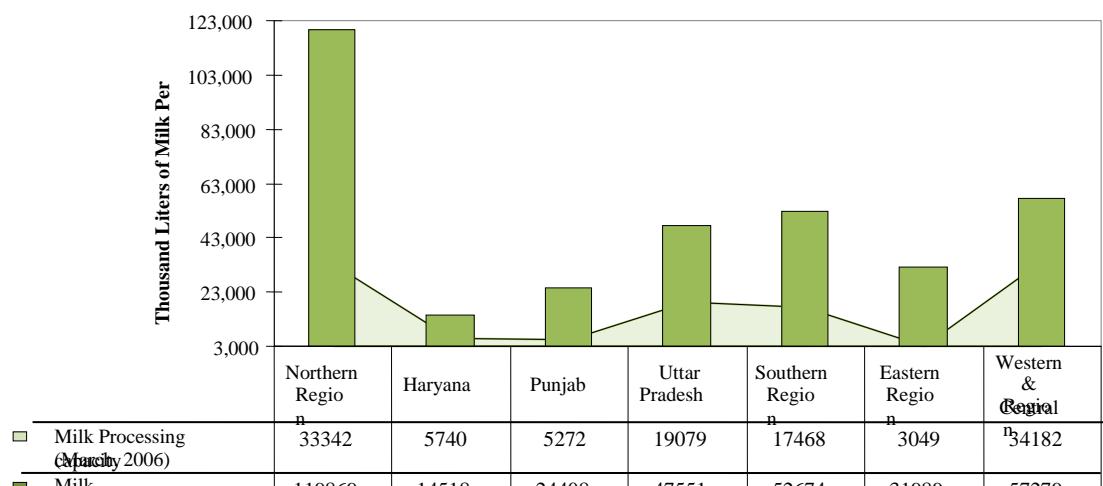
Figure 18: Percentage change in processing capacity of milk in Haryana, Punjab, and all India (1996-2006)



Source: Compiled from Government of India (2006)

The cooperative and corporate sectors in Punjab have both increased the number of plants instead of expanding the average capacity of existing plants, unlike the trend in the rest of the country. This is possibly due to increased competition with one another which benefits both producer and consumers by paying higher prices and charging lower margins. Nevertheless, the average processing capacity of dairy plants is still higher in the cooperative sector. The cooperative sector in these two states is highly dynamic. There are still ample opportunities for establishing more dairy plants both in private and cooperative sectors because the established milk processing capacity is much lower than total milk production per day.

Figure 19: Extent of milk processing capacity in comparison to milk production



Major Milk Producing Regions/ States

Source: Chandel, Jain and Dhaka (2008)

Production in the leading states is moving in favor of high fat milk with buffaloes emerging as the most preferred animals. The fat percentage of buffalo milk is almost double that of cow milk. There is a growing use of buffaloes in dairy farming in the country. Buffaloes increased as a percent of in-milk bovine stock per 100 households during the last two decades (table 32). Overall percentage of buffalo in-milk bovines stock increased from 43 percent in 1991-92 to 47 percent in 2002-03 for all India. The trends are more pronounced in Punjab and Haryana. In Haryana, the percentage share of in-milk buffaloes per 100 households increased from 79 percent in 1981-82 to 84 percent in 2002-03. While the percentage share of in-milk buffaloes was stable in Punjab during the last two decades, there was an increase in the absolute number of in-milk buffaloes being kept per household. On average, 100 households are keeping 70 in-milk buffaloes in comparison to 67 in 1981-82. In 2007-08, the share of buffalo milk in total milk produced in Haryana and Punjab reached 85 percent and 74 percent, respectively. The figure for all India was at 53 percent during the same year (Basic Animal husbandry Statistics, GOI, 2008).

Table 32: Change in Percentage of buffaloes in in-milk bovine stock per hundred rural households

State/ Bovine stock	During different rounds of National Sample Survey		
	1981-82	1991-92	2002-03
Haryana			
In-milk cattle	16	21	12
In-milk buffaloes	61	71	62
In-milk bovines	77	92	74
Percent of buffaloes in in-milk stock	79	77	84
Punjab			
In-milk cattle	23	22	24
In-milk buffaloes	67	78	70
In-milk bovines	90	100	94
Percent of buffaloes in in-milk stock	74	78	74
India overall			
In-milk cattle	20	26	19
In-milk buffaloes	17	20	17
In-milk bovines	37	46	36
Percent of buffaloes in in-milk stock	46	43	47

Source: NSSO [National Sample Survey Organization] (2006)

Reducing Price Spread and Market Margins. The marketing costs of milk and milk products are very high, especially procurement costs, which is large due to small marketed surplus per unit area and per household. Prices of liquid milk in the region are presented in table 33 at different stages of marketing. The table also reveals some information about the prevailing prices, price spread and the market margins in the region. The prices in the table were the one prevailed in organized dairy value chain.

Table 33: Prices of liquid milk at different states of organized dairy value chain in the region

Price Level by State/Region	Kind of Milk	Years		
		1995-96	2001-02	2006-07
Farm gate Price				
Haryana				
	Cow	6.67	-	12.06
	Buffalo	7.92	-	14.00
	Mix	7.30	9.43	13.03
Punjab				
	Cow	5.57	-	9.21

Price Level by State/Region	Kind of Milk	1995-96	Years		
			2001-02	2006-07	
	Buffalo	9.85	-	14.02	
	Mix	7.71	-	11.61	
Wholesale Price					
North Zone	Mix	-	-	15.94	
Delhi	Mix	14.00	-	-	
Retail Price					
Delhi	Cow	12.33	17.33	-	
	Buffalo	-	18.75	22.00	
	Mix	-	18.04	-	

Sources: Chand (1997), Kalra, Agarwal and Malhotra (2008), Dhaka, et al. (1998), Datanet India Pvt. Ltd. n.d., GOI (2002-2008).

The comparison of farm gate prices in 1995-96 and 2006-07 shows that prices received by farmers have increased substantially, while the wholesale and retail prices have not risen by the same proportion, leading to decrease in the price spread and marketing margins. In 1995-96, cow milk was priced Rs. 12.33 per liter in Delhi while the farmers in Haryana got Rs. 6.67 per liter (an 85 percent price spread) and farmers in Punjab got Rs. 5.57 per liter (121 percent price spread). In 2006/07, buffalo milk was priced Rs 22 per liter in Delhi, but the farmers in Haryana and Punjab got about Rs. 14 per liter (a 57 percent price spread). Similarly, there was also a decrease in market margins. The ratios between the wholesale price in Delhi and the farm gate prices of mixed milk in Haryana and Punjab were 1.92 and 1.82, respectively, in 1995-96. In 2006/07, the ratios decreased to 1.22 and 1.37 in Haryana and Punjab, respectively. This indicates that the margins have decreased between wholesale prices and farm gate prices and between retail prices and wholesale prices; the latter ratio has always been lower than the former.

The increased portion of the consumer's rupee that farmers receive and the reduction in marketing margins are a positive development in the dairy value chain in the region. This could be due to better coverage of farmers under a cooperative setup and innovative institutional arrangements in the process of procurement. Contract dairy farming is another institutional arrangement being adopted by private milk processors in Punjab and Haryana. Also, the increase in the number of processing plants has increased competition—leading to a healthy change in the sector.

Clean milk production. There is increased emphasis on production quality and food safety especially in dairy due to its perishable nature. Composite Milk Processing Plants involved in processing of milk are bound to comply with different quality standards like HACCP, MMPO, ISO, etc. but their share in total processing of milk is still low. However, the quality in the rest of the system highly depends upon the raw milk being inputted. Clean milk production (CMP) is focused at production and collection levels. It was taken up at Government level in 1998 in Punjab. The Ropar Milk Union was the first in Punjab State Cooperative Milk Producers Federation to implement it. Some of the experiences of this Union in clean milk production are summarized in table 34.

Table 34: Effect of clean milk production in Roper Milk Union

Status of CPM	Extraneous Matter (mg/liter)	Standard Plate Bacterial Count (SPC) cfu/ml*
In the year of implementation (1998)	0.87	> 10 million
After three years of implementation (2001)	0.66	2000
Standard for Indian Condition	-	1000-10000
Penalty imposed (Rs per litre)	0.10	-

Note: * after 24 hours when stored at temperature of 21°C

Source: Sharma and Sharma (2001)

The comparative trend of extraneous matter and bacterial count contents of milk given in table 35, show that it is possible to improve the quality of milk considerably through CPM. Cooperatives and private companies are distributing bulk milk coolers, electronic milk testers, and establishing automatic milk collection centers to strengthen the infrastructure for quality and clean milk production. In 2004-05, an investment of Rs 247 million was made on this issue in the country, of which Rs. 16 million was invested in Haryana and Rs. 18 million was invested in Punjab. In Punjab alone, about 1250 bulk milk coolers have been installed in villages by different processing plants. It is hoped that the installation of these coolers will improve milk quality by about 50 percent. This system helps in cooling the milk at the village level within one hour of milking.

Shortage of raw milk supply. Despite high production levels, most of the milk processing plants in the leading region depend on milk from adjoining states, especially during the lean period. The main reason for this is that high milk consumption leaves very little to be marketed. Other reasons include the large processing capacity and the competition among processing plants. In the cooperative system, processing plants are only working at 66 percent of their capacity. For example, in recent years supply shortage has become a problem in Punjab and Haryana, especially in lean months when milk is procured from Uttar Pradesh, Rajasthan, and Gujarat to utilize capacity, but this increases collection costs.

The cooperative and private plants have tried alternative mechanisms in the past to ensure raw milk supply—e.g., contract farming and commercial dairy production. Contract farming has benefited farmers in terms of reducing transaction costs, for instance, a study on contract farming by Nestle India, Ltd. in Punjab showed a 90 percent reduction in transaction costs while the net revenue realization by contract producers was 2 to 4 times higher (Birthal, Joshi and Gulati, Vertical Coordination 2005). In order to enhance milk production and making dairy farming a profitable and sustainable profession, Milkfed has planned to establish at least ten progressive big dairy farms in each milk union by arranging soft term loans from banks. The present situation of commercial farms in the states of Haryana and Punjab is given in table 35.

Table 35: Commercial dairy farms in Punjab and Haryana

Range of Bovine Heads	Haryana	Percent of state total		Percent of state total
		Punjab	Haryana	
1-20	16	31	6	13
20-50	23	45	12	25
50-100	4	8	17	35
> 100	8	16	13	27

Range of Bovine Heads	Haryana	Percent of state		Percent of state total
		total	Punjab	
Total	51	100	48	100

Source: compiled from Dairy India Yearbook (2007).

DAIRY VALUE CHAINS IN LAGGING REGIONS: THE CASE OF BIHAR AND ORISSA

Bihar has 6.2 million milch bovine animals and Orissa has 4.6 million. A comparative picture of Bihar and Orissa with respect to some key indicators of dairy development is provided in the appendixes. With regard to herd composition, Bihar is close to the national average with 10 percent crossbred cows, 47 percent indigenous cattle, and 43 percent buffaloes. In contrast, 81 percent of Orissa's milch bovines are indigenous, one of the highest rates in the country. By comparison, the leading dairy states of Punjab and Gujarat have three percent and 34 percent indigenous cattle, respectively. This distribution of cattle partly reflects the breeding policy and the access to health and breeding services in these states.

In terms of milk yield, productivity per animal as of 2003 in Bihar was 417 kg/year and 218 kg/year in Orissa—among the lowest rates in the country and considerably below the national average. In recent years, milk productivity has reportedly gone up. In terms of *per capita* milk availability, at the national level it is 246 gm/day. In Bihar and Orissa, the figures are 163 gm/day and 104 gm/day, respectively, whereas Punjab has the highest per capita availability at 961 gm/day.

The Bihar State Cooperative Milk Producers' Federation Ltd. (COMFED) implemented Operation Flood in Bihar following the Anand model, and it is now the apex organization for dairy cooperative societies and unions. COMPFED is the largest player in dairy business in the state and has developed a fairly integrated supply chain for liquid milk and other dairy products. COMPFED's achievements include outreach, increasing milk procurement, product and market leadership, provision of support services, and the resulting higher incomes for producers.

COMFED is currently working in 21 of the 38 districts in Bihar, and covers about seven percent of the marketable surplus, collecting 477,000 liters of milk per day. By comparison, Gujarat's milk producers' federation, which ranks first in the country, procured 7592 TKPD in 2007/08. Nearly 6,544 dairy cooperative societies (DCS) have been organized in Bihar and their membership topped 322,000 in 2007/08. However, because of low animal productivity and other problems such as floods in some of the milk-producing areas, Bihar's average daily milk procured per society is approximately 96 kg/day, which is only slightly higher than low-producing Orissa at 86 kg/day.

Around 15 percent of members of co-operative societies are women, nine percent belong to scheduled castes and tribes, and 48 percent are from underprivileged groups. The social and gender composition of the DCSs suggests that COMFED has been able to reach some the poorest sections of the population, although it is not clear to what extent they have been involved in the executive responsibilities in cooperatives.

The Orissa State Cooperative Milk Producers' Federation Limited (OMFED) works in all 30 districts of the state (table 36). It has 8 milk unions and some 2932 functional village DCSs with more than 166,000

members. OMFED has a high percentage of women members, a little less than half of total member and the highest percentage in the country. Currently, milk procurement is approximately 8-9 percent of the total state production.

Table 36: Overview of COMFED & OMFED (2007-08)

State / UT	Bihar	Orissa	Gujarat ^a	All India
No. of DCS Organized (Cumulative)	6544	2932	13141	128799
Farmer Members ('000)	322	166	2716	13411
Average # of farmers per Society (000)	49	57	207	104
Women Members ('000)	48	73	714	3697
Percent Women members in DCS	15	44	26	28
Milk Procured (TKgPD)	477	235	7592	22874
Average Milk Procured per Society	73	80	578	178
Average milk procured per farm member liter/ day	1	1	3	2
Milk Marketing (TLPD)	348	213	2706	18921

a. Gujarat, which has one of the best performing dairy cooperative model in the country is included for comparison purposes

Source: NDDB (1999-2009) and authors calculations

VALUE CHAIN ANALYSIS REVEALS CHALLENGES IN LAGGING STATES

Low margins for dairy producers. Data gathered during this study suggests that the average net income per day from dairy enterprise is very low. This is the result of three distinct factors: (a) low milk productivity from animals with low genetic potential; (b) poor health, feeding and husbandry practices; and (c) low prices offered by largely inefficient milk cooperatives. This analysis also shows considerable scope to enhance producer incomes from dairy by enhancing animal productivity, improving management practices, and ensuring more remunerative prices.

Marketing channels remain traditional. More than 85 percent of marketable surplus in milk is sold through informal channels, especially private traders in the unorganized sector and direct sale to other farmers. This is especially in the case in Bihar (table 37). This is in sharp contrast to the leading dairy states where there has also been a marked shift from cooperative to corporate sector. Regarding prices, data from a value chain analysis (VCA) survey shows that farmers received the lowest prices from milk cooperatives and the best from sales to other farmers.

Table 37: Farm income from dairy enterprise (Bihar)

Average milk production/day	5 liters
Average milk for home Consumption	1.5
Average old in the market	3.5
Cost of Production/liter (Rs.)*	6 Rs/liter
Selling Price of Milk/liter (Rs)	9 – 13
Value of Milk Produced (Rs)	45 – 65
Total Cost (Rs)	30
Income Per Day from Milk (Including home consumption) (Rs)	15 – 25
Net Income/day from milk sale (Rs)	1.5 – 15.5

* Cost of production does not include the cost of crop residues, green fodder and HH labor.

Source: Punjabi, et al. (2008)

Dairy cooperatives' marketing shows weakness. The performance of dairy cooperatives in Orissa and especially in Bihar is weak with respect to various indicators of effectiveness such as:

- share of marketable surplus going to cooperatives;
- prices received by farmers;
- transparency in pricing;
- share of consumer price going to farmers;
- availability of services to farmers; and
- Professional management of the state federation.

Only 15 percent of the villages in Bihar are covered by dairy cooperatives. Survey evidence suggests that the prices paid (Rs. 9-11 for cow milk and Rs. 13-14 for buffalo) are very low, especially given high demand for milk and rising feed prices.

Prices set by cooperatives become the benchmark for other market operations, and hence have a pervasive effect on depressing dairy incomes. Pricing is sometimes based on one composite sample per society, which sets the price for that society. This is different from other collection systems in India, where a sample is taken from every producer's milk can, tested for fat content, and priced accordingly (e.g., Gujarat). This practice is seen by some farmers as less remunerative for higher fat contents and has prompted some of them to remove some of the fat from the milk and sell it separately to brokers and/or directly to consumers.

Volumes and margins at the collector level. Both in Bihar and Orissa the scale of milk collection operations is small—e.g., cooperative societies collecting between 45-50 liters per day in Bihar and 80 liters per day in Orissa. The margins realized by different types of collectors (collector for private diaries, collector for cooperative societies, and local private traders) vary between 20-30 percent of price received by producers (Rs. 2-3). Given the low volumes involved, milk collection is done essentially through family enterprises with little external capital or labor inputs, either in the form of hired labor in milk collection or equipment/facilities to process or transport over long distances. Consequently, value-addition opportunities, which are considerable given the prevalence of milk-based products in popular diet, are not exploited. Given the very small marketable surplus with individual households it is necessary to build institutions that can vertically integrate small and scattered producers with livestock product processors.

Table 38 summarizes the issues raised by the dairy value chain analysis in terms of particular "stage" of the value chain (policy environment, services, inputs, production, marketing/processing and retailing), key roles or functions to be performed for each stage, key agents or players, and the issues/constraints arising.

