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Livestock Sector in North-Eastern Region of India: An Appraisal of Performance

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Abstract

Although agriculture is the prime source of livelihood for a majority of rural population in the North-Eastern region (NER) of India, dependence on livestock as an alternative source of income is significant. Responding to the burgeoning demand for livestock products in a sustainable manner is a big challenge. The widening gap between the demand and supply of livestock products can be met through bringing out changes in the production structure or opening up the international trade. In this context, an analysis of performance and factors influencing development of the livestock sector in NER has been carried out. The growth of livestock sector has been found slower in the NER than at the national level. However, a significant proportion of landless labourers, small and marginal farmers have access to livestock resources and acceleration in the growth of livestock in NER offers significant opportunities for household income augmentation and employment generation. Several factors identified to influence households' decision to rear livestock include availability of labour, occupation, caste, farm-size, availability of irrigation, and access to information sources. The study has shown that the NE states should take technical, institutional and policy initiatives for the improvement of breeds, feed availability, disease control and food safety of livestock.

1. Introduction

The North-Eastern Region (NER) of India comprising the states of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura occupies about seven per cent of total land area and four per cent of total population of the country. About fifty-seven per cent of the geographical area of NER is covered by forests, which are mostly

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under private or community ownership. Agriculture is the prime source of livelihood for the majority (85%) of rural population in this region. It is characterized by subsistence, low input-low output, technologically lagged mixed farming system, and is dominated by smallholders. Although cereals dominate the cropping pattern in this region, livestock are an important component of mixed farming system and dependence on livestock as an alternative source of income, is significant. Further, because of social and religious acceptance, the consumption of meat is relatively higher in this region, and that of milk and milk products is lower. Coupled with the traditional meat-eating habit, increasing per capita income, urbanization and changes in life-style, the region is deficit in production of livestock products. Some states in the region depend on inter-state trade in livestock to meet the domestic demand. However, responding to the burgeoning demand for livestock products in a sustainable manner is a big challenge.

The widening gap between the demand and supply of livestock products can be bridged by introducing changes in production structure or opening up the international trade, either of which can correct the imbalances in the long-run. Under this context, the main objectives of this paper were to: (i) study the status and performance of livestock sector in the NER, (ii) find participation of smallholders in the livestock sector, and (iii) identify factors influencing the farmers to participate in livestock rearing. The paper has been organized as follows: Section 2 explains the data and methodology used in the study. Section 3 provides the empirical results and discussion. Factors influencing farmers' decision to rear livestock and constraints to the growth of livestock sector in NER are also discussed in this section. The final section concludes with summary and policy implications.

2. Data and Methodology

In this study, data were used from various published and unpublished sources. The data on Net State Domestic Product (NSDP), Agricultural GDP (AgGDP), and value of outputs from livestock and crops were collected from various issues of *National Accounts Statistics* of the Central Statistical Organization (CSO), Ministry of Statistics and Program Implementation, Government of India. The data on livestock population were compiled from different livestock censuses. The data on production of different livestock products were taken from various issues of *Basic Animal Husbandry Statistics*, published by Department of Animal Husbandry and Dairying, Ministry of Agriculture, Government of India. The compound growth rates were computed to examine the trends in different variables like value of output from livestock, agriculture, NSDP, population of livestock species, production and availability of livestock products.

The factors that affected livestock rearing in the NER were analyzed by using household level data from 54th Round Survey conducted by the National Sample Survey Organization (NSSO) of Ministry of Statistics and Program Implementation, Government of India. The survey conducted in 1998, provided valuable information on socio-economic variables like household size, land-holding, household type, social group, access to institutional credit, irrigation, etc. These were used to explain households' decision to keep the livestock.

A logit model [Equation (1)] was estimated to identify the factors, which influenced households' decision to keep livestock. The dependent variable was binary, which took the value 1 for the livestock keeping households, 0 otherwise.

$$P_i = \sum (Y = 1 / X_i) = 1/1 + e^{-(b_1 + b_i X_i)} \quad \ldots(1)$$

where, P_i is the probability that Y=1, that is, the household rears livestock; X_is are the factors that influence household's decision to rear or keep livestock; e is the base of the natural logarithm; and β_is are the coefficients of the explanatory variables, X_is.

