Chapter- 6

ECONOMICS OF LIVESTOCK FARMING

6.1 Role of Livestock Activities in Mountain Livelihoods

Livestock based activities are an essential component in integrated mountain livelihood systems (Jodha, 2000). With dominance in marginal landholdings along with low crop-yields, livestock rearing emerges as a subsidiary form of livelihood for hill farmers, particularly in the zones which have limited access to water resource. In all mountain farming systems comprising of crops and livestock, farmers usually hold a large of number of bovine animals which include few cows and buffaloes, and a few small animals such as sheep, goats and pigs along with poultry birds to meet their multiple needs. Such animals are treated as assets, which can easily be sold at times of emergency and thus, they act as insurances. The income-generating functions of livestock vary from livestock being the main cashcrop in smallholder dairy systems to the occasional sale of chicken or goats. In the Hindu Kush-Himalayas, livestock contribute 20-40 per cent or more to the income of farming households (Tulachan, 2000b). Livestock is the best means of converting local biomass into useful products and work opportunities, and so, it is a means of diversification into high-value products, especially when the consumption patterns of people have been shifted for livestock products. Thus, livestock rearing acts as a driving factor for transforming rural hill economy (Singh, *et al.*, 2001).

Besides economic contribution, livestock also assumes significant ecological implications associated with the number and composition of livestock, and thereby its fodder requirement and complementary relation among the components of livestock as well as between livestock and cropping activities. Livestock maintains soil fertility, especially in the hill region where the soil is subject to frequent erosion and therefore, it requires application of high degrees of manure. The intensification of cropland through concentration of nutrients and acceleration of nutrient cycling, depends upon the capacity of livestock to provide manure to the crops, particularly when chemical fertilisers are unavailable or beyond the farmer's capacity.

Gender is a crucial issue for the sustainable management of livestock, since women play critical roles in livestock management. In the study region, castes and communities of the people create a barrier in rearing some components of livestock such as pigs and chicken birds, which are not reared by higher caste people, mainly the Brahmins and the Chettris. Pigs are only reared by a limited number of SC/ST people such as the Mangars, Rais, Limbus, Tamangs, Lepchas and the Bhutanese (Dash, 1947, *op. cit.*). Because of stall feeding characteristics of livestock rearing in the region, the households need to spend huge mandays for collecting fodder and cleaning the cattle shed, despite having the advantage of obtaining the entire cow-dung at home.

6.2 Bovine Livestock Activities

The limited cropping activities in the region push the farm households to combine farming operations and livestock based activities together, especially bovine livestock activities. Agroclimatic suitability of the livestock animals and greater access to green fodder in the region provide an opportunity to the farm households of rearing better quality bovine animals, particularly cattle, and of yielding much milk. This region is quite rich in certain types of local grasses such as *Thyasanolaena agrostis*, *Pillosporum nepalensis, Anthusteria* sp., which act as feeds for bovine animals. The bovine animals maintain crop-livestock integration in hill farming and complement to lower cropping extent and income generation from crop cultivation in hill agriculture. The smallholder dairies based on cattle work against crop work-seasonality.

6.2.1 Stock, Ownership and Intensity of Bovine Livestock

Table 6.1 shows the stock, ownership and intensity of bovine livestock in the study region.