Table 38: Dairy value chain analysis in lagging regions – summary of issues

Role by Stage	Agent	Issues
Policy Environment		
Developing Livestock Policy Breed development	Dept. of AHD	<ul style="list-style-type: none"> ▪ Lack of a coherent livestock development policy ▪ Implementation problem ▪ Ineffective implementation of policy and projects due to lack of clarity in roles of different agencies ▪ Lack of resources ▪ Lack of clarity between roles of different depts. ▪ Lack of Regulation for quality of feed/medicines ▪ OLRDS lacks strength, role and functions are not clear ▪ Agencies involved for breed devt lack coordination
Services		
Disease control/ Health/breeding/extension services Support to producer orgs/, WSHG	Dept. of AHD Co-operative NGOs Some Private Dairies	<ul style="list-style-type: none"> ▪ Inadequate coverage of health and breeding services ▪ Non-existent extension services ▪ Scope to enhance activities of the NGOs in these areas, especially in Bihar ▪ Lack of private sector involvement in dairy development services and activities
Inputs		
Feed supply Fodder Medicines/vaccines supply	Co-operative Feed cos. Medicine cos. Medicine store	<ul style="list-style-type: none"> ▪ Quality/cost of feed ▪ Ineffective approach for management of common property resources ▪ Quality of medicines
Formal credit for animal purchase	Banks/FI Co-operatives SHG	<ul style="list-style-type: none"> ▪ Very poor access to formal credit at the farm level
Informal loans for animal purchase or otherwise	Trader Private company Agent	<ul style="list-style-type: none"> ▪ Very high rate of interest and farmer is has to sell milk at low price to the trader is he has availed loan
Production		
Dairy farming Selling milk co-operatives/traders/private dairy agents	Farmer	<ul style="list-style-type: none"> ▪ Poor management and feeding practices because of lack of information in the absence of extension activities. ▪ Low productivity because of low genetic potential, poor feeding and management practices, poor access to health and breeding services, lack of high quality animals ▪ Availability of milk per HH is very low ▪ Low profitability from Dairy enterprise
Marketing/Processing		
Collection of milk from farmers through village level society, processing and marketing of milk in cities and urban areas	Co-operative society	<ul style="list-style-type: none"> ▪ Lack of coverage of villages ▪ Lack of transparency in milk testing and pricing ▪ Lack of democracy in village level societies ▪ Marketing only in peri-urban/urban areas ▪ Maintaining quality of milk/infrastructure ▪ Milk prices declared by co-operatives are low and are used as a benchmark price by other players

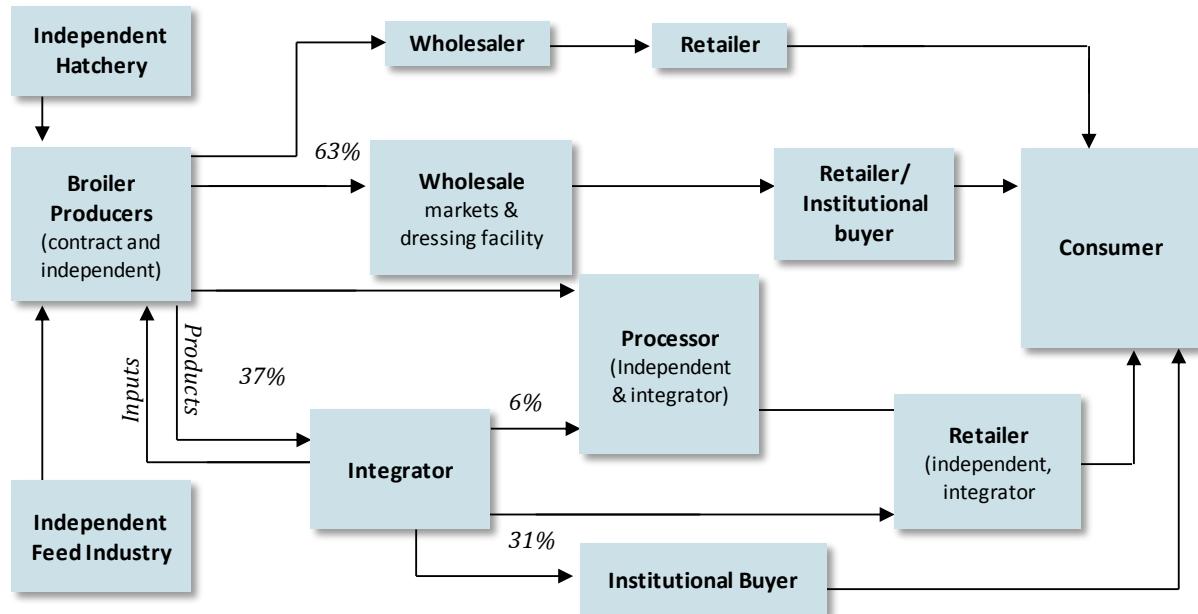
Role by Stage	Agent	Issues
Purchase milk from farmers, and sell milk and processed products to institutions/consumer	Trader	<ul style="list-style-type: none"> ▪ No transparency in pricing of milk ▪ Adulteration and quality of milk and milk products ▪ Unhygienic conditions for milk processing
Purchase of milk from farmers through agents in the village, processing and selling milk	Private dairy	<ul style="list-style-type: none"> ▪ No transparency in pricing of milk ▪ Quality of milk
Retailing		
Selling of milk and milk products processed by co-operatives and private dairies	Retailers	

Source: Punjabi, et al. 2008

POULTRY VALUE CHAINS HAVE TRANSFORMED RAPIDLY

Rapid transformation occurred in poultry value chains led by the private sector. The introduction of contract farming in broiler production has been the most important organizational change. Until the mid 1980s, backyard scavenging poultry kept by smallholders on mixed farms used to supply the majority of poultry meat and eggs. Live birds and eggs were marketed through traditional value chains involving a few intermediaries—like collectors, wholesalers and retailers—but without processing or value addition. Rapid transformation occurred since then with increased commercial production of poultry using improved technology (breeds, feeds and management), which also led to the development of new types of value chains led by the private sector. Figure 20 gives a general map of major value chains for broilers currently operating in the country. Only six percent of total poultry meat goes through value-added processing, mainly in the form of dressed broilers. The modern poultry processing sector includes 10-12 firms that together process about 12,000 tons of poultry meat annually, or 1-2 percent of consumption, and they mainly serve various fast food, hotel, and restaurant chains (Landes, Persaud and Dyck, India's Poultry Sector: Development and Prospects 2004). The rest of the poultry is sold as live birds through different retail outlets mainly in wet markets (traditional, open markets).

Figure 20: General value chains for broilers and poultry meat in India



Source: Adapted from Gandhi and Zhou (2008); Punjabi et al (2008b, 2008d)

The introduction of contract farming, especially in commercial broiler production, has been the most important organizational change in the poultry value chains. It is believed that contract farming takes market downside risks and bird disease risks away from the producers. In 2004-05, 37 percent of total broiler production in the country took place under contract arrangements (table 39). Contract arrangements may be of different types. Under fixed fee contract the contractor or the integrator provides all the inputs and services except labor and land, and has full ownership of the output while producers provide land and labor for which they receive a predetermined fixed fee or income. Special provisions for sharing disease risk may be included in the terms. In other arrangements, the contractor provides all inputs and services, often on credit, and buys back the output but there may be different ways of sharing price and disease risks with or without insurance cover. Tamil Nadu, Karnataka, Maharashtra, and Andhra Pradesh produce 41 percent of total broiler output in the country, and 78 percent of it is under contracts.

Table 39: Extent of contract broiler production by state in India, 2004-05

State	Total production (million birds/month)	Production under contract (million birds/month)	Percent production under contract
Tamil Nadu	18.5	16.5	90
Karnataka	7.4	6.5	87
Andhra Pradesh	16.0	9.5	60
Maharashtra	11.0	8.5	73
Sub-total	52.9	41.0	78
Gujarat	2.6	0.9	35
West Bengal	14.7	3.0	20
Northern states	30.0	2.0	7
Other states	30.0	1.0	3
Total	130.2	47.9	37

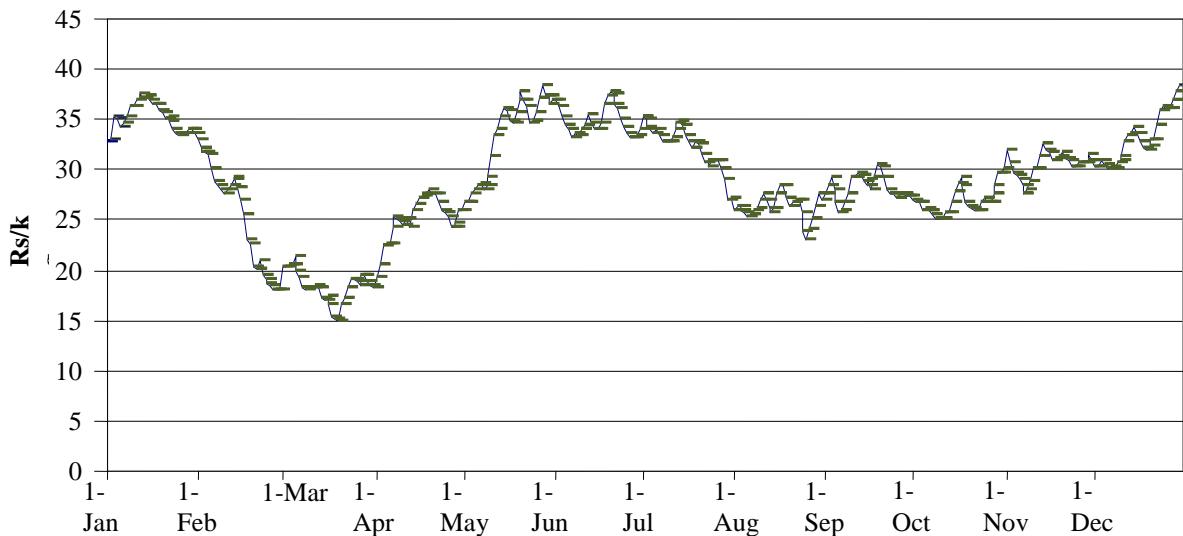
Source: Fairoze, et al. (2006)

Scaling up and geographic concentration of the broiler industry in a few states may limit its impact. Two issues have received much attention in the subject of contract farming in poultry: opportunities for small-scale producers participating in commercial poultry to benefit from the expanding market, and benefits for contract producers. In the early stages of contract farming in poultry, contract units or packages were small so it was possible for small-scale producers to participate in these value chains. Over time, however, significant scaling up has occurred in the poultry industry due to economies of scale. Nearly three decades ago, the average flock size hardly exceeded 500 birds/cycle/farm but such small-scale units are now rare. About 70 percent of the contract poultry grower units are now in the range of 3,000-50,000 birds, and 10 percent have 50,000 to 400,000 birds (Mehta, Nambiar, et al., Broiler and Egg 2003) (Mehta, Nambiar, et al., Broiler and Egg 2003). The size of the integrator's business runs into millions of birds per cycle. Scaling up has also occurred in case of independent broiler producers.

Concentration also may lead to higher costs and retail prices as products need to be transported longer distances for retailing. For example, about 30 percent of broiler output of Andhra Pradesh is exported to other states. Price at destination is higher by Rs 0.50 and Rs 1.00 per kg up to a distance of 500 km and over 500 km, respectively. Long distance traders have access to private and public sector insurance to cover risk of accident for the truck but insurance to cover the birds is not available (Punjabi et al., 2008)

There are mixed evidences on profitability of contract growers. Under some arrangement, contract broiler producers have been found to derive significant benefit as integrators absorb up to 88 percent of risks due to disease and price variation (Ramaswami, Birthal and Joshi 2006). In other cases contact producers earned less profit compared to independent producers (Mehta, et al. 2003; Fairoze, et al. 2006). But this later situation may be due to the seasonality in broiler price has not been addressed in the contract terms. Seasonality in broiler price in the country is quite high, as illustrated by the situation in Andhra Pradesh (figure 21).

Figure 21: Seasonality in farm-gate price of broilers in Andhra Pradesh, 2004-06



Source: Birthal, Overview (2008)

Costs, prices, and returns vary widely across states so comparing the nominal value of returns between states is difficult. However, the producer share of retail prices may be a good indicator of the difference in performance of different chains. For example, in Bihar, independent producers get 74 percent and 77 percent of the retail price of live birds and meat, respectively. In Orissa and Andhra Pradesh, large scale producers get 59 percent and 73 percent of retail price, respectively (table 40). In Bihar and Orissa, costs of day old chicks and feeds are higher compared to Andhra Pradesh because of lack of adequate investment in these inputs.

Table 40: Producer share of retail price of live broiler and meat in selected states, 2006-07

	Bihar		Orissa		Andhra Pradesh	
	Live bird	Meat	Live bird	Meat	Live bird	Meat
Farm/company gate price (Rs/kg)	46.0	60.0	38.0	47.5	35.0	43.8
Retail price (Rs/kg)	62.0	77.5	51.2	64.0	48.0	60.0
Farm/company price as percent of retail price	74.0	77.0	59.0	59.0	73.0	73.0

Source: Punjabi et al. (2008) and S. Raju (2008)

The commercial layer industry is also fairly concentrated in a few states like the broiler industry, so egg value chains have become longer in terms of the distance they cover. The types of actors involved in egg value chains are fairly similar to those involved in broiler value chains, except for long-distance wholesale egg trade. However, the size of business has increased along with scaling up of the layer farms. Long distance egg traders can insure trucks to cover risk of accident but not the eggs transported in the trucks. Mechanization of some activities like egg collection is taking place in some large layer farms in Andhra Pradesh induced by higher labor costs. Another characteristic of the egg market is that, unlike the broiler industry which has some regional level coordination, it is somewhat nationally integrated by the actions of the National Egg Coordination Committee (NECC). Box 15 describes how NECC has succeeded in ensuring a stable high level egg price for its members by reducing their search cost for price and markets.

Box 15: Composition and function of the National Egg Coordination Committee

The NECC was formed in 1982 as an NGO under the Societies Registration Act of 1860 and was later converted into a Trust with the motto: "my egg, my price, my life". Its primary role is to provide price information to its member producers to assure them reasonable and stable prices in value chains that were traditionally controlled by the middlemen, who used to determine price. The NECC has stabilized egg prices and ensured fair prices for farmers, in what was once a highly volatile market.

Currently it has over 28,000 poultry farmers and traders belong to NECC, which is run through 28 zonal offices and 88 local committees all over India. Depending on the local market situation, farm gate price for eggs is declared at all zonal levels, which assures farmers a reasonable price. The NECC also intervenes in the market to stabilize prices by effectively managing demand and supply by procuring and storing eggs in conditions of excess and mobilizing eggs in conditions of shortage.

GOI allocates some budget to NECC and declares the minimum support price (the government's floor price) every year. Whenever the price falls below the floor price, NAFED with the help for ACIL intervenes in the market. Government has agreed to share losses up to 25 percent of these operations.

Other activities of NECC include export promotion by offering subsidies to exporters and undertaking exports through ACIL. Advertising promotion, publicity, and consumer education to boost egg consumption is another key activity. Finally, market research is a critical area of activity to ensure monitoring of the demand and supply

situation.

Source : Sathe (2008)

Hygiene and safety standards in expanding poultry value chains have received inadequate attention.

Demand for poultry has registered the highest rate of growth among all types of meat and the broiler and layer industries have rapidly responded to demand. There is also perceived demand for quality and safety of poultry products, both live birds and meat, although empirical quantitative evidence on willingness to pay for such attributes is hard to find. However, quality and safety standards of poultry products, especially the use of antibiotics, hormones and other drugs, and disposal of manure and wastes and their environmental consequences are not effectively monitored except to some extent in the vertically integrated enterprises.

Some of these enterprises sell live birds, dressed broiler, and eggs through clean and hygienic retail stores, as found in Andhra Pradesh. Retail stores in Hyderabad, are classified as A, B, C and D:

A= modern clean and hygienic stores;

B=large, but not very hygienic;

C=relatively small and unhygienic; and

D=almost roadside sale of about 40-50 birds per day.

Category A stores are increasing, but as mentioned before, there is no apparent premium on quality. Wet markets inside town follow few if any sanitary procedures to prevent the spread of animal disease or food safety issues.

There is scope for public goods creation to reduce spillovers in risks, especially in poultry disease monitoring and surveillance. The number of public and private veterinarians in the states with a high concentration of poultry industries, most of which are also leading dairy states, is inadequate. There may be surplus veterinarians in other states; however, because of restrictions on employing veterinarians from outside a state, this anomaly in the market for veterinary service remains unresolved. When the output market is open, restrictions in the market for inputs and services are inconsistent, unjustified, and may not be in the best interest of the livestock sector. These problems along with risks and hygiene and safety standards need to be managed in an integrated way as the demand for poultry meat and quality and safety standards will continue to grow quite rapidly along with population, income and urban growth.

DOMESTIC MARKETS FOR LIVE ANIMALS AND MEAT VARY ACROSS STATES

Large scale commercial production and organized value chains have not yet developed for ruminant animals and their meat products in the domestic market, as it has for milk and poultry. Trading live animals takes place both informally from farmers to middlemen/traders visiting the village, and formally through the regulated markets. There are about 2000 markets for live animals, most of which are

irregular, uncertain, and lack transparency in their management. Besides, most markets are located far away from production areas and lack basic marketing infrastructure and facilities. These markets usually fall under the jurisdiction of the marketing department or the rural development departments, although day-to-day administration may be entrusted to local market committees. Most of these markets are not livestock specialized markets but are shared with other agricultural commodities. There are also weekly shandis that take place usually at the district level mostly for trading of small ruminants.

The quantity and quality of the markets infrastructure together with the volume of arrivals vary widely across states. Typically, markets in leading dairy states are larger in size, handle a relatively large volume of arrivals of both large and small ruminants, and cater both to domestic and out of state producers. They are usually better equipped with compound walls, gates, water tanks, drinking water, toilets, and offices. They have also trees planted to provide shade to the animals. Markets in the lagging states, however, have worse conditions. They handle a much lower volume of animals and often lack one or more of the facilities needed for livestock handling. For example, the total number of traded animals per year is estimated at 1.25 million in Orissa while the number in Punjab is twice as much, about 2.5 million large ruminants and 0.8 million small ruminants traded annually. Box 16 below provides a comparison between two livestock markets in Punjab and Orissa.

Box 16: Live animals marketing in Punjab and Orissa

Jagraon Market in Punjab

There are 49 organized market yards for livestock in Punjab. The annual trading volumes of these 49 RD market yards is estimated as some 2.50 mln large ruminants and some 0.80 mln small ruminants. The most important are the yards in Jagraon and Khanna in Ludhiana district and the Killianwally market yard in Mukatsar district. The major market yards trade in weekly / monthly haats some 1000 to 2000 large ruminants during the haat days and some 200 to 400 small ruminants.

Jagraon Yard has 4 Ha of walled and gated landwith a tube well, over head water tank, 4 drinking water troughs, one loading / unloading ramp, an open flat roofed hall, toilets and an office building. The land has some shade trees and a few more newly planted ones growing up. The Jagraon Market Yard holds trading fairs once a month, for three days at a stretch on 21, 22 and 23 of every month: the first day for trading in culled cattle and buffaloes for meat purposes, the second for work animals and the third and final day for milch animals. The Yard has good market arrivals and trades in nearly 2000 animals every month.

Nayagad Market in Orissa

In 2003, the total number of live animals traded in Orissa was estimated at 1.25 millions animals.