3. Results and Discussion

3.1. Performance of Livestock Sector in NER

(i) Contribution of Livestock to Agricultural Economy of NER

During the past several decades, the contribution of agriculture and allied sector to the GDP of the country has declined. On the other hand, the contribution of livestock to the AgGDP has been consistently increasing. It increased from 24 per cent in TE 1992-93 to 28 per cent in TE 2002-03. However, this trend was not witnessed in the north-eastern region of India. The share of livestock in agriculture of NER had in fact declined from 20 per cent to 18 per cent during this period, implying that the growth had been lower in livestock sector than crop sector in the NER (Table 1). The crop sector at aggregate level had performed better in NER than at all-India level. However, in spite of better performance of the crop sector in NER, the growth in NSDP and per-capita income had been much slower than that at the national level. During 1993-2003, the NSDP and per-capita income in NER had grown at 4.2 per cent and 2.1 per cent, respectively. The corresponding figures for India as a whole were 6 per cent and 4 per cent, respectively (Table 2). Further, there had been considerable inter-state variations within the NER. The growth rates in per capita income varied

Table 1. Contribution of livestock to agricultural economy in NER of India

States	TE 1992-93			TE 2002-03		
	Share of agric-ulture in SDP (%)	Share of livestock in agricu-ltural VOP (%)	Per capita income (Rs)	Share of agric-ulture in SDP (%)	Share of livestock in agricu-ltural VOP (%)	Per capita income (Rs)
Arunachal Pradesh	32.8	13.2	8809	25.3	20.1	9564
Assam	37.4	17.8	5737	31.7	15.0	6736
Manipur	32.3	32.9	5668	25.4	31.0	8678
Meghalaya	23.9	33.1	7123	22.8	37.2	11204
Mizoram	25.9	27.3	8319	22.2	27.6	11489
Nagaland	19.9	30.8	9395	32.8	20.7	12087
Sikkim	32.0	15.4	8500	20.4	17.3	12374
Tripura	32.8	16.1	5535	22.4	16.5	11118
NER	34.2	19.5	6073	28.8	18.1	7900
India	29.2	24.1	8222	21.4	27.6	11977

Source: National Accounts Statistics (various years), CSO, Government of India.

Table 2. Compound annual growth in NSDP and agriculture sector in NER of India: 1993-94 to 2004-05

(per cent)

States	NSDP	Per capita income	Agriculture	Crops*	Livestock*
Arunachal Pradesh	2.96	0.94	-3.32	-4.32	1.54
Assam	2.72	1.09	2.31	2.63	0.70
Manipur	6.62	4.38	2.33	2.46	2.09
Meghalaya	7.42	4.84	5.29	5.01	5.93
Mizoram	4.81	2.68	4.96	4.72	5.62
Nagaland	8.18	2.80	6.63	12.57	6.63
Sikkim	6.46	3.51	1.83	0.34	1.83
Tripura	9.20	8.02	6.37	5.22	6.37
NER	4.21	2.32	2.99	3.13	2.37
CV in CAGR in NER	35.7	58.3	87.9	119.3	58.8
India	5.95	4.01	2.48	2.09	3.51

Source: National Accounts Statistics (various years), CSO, Government of India;
*CAGR for 1992-93 to 2002-03.

from as low as 0.94 per cent in Arunachal Pradesh to as high as 8.02 per cent in Tripura. A similar trend was observed in the growth pattern of crops and livestock sectors. However, the inter-state growth in the livestock sector in NER was more equitable than the crop sector.

(ii) Changes in Livestock Resource Base in NER

In 2003, the NER had 11.9 million bovines, 4.5 million ovines, 3.8 million pigs and 36.1 million poultry birds. These accounted for about five per cent of the total bovines, three per cent of ovines and seven per cent of poultry birds in India in 2003 (Table 3). The pig population with about 28 per cent of total is concentrated in NER. Amongst NE states, Assam possessed about three-fourths each of the total bovines and ovines, and one-half of pigs and poultry birds in the region. Nagaland, where there is a strong preference for pork, possessed about 17 per cent of pigs in the NER. Assam, which is the largest state in the NER, sharing its border with the other six states, facilitates the movement of livestock, particularly beef cattle and pigs across border. This in part, fulfills the gap between the demand and supply of meat in the states like Nagaland and Manipur. The structure of livestock production is changing. The change was quite visible in the case of bovine and poultry. Between 1992 and 2003, the population of bovines declined significantly (1.8 per cent per annum) and of poultry increased considerably (2.2 per cent per annum). Pig population also increased during this period. The ovine population did not exhibit a significant change, though a slight decline was observed in it. The state-wise trends depicted a mixed picture. The bovine population had declined in all the north-eastern states with varying magnitude, except in Arunachal Pradesh and Nagaland. The ovine population declined only in Assam, while in other NE states, it remained stagnant or increased.