Table 6.1: Stock, Ownership and Intensity of Bovine Livestock across Villages

Villages	The Stock of the Livestock [Number]					The Ownership of the Livestock								The Intensity of the Livestock		
						Per Household [Number]					Proportion to Total Households [%]			Per Hectare NCA & Pasture Land		Per 100 Popula-tion
	Cattle			Goat & Sheep+	Total	Cattle			Goat & Sheep	Total	Total Live-stock	Total Cattle	Goat & Sheep	Total Live-stock	Total Cattle	Total Live-stock
	Indige-nous	Cross-bred	Total			Indige-nous	Cross-bred	Total								
High Diversification Areas																
Chisopani	10	39	49	28	77	0.40	1.56	1.96	1.12	3.08	*92*	*80*	*36*	5.9	3.8	50
Poshyore	24	45	69	58	127	0.96	1.80	2.76	2.32	5.08	*96*	*92*	*64*	9.7	5.2	83
Ramitay	6	58	64	50	114	0.24	2.32	2.56	2.00	4.56	*88*	*88*	*56*	9.1	5.1	80
Moderate Diversification Areas																
Mahakaldara	14	57	71	43	114	0.56	2.28	2.84	1.72	4.56	*84*	*80*	*52*	9.5	5.9	73
Lamini Gaon	0	60	60	92	152	0.00	2.40	2.40	3.68	6.08	*88*	*72*	*68*	9.7	3.8	95
Lepcha Gaon	22	32	54	45	99	0.88	1.28	2.16	1.80	3.96	*92*	*92*	*56*	8.0	4.4	60
Yogda	66	19	85	6	91	2.64	0.76	3.40	0.24	3.64	*96*	*96*	*8*	6.7	6.2	54
Low Diversification Areas																
Lower Gairi Gaon	10	68	78	50	128	0.40	2.72	3.12	2.00	5.12	*100*	*96*	*60*	11.8	7.2	91
Khawas Gaon	37	40	77	27	104	1.48	1.60	3.08	1.08	4.16	*96*	*96*	*44*	6.4	4.8	75
Upper Gairi Gaon	0	70	70	29	99	0.00	2.80	2.80	1.16	3.96	*100*	*100*	*32*	10.6	7.5	74
Bimbong	55	20	75	15	90	2.20	0.80	3.00	0.60	3.60	*100*	*100*	*24*	5.0	4.2	62
Sundung	20	19	39	36	75	0.80	0.76	1.56	1.44	3.00	*92*	*68*	*52*	6.5	3.4	56
All Villages	**264**	**527**	**791**	**479**	**1270**	**0.88**	**1.76**	**2.64**	**1.60**	**4.23**	***93.7***	***88.3***	**46.0**	**8.0**	**5.0**	**71**

Source: *Sample Survey*

* 4-chambered stomach ruminates, unbranched horns and universal presence of gall bladder, and comprises cattle, buffalo which was absent in the sample, goat and sheep; + only in Chisopani one household rears 2 indigenous sheep with goat

Over the whole sample, the households reared an average of 4.23 bovine animals comprising of 2.64 heads of cattle and 1.6 goats and sheep. The stock of bovine animals, especially cattle, per household was high in the study villages. Such livestock, particularly cattle, played a complementary role in the extension of cropping activities in the hamlets. In the less irrigated villages where the extension of crop cultivation activities was lower, the average cattle animals owned per household were more than in villages with better irrigation access. The households emphasised more on rearing cattle than on rearing goats in the villages. Consequently, the proportion of households engaged in rearing the animals and the holding of the animals per household were comparatively higher for cattle than for goats. In the study hamlets, the rearing of cattle was substituted by rearing of goats. For instance, the households owned less cattle heads along with the largest number of goats in the nearer villages, while the households held the lowest number of goats accompanied with the highest number of cattle in the more remote villages. Goat rearing was practised more in the nearer villages than in the more distant villages.

The necessity of bovine livestock in hill farming and their importance in the hill farmers's livelihoods were reflected in terms of very high proportion of engagement of the households in rearing such animals, especially cattle in the villages. The proportion of farm households involved in rearing such animals was higher in villages like Lower Gairi Gaon which are located away from market centres than in villages like Mahakaldara located closer to the market centres. Nevertheless, the biotic pressure of the cattle in terms of number of cattle per hectare cropland and pasture land, was relatively greater in the more distant villages. However, the economic dependency of the population in terms of number of such animals per 100 human populations, was relatively lower in the more remote villages like Yogda, while it was comparatively higher in the nearer villages like Lamini Gaon.

Table 6.2 shows the effects of holding-size on stock, ownership and intensity of bovine livestock.

Table 6.2: Stock, Ownership and Intensity of Bovine Livestock across Holding-size Categories

Landholding Categories	The Stock of the Livestock [Number]					The Ownership of the Livestock								The Intensity of the Livestock		
						Per Household [Number]					Proportion to Total Households [%]			Per Hectare NCA & Pasture Land		Per 100 Popula-tion
	Cattle					Cattle										
	Indige--nous	Cross-bred	Goats & Total	Sheep+	Total	Indige--nous	Cross-bred	Total	Goat & Sheep	Total	Total Live--stock	Total Cattle	Goat & Sheep	Total Live--stock	Total Cattle	Total Live--stock
Upto 1 acre (≤0.405 ha)	61	131	192	142	334	0.58	1.24	1.81	1.34	3.15	*90*	*78*	*42*	15.4	8.9	58
1-3 acres (0.405-1.214 ha)	150	287	437	246	683	0.99	1.89	2.88	1.62	4.49	*95*	*94*	*47*	7.6	4.9	75
Above 3 acres (>1.214 ha)	53	109	162	91	253	1.26	2.60	3.86	2.17	6.02	*98*	*93*	*55*	5.4	3.5	83
All Land Categories	**264**	**527**	**791**	**479**	**1270**	**0.88**	**1.76**	**2.64**	**1.60**	**4.23**	***94***	***88***	***46***	**8.0**	**5.0**	**71**