In Nayagad market, livestock is traded on a road side plot of some 1 ha land with no fence or compound walls. The land is bare with no shade trees and no facilities for drinking water for the animals. The yard has no loading/unloading ramps and is frequented mostly by local farmers. The yard is equipped with special facilities for agricultural commodities marketing, however, there are no special facilities for livestock trading

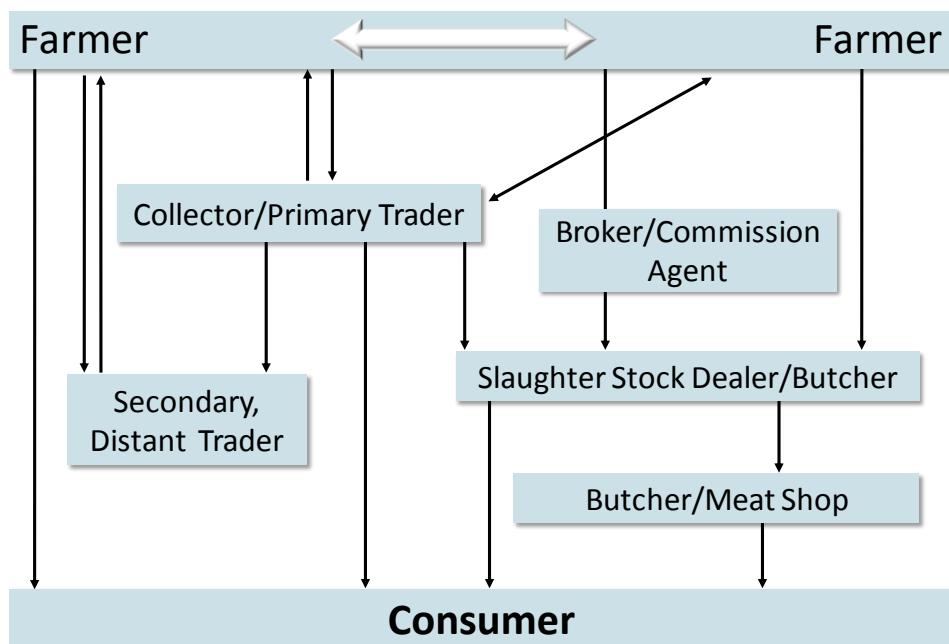
Source: Kurup, Orissa (2008); Kurup, Punjab (2008)

Generally market chains for cattle and small ruminants are fairly similar and each involves a number of intermediaries. Typical market chains for cattle and small ruminants found in Bihar and Orissa are shown in figure 22. Farmer-to-farmer exchanges account for about 20 percent of transactions, which mainly take place for breeding stock and replacement animals; farmers prefer to buy these types of

animals from known sources. These transactions reduce the net off-take rate for slaughter as these animals change hands but do not leave farm households.

Transactions in meat animals are dominated by traders, who buy animals from farmers directly or through brokers, and after aggregating their numbers, sell the animals in urban markets to larger traders or butchers for slaughter at much higher prices. In some states, slaughtering of cattle is prohibited so cattle from these states are taken to neighboring states where slaughter may be allowed. The role and degree of involvement of intermediaries, including brokers, varies according to market type and location (Bhatia, Pandey and Suhag 2005). Due to lack of access to institutional credit, farmers and traders sometimes borrow from informal sources at higher rates of interest.

Figure 22: Typical market chains for cattle and small ruminants in Bihar and Orissa



Source: Authors' Field work (2008)

Farmers also lack access to market information on supply, demand, and prices—all of which fluctuate—so they do not always benefit from higher prices prevailing in the market. Consequently overall transaction costs of marketing animals are high. For example, in Andhra Pradesh, marketing costs associated with bovine transactions in wet markets eat up 20-30 percent of the sale price (Reddy 2000). This is one of the reasons for a sizeable proportion of transactions taking place between farmers. Estimates indicate that traders' net margins range from 15-100 percent of their acquisition and transportation costs (Subrahmanyam and Murthy 2006). In Bihar, farmer price was found to be 50 percent of retail price while in Orissa, farmer share was only 36 percent (Punjabi, et al., 2008).

For the domestic consumer market, animals are slaughtered in registered and unregistered slaughterhouses, unregistered slaughter slabs, and in open places in urban areas. In rural areas, slaughter in slabs and open spaces are widely used. There are 5,520 registered and 4,707 unregistered slaughterhouses in the country. About half of the total marketed meat for domestic consumption comes

from unregistered slaughterhouses. Most of the slaughterhouses are owned by municipalities and are in dilapidated conditions with poor hygiene and management of waste disposal (Chawla, Kurup and Sharma, Animal Husbandry: State of the Indian Farmer 2004). Meat is generally sold to consumers after slaughter through retail meat or butcher shops in the wet market without any value-added processing. The hygienic standard of the meat or butcher shops is generally poor. Orissa has 63 registered slaughter houses, all of which lack basic standards of hygiene and sanitation. In a few big cities, a small number of super markets sell fresh or chilled meat which is kept under hygienic conditions, and this market outlet is expected to increase.

Despite consistent growth in the livestock industry, the level of processing or value addition to livestock production has remained low. Only about six percent of the poultry meat, 21 percent of the buffalo meat undergoes value addition. The bulk of buffalo meat is processed through the organized sector and is primarily for exports. In the registered sector, 3.6 million cattle were slaughtered in the country in 2005-06, with nearly one-third in West Bengal alone. Uttar Pradesh leads all Indian states with the proportion of buffaloes slaughtered, with nearly 30 percent of total slaughtered buffaloes in the country.

The processing of buffalo meat, which caters to foreign markets, is mostly done in specialized slaughtering and processing facilities established by the private sector. Six large slaughterhouses have the capacity to handle 30,000-180,000 buffaloes per enterprise per year, and they have a combined capacity of handling about 600,000 buffaloes per year. There are also four slaughterhouses for pigs in eastern India with a combined total capacity to handle 90,000 pigs per year (Gandhi and Zhou, 2008). Hygiene and safety standards in these facilities are better. Box 17 provides an example from Punjab.

Box 17: Meat processing plants in Punjab

Punjab has three large meat processing plants. Together they process some 330,000 buffaloes per year with an output of some 66,000 metric tonnes per year (MTPY). All three plants are processing buffalo meat and exporting their products to countries overseas mainly to Gulf countries, Philippines and Malaysia. The three plants are:

Punjab Meats Limited: This is the oldest of all the plants. Its installed capacity is around 600 animals per day (40,000 MTPY). But it is running under capacity at around 300 animals per day (20,000 MTPY).

M K Foods: This is the biggest plant out of all three plants. It has an installed capacity of around 1,200 animals per day (70,000 MTPY) and is slaughtering around 600-700 (40,000 MTPY) animals per day.

Abbot Cold Store: This unit has an installed capacity if around 700 animals per day (40,000 MTPY) and are processing around 350-400 animals per day (2,500 MTPY).

Source: Kurup, Punjab (2008)

Off-take rates for live animals are low and domestic markets for live animals and meat are thin and unorganized. While majority of the producers are small, so sell one or two animals in a year, in some places, there are some larger flock owners who sell a larger number of animals. In Bihar, generally younger animals are sold, while in Orissa mature animals are sold. At festival times, farmers fatten animals for the season to get a premium price and a large number of animals are traded (S. Kumar 2007). Many times, farmers are forced to sell their animals at lower price to avoid bringing them back to their households. Weekly markets for small ruminants are characterized by lack of transparency. The

most prominent reasons cited by farmers for the low prices they receive are lack of bargaining power, distress sale, poor health of the animals, and lack of market information.

GOAT PROCESSING, SLAUGHTERING, AND MARKETING IN LAGGING REGIONS

Goat meat is the most heavily consumed meat in the rural areas because poultry development is still limited to the urban and peri-urban areas. There are two types of markets for goats: rural *haats* close to villages and large markets close to the city area. Survey evidence suggests that in Bihar, 75 percent of the retail shops are on the roadside, with hardly any amenities of water supply or electricity and no basic norms of health and hygiene. The scale of operations was low, with the average retailer selling around 25 animals per week. In Orissa, an average retailer sells about 150 animals per week with better amenities: *pucca* shops with basic amenities of water and electricity. Because of the high demand, shopkeepers are interested in upgrading the hygiene and cold storage facilities to enhance their business.

Middlemen often bring goats from the farmers' households to rural and urban markets. There are four types of middlemen involved in the goat chain: (a) collector/primary trader; (b) secondary trader; (c) commission agents (who bring buyers and sellers together in large markets); and (d) big traders. Again, survey data suggests that in Bihar, 75 percent of farmers sold their goats to traders/primary collectors at their doorstep for cash at what they regarded to be a low price. The main reasons for undertaking doorstep sales was uneconomic scale (with an average holding of 2-4 goats it was not worthwhile going to distant markets), lack of market information, perceived lack of transparency in price setting in weekly markets, sense of weak bargaining power in the market, and the fear of bringing animal back unsold.

The goat skin from Bengal goats is of high quality and attracts a premium price in the leather industry. Some industrial houses have, therefore, shown interest in the promotion of Bengal goats with the objective of improving the quality of their skin. This can help to increase the returns from the goat farming. A project financed by Sir Dorabji Tata Trust, Mumbai, is being implemented in West Bengal by Bhartiya Agro Industries Foundation (BAIF), Pune, to develop and improve Black Bengal goats.

GOAT VALUE CHAINS PRODUCE LOW RETURNS, BUT IMPROVEMENTS ARE POSSIBLE

Health Services. In Bihar, only 25 percent of goat-rearing households surveyed, reported having access to vaccinations; these were mostly in areas around Patna city where veterinary clinics were providing vaccinations free of cost. Also, about 50 percent of farmers reported access to primary health care and first aid, through veterinary centers in areas around the city and community health workers in the interior areas. Nevertheless, there is much more scope to enhance these services in the interior parts of the state.

Credit. Access to institutional credit is very poor. Credit is typically available from informal sources—money lenders, relatives, friends and traders—and mostly for agricultural purposes and social needs. Hardly any credit was availed for livestock purchase, and it was almost impossible to get credit for small

ruminants. Thus, strengthening alternate approaches to credit through women self help groups, etc. could be very helpful for the development of this sector.

Marketing – early sale by small farmers. In the case of Bihar, the average age of goats coming to the market is between 6-12 months (approx 9 kg body weight/6kg dressed meat), where a majority of the goats coming to the market are below 10 months of age. Average price received per goat is around Rs. 500. In Orissa, most of the goats sold were between the ages of 12-14 months, with an average selling price of about 1040. In both the states, the sale of animals is mostly in the nature of distress sale to overcome some immediate crisis. However, selling goats at a very young age does not allow the farmers to capitalize on the optimum returns.

Small Scale in Production. In the case of Bihar, the average animals sold per farmer is only about two. There is scope to introduce semi-intensive scale of operations, up to 10 animals per household. Also, if the goats are reared for up to 18 months instead of the usual practice of selling goats at below 10 months, the farmer returns can be much higher, up to Rs. 10,000 per year from goat rearing.

Small Scale in Trading and Marketing. In Bihar, the collector who goes door to door to collect animals has to travel large distances and is able to collect and sell about 15 goats per week. In the case of the trader and retailer, the average number of animals sold are about 25/week.

Low Returns. Returns to goat rearing for small farmer are low: approximately Rs 1.50 per day per goat in Bihar and Rs 3 in Orissa. The goats are reared on grazing and mostly children and women are involved in goat rearing. Goats are usually used to get immediate income in times of immediate need for money. There is need and scope to transform this into more income generating opportunity

Several goat development projects are trying to improve productivity and livelihood of the poor. Several development projects implemented by state governments and NGOs are promoting goat or sheep as a vehicle for poverty reduction. For instance, BAIF is implementing a small ruminant project in West Bengal covering 2500 families in nearly 40 villages and their hamlets in the two districts rearing about 10,000 goats. Farmer resource persons called ‘Prani Bandhu’ are selected from the villages and they are trained in improved goat husbandry and small farmer group management. Then groups of 10 smallholder producers are formed and given revolving credit to buy goats. Inputs and services like vaccines, drugs and feeds are also provided to improve productivity.

The Rajasthan Microfinance Initiative of the Sir Ratan Tata Trust (SRTT) has been implementing projects in collaboration with two NGOS—PRADAN and SRIJAN—aimed at poverty reduction through various activities including goat and dairy cattle rearing in 230-250 villages in three districts in Rajasthan (box 18). For goat rearing, the target is about 2000 families in Rajasthan who are given subsidized credit to buy improved animals but not for inputs though training is provided on improved husbandry including better housing and veterinary care, especially immunization against certain well-known killer diseases, such as Peste des Petits Ruminants. PRADAN is also implementing similar goat projects in Jharkhand and Orissa with funding from other sources.

Box 18: Building grassroots institutions to reach small ruminant markets in Rajasthan

In Rajasthan, there are more than 3500 small ruminant common interest groups (CIGs) promoted under the World Bank assisted District Poverty Initiative Project (DPIP) and several of them have federated themselves into goat federations (comprising 100-150 CIGs). The goat federation under DPIP in Jhalawad District, organized and managed by the Sadguru Foundation (an accomplished NGO), will be a model to follow. The AHD should work with the DPIP and Sadguru Foundation to promote the formation of SR Federations in all 7 DPIP Districts and equip them with a local weekly haat as a first step towards organized goat / sheep marketing.

The AHD should have a Chief Goat Federation Promoting Officer in its headquarters in Jaipur and one district level Goat Federation Promoting Officer (all as additional tasks to existing functionaries) in the 7 DPIP Districts. The model by-laws for the federation and the cost details are available with the DPIP and the AHD should adopt and follow them whole heartedly.

A few private sector initiatives are currently ongoing to develop large scale goat production farms and in some cases integrated goat value chains. An example of a large goat rearing farm is the Nadur Goat Farm situated in the southern part of India established in 2002 which specializes in breeding healthy goats. Its current production is more than 1000 goats per year. Another example of an emerging integrated large scale enterprise is the Shivaji Estate Livestock Farms Pvt. Ltd. (SELF), which is currently rearing 5000 heads of goats on several farms. The company represents an integrated chain with feed mills, slaughterhouse, a consultancy division to provide guidance on commercial goat farming. It is also currently expanding in the retail sector with restaurants, retail outlets for goat meat and milk in major cities of Maharashtra, a boar goat production farm to improve breeds, modern abattoirs, and tannery units and rendering plants for export of goat meat and leather, a training center to worker who would also be given goats for rearing under a scheme of the state government under which SELF has been given responsibility of providing loan and goats to 2000 persons below poverty line to improve their income.

MARKETING AND PROCESSING OF HIDES AND SKINS

The leather industry is concentrated in a few states but raw materials collected from around the country are of poor quality. The Indian leather industry has 125 medium and large-scale firms, and about 1,200 small-scale firms. Also thousands of tiny tanneries in rural areas process raw hides and skins before selling them to larger tanneries for proper processing. Three states—Tamil Nadu, Uttar Pradesh, and West Bengal—account for more than 80 percent of the country's leather output. Tamil Nadu alone accounts for about 50 percent of production, largely because it allows the slaughter of cattle. Hides and skins are traditionally collected from villages and towns and transported to major terminal markets. In recent years, tanneries have also started collecting skins from the district-level markets and urban areas. The quality of hides and skins retrieved from slaughterhouses is usually poor due to improper slaughtering and skinning. In addition to absorbing domestic supplies, the tanning industry imports skins to increase capacity utilization (Chawla, Kurup and Sharma, Animal Husbandry: State of the Indian Farmer 2004).

The industry has expanded taking advantage of low wages and lax environmental regulations compared to the leading countries. In the mid 1990s, the leather industry outputs consisted of 60 percent footwear, 12 percent garments and 10 percent bags (World Bank 1996). More recent figures are

not available. However, it is generally believed that the leather industry exhibited tremendous growth as a result of the simplification of export procedures, the government's decision to encourage exports of value-added leather, and the liberalization of capital goods and raw materials imports. Higher wages and strict enforcement of environmental regulations in the advanced countries on the one hand and low wages and lax environmental regulations domestically, on the other hand, have helped improve the competitiveness of Indian leather products. However, the tanning industry faces many problems including sizable losses due to the defective curing, preservation, storage, and handling of skins, and environmental pollution resulting from the improper disposal of waste products from the tanning process. To address the pollution problem, the government is restricting the establishment of new units and the expansion of existing tanneries.

Processing of goat for leather production offers good potential. The private sector has shown interest in the sector in West Bengal to take advantage of quality leather produced by Black Bengal goats. The private sector should be encouraged to put up leather processing plants to take advantage of large population of Black Bengal goats in Bihar and Orissa as well.

There are significant opportunities for growth but this requires technological improvement and investment. Growth in domestic demand and the export of meat will generate larger numbers of hides and skins in the future. Therefore, attention needs to be given to improve the quality of hides and skins by improving slaughtering and skinning techniques, and techniques to process raw hides and skins in primary small scale tanneries. In the future, importers may make greater demand for environmental regulations in the industry, so efforts should also be made to proactively and gradually improve the regulations and their enforcement rather than waiting for the demand to come and react later.

SUMMARY OF KEY POINTS

- Dairy sector reform in the 1990s benefited all parties: private investors, cooperatives, producers, and consumers. Competition has helped cooperatives to accept challenges and address some inefficiencies. Private sector plants have been mainly established in leading dairy states, thereby increasing competition for supply from the same hinterland.
- There have been increasing calls for dairy cooperatives' reforms, in areas of regular and timely elections; setting clear criteria for Board membership; autonomy in deciding milk procurement prices and sales prices; autonomy in staffing and CEOs appointment.
- Private enterprises have developed different kinds of value chains with different collection mechanisms, price determination, mode of payment, input and service delivery, and output marketing. In some cases, they have adopted the some of the lessons and principles of the cooperative value chains while in others, they adopted their own norms.
- Aggregate capacity utilization of cooperative processing plants are, at present, comparable to private processors and in some leading dairy states, cooperative value chains provide a larger share of consumer price to producers compared to private value chains. However, management

and performance of both cooperative and private sector enterprises in the lagging states remain poor.