Table 3. Trend in livestock population in NER of India: 1992 and 2003

(million)

States	1992				2003			
	Bovines	Ovines	Pigs	Poultry birds	Bovines	Ovines	Pigs	Poultry birds
Arunachal Pradesh	0.4	0.2	0.2	1.2	0.6	0.3	0.3	1.7
Assam	11.1	3.6	1.4	16.4	8.8	3.2	1.5	21.7
Manipur	0.9	0.1	0.4	3.3	0.5	0.0	0.4	2.9
Meghalaya	0.7	0.2	0.3	1.8	0.7	0.3	0.4	2.8
Mizoram	0.1	0.0	0.1	1.1	0.0	0.0	0.2	1.1
Nagaland	0.4	0.2	0.5	2.2	0.5	0.2	0.6	2.8
Tripura	1.0	0.4	0.2	2.6	0.8	0.5	0.2	3.1
NER	14.5	4.6	3.1	28.5	11.9	4.5	3.8	36.1
India	289.0	166.1	12.8	307.1	278.0	185.8	13.5	489.0
Share of NE in India, %	5.01	2.79	24.28	9.28	4.27	2.40	27.94	7.39

Source: Livestock Census (1992 & 2003), Ministry of Agriculture, Government of India, New Delhi

Similarly, the poultry population increased in all NE states, except Manipur. The pig population did not witness any decline in any of the NE states.

As a result of these observed changes in the population of livestock and poultry birds, their density varied across the north-eastern states (Table 4). The stocking rate of all livestock species, except poultry birds, in terms of per 1000 human population had declined in the NER. However, growth in the population of poultry birds per capita human population was not significant. Therefore, the overall picture is that of declining livestock assets per capita.

Livestock supplements the livelihood of all categories of households in the NER. At the aggregate level, 57 per cent of households possess livestock in the NER, the corresponding figure for India being 56 per cent. However, there exists a wide inter-state variation in the NER. The range of households possessing livestock varied from 37 per cent in Tripura to 86 per cent in Nagaland. Proportionately, a lower percentage of households in Meghalaya and Manipur (about 40 %) rear livestock while in the remaining NE states more than two-thirds of the households rear livestock. Though about 30 per cent of landless and 48 per cent of marginal households keep livestock in the NER, proportion of households having livestock increases with the size of holding. It was exhibited more or less in all the NE states. However, it is worth mentioning that 82 per cent of the smallholders in the NER rear livestock to supplement their livelihood.

Landless comprise 19 per cent of the rural households in NER and are the most deprived group. Their share in total population of different livestock species ranged between 0 and 3 per cent. Small landholders (< 2ha) are a big deal in the NER with a share of 76 per cent in rural households. They possess nearly half of the arable land, about 88-90 per cent of all the livestock species. It implies that there are more income and employment opportunities for smallholders in the livestock production than in land-intensive crop production. This also indicates that the development strategy for livestock must be focused on the small farm sector.

(iii) Status of Technological Change

The extent of technological intervention in breed improvement can be assessed through the compositional changes in livestock population over time. The percentage share of crossbred in cattle population was found significantly lower in the NER than at national level. However, the technological intervention was not uniform across the NE states. In about half of the NE states, namely Manipur, Mizoram, Nagaland and Sikkim, the percentage of crossbred cattle was significantly higher than that of the national average. However, in Assam which accounts for more than three-