Source: Sample Survey

+ only one household in the large holding-size category rears 2 indigenous sheep with goat

Along with capacity of maintaining cross-bred cattle, requirement for draught animals and manure for crop cultivation, as well as availability of crop residue, fodder and forage, gradually rose with growing holding-sizes. Consequently, on an average the number of all bovine animals owned per household gradually rose with increased holding-sizes. Larger farmers owned considerably more bovine livestock assets per household. The proportion of farm households engaged in rearing bovine animals was directly related to holding-size. Hence, the inequality in rural land-asset holding was further enlarged in terms of ownership of bovine livestock heads. The intensity of bovine livestock, especially cattle, in terms of animals per hectare cropland and pasture land gradually decreased, while the intensity of such livestock in terms of animals per 100 human populations steadily increased with growing holding-sizes. So, the economic dependency of the farm households on bovine livestock gradually increased with growing holding-sizes, although the pressure of these animals on farmland was relatively higher for smaller farms when compared with larger farms.

6.2.2 Composition of Bovine Livestock

The variations in composition of the bovine animals across the study villages have been analysed in Table 6.3 for better assessing of the economic potential, purpose of rearing and environmental implications of such animals. Farm households reared goats mainly for meat sale, and these animals were considered as assets for being sold during emergency. The villages where dairy development was less, more goats were reared by the households. The proportion of goats and sheep to bovine animals was higher in villages located closer to market centres because of their greater opportunity of selling meat in the markets. Over the whole sample, the proportion of goats and sheep to bovine animals was 37.7 per cent, and of goats, only 0.6 per cent was *israyeli* cross-bred and 99.4 per cent were indigenous *sinjalay and paharay*. The cattle were reared for milk-yielding, draught power and manure, although the milk-yielding purpose was predominant, and thereby the milch cattle were dominant over the total cattle population in the villages. Nevertheless, 1.9 per cent of the cattle-holding households grazed their cattle for an average of 5.6 hours a day over the whole sample, but 10.1 per cent of the goat-holding households grazed their goats for an average of 4.7 hours a day. Hence, bovine livestock animals were mainly reared on stall feeding. The grazing opportunity was relatively greater for goats than for cattle mainly because of differences in their physical structure, accompanied by land gradients. The goats had more adverse effect on contiguous forest vegetation than the cattle, since the former were more dependent on tree leaves and branches, shrubs, young tree saplings and other forest vegetation for food than the latter.

Table 6.3: Composition of General & Cattle Livestock across Villages

Villages	The Composition of Cattle [Number of Animal]						The Composition of the Live Stock and Cattle [%]									
							Livestock		Cattle							
									Usages						Breeding	
	Bree--ding	Drau--ght	Milch	Dry	Heifer	Other*	Cattle	Goat/ Sheep	Bree--ding	Drau--ght	Milch	Dry	Heifer	Other*	Cross-bred out of Total	Cross-bred Milch out of Total Milch
High Diversification Areas																
Chisopani	0	8	18	5	1	17	*63.6*	*36.4*	*0.0*	*16.3*	*36.7*	*10.2*	*2.0*	*34.7*	*79.6*	*88.9*
Poshyore	0	12	17	11	6	23	*54.3*	*45.7*	*0.0*	*17.4*	*24.6*	*15.9*	*8.7*	*33.3*	*65.2*	*76.5*
Ramitay	0	10	21	4	4	25	*56.1*	*43.9*	*0.0*	*15.6*	*32.8*	*6.3*	*6.3*	*39.1*	*90.6*	*100.0*
Moderate Diversification Areas																
Mahakaldara	0	4	30	2	3	32	*62.3*	*37.7*	*0.0*	*5.6*	*42.3*	*2.8*	*4.2*	*45.1*	*80.3*	*80.0*
Lamini Gaon	1	0	22	6	3	28	*39.5*	*60.5*	*1.7*	*0.0*	*36.7*	*10.0*	*5.0*	*46.7*	*100.0*	*100.0*
Lepcha Gaon	0	14	11	9	4	16	*54.5*	*45.5*	*0.0*	*25.9*	*20.4*	*16.7*	*7.4*	*29.6*	*59.3*	*90.9*
Yogda	1	8	30	10	2	34	*93.4*	*6.6*	*1.2*	*9.4*	*35.3*	*11.8*	*2.4*	*40.0*	*22.4*	*20.0*
Low Diversification Areas																
Lower Gairi Gaon	1	8	29	4	1	35	*60.9*	*39.1*	*1.3*	*10.3*	*37.2*	*5.1*	*1.3*	*44.9*	*87.2*	*89.7*
Khawas Gaon	0	28	17	7	5	20	*74.0*	*26.0*	*0.0*	*36.4*	*22.1*	*9.1*	*6.5*	*26.0*	*51.9*	*76.5*
Upper Gairi Gaon	0	2	31	3	2	32	*70.7*	*29.3*	*0.0*	*2.9*	*44.3*	*4.3*	*2.9*	*45.7*	*100.0*	*100.0*
Bimbong	0	11	24	10	1	29	*83.3*	*16.7*	*0.0*	*14.7*	*32.0*	*13.3*	*1.3*	*38.7*	*26.7*	*25.0*
Sundung	0	16	6	5	1	11	*52.0*	*48.0*	*0.0*	*41.0*	*15.4*	*12.8*	*2.6*	*28.2*	*48.7*	*100.0*
All Villages	**3**	**121**	**256**	**76**	**33**	**302**	***62.3***	***37.7***	***0.4***	***15.3***	***32.4***	***9.6***	***4.2***	***38.2***	***66.6***	***75.8***