- The future of dairy cooperatives in the leading dairy states lies in embracing more competition and investment in modernization of their facilities. Regional inequality in development can stifle the overall development potential of the sector, so in the lagging states, cooperatives and other forms of collective action need focused support to facilitate commercialization of smallholder dairy as the private sector is not likely to play that role adequately and effectively.
- Private sector led development in the poultry industry has benefited both producers and consumers. Contract farming in poultry, especially in broiler production, has increased rapidly and it has led to scaling up of production units.
- The concentration of the dairy and poultry industries in a few states and the increased scaling up of existing production units has seriously limited the opportunities to create wider geographical impact through participation of a larger number of smallholders, especially in the lagging states.
- Live animal and meat market chains have by poor infrastructure, high transaction costs, low producer share of consumer price, and are dominated by traditional intermediaries. Because of low meat consumption levels in the country, especially in the lagging states, off take-rates for animals in crop-livestock and pastoral systems are low.
- Development projects with small ruminants aimed at improving livelihood of the poor are primarily addressing problems of productivity improvement with little attention to market and consumer preferences to assure remunerative prices, though there are a few exceptions. A small number of private sector enterprises are trying to develop large scale integrated goat value chains but without adequate market assessment. There is room for integration of smallholder producers in such chains for the benefit of all stakeholders in the chains.
- Export is still a minor activity but has good potential. Export can be an alternative route to increase the off-take rate to improve productivity and solve the feed problem, but achievement of that will require investment to improve quality of output.
- Demand for more livestock products has been accompanied by demand for quality, safety, variety, and convenience; however, quality and safety standards in all value chains—dairy, poultry, ruminant meat, hides, and skins—leave much to be desired. Quality and safety standards in domestic and export value chains are managed through a mix of regulations and implementation agencies, and there is hardly any coordination among these agencies even where there is overlap and synergy. An integrated systems approach to value chain management by harmonizing the multiplicity of regulations will be needed to improve hygiene and quality standards.

- The market for inputs and outputs are drivers of intensification, commercialization, and specialization. However, information about the characteristics and constraints of emerging market institutions and value chains for different livestock commodities are scarce. For example, information on the volume of milk, meat, and eggs flowing through various value chains and their costs and margins too fragmentary to develop a clear picture on an objective basis to guide investment to improve the value chains. Development of appropriate policy and investment strategy by the government, private sector, cooperatives, and NGOs will require adequate empirical information on various components of the market and its dynamics.

SWOT ANALYSIS OF DAIRY, POULTRY AND SMALL RUMINANTS IN LEADING AND LAGGING STATES

DAIRY SUB-SECTOR

	Leading states	Lagging states
Strengths	<ul style="list-style-type: none"> • Strong demand for dairy products due to high income • History of dairy cooperatives in commercializing smallholder dairy • Green revolution created platform for commercial dairy. Scale of production and marketed surplus increasing • Large private sector investment in processing • Strong supporting infrastructure for breeding and health services • Fodder production and marketing on the rise 	<ul style="list-style-type: none"> • Smallholder producers waiting to be linked to urban markets • Cooperatives taken lead for infrastructure development in some places • Traditional milk marketing channels are short and inefficient but can provide a basis for modernization
Weaknesses	<ul style="list-style-type: none"> • Processing capacity concentrated in a few states, local supply shortage, need to procure from far at high transportation cost • Lack of private sector support for infrastructure development for production improvement • Quality and safety standards of products not adequately addressed • Public vets derive private benefits from the large and expanding market for health • Cooperative plants are small scale and use outdated technology 	<ul style="list-style-type: none"> • Poor and inadequate infrastructure, breeding and health services to support commercialization • Performance of both coops and private sector poor • Policy environment not conducive to attract large private investment • Lack of proper assessment of investment options • Inadequate crop sector growth to provide platform for dairy growth
Opportunities	<ul style="list-style-type: none"> • High growth potential due to expanding domestic market, and export market if standard and competitiveness can be improved • Integrated value chains and value additions to meet emerging demand for quality and variety 	<ul style="list-style-type: none"> • Potential local market due to rising income and demand • Unmet demand in leading states may be met • Traditional large dairy traders can innovate to enter modern marketing arena using their experience and skills
Threats	<ul style="list-style-type: none"> • Too much concentration and failure to modernize may lead to inefficiency 	<ul style="list-style-type: none"> • Small states may make unviable investments • Leading states may capture local market due to lack of competitiveness of local enterprises

COMMERCIAL POULTRY SUB-SECTOR

	Leading states	Lagging states
Strengths	<ul style="list-style-type: none"> • Strong demand for poultry due to high income and urbanization • Private sector taken lead in investment, research and creating support services and market institutions like contract farming • Strong supporting infrastructure for breeding, day old chick production and health services • Feed supplies nearby and feed import facilities convenient 	<ul style="list-style-type: none"> • Experiences of the small number of existing industries can guide plan for future development
Weaknesses	<ul style="list-style-type: none"> • High concentration of production enterprises in a few states, high transportation cost to access distance markets • Producers' and traders' organizations may show tendency to control market • Quality and safety standards of products not adequately addressed • Public vets derive private benefits from the large and expanding market for health due to restrictions on movement of vets between states 	<ul style="list-style-type: none"> • Poor and inadequate physical infrastructure including day old chick and feed supplies to support the industry • Rate of return lower than in leading states due to high cost of DOCs and feeds • Policy environment not conducive to attract large private investment • Lack of proper assessment of investment options • Some states have small overall size of market
Opportunities	<ul style="list-style-type: none"> • High growth potential due to expanding domestic market, and export market if standard and competitiveness can be improved • Integrated value chains and value additions to meet emerging demand for quality and variety 	<ul style="list-style-type: none"> • Potential market due to rising income and demand • Alliance of smaller states may make market larger and investment attractive
Threats	<ul style="list-style-type: none"> • Too much concentration may make the industry vulnerable to epidemics like Avian Influenza 	<ul style="list-style-type: none"> • Smaller states may make unviable investment • Local enterprises may not be able to compete with leading states in the market

SMALL RUMINANT SUB-SECTOR IN LAGGING STATES

Strengths	<ul style="list-style-type: none"> • Smallholder producers are waiting to be linked to urban and distant markets • A strong tradition for mutton consumption
Weaknesses	<ul style="list-style-type: none"> • Level of consumption is low due to low income, so off take rates are currently low • Traditional marketing channels are dominated by traders and brokers, producer share of retail price is low • Small ruminant development projects are production oriented. More attention should be given to market to assure remunerative prices and income to producers • Access to information on market supply, demand and prices is poor • Large scale integrated goat enterprises are being planned without proper market assessment • Policy environment not conducive to attract large private investment • Lack of proper assessment of investment options • Some states have small overall size of market • Low processing capacity
Opportunities	<ul style="list-style-type: none"> • Potential market due to rising income and demand locally and in some leading states • Smallholders can be linked with high value markets through contract farming to induce commercialization of smallholder production and improve quality of products demanded by high income consumers • Good Opportunities for goat meat and leather processing
Threats	<ul style="list-style-type: none"> • Decline in mutton consumption in recent years may continue due to changes in food habit and preferences for different types of meat, thus limit the future size of the mutton market • Leading states may be in a better position to respond to market demand due to already developed production systems and market infrastructure

6. LIVESTOCK TRADE

Prior to 1991, India had a protectionist trade policy and used instruments like quotas, tariffs, and non-tariff measures to protect its markets. However, since 1991, the economy has undergone a drastic reform process to better integrate with the world economy by relaxing controls and regulations, especially in the areas of trade, industry, and agriculture. GOI removed industrial licensing requirements, opened up the agriculture sector, and reformed its monetary policies and the financial sector.

In the post-reform era, the level of tariff protection on all Indian livestock products changed considerably. In 1995-96 almost 57 percent of livestock imports (based on tariff lines) were restricted by tariff rates of more than 35 percent. A 50 percent tariff was imposed on 70 out of 164 tariff lines. In 2005-06, the tariff rates levied on almost 90 percent of livestock commodities (based on tariff lines) dropped below 35 percent, some as low as 15 percent.

STRUCTURE AND PATTERN OF INDIA LIVESTOCK EXPORTS AND IMPORTS

Policy reform led to an increase in livestock trade activity. The value of India's livestock export value grew by 141 percent between 2000 and 2005 to reach a value of USD 1.02 billion (table 41). Similarly, the value of livestock imports rose by 39 percent over the same period to reach a value of USD 313 million in 2005. The share of livestock products in India's total agricultural exports reached 6.11 percent in 2004, rising up from 2.9 percent a decade before. At the same time, the share of livestock products in total agricultural imports declined from 7.54 percent in 1989-1991 to 1.82 percent in 2004.

Table 41: India's global export value for livestock and livestock products by broad commodity groups, 2001-2005, (US thousands)

Commodity Group	2001	2002	2003	2004	2005
Live Animal; Animal Products	1,042 (0.2)	1,259 (0.3)	4,383 (0.8)	5,238 (0.8)	5,920 (0.6)
Meat and Edible Meat Offal	250,942 (59.3)	279,705 (60.4)	365,024 (64.9)	379,678 (57.3)	618,598 (60.6)
Milk and Milk Products, Eggs	74,844 (17.7)	73,513 (15.9)	88,857 (15.8)	150,358 (22.7)	251,452 (24.6)
Products of Animal Origin, NES	41,763 (9.9)	41,104 (8.9)	36,637 (6.5)	34,430 (5.2)	40,158 (3.9)
Animal Fats	11,523 (2.7)	12,340 (2.7)	10,587 (1.9)	26,070 (3.9)	23,416 (2.3)
Wool & Woven Fabrics of Animal Hair	42,745 (10.1)	55,524 (12.0)	56,739 (10.1)	67,279 (10.1)	81,155 (8.0)
Total	422,859	463,445	562,227	663,053	1,020,699

Definition based on HS-6 digit 2002 classification is arrived at on the basis of author's interpretation of livestock products. Figures in parentheses represent the percentage share in the total value; Source: R. Mehta (2008)

Meat products constitute 60 percent of India's livestock exports. Meat is followed by milk products and eggs (25 percent) and wool, woven fabrics, and hair products (8 percent). Egg powder exports have been

a new addition in recent years but the quantities are still fairly small. The top five export destinations are Malaysia, Saudi Arabia, the United States, UAE, and Philippines. In 2005, over 27 percent of total livestock export value was generated by Malaysia, followed by the United States (20 percent).

Among meat products, bovine meat is the leading meat product exported. Bovine meat, alone, accounts for 96 percent of India's meat exports (table 42). It is followed by sheep and goat meat with a much smaller share of 2.5 percent. Chicken meat is also exported in smaller quantities, given the high domestic demand for poultry meat, which is not subject to the same socio-religious factors affecting beef and pork consumption.

Table 42: India: export of different meats in thousands of tons, 1995-2005

Commodity	1995	2000	2001	2002	2003	2004	2005
Bovine meat +	156.98	273.14	243.35	296.1	334.34	302.4	456.02
Chicken meat+	1.9	0.98	1.17	1.84	5.75	3.31	0.68
Duck, goose ,etc.meat+	9.17	5.62	3.07	3.73	3.74	2.23	0.86
Equine meat +	0	0	0.02	0.04	0.01	0.01	3.14
Meat, nec (inc. camel, game) +	0.35	0.42	0.15	0.48	0.79	2.15	1.43
Pig meat +	0.02	0.12	0.03	0.08	0.15	0.12	0.17
Rabbit meat +	0	0.01	0.01	0	0	0	0
Sheep and goat meat +	9.05	12.58	6.52	9.07	18.48	14.01	12.06
Turkey meat +	0.23	0.24	0.18	0.53	0.71	0.18	0.12

Source: (FAO 2009).

On the import side, wool and woven fabrics of animal hair are the major imported livestock products, with its share increasing dramatically from 64 percent of total livestock imports in 2001 to 85 percent in 2005. The shares of other livestock products imported—such as live animals, meat products, and milk products—remained essentially unchanged over the same period. Major import partners include Sri Lanka, Nepal, Malaysia, China, and Italy.

LIVESTOCK TRADE POLICY REFORMS

As mentioned earlier, India opened up its agriculture sector—reducing both tariff and non-tariff barriers—in the early 1990s to better integrate with the world economy. Non-tariff barriers, in the form of restrictive and centralized policies and the drive for self-sufficiency through quantitative restrictions, have significantly declined. However, from the mid-1990s through 2004/05, India's simple most favored nation (MFN) average tariff on livestock products continued to hover around 30 percent.

Though India's trading partners lowered their average tariff rates for livestock products, overall, their tariff rates on individual meat commodities remained relatively high (table 43). For instance, the average applied MFN tariff rate for livestock products by the United States was 4.6 percent in 2006. The applied tariff rate for bovine meat, however, was 18.7 percent, followed by 10 percent for poultry meat. China had the highest average tariff rate on livestock products among India's partners with 11.5 percent. These tariff rates indicate that there is considerable export demand that can be exploited if tariffs are reduced or eliminated.

Table 43: Structure and pattern of India's livestock exports/imports and Applied MFN Tariffs for Livestock Products-Select Countries

Class Interval	USA -06*	UAE-06	S.Arab-06	Malaysia-05	China-05	EU-06
A. Percentage Distribution (percent)						
0-5	66.4	12.4	12.4	89.3	5.4	69.4
5-10	10.9	87	87.6	8.6	27.7	20.1
10-15	16.4	0	0	0.5	30.1	4.9
15-20	4.7	0	0	1.5	21.7	5.6
20-30	1.6	0.5	0	0	15.1	0
Simple Average	4.6	4.5	4.4	0.9	11.5	3.4
B. Tariff rates* of different meats (percent)						
Meat of bovine animals	18.64	2.5	2.5	0	12	NA
Meat of swine	0	5	5	0	14.7	0
Meat of sheep or goats	Na	1.25	1.25	0	15.3	na
Meat and edible offal of the poultry	10	5	5	0	14	4.3
Rabbit meat	6.4	2.5	2.5	0	20	4.27
Pig fat, free of lean meat, and poultry fat	3.2	5	5	0	na	na
Meat and edible meat offal, salted, in brine, dried	1.1	5	5	0	25	14.3

* USA - 06 implies that MFN rates used to calculate the percentage distribution are for the year 2006. Similarly for UAE, Saudi Arabia, and the European Union. For Malaysia and China MFN rates were available for the year 2005.

**All given rates are averages of tariffs available at 6-digit HS 2002 description.

Source: Mehta (2008) based on World Integrated Trade Statistics

The average levels of tariff protection on animal feed have been reduced considerably from 50 percent in 1995/96 to 30 percent in 2005/06 leading to an increase in the import value of feed products (table 44). The import value of feed products increased by 131 percent during 2001-2005, though it remains small in absolute terms. The major commodity of animal feed imports is “animal feed preparation not elsewhere specified”, which constitutes more than 51 per cent of total feed imports. These include only compound feed and not coarse grains, like maize, which is perhaps the most important feed product used in India.

Demand for maize has been consistently increasing, but supply has more or less stagnated. India now follows tariff-quota regime for maize imports. The amount of in-quota has increased from 0.25 million tons during 2000 to 0.4 mill tons in 2006. The two ways in which this growing demand and supply imbalance of maize can be curtailed are: (a) farmers can increase production by using high yielding varieties of seeds, and (b) government reduces the applied tariff on maize to stimulate imports.

Table 44: India's trade value to world for animal feed, 2001-2005 (US\$ million)

Year		2001	2002	2003	2004	2005	percent change 2001-05
Total Export		509	316	730	7001	1126	121.4
Top 3 export items	Soya-bean oil-cake & other solid residues, whether or not ground or pellet	437	274	654	530	968	121.5
	Rape/colza seed oil-cake & other solid residues, whether/not ground/ pellet	28	22	27	107	81	183.6
	Ground-nut, oil-cake & other solid residues, whether or not ground or pellet	9	3	22	28	23	151.1
Total Import		41	58	75	79	97	131.2
Top Import item	Animal feed preparations nes	25	25	26	32	47	84.4

Source of data: R. Mehta, India's Livestock Trade Review (2008)

As table 44 also suggests, India has shown huge export potential in the feed sector with its exports increasing by almost 121 percent between 2001 and 2005. However, this is primarily driven by oil-cakes, particularly soya bean oil-cake, rapeseed oil cake, and ground-nut oil cakes.

GOI's fiscal incentives to develop the food processing industry have not been fully realized throughout the sector. Apart from deregulating the industry, GOI has provided the following incentives to attract private investment in the sector:

- Minimum export price condition on meat export was removed in 1993. This encouraged buffalo meat export.
- Exports of dairy products that were canalized through NDBD have been freed subject to quota.
- Excise duties on processed food products have been brought down from 16 percent in the late 1990s to eight percent now, and most livestock products are exempted from excise duties. Further, the new entrants in the industry are exempted from excise duties for their five years in the market.
- Custom duties on machinery and equipment used in processing have been reduced considerably.
- Ice-cream manufacturing, which was earlier reserved for the small-scale sector, is now open for large private sector investment.
- The food processing industry was accorded priority sector status for institutional financing in 1999. Several non-tax benefits, in the form of capital and credit subsidies are provided by the central and state governments to promote exports from lagging areas.
- The Agricultural and Processed Food Products Export Development Authority provides transport subsidies for exports of agricultural products, including dairy and meat products.

Limit to foreign direct investment (FDI) in the food processing industry has gradually been removed. Food processing now accounts for over four percent of the total FDI. FDI in food retailing is not allowed, except in single brand product retailing.

EXTERNAL COMPETITIVENESS OF INDIA'S LIVESTOCK PRODUCTS

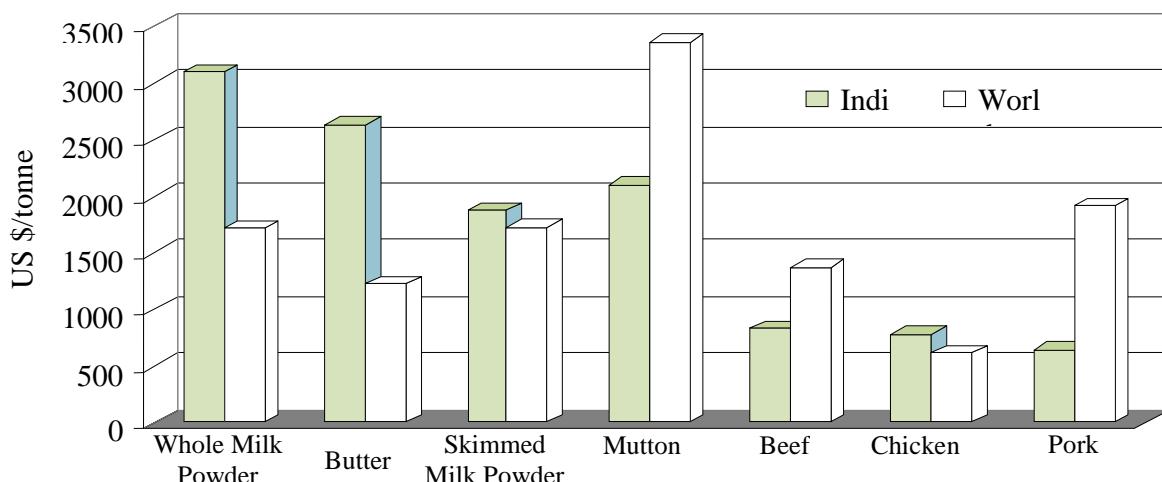
India lacks competitiveness in exports of dairy and chicken products but is highly competitive in the case of beef, mutton, and pork. Access to industrial country markets is limited by food safety and quality standards. Moreover, the world market for livestock products, especially dairy, is highly distorted due to 40-50 percent support given to producers in the developed countries (table 45 and figure 23).