Table 4. Density of livestock in NER of India: 1992 and 2003

States	1992								2003							
	Bovine		Ovines		Pig		Poultry		Bovine		Ovines		Pig		Poultry	
	Per Sq. km	Per 1000 people	Per Sq. km	Per 1000 people	Per Sq. km	Per 1000 people	Per Sq. km	Per 1000 people	Per Sq. km	Per 1000 people	Per Sq. km	Per 1000 people	Per Sq. km	Per 1000 people	Per Sq. km	Per 1000 people
Arunachal Pradesh	5	501	2	177	3	268	14	1341	7	530	3	224	4	294	21	1556
Assam	141	486	46	158	17	60	209	719	112	321	40	115	20	56	276	792
Manipur	38	453	2	28	17	203	146	1728	22	199	2	16	19	169	132	1200
Meghalaya	30	367	10	119	13	162	81	1001	32	300	15	146	19	177	126	1192
Mizoram	3	96	1	30	5	158	52	1535	2	44	1	20	10	238	53	1230
Nagaland	24	307	9	120	32	414	131	1702	30	243	11	88	39	316	168	1367
Tripura	92	502	41	308	18	105	248	722	23	298	18	234	5	68	45	580
NER	45	346	16	155	14	67	115	928	38	232	17	145	17	64	139	933
India	88	338	51	194	4	15	93	359	85	264	57	176	4	13	149	464

Source: Livestock Census (1992 & 2003), Ministry of Agriculture, Government of India, New Delhi

Table 5. Access of households to livestock assets in NER of India: 1998

States	Landless	Marginal	Small	Medium	Large	All
Arunachal Pradesh	24.9	57.7	78.2	93.5	98.5	68.7
Assam	41.0	50.8	87.6	95.7	97.6	62.2
Manipur	7.0	36.2	52.4	83.9	71.3	40.2
Meghalaya	10.5	26.8	58.2	60.5	53.9	37.5
Mizoram	33.5	59.9	49.9	58.2	100.0	55.1
Nagaland	27.3	70.5	88.3	93.9	95.3	86.2
Sikkim	6.2	64.4	95.3	97.7	100.0	61.6
Tripura	28.7	37.2	68.9	68.7	41.5	37.0
NER	29.7	47.6	82.4	90.5	91.1	57.2
India	23.5	54.5	83.3	89.3	92.5	56.0

Source: Unit Level Data of NSS, 54th Round, 1998.

Table 6. Distribution of land and livestock holdings in NER of India: 2003

Item	Landless (0 ha)	Marginal (<1.0ha)	Small (1-2ha)	Medium (2-4ha)	Large (>4ha)	All
Share in households, %	18.7	61.8	14.6	4.2	0.7	100.0
Share in land, %	0.00	23.8	24.2	28.2	23.9	100.00
Size of holding, ha	0.00	0.38	1.48	2.81	6.58	1.20
Share in livestock, %						
Cattle	0.0	59.0	27.8	11.1	2.0	100.0
Buffalo	0.0	57.0	33.3	8.9	0.9	100.0
Sheep and goat	1.4	67.7	21.7	7.0	2.3	100.0
Pig	0.9	64.9	22.7	9.7	1.8	100.0
Poultry	3.0	68.7	19.8	6.9	1.6	100.0

Source: NSS Report, Land and Livestock Holdings, 2003.

fourths of the cattle population of NER, the percentage share of crossbred was abysmally low (only 5 %) (Table 7). The indigenous pigs are small and low carcass yielder, while the crossbred pigs grow fast and produce high carcass. Assam also possessed the largest number (40%) of pigs in NER of India, in which the crossbred pig constituted 32 per cent of total pig population (Table 7). More than half of the pigs in Nagaland were crossbred. Due to increase in demand arising from high population growth and income, the indigenous pigs are being replaced gradually by crossbred pigs in most of the NE states. However, the tribal people's preference for indigenous pig meat over crossbred and the premium price paid for it by urban consumers, induce the pig producers to continue to rear the indigenous pigs in states like Meghalaya and Nagaland. In fact, the indigenous pig population increased marginally in Nagaland and doubled in Meghalaya between the period 1992

Table 7. Adoption of crossbreds in NER of India: 1992 and 2003

(per cent)

States/species	1992			2003		
	Cattle	Sheep	Pig	Cattle	Sheep	Pig
Arunachal Pradesh	5.9	3.1	3.0	3.2	0.1	2.4
Assam	3.2	4.1	21.9	5.4	0.8	31.8
Manipur	9.9	-	34.5	17.4	2.0	50.1
Meghalaya	2.4	-	34.6	3.3	3.5	6.8
Mizoram	10.2	70.0	65.2	26.2	58.0	90.0
Nagaland	39.5	36.3	46.4	56.4	50.9	56.1
Sikkim	22.7	8.7	18.2	51.0	4.6	50.4
Tripura	11.4	5.2	6.4	7.7	1.5	45.4
NER	5.4	5.9	27.9	8.5	2.3	36.9
India	7.4	7.2	14.5	13.7	9.3	16.1

Source: Livestock Census (1992 & 2003), Ministry of Agriculture, Government of India.

and 2003. On health grounds and to prevent damage to field crop, free grazing of pigs is not allowed in most parts of the NER. Thus, the year round availability of quality feeds and disease control hold the key for the rapid expansion of pig production through adoption of improved species.