Source: *Sample Survey*
*incl. Young Cattle

The costs of maintenance and requirement for market-purchased inputs were considerably higher for rearing cross-bred cattle than for rearing indigenous cattle. Consequently, the proportion of cross-bred cattle to the total cattle heads was comparatively greater and thereby, the quality of cattle was better in villages, located closer to the market centres like Lamini Gaon. In the study region, around two-thirds of the cattle population were cross-bred, and around one-thirds of the cattle-holding households reared only indigenous cattle such as *paharay*, *mali*, and *pangri*, while two-thirds of the cattle-holding households reared cross-bred cattle such as jersey, cross-bred mixed, holstein, and siri. The indigenous cattle were superior to the cross-bred cattle for draught power since the former were relatively stronger, shorter and more adaptable to local topography compared to the latter. Over the whole sample, approximately three-fourths of the draught cattle heads were indigenous. The holding of draught cattle was dependent upon the extent of crop cultivation activities in the villages, and thereby the draught cattle population was relatively higher in villages with better irrigation access. Besides having ploughing operation on the land owned by the cattle holder, the draught cattle also generated animal rental for the poor households.

Since the cattle rearing households were more dependent on milch cattle for earning income, the stock of milch cattle was really supplementary to crop cultivation activities in the villages. Every household owned one milch cattle on an average and the proportion of milch cattle to the total cattle population was approximately one-thirds in the study region. On an average, each household held more milch cattle and the proportion of milch cattle to the total cattle population was higher in less irrigated villages like Mahakaldara. Over the whole sample, the proportion of cross-bred milch cattle to the total milch cattle was around three-fourths, and this proportion was relatively lower in more remote villages likeYogda. The local department of animal husbandry had provided insemination service through the exotic cattle breed, mainly jersey, to the farm households in the nearby villages for increasing the proportion of cross-bred cattle to the total cattle, while the households in the more remote villages were deprived of such opportunity. The households also attempted to increase the stock of cross-bred cattle by using whole breeding animals as cross-bred in the villages.

Table 6.4 depicts the composition of the bovine livestock across the holding-size categories.

Table 6.4: Composition of General & Cattle Livestock across Holding-size Categories

Landholding Categories	Composition of Cattle [Number of Animal]						The Composition of the Live Stock and Cattle [%]									
							Livestock		Cattle						Breeding	
									Usages							
	Bree-ding	Drau-ght	Milch	Dry	Heifer	Other*	Cattle	Goat/ Sheep	Bree-ding	Drau-ght	Milch	Dry	Heifer	Other*	Cross-bred out of Total	Cross-bred Milch out of Total Milch
Upto 1 acre (≤0.405 ha)	1	13	66	22	13	77	*57.5*	*42.5*	*0.5*	*6.8*	*34.4*	*11.5*	*6.8*	*40.1*	*68.2*	*72.7*
1-3 acres (0.405-1.214 ha)	2	74	140	42	13	166	*64.0*	*36.0*	*0.5*	*16.9*	*32.0*	*9.6*	*3.0*	*38.0*	*65.7*	*77.1*
above 3 acres (>1.214 ha)	0	34	50	12	7	59	*64.1*	*35.9*	*0.0*	*21.0*	*30.9*	*7.4*	*4.3*	*36.4*	*67.3*	*76.0*
All Land Categories	**3**	**121**	**256**	**76**	**33**	**302**	***62.3***	***37.7***	***0.4***	***15.3***	***32.4***	***9.6***	***4.2***	***38.2***	***66.6***	***75.8***