Table 45: Producer prices of livestock products: India and other competitive countries

Commodity	India's Producer Price (US\$/ton) for the year 2005	Producer Price (US\$/ton) for the year 2005 of three competitive countries			Countries whose price is lower than India
Buffalo meat	360.08	454.36 (Indonesia)	762.67 (Sri Lanka)	890.68 (Bangladesh)	0
Cattle meat	360.08	876.45 (Indonesia)	657.92 (Sri Lanka)	962.9 (Bangladesh)	0
Chicken meat	1597.37	649.02 (Brazil)	831.97 (Indonesia)	909.16 (Pakistan)	50
Goat meat	2310.37	383.17 (Norway)	651.8 (Venezuela)	1061.45 (Brazil)	24
Pig meat	458.34	202.04 (Ethiopia)	471.5 (Guinea)	526.2 (Costa Rica)	1

Source of primary data: (FAO 2009).

Figure 23: Domestic and World Prices of Livestock Products, 2001-03



Source: Birthal, ISAE Conference (2007)

A number of factors like high domestic demand, high processing and transportation costs, distortions in world markets, and stringent food safety and quality standards hamper the free flow of export of livestock products from India. However, with the completion of the ongoing WTO negotiations, developed countries will reduce the subsidies they provide to their livestock sectors. This is expected to

lead to changes in external prices, which, in turn, will increase the external competitiveness of India's livestock exports in the global market to meet the growing demand.

FOOD SAFETY STANDARDS

With lowering tariff barriers and removal of quantitative restrictions on imports, non-tariff measures have emerged as the means to regulating trade flows. According to (Mehta, Nambiar, et al., Broiler and Egg 2003) the most commonly used non-tariff measures hindering India's export of livestock products are sanitary and phyto-sanitary (SPS) measures and Technical Barriers of Trade (TBT). Among the non-tariff measures, product characteristics required to protect human health, non-automatic license and licensing, and prohibitions to protect animal health and life have been levied the most. Testing, packaging, and labeling requirements have also hindered the flow of India's livestock exports.

With its attention previously centered on self sufficiency and quantitative regimes, India had not originally put enough emphasis on domestic and international food safety standards. Most of the standards were set up a couple of decades ago and inspection and certification of domestic standards are based on the set of rules defined in the Prevention of Food Adulteration Act of 1953. International standards, harmonization, certification, inspection etc. are being carried out under different rules.

Many institutions are dealing with food safety standards. In a way, food safety standards for export-oriented units were significantly higher than the domestic standards. The implementation of WTO-SPS has lead to significant concerns in India. A number of steps are being taken to breach the gap between domestic and international standards. The Indian livestock industry has faced some real challenges in order to follow these standards. This has lead, in some instances, to the closure of a number of export-oriented units in India and to increased production costs and the import of high technology to meet the changes in standards by the surviving units. In fact, the change in SPS standards (in destination markets) over time has affected the industry more than the higher level of standards.

SUMMARY AND POLICY IMPLICATIONS

Increased market liberalization may create opportunities for cheap imports of meat and other animal products and a challenge for export. With lifting of quantitative restrictions and reduction in tariffs on imports, there is a looming threat of cheap imports, which may reduce the competitiveness of meat export and also adversely affect the domestic meat value chains. Most importantly, livelihood of a large number of small-scale livestock producers may be adversely affected due to missed opportunities to increase their production, productivity and quality of products demanded by the market (R. Mehta, India's Livestock Trade Review 2008; Birthal, Linking 2008). But without significant investment for improvement of safety and quality standards in the export chains, opportunities for expanding export will be limited.

To deal with the challenges and the opportunities to expanding exports, the government could follow a variable tariff regime based on trends in international prices, in the short run, and continue to forcefully argue for reduction of subsidies and unbalanced support to the livestock sector in the major exporting

countries, in the medium to long term. More importantly though, especially in the ruminant livestock sector, development strategies for dairy and meat production should be considered in an integrated manner as there is a synergy between the two.

Development strategies should encompass more support to domestic livestock producers in the form of inputs, technology, extension, and market institutions to commercialize production, increase productivity, and the quality of products. Investments should also be made in both domestic and export value chains to improve the hygiene and safety standards of products demanded in the market. Appropriate infrastructure should be developed to better integrate domestic production with the global economy through the development of processing capacity, better transportation and port facilities, etc.

Concrete steps should be taken to see that the main ingredients of animal feed—i.e., maize and soya are available to livestock producers at reasonable rates. This can be done by increasing domestic production by (a) upgrading technological, and (b) setting minimum support prices at an appropriate level.. In addition, the tariff-quota regime of maize should be liberalized.

Steps should be taken to improve the existing domestic institutional set up of food safety regulations by avoiding a multiplicity of food laws and regulatory bodies, and to provide capacity building related to regulatory frameworks and enforcement. There should be coordination between different central/state ministries and export promotional councils/apex industrial bodies to respond to changing food safety standards.

Steps should be taken to upgrade and harmonize domestic standards with international standards. Livestock food testing laboratories in India should be encouraged to obtain accreditation from international agencies.

Market surveys, particularly in buffalo meat and beef, should be carried out to trace India's stand in relation to international standards. A technical institute could be set-up to provide scientific advice on matters relating to food safety. Similarly a system should be developed so that the information is disseminated to traders/producers in a timely manner.

7. TOWARDS A LIVESTOCK SECTOR DEVELOPMENT STRATEGY

India's 'white revolution' is a phenomenon as celebrated as the 'green revolution' in the development literature. National production levels of milk and other livestock products have increased exponentially over the last two to three decades and per capita availability of these products more than doubled over the same period. A key driver of increased supply was the increase in demand. As the economy grew and incomes rose, the share of livestock products in households' expenditures increased. As a result per capita consumption levels of major livestock products went up. This trend is expected to continue in the future.

Today, India has one of the largest livestock sectors of any country. It has the largest ruminant population in the world, including the largest national share of world cattle population, more than half of the world's domesticated buffaloes, the second largest number of goats, and the third highest in number of sheep. The livestock sector is an integral part of the farming system in the economy, driving agricultural growth, and providing employment to more than 20 million people, particularly women. Livestock sector development is not only important for overall economic growth, but essential for lifting a large number of rural households, who depend on the sector for living, out of poverty.

Notwithstanding the past success achieved, the Indian livestock sector is facing renewed development challenges which need to be squarely addressed for the sector to achieve its full potential. These challenges include low productivity levels, uneven regional development, weak and inadequate public services delivery, inadequate breeding strategy, feed deficits, high diseases incidence, limited access of producers to organized value chains, need for institutions reforms, low and misaligned levels of public expenditures, and a crowding out effect by the government, particularly in support services delivery.

INSTITUTIONS, PUBLIC EXPENDITURES, AND PUBLIC GOODS

Strategies for exploiting the potential for livestock sector growth need to be based on recognition of the existing uneven development among states. The development challenge in the lagging states is to capitalize on the potential for growth in livestock and feed sales to more prosperous consumption centers, including favoring supply response where the potential for marketing exists. This entails elaborating a strategic framework for livestock sector development that would encourage movement towards a broad-based and market-oriented production system in the lagging states.

Continued policy support for appropriate institutions and infrastructure development will be required in the leading states for further intensification and specialization of production systems to increase productivity, produce better quality, and safer products to respond to changing domestic and long-distance markets. In lagging states, appropriate policy and incentive structures need to be created to attract private sector and other sources of investment. In making policy and investment strategy, the comparative advantage of each lagging state in different commodities—dairy, poultry, ruminant meat, pork and hides and skins—should be objectively assessed and fed into prioritization, rather than trying to develop everything in each state.

Public expenditures on the livestock sector should increase in real terms to be more in line with the contribution of the sector to GDP. Public expenditure should be primarily for key public goods, as opposed to private goods. Prioritization and rationalization of public expenditures needs urgent consideration, given funding limitations and the often ineffective present use of budget allocations. Policies on public expenditure should vary between leading and lagging states depending on the degree of development of the livestock sector and the degree of market orientation for livestock inputs, services and outputs. In the leading areas, private sector firms may be able and willing to provide services for a profit that only the public sector can and will provide in the lagging areas.

Expenditures on research, education, and training are essential public goods for generation of new technologies, inputs and institutions to commercialize production systems. Yet they are meager and have increased only marginally over time. Raising investment in livestock research especially at state level, and its efficient deployment is critical. Incentives need to be created for private R&D targeted to the poor. There is also a need to strengthen research-policy-extension linkages and provide incentives for multidisciplinary systems research. Better coordination among various central and state government agencies collecting macro statistics should be increased to increase complementarities and compatibility of data, thus make better use of scarce resources.

Access to credit and insurance services should be enhanced significantly as finance is a major constraint for investment in improved technologies. The absence of an integrated approach to provision of credit and insurance services works to the disadvantage of not only smallholders but also for potential entrepreneurs interested in setting up livestock farms on a commercial scale. Workable public roles still need to be established, but there are elements to draw on. For example, the venture capital fund scheme of government of India implemented by NABARD has been very popular and might be expanded. Similarly, the network of micro-credit providers should be expanded specifically to lower potential areas. The problems faced by insurance products in India, like the costly claims adjustments and monitoring required for moral hazard and adverse selection might also be addressed to a large extent by offering index based insurance products. Index insurance and carefully layering of risks can offer a start to getting the biggest risks out of the local community.

BREEDS AND FEEDS

A national breeding policy needs to be developed to upgrade best performing indigenous breeds through selection and grading. This strategy should run alongside current AI programs with a view to merging the two into a single strategy in the medium to long term. Moreover, policy should encourage competition among alternative AI suppliers – government, cooperatives, NGOs, private sector – but choice of breeds should be guided by national breeding policy. Quality of breeding materials and infrastructure needs to be monitored carefully. It is important to integrate provision of AI and mainstream veterinary service to reduce reproductive disorders in crossbred animals. AI services should be delivered at farmers' doorsteps as paid inputs. Adequate attention needs to be given for buffalo breeding.

Inadequate feed supply (including roughage) is a major constraint to the increased production of ruminant livestock. Both domestic and world markets for feeds are volatile at present so price movements in the markets will need careful monitoring for choosing supplies from alternative sources. There is a need to increase production of quality fodder seeds, preferably by private sector players. Areas specific nutrient deficiencies should be assessed with interventions tailored to address them. In addition, there are opportunities to enrich crop residues through blocking with enrichment with molasses, and/or pelleting which would help in reducing the feed deficit. Feed technology packages can be based on degree of market-orientation and potential demand for feeds. Strategies for better management of CPRs through alternative institutional arrangements need to be developed, especially for pastoral systems. Development of such strategies will require innovations in reconciling the administrative and legal procedures in place with traditional institutions.

Compound feed should be encouraged and large scale investments in animal feed should be promoted with particular attention to quality. In addition, import restrictions on key feed ingredients should be removed, and tariff levels reviewed with participation from both feed producers and users.

ANIMAL HEALTH

New approaches are necessary for rationalization and reform in the animal health sector. Reform in the health services is required to allow an increasingly larger role for the private sector in the provision of these services, particularly with regard to curative services, which are largely private goods. Leading states, and better-off districts of lagging states, appear to profitably support the private veterinary sector. The role of the government here should focus on providing public goods such as disease surveillance and monitoring, regulation, and creating an enabling environment for private sector and other players to participate.

Complete privatization of government service delivery in the immediate future may not be feasible, however, especially in the relatively remote and marginal areas. A reform policy, therefore, needs to identify an appropriate targeting mechanism for the poor in marginal areas, as well as for those who live amongst better-off farmers in leading areas and who may not have access to these services due to their low financial capacity. The Government will have a much more direct role in these areas compared to relatively better-off areas. However, even in remote and marginal areas the government need not be the only--or even the dominant--player. It will be desirable to work with non-government organizations and other stakeholders in sensitizing poor communities towards creation of demand for these services, training community based health workers for minor treatments, providing drugs and supplies on cost in areas where private distribution network is weak, providing extension advice related to animal husbandry including feeding practices and shelter innovations, etc. Given the current concentration of government veterinary centers in relatively better-off areas, reducing government presence in curative service delivery in these areas can release significant resources for focusing on marginal areas.

Restrictions on inter-state movement of veterinarians should be relaxed to correct imbalances in supply and demand for veterinarians. However, lagging states should take into account meeting their emerging

requirements. State governments should also disinvest loss-making vaccine production units and collaborate with neighboring states for specialization and inter-state trading of vaccines.

Development of cost-effective disease control strategies and catalytic regional, national and international action for the control of trans-boundary diseases is needed. In order to reduce the threat of trans-boundary animal diseases like bird flu, preventive health care needs more investment. The government should facilitate rational resource allocation by undertaking sound epidemiological and economic analysis of various diseases. Disease investigation facilities should be modernized, where existing, and created where non-existing and the capacity building of the public sector staff should also be given higher importance. The system of Avian Influenza monitoring needs extensive community participation and integration with the system of general disease reporting and diagnosis, especially in the case of backyard poultry.

PUBLIC AND PRIVATE ROLES IN MARKETING

Demand for livestock products in terms of quantity, quality and variety is expected to increase rapidly in the future. However, the marketing systems of the livestock sector remain relatively unorganized, leading to high transaction costs for the smaller players. Investment in promoting access to growing urban markets and processing of dairy and meat products will be one of the critical elements for enhancing the competitiveness of small producers and poor households. There are significant economies of scale in collection, distribution and processing of livestock products. Given the very small marketable surplus of individual households, it is necessary to build institutions that can vertically integrate small and scattered producers with dairy processors. Hence, it is essential that new and durable systems such as producer cooperatives, efficient contracting and procurement by private players be developed. There is a need to raise producers' awareness to produce quality dairy products with reduced safety risks.

The future of dairy cooperatives in the leading states lies in embracing more competition and investment in modernization of its facilities. In the lagging states, cooperatives and other forms of collective action need considerable support to improve efficiency and facilitate commercialization of smallholder dairy, as the private sector is not likely to play that role adequately and effectively. In order to achieve better performance, the cooperatives need to be in a position to separate politics from business, insist on competent professionals in management, and avoid interference in technical and business decisions.

Meat processing and marketing offer great scope for private investment to meet domestic and export demand. There is a public role in encouraging such investment; for example, slaughterhouses and meat processing plants for mutton should be set up in major consuming areas for sheep and goats in the lagging states, and this may need some state involvement to get going. There is an increasing need to improve the quality of livestock products and follow good hygienic practices that would meet the sanitary and phyto-sanitary specifications for export. Investment is required for establishment of laboratories for quality testing, human resource development and building public awareness towards the quality of livestock products. The government's role should not be of direct involvement, but one of

promoting and ensuring fair competition in the market, and the establishment and enforcement of hygiene, sanitary and quality standards. Government needs to harmonize rules, regulations and regulatory authorities to strengthen public monitoring of hygiene standards. It is also important to increase farmers' awareness about the importance of quality and hygiene standards through extension and communication campaigns.

The organized private sector has developed efficient production systems for eggs and broilers in the leading states. It has improved the efficiency of the production and marketing systems, brought down retail prices, and is conducive to the adoption and benefit of large sections of the rural population. There is potential to encourage this model throughout the country through public-private partnership that targets finance and services.

Identification of real marketing bottlenecks and critical areas of market development through a good livestock market information and research system would be very helpful in promoting market competition. In leading states, producer associations have met this challenge. In Andhra Pradesh, the National Egg Coordinating Committee, for example, has contributed to much more stable egg prices that benefit both producers and consumers, all through improved market information and coordination. The Gujarat Milk Marketing Federation has already created an e-network covering their district milk producers' cooperative unions.

To improve the functioning of regulated markets, reforms are required in the State Agricultural Product Markets Acts. The draft model legislation on agricultural marketing has been discussed by the states at several levels and has already been adopted by several states. At present, the markets in question are regulated at the initiative of state governments alone. Proposed reforms in the draft model legislation provide for the establishment of markets by private persons, farmers and consumers, including allowing more than one market in a market area or milkshed. The proposed Model Act includes provisions for promoting direct marketing. The objective is to create incentives for quality and enhanced productivity, better technology and technology support, reduction of distribution losses and the raising of farmers' income. The government's role should be that of a facilitator rather than that of having control over the management of the markets. Adoption of the Model Act by the states needs to be accelerated.

Finally, government has a continuing role in promoting food safety, especially as it is often difficult for private actors to recover the extra costs of proving safer food. Dairy product marketing over time will need to change from door-to-door sale to organized and coordinated chains and subsequently to supermarkets sales, especially since large numbers of urban households have refrigeration facilities at home allowing larger purchases, and prompt refrigeration of packaged purchases made away from home. Poultry product retailing needs to move from live/raw to the processed and frozen mode. The retailing of other meats also needs to be consolidated and modernized into managed outlets that take into account minimal food safety norms. As these changes occur, the setting, monitoring, and certification of standards by competent authority will become increasingly important.

SUMMARY OF KEY POLICY PROBLEMS AND RECOMMENDATIONS

Policy recommendations, needed supportive measures, expected outcomes and risks are summarized in the Policy Matrix below.