(iv) Trends in Production of Livestock Products in NER

In absolute terms, milk production has increased in all NE states, except Manipur. The share of NER in country's annual milk production was 1.6 per cent in TE 1993-94 which declined to 1.3 per cent in TE 2003-04 (Table 8). This implies that milk production had increased at a slower rate in NER (1.62%) than at the national level (4.27%). There existed a considerable variation in growth rates of milk production across states in the NER. It varied from 0.56 per cent in Assam to as high as 10.7 per cent in Tripura. In Meghalaya, milk production witnessed a decline at an annual rate of 1.3 per cent. Such wide variations in milk production have implications on the trends of milk availability.

The per capita milk availability had declined at the aggregate level in NER and it was well below the recommended level of per capita milk consumption of 220 g/day. Arunachal Pradesh, Sikkim and Tripura witnessed an increase in per-capita availability of milk while in other states, it either declined or stagnated. Assam which accounts for two-thirds of milk production of NER registered a significant decline in per capita availability of milk. Similarly, growth in egg production had also been much slower in NER than at all-India level. Egg production had increased at an annual growth rate of 2.1 per cent in the NER and at 5.7 per cent at all-India level

Table 8. Trends in milk production in NER of India: TE 1993-94 and TE 2003-04

('000 tonnes)

States	Milk production ('000 tonnes)				Milk Availability		CAGR (%)	
	TE 1993-94		TE 2003-04		(g/day)		Milk	Milk
	Production	Share %	Production	Share %	TE1993-94	TE2003-04	production	availability
Arunachal Pradesh	20	2.1	45	4.1	49	109	8.87	7.77
Assam	658	70.8	705	64.8	78	71	0.56	-1.12
Manipur	83	9.0	69	6.4	120	85	-1.30	-2.64
Meghalaya	52	5.6	68	6.2	77	78	2.80	-0.12
Mizoram	9	0.9	15	1.3	32	44	6.89	3.45
Nagaland	44	4.7	59	5.5	95	80	3.01	-1.77
Sikkim	30	3.2	43	4.0	190	213	3.55	0.47
Tripura	34	3.6	84	7.8	32	70	10.70	6.87
NER	928	100.0	1088	100.0	76	74	1.62	-0.41
All-India	58063		86892		183	229	4.27	2.10
Share of NER in India, %	1.6		1.3					

Source: Basic Animal Husbandry Statistics (1999 & 2005), Ministry of Agriculture, Government of India.

(Table 9). Consequently, the share of NER in total production of eggs in the country declined from 2.85 per cent in 1993-94 to 2.21 per cent in 2003-04. Two NE states, viz. Arunachal Pradesh and Sikkim in fact registered a decline in egg production during this period. In other NE states, the annual growth rate in egg production varied from 1.2 per cent in Assam to 9.1 per cent in Tripura. Assam which accounted for about 58 per cent of egg production in the NER registered a very slow growth rate. The per capita availability of eggs in NER states had gone down from 24 in 1993-94 to 22 in 2003-04. In fact, Arunachal Pradesh, Assam and Sikkim registered a decline in per capita egg availability during this period. For other livestock products state-wise reliable production data were not available and therefore analysis was not attempted.

Table 9. Trends in egg production in NER of India: 1993-94 and 2003-04

States	Egg production (No. in lakhs)		Per capita egg availability (No./year		CAGR (%)	
	1993-94	2003-04	1993-94	2003-04	Egg production	Egg availability
Arunachal Pradesh	228	87	24	8	-14.2	-15.0
Assam	4604	5100	23	19	1.2	-1.1
Manipur	605	749	31	36	3.2	2.4
Meghalaya	751	927	40	39	2.6	0.6
Mizoram	198	300	25	34	5.7	4.4
Nagaland	449	634	33	33	5.0	0.2
Sikkim	150	110	34	23	-5.8	-7.7
Tripura	420	869	14	31	9.1	8.9
NER	7405	8776	24	22	2.1	-0.4
All-India	259746	396516	29	40	5.7	4.1
Share of NER in India, %	2.85	2.21				

Source: Basic Animal Husbandry Statistics (1999 & 2005), Ministry of Agriculture, Government of India.