Source: *Sample Survey*

The proportion of cattle heads to all bovine animals as well as milch cattle per household rose gradually with growing holding-sizes, which pointed towards accumulation motive for farm diversification. With increase in holding-size, the requirement for draught animals rose for farming operations, and thereby the average draught cattle held per household and the proportion of draught cattle to the total cattle rose with growing holding-sizes. Consequently, the proportion of milch cattle to the total cattle population decreased steadily with growing holding-size.

The small farm households required less draught power, but they were more dependent on cattle for income. So, the proportion of cross-bred cattle to the total cattle heads was the highest in households with small-sized holdings and the lowest for medium farmer households. The opposite held true in case of the ratio of cross-bred milch cattle to the total milch cattle. Because of the requirement for additional care for rearing breeding cattle, this sort of cattle was not reared by large farmer households.

6.2.3 Economics of Bovine Livestock

The status and economics of the bovine livestock animals in the study region have been explored in Table 6.5. The cattle were generally sold for replacing the older cattle with young ones or the indigenous cattle with the cross-bred ones, and also for clearing excess stock. The goats were sold for meat, especially to meet emergency expenses. Along with very negligible contribution to manure, goats and sheep primarily contributed income to the hill farm households. However, the annual net sale value of goats and sheep per household was low in the villages. This sale value was relatively higher in the villages located closer to the market centres. Thus, the goats and sheep had low economic potential of diversification in the villages. The annual net sale value of the cattle per household was also low in the villages. The yearly sale value of cattle per household was higher, however, in the less irrigated villages. Hence, the farm households earned less income through market transaction of bovine animals in the villages.

The animal rental income was generated through the breeding process of bred-animals and through ploughing activities of draught cattle on others' land. Over the whole sample, of the total annual income generated from the bovine livestock, 5.3 per cent was animal rental, and around 90 per cent of animal rental was earned from draught cattle. With relatively more cropping activities in villages with better irrigation access like Khawas Gaon, the animal rental and contribution of draught cattle on others' land per household were relatively higher in well irrigated villages.

Through cattle rearing, the households got manure in the form of cow-dung for cultivating their crops and for maintaining the fertility of their cropland and also to protect their cropland from high soil

Table 6.5: Status and Economics of Bovine Livestock across Villages

Villages	Net Sale Value [Rs/yr.] Cattle	Goat/ Sheep	Ani--mal Rental [Rs/ yr.]	Contri--bution of Draught Cattle on Own Land [Rs/yr.]	Value of Cow--dung Yield [Rs/ yr.]	Milk Production and Sale of Cattle: Yield [Lit./ yr.]	Value of Yield [Rs/ yr.]	Sale [Lit./ yr.]	Sale Value [Rs/ yr.]	Cost Components of the Livestock [Rs/yr.]: Straw	Green--fodder & Others*	Special Feed	Other Husba--ndry	Net Return [Rs/yr.]	Income [Rs/yr.]
High Diversification Areas															
Chisopani	9520	5430	8200	7908	31317	32485	297840	20623	190895	51630	84008	113880	6490	104207	214045
Poshyore	4460	10640	23200	8165	31427	28561	206773	20623	149011	26593	111083	100010	3870	43109	187311
Ramitay	8020	15115	18600	13200	38100	43253	419385	33580	327040	33650	106305	139886	4750	227829	368775
Moderate Diversification Areas															
Mahakaldara	15360	9116	6400	1200	37479	70628	531258	61138	490179	2563	88451	176295	8960	324544	522555
Lamini Gaon	8980	15500	7800	0	29600	67160	555165	58035	478880	21073	96059	158593	7210	334111	513760
Lepcha Gaon	4960	6880	19400	8075	25348	20258	159231	15878	124191	28128	98473	73456	3200	20638	156431
Yogda	10480	420	17960	2870	37580	47085	350309	41063	312784	10163	113202	150380	3010	142864	341644
Low Diversification Areas															
Lower Gairi Gaon	-4780	5290	16400	2310	30120	67708	508536	51283	384801	46358	115123	160600	3350	232446	401711
Khawas Gaon	-290	2336	29600	22480	34998	20988	178381	13870	131358	27850	91954	65518	2190	79994	163004
Upper Gairi Gaon	14120	5540	6600	1120	26548	70080	525600	58218	436631	25330	101124	159140	3740	290194	462891
Bimbong	1430	250	14560	1890	35344	43526	308037	37960	268184	3688	110639	93440	1650	152094	284424
Sundung	-300	5640	28000	8415	18280	12228	108040	9490	83950	17870	69411	38234	2360	40200	119190
All Villages	**71960**	**82157**	**196720**	**77633**	**376141**	**523958**	**4148554**	**421758**	**3377904**	**294893**	**1185831**	**1429431**	**50780**	**1992230**	**3735741**