Problem area	Recommendation	Supportive Measure	Expected outcome	Risks
I. Development Strategy				
Uneven development across regions and states	<p>GOI</p> <ul style="list-style-type: none"> Take proactive measures to reduce inter-regional and inter-state differences in development through policy and investment support to the states. <p>State governments</p> <ul style="list-style-type: none"> Create incentive structures to attract private sector and other sources of investment Provide considered support to cooperatives to facilitate commercialization of smallholders Make blocks or alliances with neighbouring state(s) in investment projects to derive benefits of economies of scale and larger market 	<p>GOI</p> <ul style="list-style-type: none"> Facilitate collaboration among states where there are opportunities to benefit from economies of scale and larger size of market. <p>State governments</p> <ul style="list-style-type: none"> Make objective assessment of potentials and constraints to help investors – private or public- to take investment decisions on rational and realistic basis. 	<ul style="list-style-type: none"> Increased investment and infrastructure development in lagging states Greater market orientation among smallholder livestock producers and increased income and employment Reduced inequality between states and regions in livestock development and its overall impact on growth 	Competition among states, especially smaller ones, to attract investment may lead to adoption of unviable policy and misdirected investment strategy.
II. Breeding				
• Breeding policy based on exotic blood and artificial insemination is inadequate for sustained development	<p>GOI</p> <ul style="list-style-type: none"> Develop a national breeding policy to upgrade best performing 	<p>State governments</p> <ul style="list-style-type: none"> Participate in national breeding policy implementation strategy 	<ul style="list-style-type: none"> A sustainable basis for development of breeds in the country Exploitation of the 	Building consensus among breeders may be difficult to adopt and launch a breeding policy to develop indigenous

Problem area	Recommendation	Supportive Measure	Expected outcome	Risks
<p>of breeds and development of the dairy sector.</p> <ul style="list-style-type: none"> Efficiency in AI is generally low and more costly for government and cooperative providers 	<p>indigenous breeds through selection and grading, and help run this strategy alongside current AI programs with a view to converge the two into a single strategy in the medium to long term.</p> <ul style="list-style-type: none"> Give adequate attention to buffalo breeding. Focus public sector poultry breeding mainly on conservation 	<p>on an objective basis for development of local breeds.</p> <ul style="list-style-type: none"> Create environment for competition among alternative suppliers of AI where appropriate based on existing conditions of infrastructure and market. Integrate provision of AI and mainstream veterinary service to reduce reproductive disorders in crossbred animals. 	<p>potential of buffaloes.</p> <ul style="list-style-type: none"> Improved performance of AI programs and higher efficiency in dairy production. Diversity of poultry genetic resources conserved before they are lost 	breeds through selection and grading.
III. Feeds				
<ul style="list-style-type: none"> Inadequate feed supply is a general technical constraint to increase production of ruminant livestock but feed technology packages have been promoted without regard to its potential demand in different production systems. In leading states, good fodder varieties and good quality seeds are in short supply High volatility in world feed market for commercial poultry and dairy production, 	<p>GOI</p> <ul style="list-style-type: none"> Maintain balance between domestic production and import of feeds given high volatility in world feed market. Remove import restrictions on feed ingredients <p>State governments</p> <ul style="list-style-type: none"> Develop feed technology packages for extension dissemination taking into account potential demand for feeds which is driven by the degree of market-orientation and 	<p>State governments</p> <ul style="list-style-type: none"> Use GIS-based analysis to map production systems and recommendation domains for different feed technology options based on area specific nutrients deficiency, degree of market-orientation, and potential demand for feeds. Encourage private sector investment in feeds and fodder seeds and other technologies based on potential market. Increase domestic production key feed 	<ul style="list-style-type: none"> Better targeted feed technology options for extension More efficient use of available feed resources Increased productivity of livestock 	Failure to distinguish feed scarcity and need from feed demand in different production systems may continue to influence policies on feed technology research, extension and investment for feed production.

Problem area	Recommendation	Supportive Measure	Expected outcome	Risks
inadequate domestic production of feeds yet reduced import, and larger increase in feed prices than prices of outputs.	<p>intensification of production systems.</p> <ul style="list-style-type: none"> • In less market oriented production systems facing feed constraint, extension messages should include advice on rationale for culling unproductive animals as a route to improve efficiency in use of available feeds. • Where CPRs are main feed sources, harmonize formal rules and regulations with local institutions to better manage such resources. 	ingredients.		
IV. Animal Health - Veterinary and extension services				
<ul style="list-style-type: none"> • Preventive health care services are given highly inadequate attention in relation to the importance of various diseases. Avian Influenza is a new challenge. • Curative health care services are underfunded and ineffectively utilized. Public sector subsidies do not reach many, especially poor, as only a small proportion of households use veterinary services • Extension services are 	<p>GOI</p> <ul style="list-style-type: none"> • Preventive health care, including Avian Influenza monitoring and control, needs more investment. <p>State governments</p> <ul style="list-style-type: none"> • Increase coordination with GOI and the neighbouring states for designing strategies for disease control. • Disinvest loss making vaccine production units and collaborate with neighbouring states for specialization and inter-state trading of vaccines. • Leading states, where 	<p>GOI</p> <ul style="list-style-type: none"> • Facilitate rational resource allocation by undertaking sound epidemiological and economic analyses on various important diseases. <p>State governments</p> <ul style="list-style-type: none"> • Develop alternative options or models for transition from public sector to multiple supplier based systems and undertake pilot tests. Different states may test different models and share experiences for 	<ul style="list-style-type: none"> • More effective allocation and utilization of limited public funds • More targeted delivery of veterinary and extension services leading to higher rate of use of health inputs • Increased productivity 	Withdrawal of public veterinary services may unduly disadvantage smallholders and the poor if adequate safeguards for them are not included in the transition programs.

Problem area	Recommendation	Supportive Measure	Expected outcome	Risks
used by even fewer households.	public veterinarians provide private services extensively, should immediately start the transition from public sector based service to competitive multiple supplier based service and make appropriate arrangements with the veterinarians for provision of private vs. public services during the transition period. In lagging states, degree of market orientation of producers and status of infrastructure and personnel will determine course of action.	final adoption and scaling up. <ul style="list-style-type: none">• Relax restrictions on inter-state movement of veterinarians to correct imbalances in the supply and demand for veterinarians in some states but the lagging states should protect their interest to meet their emerging requirements.		

V. Markets, institutions and value chains

<ul style="list-style-type: none"> • Cooperative dairy value chains in lagging states perform poorly • Private sector dairy and poultry industries are concentrated in a few leading states • Poor quality and safety standards of products is a problem for export as well as for higher end domestic market • Information on characteristics and 	GOI <ul style="list-style-type: none"> • Create incentive structures for investment in lagging states to reduce gaps in development. • Harmonise rules, regulations and regulatory authorities, in collaboration with state governments, to strengthen public monitoring of hygiene standards • Make more investment 	State Governments <ul style="list-style-type: none"> • Facilitate research and assessment of market and investment potentials to guide public and private sector investment in the sector. • Give attention to market demand and necessary infrastructure while developing livestock development projects targeted to the poor. 	<ul style="list-style-type: none"> • Greater efficiency in market performance and benefits for all actors in value chains • More functional market links between leading and lagging states • Reduction of regional and inter-state inequality in livestock development 	Limited size of markets in smaller lagging states may be a constraint in attracting private sector investment
--	--	--	--	---

Problem area	Recommendation	Supportive Measure	Expected outcome	Risks
<p>constraints of emerging value chains highly inadequate.</p> <ul style="list-style-type: none"> Development projects on cattle, small ruminants and pigs are production oriented without attention given to market and demand to assure remunerative price and income. 	<p>for improving hygiene standards</p> <ul style="list-style-type: none"> Undertake more research on input and output markets including export. <p>State governments</p> <ul style="list-style-type: none"> Give considered support to cooperatives and other forms of collective action in lagging states but take measures to improve efficiency. Make proactive measures to encourage private sector investment in lagging states. Try to link new investment with both local demand, which may be small in the beginning, and supply shortages in some leading and high growth states. Expand investment for expanding export of ruminant meat both for export earnings and as a mechanism to increase off take rates, which will indirectly resolve problems of inadequate feed supply and inefficient feed utilization. 			
VI. Public expenditure, credit and insurance				
<ul style="list-style-type: none"> Public expenditure is 	GOI		<ul style="list-style-type: none"> More effective and 	

Problem area	Recommendation	Supportive Measure	Expected outcome	Risks
<p>inadequate, spent mostly on salaries and administration</p> <ul style="list-style-type: none"> Allocation of budget among species, disciplines and problem areas is not ideal. Research expenditure is small, research-policy-extension linkage is poor Access to credit and insurance is limited, especially for smallholders. 	<ul style="list-style-type: none"> Increase and rationalise public expenditure among species, disciplines and problem areas. Increase research expenditure, strengthen research-policy-extension linkage, provide incentives for multidisciplinary systems research. Create incentives e.g. tax subsidy, for private sector investment in research targeted to poor. <p>State governments</p> <ul style="list-style-type: none"> Complement GOI policies and rationalise state budget expenditures, especially on provision of public vs. private goods. Recognize different credit and insurance needs of large vs. small farms, and develop appropriate credit and insurance delivery programs for them. 		<p>productive utilization of public funds</p> <ul style="list-style-type: none"> More client oriented, relevant and productive research outputs. Stronger research-extension linkage 	<ul style="list-style-type: none"> Implementation of a dual system - quick transition to multiple supplier based vet service in leading states and slow transition in lagging states - may be difficult. Disciplinary biased research systems may continue to drive research agenda and limit effective delivery of research outputs.

WORKS CITED

- [CLMFA] Compound Livestock Feed Manufacturers Association. *CLFMA Of India*. <http://www.clfmaofindia.org/> (accessed May 15, 2009).
- Ahuja, V, and E. Redmond. "Economic and Policy Issues in the Livestock Service Delivery to the Poor." In *Tropical and Animal Health and Production*. 2004.
- Ahuja, V, J Morrenhof, and A Sen. "The Delivery of Veterinary Services to Poorer Communities: The Case of Rural Orissa, India." *Scientific and Technical Review (OIE)* 22, no. 3 (2003): 931-948.
- Ahuja, V, K.E. McConnell, D Umali, and C de Haan. "Are the Poor Willing to Pay for Livestock Services? Evidence from Rural India." *Indian Journal of Agricultural Economics* 58, no. 1 (2003): 84-100.
- Ahuja, V, M Rajasekhar, and R Raju. *Animal Health for Poverty Alleviation: a Review of Key Issues for India*. Background Paper, Washington, DC: mimeo, 2008.
- Ahuja, V., et al. *Agricultural Services and the Poor: Case of Livestock Health and Breeding Services in India*. IIM, Ahmedabad, The World Bank, Washington DC and SDC, Bern: processed, 2000.
- Akter, S, et al. *Drought and Vulnerability of Livestock in India*. Vol. ILRI Targeting and Innovation Discussion Paper 9. London and Nairobi: Overseas Development Institute, 2008.
- Bhasin, N.R. "Livestock and Pro-poor in Bihar and Orissa". Background paper prepared for a World Bank study. Washington DC: processed 2008
- Bhatia, J., K. Pandey, and K.S. Suhag. "Economic Analysis of Sheep and Goat Rearing in Rainfed Region of Haryana." *Indian Journal of Animal Sciences* 75, no. 12 (2005): 1423-1432.
- Birthal, P.S. *India's Livestock Sector: an Overview*. Background Paper prepared for a World Bank study, Washington, DC: processed, 2008.
- . "Linking Smallholder Livestock Producers to Markets: Issues and Approaches." *67th Annual Conference of the Indian Society of Agricultural Economics, November 5-7, 2007*. Lucknow: Indian Society of Agricultural Economics (processed), 2007.
- Birthal, P.S. "Linking Smallholder Livestock Producers to Markets: Issues and Approaches." *Indian Journal of Agricultural Economics* 63, no. 1 (2008): 19-37.
- Birthal, P.S., A.K. Jha, and A.K. Joseph. *Livestock Production and the Poor in India*. processed, New Delhi: processed, 2006.
- Birthal, P.S., and A.K. Jha. "Economic Losses Due to Various Constraints in Dairy Production in India." *Indian Journal of Animal Sciences* (75) 12 (2005): 1470-1475.

Birthal, P.S., and V.K. Taneja. *Livestock Sector in India: Opportunities and Challenges for Smallholders*. Vol. Workshop proceedings 14, in *Smallholder Livestock Production in India: Opportunities and Challenges*, edited by P.S. Birthal, V.K. Taneja and W. Thorpe. New Delhi and Kenya: National Centre for Agricultural economics and Policy Research (NCAP); The International Livestock Research Institute (ILRI), 2006.

Birthal, P.S., P.K. Joshi, and A. Gulati. *Vertical Coordination in High-value Food Commodities: Implications for Smallholders*. Markets, Trade and Institutions Division Discussion Paper No. 85, Washington, DC: International food Policy Research Institute, 2005.

Birthal, P.S., P.R. Deoghare, S. Kumar, Riyazuddin, J. Jayshankar, and A. Kumar. *Development of Small Ruminant Sector in India*. Project Report, New Delhi: NCAP, 2003.

Blümmel, M., and P. Parthasarathy Rao. "Fodder Market in Hyderabad in India and Stover Value Chain Evaluation from Farmer to Trader in One Selected Supply Area: a Rapid Assessment." Draft report prepared for the International Livestock Research Institute, Nairobi, 2008.

Central Statistical Organization. *Central Statistical Organization*. http://mospi.nic.in/cso_test1.htm (accessed 2008).

Central Statistical Organization. *National Accounts Statistics Back Series 2007*. Government of India report, New Delhi: Ministry of Statistics & Programme Implementation, 2007.

Chand, S. *An Economic Analysis of Production and Marketed Surplus of Milk on Rural Farms in Kurukshetra District*. PhD Thesis, Karnal: Division of Dairy Economics, Statistics and Management, National Dairy Research Institute, 1997.

Chandel, B.S., D.K. Jain, and J.P. Dhaka. *Dairy Value Chain Analysis in Dynamic Regions of India*. Background paper to the India Livestock Sector Review, Washington, DC: World Bank, processed, 2008.

Chawla, N.K., M.G.P. Kurup, and V.P. Sharma. *Animal Husbandry: State of the Indian Farmer*. Vols. A Millennium Study, Vol. XII. New Delhi: Academic Foundation, 2004.

—. *Animal Husbandry: State of the Indian Farmer*. Vols. A Millennium Study, Vol. XII. New Delhi: Academic Foundation, 2004.

Comptroller and Auditor General of India. *Comptroller and Auditor General of India*. 2009. <http://www.cag.gov.in/> (accessed 2009).

Conroy, C. *Livestock Sector Growth and Poverty, with Particular Reference to India*. Chatham: National Resources Institute, 2004.

Conroy, C., et al. "Improving Backyard Poultry Keeping: A case study from India." *Agricultural Research and Extension Network*. 2005. <http://dfid-agriculture-consultation.nri.org/theme1/keypapers/livestockrevolution.pdf>.

Punjabi, M., K.M. Singh, R.K.P.Singh, Sujitav Dash, N.R. Bhasin. *Dairy Value Chains in Bihar and Orissa*. Background paper for the India Livestock Sector Review, Washington, DC: Worldbank, processed, 2008.

Punjabi, M., K.M. Singh, R.K.P.Singh, Sujitav Dash, N.R. Bhasin. *Goat Value Chain Analysis in Bihar and Orissa*. Background Paper for the India Livestock Sector Review, Washington, DC: World Bank, processed, 2008.

Punjabi, M., K.M. Singh, R.K.P.Singh, Sujitav Dash. *Poultry Value Chains in Bihar and Orissa*. Background paper prepared for the India Livestock Sector Review, Washington, DC: World Bank: processed., 2008.

Punjabi, M., B.S. Sathe. *Poultry Value Chains in Andhra Pradesh*. Background paper prepared for India Livestock Sector Review, Washington, DC: World Bank: processed, 2008.

Dairy India Yearbook. *Dairy India 2007*. 2007. <http://www.dairyindia.com/> (accessed 2009).

Datanet India Pvt. Ltd. . *Indiastat.com*. <http://www.indiastat.com/default.aspx> (accessed 2008).

Delgado, C, M.W. Rosegrant, and S. Meijer. "Livestock to 2020: The Revolution Continues." *International Food Policy Research Institute*. 2001. http://www.ilri.org/ILRI_Dev/misc-pdf/delgado.pdf (accessed October 2, 2007).

Delgado, C., M.W. Rosegrant, H. Steinfeld, S. Ehui, and C. Courbois. *Livestock to 2020: The Next Food Revolution*. Vol. Agriculture & Environment Discussion Paper 28. Washington, DC: International Food Policy Research Institute, 1999.

Department of Animal Husbandry, Dairying, & Fisheries. *17th Indian Livestock Census 2003-District Wise*. 2003. (accessed June 2, 2009).

Dhaka, J.P., D.K. Jain, V.K. Kesavan, and L. Singh. *A Study of Production and Marketed Surplus Functions for Milk in India*. Indo-Swiss Project Report, Karnal: Division of Dairy Economics, Statistics and Management, National Dairy Research Institute, 1998.

Dixie, Grahame. "Personal communication." 2008.

Erenstein, O., W. Thorpe, J. Singh, and A. Varma. *Crop-Livestock Interactions and Livelihoods in the Indo-Gangetic Plains, India: A Regional Synthesis* . Mexico City: CIMMYT., 2007.

Fairoze, M.N., et al. "Equitable intensification of smallholder market-oriented poultry production in India through contract farming." In *Contract Farming of Milk and Poultry in India: Partnerships to Promote the Environmentally Friendly and Equitable Intensification of Smallholder Livestock Production*, by IFPRI-FAO. Washington, DC: International food Policy Research Institute, 2006.

FAO. *FAOSTAT*. Rome: Food and Agriculture Organization of the United Nations, 2009.

Gandhi, V., and Z. Zhou. *Marketing Of Livestock And Livestock Products*. ackground paper to the India Livestock Sector Review, Washington, DC: processed, 2008.

GOI. *Department of Consumer Affairs*. 2002-2008. <http://wbconsumers.nic.in/> (accessed 2008).

Government of India. *Basic Animal Husbandry Statistics*. AHS Series 10, New Delhi: Ministry of Agriculture, 2006.

—. *Census of India*. Registrar General and Census Commissioner. 2001. <http://www.censusindia.net/> (accessed April 15, 2009).

Government of India. *Employment and Unemployment Situation in India: 2004-05*. NSS Report No. 515, New Delhi: National Sample Survey Organisation, Government of India, 2006.

Government of India. *Report of the Working Group on Animal Husbandry and Dairying for the Eleventh Five Year Plan (2007-2012)*. New Delhi: Planning Commission, Government of India, 2007.

Government of India. "Report of the Working Group on Animal Husbandry and Dairying for the Tenth Five Year Plan (2002-2007)." Planning Commission Report, New Delhi, 2002.

Gupta, J.N., C.B. Singh, and R.K. Patel. "Creditworthiness of Landless Farm Labours, Marginal and Small Farmers for Dairy Loans." *Asian Journal of Dairy Research* 2, no. 3 (1983): 153-156.

Kalra, K.K., S.B. Agarwal, and R. Malhotra. *Milk Pricing for Dairy Farms in Milk Shed Area of a Dairy Federation*. Research Project Report, Karnal: National Dairy Research Institute (Deemed University), 2008.

Krishnan, C., and B. Krishnan. "Role of RRB's in Dairy Financing- A Case Study." *Agricultural Banker* 12, no. 3 (1989): 10.

Kulkarni, S.D. "Agricultural Mechanization: Present Scenario and Perspective." Paper presented at the meeting of the Governing Council of the Asia and the Pacific Center for Agricultural Engineering and Machinery of the UNESCAP, New Delhi, 2005.

Kumar, P., and P.S. Birthal. "Changes in Consumption and Demand for Livestock and Poultry Products in India." *Indian Journal of Agricultural Marketing* 18, no. 3 (2004): 110-123.

Kumar, P., Mruthyunjaya, and M.M. Dey. "Long Term Changes in India Food Basket and Nutrition." *Economic and Political Weekly*, 2007.