(v) Productivity of Animals

The NER has relatively low-yielding animals, which is clearly evident from Table 10. The average productivity of crossbred cattle (in milk) in India is 6.5 litres per day but in NER, it is 4.7 litres per day. Assam which is the major milk producing state in NER, has low productivity of animals compared to other NE states, except Sikkim and Tripura. The situation was found worse in case of milk productivity of local cattle and buffalo. The average productivity of local cattle and buffalo was less than half of the national average. Similarly, the productivity of deshi and improved poultry

Table 10. Average milk and egg productivity in NER of India: TE 2003-04

States	Milk (kg/day)			Eggs (No./annum)	
	Crossbreed	Local	Buffalo	Deshi	Improved
Arunachal Pradesh	7.51	1.15		143.11	180.43
Assam	4.38	0.91	1.73	86.52	184.01
Manipur	6.71	1.36	3.00	55.10	106.94
Meghalaya	8.93	0.75	1.76	102.00	218.00
Mizoram	8.14	1.56	1.74	58.73	205.67
Nagaland	7.44	1.27	2.82	82.01	172.67
Sikkim	3.33	1.33	1.33	73.33	134.33
Tripura	3.46	1.12	2.31	97.00	123.33
NER	4.66	0.95	1.83	85.08	163.94
All-India	6.50	1.91	4.15	100.39	247.15

Source: Basic Animal Husbandry Statistics (2005), Ministry of Agriculture, Government of India.

birds in terms of egg/annum/bird was quite lower in NER than at national level.

3.2. Infrastructure and Services

(i) Feed and Fodder

Adequate supply of feed and fodders is crucial to the growth of livestock sector. Livestock in India are fed largely on crop residues and byproducts and grazing lands. The same holds true for the NER too. Cultivated fodders and gathered grasses are two important sources of green fodder supply. About 2.5 per cent of the gross cropped area in the country is allocated to fodder crops but in the NER farmers virtually do not allocate any land for fodder cultivation (Table 11). Only 0.16 per cent of the gross cropped area has been estimated to be allocated for fodder cultivation. Therefore, the farmers largely depend on common grazing lands, i.e. permanent pastures and grazing lands, wastelands, fallows, excluding current fallows, etc. for fodder. However, these resources have been dwindling over time. The problem is further compounded by lack of availability of locally produced feed. The feed requirement in the NER is generally met through import from other states, which makes it costly and is often beyond the affordability of the farmers.

(ii) Veterinary Services

Growth in production cannot be sustained unless livestock is protected against diseases. The veterinary infrastructure in NER is inadequate in terms

Table 11. Area under fodder by states in NER of India: 1998

(per cent)

States	Marginal	Small	Medium	Large	Total
Arunachal Pradesh	0.17	0.03	0.00	0.00	0.04
Assam	0.15	0.02	0.37	0.00	0.15
Manipur	0.04	0.00	0.00	0.00	0.02
Meghalaya	0.04	0.00	0.07	0.00	0.03
Mizoram	0.09	0.07	0.00	0.00	0.07
Nagaland	0.23	0.09	0.79	0.11	0.36
Sikkim	2.25	2.81	3.50	0.27	2.58
Tripura	0.00	0.00	0.00	0.00	0.00
NER	0.16	0.05	0.38	0.02	0.16
All-India	1.89	2.25	2.39	2.50	2.29

Source: Unit Level Data of NSS, 54th Round, 1998.

of both quantity as well as quality. The NER accounted for 4.7 per cent and 8.8 per cent of country's veterinary dispensaries and veterinary-aid centres, respectively (Table 12). However, it accounted for only 1.4 per cent of veterinary hospitals and polyclinics. In fact, the veterinary hospitals and polyclinics are the indicators of the availability of quality veterinary services. The inadequacy of infrastructure had resulted in less access of livestock farmers to veterinary services. In the NER, only about 22 per cent of the farmers could avail veterinary services, while at all India level 32 per cent of the farmers could use this service. A significant inter-state inequality was observed in the distribution of veterinary facilities across NE states and consequently, in the access of veterinary facilities by the farmers. Again, the available facilities were mainly used for curative purposes and very less attention was being paid for the prophylactic measures. In fact, the frequent spurt in the disease incidence is largely due to lack of emphasis on prophylactic measures. Therefore, a greater emphasis is needed on prophylactic control measures rather than curative measures. The prophylactic measures assume greater importance in view of emergence of exotic diseases like Avian Influenza, Mad Cow Disease, etc.