Kumar, P., Mruthyunjaya, and P.S. Birthal. "Changing cosumption Pattern in South Asia." In *Agricultural Diversification and Smallholders in South Asia*, edited by P.K. Joshi, A. Gulati and Jr., R. Cummings. New Delhi: Academic Foundation, 2007.

Kumar, S. *Commercialization of Goat Farming and Marketing of Goats in India*. Mathura: Central Institute for Research on Goats, 2007.

Kurup, M.P.G. *Livestock Sector: Punjab*. Background paper for the India Livestock Sector Review, Washington, DC: World Bank (processed), 2008.

Kurup, M.P.G., ed. *Livestock: the Socio-economic Perspective in Orissa*. New Delhi: Manohar Publishers and Distributors, 2003.

Kurup, M.P.G. *Study of the Livestock Sector in Selected States of East India: Orissa*. Background paper for the World Bank review of the India livestock sector, processed, 2008.

Kurup, M.P.G. *Study of the Livestock Sector in Selected States of East India: Punjab*. Background paper for the World Bank review of the Livestock Sector, processed, 2008.

Landes, M., S. Persaud, and J. Dyck. "India's Poultry Sector: Development and Prospects." *Agriculture and Trade Reprot WRS04-03*, 2004.

Landes, M., S. Persaud, and J. Dyck. *India's Poultry Sector: Development and Prospects*. USDA Agriculture and Trade Report WTS -04-03, Washington, DC: USDA, 2004.

Mehta, R. *India's Livestock Trade Review*. Background paper for the India Livestock Sector Review, Washington, DC: World Bank (processed), 2008.

Mehta, R., R.G. Nambiar, C. Delgado, and S. Subrahmanyam. *Policy, Technical, and Environmental Determinants and Implications of the Scaling-Up of Broiler and Egg Production in India*. Annex II, Final Report of IFPRI-FAO Livestock Industrialization Project: Phase II, Washington, DC: International Food Policy Research Institute, 2003.

Mehta, R., R.G. Nambiar, C. Delgado, and S. Subramanyam. "Policy, Technical and Environmental Determinants and Implications of the Scaling-up of Broiler and Egg Production in India." In *Livestock Industrialization, Trade and Social-Health-Environmental Impacts in Developing Countries, Phase II*, by IFPRI-FAO. Washington, DC: International Food Policy Research Institute, 2003.

Mehta, Rajesh. *India's Livestock Trade Review*. Background paper for the World Bank review of India's livestock sector, processed, 2008.

Milne, Grant. "Personal communication." Washington, DC, June 9, 2009.

NABARD. *National Bank for Agriculture and Rural Development*. 2007. <http://www.nabard.org/> (accessed 2009).

NDDB [National Dairy Development Board]. *Annual Report 2007/07*. Anand: National Dairy Development Board, 2007.

NDDB. *National Dairy Development Board*. 1999-2009. <http://www.nddb.org/> (accessed 2009).

NSSO [National Sample Survey Organization]. *Access to Modern Technology for Farming: Situation Assessment Survey of Farmers*. NSS Report No. 499, New Delhi: Government of India, 2005.

NSSO [National Sample Survey Organization]. *Livestock Ownership Across Operational Land Holding Classes*. Report of the Ministry of Statistics and Programme Implementation Report No. 493 (59/18.1/1), New Delhi: Government of India, 2006.

Pathak, N.N., and A.K. Garg. "Role and Expectations from Indian Livestock Feed Industry in the Next Millennium." In *Proceedings of the 41st National Symposium on Animal Production in the Next Millennium*. Mumbai: Compound Livestock Feed Manufacturers Association of India, 1999.

Planning Commission. *Planning Commission, Government of India*. 2008. <http://planningcommission.nic.in/> (accessed 2009).

Pradhan, P., V. Ahuja, and P. Venkatramaiah. *Livestock Services and the Poor in Orissa – a Case Study*. Copenhagen: DANIDA, 2003.

Punjabi, M. *Private Sector Initiative in Dairy Development in India: Case Study of Nestlé India in Punjab Region of India*. Background paper for the World Bank, Washington, DC: processed, 2008.

Raju, S.R. *Dairy Value Chain in Andhra Pradesh*. Background paper prepared for the World Bank, Washington, DC: processed, 2008.

Raju, S.S., and R. Chand. *Agricultural Insurance in India: Problems and Prospects*. New Delhi: National Centre for Agricultural Economics and Policy Research, 2008.

Ramachandra, K.V., V.K. Taneja, K.T. Sampath, S. Anandan, and U.B. Angadi. *Livestock Feed Resources in Different Agro-ecosystems of India: Availability, Requirement and Their Management*. Bangalore: National Institute of Animal Nutrition and Physiology, processed., 2007.

Ramaswami, B., P.S. Birthal, and P.K. Joshi. *Efficiency and distribution in contract farming: The case of Indian Poultry Growers*. Markets, Trade and Institutions Discussion Paper No. 91, Washington, DC: International Food Policy Research Institute, 2006.

Rao, Viroji S.T. "Research Priorities and Policy Options for Backyard Poultry Development to 2020." In *Poultry Research Priorities to 2020*, edited by P.V.K. Sasidhar. Izatnagar: Central Avian Research Institute, 2006.

Reddy, Y V R Chandra Mohan. "A Study of Livestock Markets and Marketing of Livestock in Rangareddy District of Andhra Pradesh." Hyderabad: MSc Dissertation, Department of Agricultural Economics, Acharya N.G. Ranga Agricultural University, 2000.

Saha, A. "An Analysis of the Dairy Knowledge and Information System in Birbhum West Bengal." Karnal: National Dairy Research Institute (unpublished M.Sc. Thesis), 2001.

Sathe, B.S. "Personal communication." January 2008.

Sharma, R., and A. Sharma. "Cytokines: Novel immunoregulatory molecules." In *Advance in Immunology and Immunopathology*, edited by R.S. Chauhan, G.K. Singh and D.K. Agrawal, 19-25. Patnagar: SIIP, 2001.

Sharma, V.P., A. Nin Pratt, A. Kumar, R.V. Singh, and S. Staal. *Dairy Development in India*. Vol. Pakistan and India Dairy Development Case Studies, in *Dairy Development for the Resource Poor*, edited by S. Staal, A. Nin Pratt and M.A. Jabbar. Rome and Nairobi: FAO and ILRI, 2008.

Singh, C.B., S.B. Agarwal, N. Chandra, S.K. Jha, and R.A. Dey. *Crossbreeding Technology Adoption and Constraints Identification in Different Regions of India*. Karnal: Dairy Economics, Statistics and Management Division, National Dairy Research Institute. processed, 1998.

Singh, M., and A. Chauhan. "Constraints Faced By Dairy Owners In Adoption Of Scientific Dairy Farming Practices." *Indian Journal of Dairy Science* 59, no. 1 (2006): 49-51.

Singh, N., K.B. Singh, H.K. Verma, and J. Singh. "Adoption Pattern of Artificial Insemination in Punjab." *Indian Journal of Animal Reproduction* 27, no. 1 (2006): 23-26.

Singh, R., A.L. Nanda, and P.S. Dahiya. "Agricultural Credit Overdues." *Financing Agriculture* 27, no. 1 (1995): 4-7.

Singh, Surjit, and Radheyshyam Sharma. *Impact Assessment of the District Poverty Initiative Project, Rajasthan*. Impact Assessment, Institute of Development Studies, Jaipur: Institute of Development Studies, 2008.

Sinha, M.K. "Economic Analysis of Institutional Dairy in Tribal Area of Bihar." Karnal: Ph.D. Thesis, National Dairy Research Institute, processed, 2001.

Sirohi, S., A. Kumar, S. Gokhale, K. Elumalai, G. Sinha, and I. Wright. *Livestock Support Services in India*. Washington, DC: processed, 2008.

Skees, J. R., and A. Enkh-Amgalan. "Examining the Feasibility of Livestock Insurance in Mongolia." Working Paper 2886, Washington, DC, 2002.

Staal, S., A. Nin Pratt, and M.A. Jabbar. *Dairy Development for the Resource Poor: a Comparison of Dairy Policies in South Asia and East Africa*. Vol. 2. Rome and Nairobi: FAO and ILRI, 2008.

Subrahmanyam, S., and C.S. Murthy. "Economics of Small Ruminant, Pigs, and Backyard Poultry Production in Orissa." *ISNRMPO Programme Series* 5, 2006.

Thornton, P.K., et al. "Mapping Poverty and Livestock in the Developing World." *International Livestock Research Institute*. International Livestock Research Institute. 2002. <http://www.ilri.org/InfoServ/Webpub/Fulldocs/Mappoverty/index.htm> (accessed April 21, 2009).

Vaidya, S.V. "Presidential Address." In *Proceedings of 41st National Symposium on Animal Production in the Next Millennium*. Mumbai: Compound Livestock Feed Manufacturers Association of India, 1999.

World Bank. *India Livestock Sector Review: Enhancing Growth and Development*. Economic and Sector Work, Washington, DC: The World Bank, 1996.

—. *World Development Report: Agriculture for Development*. Washington, DC: The World Bank, 2008.

APPENDIX 1. CHARACTERISTICS OF DIFFERENT MODELS OF LIVESTOCK SERVICE PROVISION

Delivery system	Service provider by Delivery System		Responsible to	Income depending on	Strengths	Weakness
	Delivery system	Service provider				
Public services	Frontline staff in government department	Government	National and State budget	Assured budget, strong base of infrastructural support	Supply driven, uniform spread approach, inefficiency in the delivery, rigidity for local adaptation, lack of incentives for performance, lack of accountability, long gestation period between planning and execution	
National NGO services	NGO frontline staff	Donor	Donor policy and funding	Efficient delivery, greater focus on small and marginal sections, flexibility for local adaptation, short gestation period between planning and execution	Driven by donor's agenda and priorities, compromise of agenda for seeking funds, long term sustainability in question after withdrawal of interventions	
Local NGO	NGO staff	Donor	Donor policy and funding	Efficient delivery, greater focus on small and marginal sections, flexibility for local adaptation, short gestation period between planning and execution	Driven by donor's agenda and priorities, greater compromise of agenda for seeking funds, long term sustainability in question after withdrawal of interventions, threat of emergence of NGOs of suspicious reliability, lack of capacity for quality delivery	
Private services	Individuals, staff, or owners of private enterprise	Enterprise owner and users	Economic capacities and priorities of users	Demand driven, higher prospects for long term sustainability and expansion, efficient delivery, flexibility for local adaptation	Poorest may be left out, threat of monopsony particularly in more backward and remote areas, profit motivated, problems in quality assurance in absence of effective regulatory mechanism, some services which do not have higher prospects of profit generation may be left out, legal obstacle for service providers like para-	

Delivery system	Service provider by Delivery System		Responsible to	Income depending on	Strengths	Weakness
Co-operatives	Staff of cooperatives members	Board of cooperatives/ members	Govt. support/Economic capacities/ priorities of members	Strong network, infrastructures, capable manpower, capable of delivering integrated services, strong backward and forward linkages	Supply driven, motivated by assured procurement, cross-subsidization, uniform approach, rigidity in local adaptation, stark regional variation in performance	veterinarians.
Government- NGO-Small scale private service providers	Community based worker	Government, Community and users	Government support, economic capacities and users/community's priorities	Demand driven, greater participation of community, long term sustainability, flexibility for local adaptation, local capacity building	Threat of government interference, potential for conflicts between stakeholders	
Informal service systems	Traditional institutions, informal user groups	Users	Economic capacities and priorities of users	Demand driven, availability in the vicinity	Lack of modern facilities, lack of higher skills, less prospects for scaling up of the service delivery	

APPENDIX 2. PROVISIONS PERTAINING TO ANIMAL HEALTH SERVICE DELIVERY IN THE NEW LIVESTOCK SECTOR POLICY OF ORISSA

The Government of Orissa appointed a high powered Steering Committee in 1998 to carry out a comprehensive review of the state livestock sector and to recommend new policy directions, to enable the State Government to formulate a new Livestock Sector Policy Framework. On the basis of the livestock sector review, a new livestock sector policy was formulated and approved in 2002. Aspects of the new policy that relate to provision of animal health services are reproduced below

PROVISION OF ANIMAL HEALTH AND BREEDING SERVICES

Animal health care and breeding services are the two most important services that the state now provides free to the livestock producers. Improving the quality of these services and their usefulness to the producer is the prime consideration under the new policy. There is increasing evidence that farmers prefer good quality paid services to poor quality free service.

In order to make these services improve their quality, reach out to the farmers whom it seeks to serve and become accountable, the government will progressively make veterinary and artificial insemination services, mobile practices operating within their existing jurisdictions and delivering the service at the farmer's door-step, as paid inputs. Under the new policy the government will permit the government employed Veterinarians, Livestock Inspectors and Inseminators to practice their profession /trade and to charge for the services delivered at the farmers' door-step at market rates. These reforms will be implemented in a phased manner; first in well developed areas, which can absorb the change and work it to their advantage. Extension of the policy and introduction of the new delivery systems in other areas will follow an economic change scale.

There are many services and inputs needed by livestock owners in the day to day management of their livestock enterprise and most of these do not need the services of a qualified Veterinarian or Livestock Inspector. The magnitude of the task is so large that the only solution is to create such skills among the users themselves in the villages. The tasks are veterinary fist aid, vaccination of birds and animals, ecto and endo parasite control, innovative feed supplementing techniques, shelter innovations and candling of desi eggs for hatching. These are all simple skills needed in villages constantly. Young men and women from the small holder households can be trained to practice these skills, provide service to the smallholders and even earn a small income for their services.

The mandate of the Department of Animal Husbandry under the new policy would be: (i) control containment and eradication of animal diseases; and (ii) livestock sector development. Department

will progressively move away from delivery of veterinary care and AI services, first converting them into mobile practices; gradually retreating towards the privatization of the services. The department will have a bipolar structure, reflecting the mandate—one group engaged in disease control and the other in livestock development. Disease control will be direct action by the department; but for livestock development the department will work in a participatory format. The department's training capacity will be geared up to cater to the needs of intensified participatory extension service and empowerment of Non-Governmental Organizations active in livestock development.

This change over in veterinary service delivery however will be gradual, over a 25 year period. As a first step the veterinary hospitals, dispensaries and livestock aid centers in selected districts will be converted into mobile practices delivering the services at the farmers door step. The veterinary and the para-veterinary officers involved in the mobile practice will be allowed to treat door-step delivery of services as a private arrangement between the practitioner and the farmer. The practitioners will continue to be employees of the Government of Orissa in the Department of Animal Husbandry and will receive all their emoluments, allowances and perks till they superannuate.

The programs for animal health care comprise the conversion of the veterinary hospitals, dispensaries and livestock aid centers into mobile practice veterinary and AI services delivery, the capital grants required to equip the veterinarians and the inseminators and reequipping these institutions to handle the changed system.

User charges will be collected for vaccination/AI/diagnostic services and feed analytical services etc. as prescribed by the state government from time to time.

The development tasks under the new policy will necessitate the promotion of a new autonomous body “the Orissa Livestock Resource Development Society” a registered society under the Societies Act, which will take over all of the AI infrastructure, except the field AI centers. It will generate all the genetic outputs for breeding of cattle and buffalo and will establish a state-wide infrastructure for the distributed bulk movement and bulk storage of liquid nitrogen. Frozen semen and liquid nitrogen will be delivered to all AI practitioners at their doorstep by the OLRDS, against payment.

DISEASE CONTROL

The state government in consultation with the central government and the governments of the neighbouring states will draw up a State Foot and Mouth Prevention, Control and Containment Project, as a part of a Larger National Project for the Control and Containment of FMD. The project will cover the entire state, but will create a disease containment zone covering the 9 coastal districts in category 'A' with the exception of Baragarh District, as it is not a coastal district, and as it also happens to be a border district along the boundary of Madhya Pradesh.

Containment of FMD along the coast will be comparatively easy as the sea prevents ingress of the disease all along the coast and border vaccinations along the open boundaries will effectively keep the most productive coastal districts under category 'A', disease free. The strategy for control will be

the tested methodology of the erstwhile FMD Control project in Southern Peninsula, suitably modified to conform to the geographical formation of Orissa.

Vaccinations and control programsme for other disease like HS and BQ will continue on “need basis”, preventive vaccinations in the endemic areas annually based on the state endemic chart and ring vaccinations and stamping out procedures during outbreaks. Vaccines against diseases of sheep, goat and poultry will be stocked in distributed storage points in the districts and delivered to Breeders' Associations and Self Help Groups for timely vaccinations by the village technicians.

DIAGNOSTIC LABORATORIES

The existing diagnostic laboratories will be suitably strengthened to take up challenges of emerging diseases with bio-technological methods. Each district will have a district diagnostic laboratory and related laboratories of the Orissa Veterinary College and the Animal Disease Research Institute will act as referral laboratories. Institute of life science will also be involved in the exercise.

Bio-security measures will be adopted against hazards likely to emanate at all levels of production of biologicals and livestock. An excellent but simple disease reporting and monitoring system with NCI network link at district and state level including OUAT, a credible cold chain, systematic vaccination and well orchestrated coordination with border states and the center will be the key components.

APPENDIX 3. COMPARATIVE ANALYSIS OF THREE DAIRY VALUE CHAINS MODELS IN ANDHRA PRADESH

Leading Private Sector Dairy	MACS at district level	State Cooperative
Background		
<ul style="list-style-type: none"> Initiated in 1992 after MMPO permitted private dairies Traded on the stock exchange Collecting milk about 7 lakh liters per day/ 1,50,000 HH/3500 villages Leading well recognized brand, also have own supermarket stores 3 Metros, Hyderabad, Bangalore, Chennai, and now enter Mumbai 	<ul style="list-style-type: none"> Dairy activities started in 1971 in the district Changed to MACS society in 1998, (MACS Act, 1995) Collecting milk from 650 villages in the district Milk collection is 60,000 liters per day, likely to go up to 1,00,000 in the coming 2-3 years 	<ul style="list-style-type: none"> Is an apex level Dairy Cooperative Society registered under Cooperative Society Act – 1962 Milk procurement from 12 district unions 3,22,000 liters per day/3800 village societies 2,24,000 farmers Not much competition with private sector in the area as yet
Business Model		
<ul style="list-style-type: none"> Has agents in the village for milk procurement No direct company involvement with farmers The company has negotiated price with agent, but is not involved with what price the agent gives the farmers (slightly above co-op) Farmer price at least state co-op price Agent often times gives loans to farmers to maintain loyalty Competing with other private players for procurement Employees are previous dairy co-op employees Collection areas depend on milk density and areas in which district co-op is less active 	<ul style="list-style-type: none"> As per MACS norms, 2 tier operation, village level and district level Village level managed by village society, district level by BOD Elected members every year The village level society itself is registered as a separate MACS society and has the freedom to use its own profits MACS has the freedom to set own farmer prices, higher than co-op District Union managed by professionals 	<ul style="list-style-type: none"> As per co-op norms, 3 tier operation, village level and district level, and state level Village level managed by village society president State level managed by bureaucrat No democratic election at village level Profits of village level society not distributed to farmers, no ownership Prices set by co-op (low prices because of services and bonuses)
Input Supply		
<ul style="list-style-type: none"> No provision for input supply except for loans given to farmers sometimes 	<ul style="list-style-type: none"> Breeding and health services tie up with NGO/state dept. Own manufacturing of quality feed at subsidized rate Organized thrift and credit co-operative for credit for animal purchase 	<ul style="list-style-type: none"> Limited Breeding and health services Feed available at subsidized rate through village society Not much facility for loans Medicines available at cost, availability is sometimes a

Leading Private Sector Dairy	MACS at district level	State Cooperative
	<ul style="list-style-type: none"> Medicines available at cost/Farmer meetings for extension 	problem
Milk Purchase from farmers		
<ul style="list-style-type: none"> Done through agent Agent decides what price he will give, usually competition with agents of other companies Testing is done in very few cases, that is also not transparent 	<ul style="list-style-type: none"> Done through Village MACS society Prices declared by the Union, higher than Co-op pricing Testing of milk through electronic milk-o-testers 	<ul style="list-style-type: none"> Done through village society Prices declared by co-op (lowest prices) No testing, average prices for cow and buffalo milk.
Primary processing and transportation		
<ul style="list-style-type: none"> Clean milk practices at village level Efficient transportation Good infrastructure for bulk coolers/Chillers 	<ul style="list-style-type: none"> Clean milk practices at village level Efficient transportation Has developed good infrastructure for bulk/chillers 	<ul style="list-style-type: none"> Limited attention to clean milk practices Inefficient transportation Has not availed of the government funds to develop this infrastructure
Processing/ Quality/ Variety of products		
<ul style="list-style-type: none"> ISO certified plant meeting all quality requirements, Has a variety of quality products catering to children and younger generation (yoghurt, flavored milk) Selling mostly in metros, market expansion in urban areas 	<ul style="list-style-type: none"> Good quality products, but no certification as yet Traditional products Tapping the rural markets as well, through village societies (small packets, 250 ml) 	<ul style="list-style-type: none"> Quality of products has improved Traditional products Tapping only the urban market
Future Growth		
<ul style="list-style-type: none"> Not involved in dairy development activity, only procurement, will have to move to newer areas for expansion In future if MACS becomes strong in these areas, procurement will be affected 	<ul style="list-style-type: none"> Involvement in dairy development activity will help them to grow Face competition from private sector because of community tie up 	<ul style="list-style-type: none"> Easy target for private sector entry Lack of variety and quality of products will make it difficult for them to compete with private sector

Source: Punjabi, 2008

APPENDIX 4. QUALITATIVE ANALYSIS OF THE GOAT VALUE CHAIN

Stage of Chain	Agents Involved	Functions	Issues
Policy Environment			
Policy	DAH	<ul style="list-style-type: none"> ▪ Policy for small ruminant sector focusing critical issues such as health services, breeding issues, common property resources, producer associations for marketing linkages 	<ul style="list-style-type: none"> ▪ Sector largely neglected in policy focus ▪ Some recent initiatives to focus policy in this area in recent years ▪ Challenges ahead lie in implementing the initiatives by exploring initiatives in various modes – WSHG, NGO, PPP mode etc.
Input Stage			
Health Services/ Extension	DAH/Link workers	<ul style="list-style-type: none"> ▪ Provision of health services through veterinary dispensaries in this area. ▪ Link workers are also involved in providing services to some extent 	<ul style="list-style-type: none"> ▪ No formal institutional mechanism for providing services to this sector, keeping in mind the special needs of the small ruminants (movement of herds, timing, etc) ▪ Current coverage is very poor and limited to peripheries of cities
Feed & Fodder	DAH/ Village Panchayats/ NGOs/ Forest Dept	<ul style="list-style-type: none"> ▪ Management of Common Property Resources 	<ul style="list-style-type: none"> ▪ Lack of effective CPR policies and implementation of the same ▪ Lack of representation of small ruminant owners in planning, forest management
Medicines/ Vaccines	State Dept. Private Sector	<ul style="list-style-type: none"> ▪ Production of vaccines and supplying to state vet. institutions ▪ Production and marketing of vaccines 	<ul style="list-style-type: none"> ▪ Lack of regulation for quality control ▪ Govt involvement in vaccine production ▪ Lack of infrastructure for maintaining cold chain of vaccine ▪ Lack of funds for implementation of vaccine programs
Credit		<ul style="list-style-type: none"> ▪ No formal mechanism for credit to this sector 	<ul style="list-style-type: none"> ▪ No formal mechanism for credit to this sector—credit through SHG, banks etc. to be explored
Production Stage			

Stage of Chain	Agents Involved	Functions	Issues
Goat Rearing	Farmer/ Producer	<ul style="list-style-type: none"> ▪ Small farmers keeping few goats (2-4) ▪ Goat herders keeping larger herds of 40-60 goats 	<ul style="list-style-type: none"> ▪ High Mortality because of poor management practices due to lack of health services, extension and resources to develop a shed for small ruminants
Marketing of Live Goats			
Marketing of goats at farmer level	Farmer/ Producer	<ul style="list-style-type: none"> ▪ Selling of goats to traders/butchers at doorstep ▪ Taking goats to rural haats 	<ul style="list-style-type: none"> ▪ Early selling of animals do to financial problems ▪ Not getting optimum price due to lack or information, fragmented production, low bargaining power
Marketing of goats at village level	Primary trader Rural Butchers/ Agents	<ul style="list-style-type: none"> ▪ Collection of goats from farmers/producers for selling in rural haats and/or taking to urban areas ▪ Collection of goats from farmers for retailing meat in rural areas 	<ul style="list-style-type: none"> ▪ Time spent in collecting goats from farmer doorstep ▪ Mortality of animals in transportation ▪ Low farmer prices
Marketing of goats in urban areas	Secondary traders Commission Agents	<ul style="list-style-type: none"> ▪ Purchase of goats from rural haats and transportation to goat markets in urban areas ▪ Link between buyers and sellers of goats in urban areas 	<ul style="list-style-type: none"> ▪ Mortality of animals during transportation ▪ High trader margins ▪ No proper market yard for livestock ▪ Lack of amenities in market yards ▪ No recording of market arrivals, prices etc.
Retailing of Goats			
Selling Meat to consumers	Butcher/ Retailer in Urban areas	<ul style="list-style-type: none"> ▪ Purchase of goats from goat market and selling meat to consumers 	<ul style="list-style-type: none"> ▪ No quality control over meat sold ▪ High margins at retail level

APPENDIX 5. AMUL: THE GUJARAT COOPERATIVE MILK MARKETING FEDERATION LTD. (GCMMF) (AMUL)

Gujarat Cooperative Milk Marketing Federation's brand name, "AMUL," is a household name in India. It started in 1946 with a small cooperative in Anand, a small town in the Kaira (Kheda) district of Gujarat, south of Ahmedabad. Today, it is jointly owned by more than 2.28 million milk producers spread throughout Gujarat. Its product range includes milk, milk powder, butter, ghee, cheese, chocolate, ice cream, pizza, sweets, flavoured milk, and soups. The products are widely used throughout India and have made AMUL the largest food brand in India today with an annual turnover of about Rs. 27 billion (US\$584 million).

THE GENESIS OF GCMMF

The Kaira district was famous for its milk production. The farmers of Kaira district were selling milk to a private firm called M/s. Polsons Dairy. Polsons were procuring milk from the farmers through private contractors and were supplying milk to Mumbai (Bombay at the time). The farmers felt that they were being exploited by the contractors and Polsons and were not being paid a fair price for the milk. The disgruntled farmers met the freedom movement leader and follower of Mahatma Gandhi, Sardar Vallabhai Patel, for advice to overcome this exploitation. He advised them to form a cooperative of their own and market their product directly, instead of through the contractors and Polsons Dairy.

The farmers were convinced and started to form a dairy cooperative society in every village. They then decided to form a union of the village dairy cooperatives, the "Kaira District Cooperative Milk Producers' Union" (initially called the Anand Milk Union Limited (AMUL)) and so AMUL was born in 1946. It had a visionary Chairman Shri Tribhuvandas Patel who was a leader of the farmers and helped them to organize the cooperative. His leadership, sincerity and the farmers' confidence in him helped the organization to overcome stiff resistance and difficulties.

The Kaira Union initially began its operation with just a handful of farmers from two village dairy cooperatives, collecting about 250 litres liters of milk every day. An assured market provided a good incentive to the milk producers and it grew. The Union soon realized that they needed professional management, and soon built a team of dedicated managers under Dr. Varghese Kurien to provide good management and guide them in their growth. They gradually initiated a set of milk production enhancement measures, including services such as animal health care, breeding services, fodder seeds supply and supply of balanced cattle feed. To keep pace with the increased milk collection, it created and expanded processing facilities and under its brand name AMUL it started manufacturing and marketing many milk products including butter, cheese and milk powder.

The success story of these farmers of Kaira spread and became famous as the ANAND PATTERN. Farmers came from all parts of Gujarat to see and learn and went back to their own districts and started their own cooperatives, and soon there were many district milk unions. In the early sixties, the district milk

producers unions of Gujarat came together to form a Federation called “The Gujarat Cooperative Milk Marketing Federation” (GCMMF). The major objective was to provide better marketing for the milk and milk products of the milk cooperatives in Gujarat. This has been a very successful organization.

ACTIVITIES AT A GLANCE:

The GCMMF is India’s largest food organization. It is a state level apex body of milk cooperatives in Gujarat. The major objective of this organization is to help the farmers, and also serve the interest of consumers by providing quality products and value for their money. A profile of GCMMF is given below:

Total No. of Milk Unions	12 district cooperative milk producer's unions
No. of producer members	2.35 million
No. of village coop. societies	11,400
Total milk handling capacity	6.7 million litres liters per day
Milk collection	1.86 billion litres liters (2002-2003)
Av. Daily milk collection	1.08 million litresliters
Milk drying capacity	510 MT per day
Cattle feed manufacturing capacity	1450 MT per day

SYSTEM OF MILK COLLECTION

In this system, the village cooperative society collects the milk brought to it by the farmers twice a day, in the morning and evening. The process of collection is described below in figure 24:

The trucks from the Union collect the milk from the village cooperatives societies by 8.30 a.m. in the morning and by around 8.00 PM in the evening and brings it immediately to the dairy plant. The societies may sell part of the collected milk to the villagers. After delivering milk the farmer may buy inputs such as animal feed available at the society—produced and supplied by the Union. The District Unions combines farmers’ cooperative activity with professional management. The Unions have large-scale milk processing facilities. They seek to offer a good and assured price to the farmers for the milk and also provide services for animal care and development of dairying. Various activities of the village cooperative and the union are shown in the figure below.

Figure 24: AMUL's milk collection process

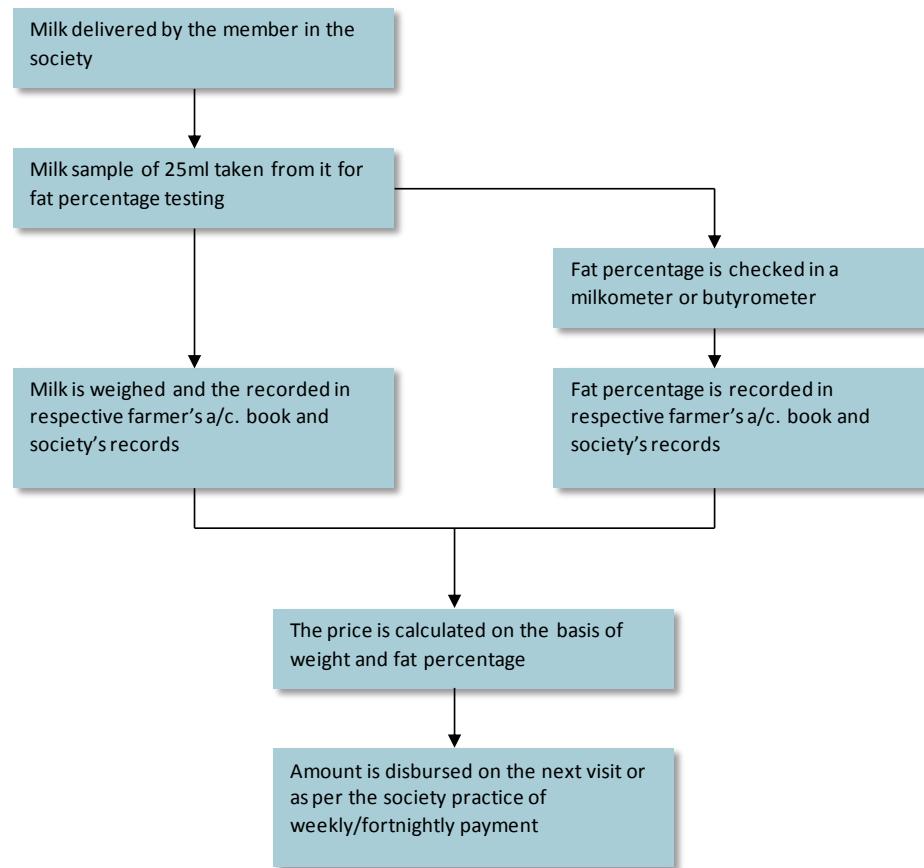
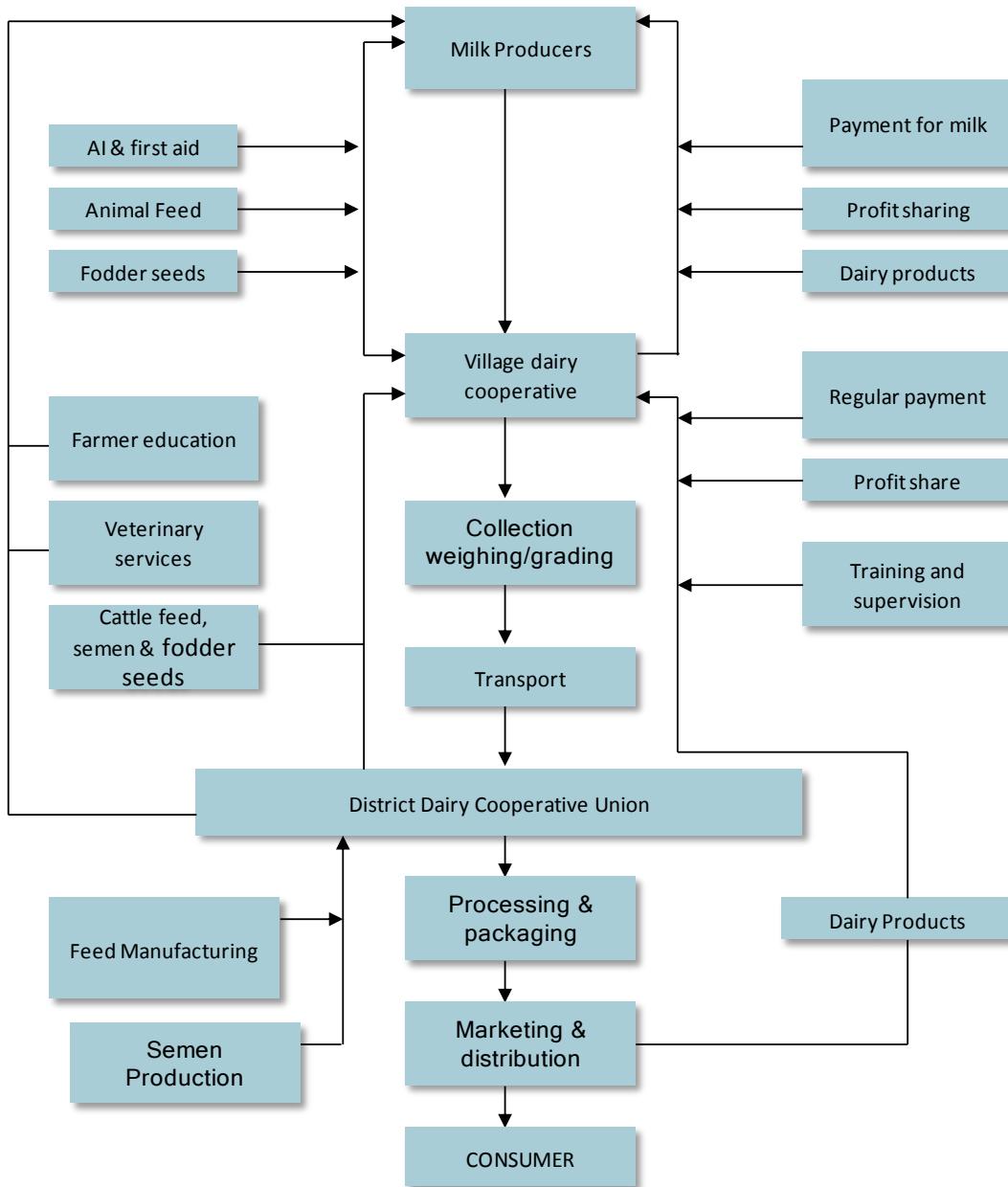


Figure 25: Village cooperative and union activities in AMUL



The trucks from the Union collect the milk from the village cooperatives societies by 8.30 AM in the morning and by around 8.00 PM in the evening and brings it immediately to the dairy plant. The societies may sell part of the collected milk to the villagers. After delivering milk the farmer may buy inputs such as animal feed available at the society - produced and supplied by the Union. The District Unions combines farmers' cooperative activity with professionals management. The Unions have large-scale milk processing facilities. They seek to offer a good and assured price to the farmers for the milk and also provide services for animal care and development of dairying. Various activities of the village cooperative and the Union are shown in the figure below:

VALUE ADDED MILK PRODUCTS

The average daily milk collection is about 50 lakh liters per day. Sixteen state-of the-art dairy plants of the Unions process the milk and convert it into value-added products. The AMUL brand which has a very high brand awareness and value in India helps in marketing the products throughout the country.

List of products marketed by GCMMF

- Fresh Milk
- Milk Powders
- Ghee
- Cheese: Range
- Breadspreads
- Infant Milk
- Sweetened Condensed Milk
- Curd Products
- Amul Ice Creams
- Chocolate & Confectionery
- Chocolate Beverages
- Milk Drinks
- Mithaee Range (Ethnic sweets)
- UHT Milk
- Ready to Serve Soups