(iii) Marketing of Livestock Products

The productivity of animal is very low in NER compared to other parts of the country. While increasing farm-level production and productivity will require more improved animals, improved fodder/feed technology, and better access to livestock services, smallholders' access to reliable markets to absorb more milk at remunerative prices is also a critical constraint. Organized marketing of livestock in the NER remains relatively insignificant,

Table 12. Number of veterinary institutions in NER of India: 2003

States	Veterinary hospitals & polyclinics	Veterinary dispensaries	Veterinary-aid centres (Stockmen centres/Mobile dispensaries	Farmers availing veterinary services (2002-03), %
Arunachal Pradesh	1	93	189	20.7
Assam	26	434	1213	22.4
Manipur	55	101	29	7.3
Meghalaya	4	65	153	11.8
Mizoram	5	35	103	10.4
Nagaland	4	27	127	33.7
Sikkim	12	25	58	16.8
Tripura	15	56	375	41.7
NER	122	836	2247	21.8
India	8720	17820	25433	31.4
Share of NER in total, %	1.40	4.69	8.83	

Source: Annual Report 2005-06, Department of Animal Husbandry and Dairying, Ministry of Agriculture, GOI; Unit Level Data of NSSO, 59th Round.

despite efforts in the past to develop and promote collective market mechanisms. For instance, in Assam formal pasteurized milk and dairy product channels, both cooperative and private, could hardly account for 3 per cent of total locally produced marketed milk[4]. The traditional market, for either fresh liquid milk or for traditional milk products such as sweets, thus accounted for about 97 per cent of the market opportunities for farmers. For smallholder producers in areas with poor market access, there are likely to be no alternative market options besides the traditional markets. It is thus apparent that developments in the traditional market will be very important.

(iv) Credit

Credit flow in the NER is very low. The credit availability was Rs 650/- per ha of net sown area, which was much lower than the national average of Rs 3450/ha. The lack of institutional credit is a severe constraint to development of livestock as the flow of credit to livestock is even worse

[4] This conservative estimate is based on 734M litres annual production (NEDVC, 2003), 50 per cent of which is assumed to be retained for home consumption by producers, and an upper limit of 35,000 litres/day is handled by the formal organized sector, mostly WAMUL. The estimate does not include milk powder, which is sourced from outside Assam.

than that of agriculture. While in rest of the country a significant proportion of agricultural credit is provided by co-operative institutions, in the NER, the co-operative structure is in a moribund state. Commercial banks and even RRBs are functioning mainly as deposit mobilization centres in the NER. Thus, situations compel the farmers to borrow from money lenders at an exorbitantly high rate of interest. A qualitative assessment of dairy in Assam has revealed that money lenders charge interest from 24 to 120 per cent per annum (CHD-ILRI-DDD, 2006).

3.3. Factors Influencing Livestock Rearing

Farmers' decisions to keep livestock are influenced by a number of household factors and the surrounding socio-economic environment. In this section we have examined the influence of such variables in farmers' decision in keeping livestock by using household level information from the NSSO data set. We have estimated a logit model where the dependent variable was binary, taking a value of 1 if a farmer reared livestock, zero otherwise. Explanatory variables included farmer's experience and management skills, occupation, social group, land and labour endowments, access to credit, media, etc. The results of logit regression have been presented in Table 13. The family size was taken as a proxy for availability of labour for rearing of livestock by the households. The coefficient of labour was positive and significant at less than one per cent, implying that sufficient availability of family labour facilitated the livestock rearing. Occupation of the household also had a significant role in the decision-making for adopting an enterprise. The coefficients for agricultural labour and other labour households were negative. The labourers may face trade - offs between allocation of their labour for wage earning and rearing livestock to supplement their household income. Further, other resource constraints can also discourage them to go for livestock rearing. The coefficients for households self-employed in agriculture and other households were positive and significant. These were expected, as households whose primary occupation was self-employment in agriculture would like to maximize their income by pursuing agricultural and allied activities. They also gained comparative advantage of experience, skills and availability of agricultural bye-products for livestock as feed and fodder. The effect of other demographic variables like age and sex of the head of the household was not significant.

The relationship between farm size and livestock rearing was found positive and significant, which indicated the existence of strong crop-livestock interaction. It was expected that with increase in size of holding, the availability of feed and fodder would increase. Similarly, the coefficient of tubewell

Table 13. Factors influencing farmers' decision to keep livestock in NER of India

Explanatory variables	Coefficient	Standard error
Age of the head of the household (years)	-0.0036	0.0031
Gender of the head of the household, Male =1, otherwise =0	0.1841	0.1321
Household size	0.1384***	0.0213
Farm size (hectare)	0.7801***	0.0729
Household type		
Agricultural labour=1, otherwise=0	-0.0981	0.1313
Other labour=1, otherwise=0	-0.2263*	0.1324
Self-employed in agriculture=1, otherwise=0	1.2558***	0.1249
Other household=1, otherwise=0	0.2687**	0.1231
Own tubewell=1, otherwise=0	0.5185***	0.1108
Access to institutional credit =1, otherwise=0	0.2615	0.2427
Access to telephone=1, otherwise=0	-0.3322	0.4399
Access to newspaper =1, otherwise=0	0.1146	0.0948
Access to television =1, otherwise=0	-0.4173***	0.0916
Access to radio =1, otherwise=0	0.1717***	0.0707
Caste+		
Scheduled tribe=1, otherwise=0	0.1769	0.1217
Scheduled caste=1, otherwise=0	0.1983	0.1412
Others=1, otherwise=0	0.5296***	0.1019
States#		
Arunachal Pradesh=1, otherwise=0	0.5881***	0.1740
Assam=1, otherwise=0	0.6386***	0.1462
Manipur=1, otherwise=0	-0.6585***	0.1598
Meghalaya=1, otherwise=0	-1.1230***	0.1564
Nagaland=1, otherwise=0	1.2719***	0.1884
Sikkim=1, otherwise=0	0.9817***	0.1541
Tripura=1, otherwise=0	0.1920	0.1618
Constant	-2.22364	0.2690
Chi-squared	1084.2	
log-likelihood	-4952.96	
Number of observations	9442	
R^2	0.2317	

Notes: *** 1 % level of significance; ** 5% level of significance; * 10% level of significance
+-Other Backward Caste was treated as reference caste; # Mizoram was treated as reference state.
Source: Unit Level Data of NSSO, 54th Round, 1998.

was positive and significant. This means assured irrigation by ensuring availability of fodders, particularly green fodders induces farmers to keep livestock. Possession of assured irrigation facility also reduces the risk of fodder shortage.

Access to farm households to institutional credit though influenced the farmers' decision to rear livestock positively, but not significantly. The access to different information sources had different influences on farmers' decision to rear livestock. While the access to radio had a positive and significant effect, access to television was negative and significant. The access to telephone and newspaper did not show any significant effect. The effect of caste (general) had a positive and significant influence on the decision of livestock rearing. It could be because of better resource endowments available to the general caste. The coefficients for state dummies showed different effects. Most of the states showed positive and significant effect, which indicated the role of state in promoting livestock development. Some states were more proactive to encourage farmers to keep livestock by institutional, technological and policy interventions, while some of the states lagged behind.

4. Summary and Conclusions

The study has shown that the growth of livestock sector has been slower in NER than at the national level. However, a significant proportion of landless labourers, small and marginal farmers has access to livestock resources and the acceleration in the growth of livestock sector in NER offers significant opportunities for household income augmentation and employment generation. It also performs an important input functions in terms of contributing draught power and dung to crop production. The factors responsible for growth in the livestock rearing in NER have been highlighted. These factors should be addressed to accelerate the development of livestock sector in the NER, which is an important source of livelihood for million of poor people. Moreover, among various agricultural enterprises, livestock production has more income redistributive effect on households and is very effective in reducing rural income inequality (Adams Jr and Jane, 1996; Birthal and Singh, 1995; Kumar *et al.,* 2007). Therefore, supportive technical, institutional and policy initiatives for improvement of breeds, feed availability, disease control, food safety and private investment are further required to expand production and improve productivity. Attention should also be paid to improve the viability of small farms by improving their accessibility to both input and output markets.

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