Villages	Per Hh Net Sale Value [Rs/yr.] Cattle	Goat/ Sheep	Per Hh Ani--mal Rent--al [Rs/ yr.]	Per Hh Contri--bution of Draught Cattle on Own Land [Rs/yr]	Per Hh Value of Cow--dung Yield [Rs/ yr.]	Milk Production of Cattle: Per Hh [Lit./ yr.]	Per Hh [Rs/ yr.]	Per Milch Cattle [Lit./ yr.]	Per Capita [Lit./ day]	Per Hh Milk Sold Value [Rs/ yr.]	Per Hh Gross Return [Rs/ yr.]	Net Return: Per Hh [Rs/ yr.]	Per Capi--ta [Rs/ yr.]	Income: Per Hh [Rs/ yr.]	Per Capi--ta [Rs/ yr.]	House--holds [Hhs] Havi--ng Milk Sale (%)	Milk Output Sold (%)
High Diversification Areas																	
Chisopani	381	217	328	316	1253	1299	11914	1805	0.57	7636	14409	4168	672	8562	1381	*56*	*63.5*
Poshyore	178	426	928	327	1257	1142	8271	1680	0.51	5960	11387	1724	282	7492	1224	*60*	*72.2*
Ramitay	321	605	744	528	1524	1730	16775	2060	0.83	13082	20497	9113	1593	14751	2579	*72*	*77.6*
Moderate Diversification Areas																	
Mahakaldara	614	365	256	48	1499	2825	21250	2354	1.24	19607	24033	12982	2080	20902	3350	*76*	*86.6*
Lamini Gaon	359	620	312	0	1184	2686	22207	3053	1.15	19155	24682	13364	2088	20550	3211	*64*	*86.4*
Lepcha Gaon	198	275	776	323	1014	810	6369	1842	0.34	4968	8956	826	125	6257	948	*44*	*78.4*
Yogda	419	17	718	115	1503	1883	14012	1570	0.77	12511	16785	5715	850	13666	2034	*64*	*87.2*
Low Diversification Areas																	
Lower Gairi Gaon	-191	212	656	92	1205	2708	20341	2335	1.33	15392	22315	9298	1660	16068	2869	*88*	*75.7*
Khawas Gaon	-12	93	1184	899	1400	840	7135	1235	0.42	5254	10700	3200	580	6520	1181	*60*	*66.1*
Upper Gairi Gaon	565	222	264	45	1062	2803	21024	2261	1.43	17465	23181	11608	2166	18516	3454	*92*	*83.1*
Bimbong	57	10	582	76	1414	1741	12321	1814	0.82	10727	14460	6084	1042	11377	1948	*80*	*87.2*
Sundung	-12	226	1120	337	731	489	4322	2038	0.25	3358	6723	1608	302	4768	896	*24*	*77.6*
All Villages	**240**	**274**	**656**	**259**	**1254**	**1747**	**13829**	**2047**	**0.80**	**11260**	**16511**	**6641**	**1112**	**12452**	**2086**	***65***	***80.5***

Source: *Sample Survey*

* the cost of green-fodder is the cost of its collection, and other costs involve the costs of home produced maize *khosala*, paddy husk and pulses residue

erosion. Cattle rearing was thus a common practice in the hills, and the yearly cow-dung yields per household were high in the study villages. The cow-dung yields were relatively higher in the more distant villages like Yogda. In the study region, the proportion of the money value of cow-dung to gross return of the cattle was 7.6 per cent, and this varied widely from one hamlet to another. Since most of this cow-dung was used on one's own cropland, less income was earned from cow-dung sale in the villages.

The most significant contribution of the cattle was milk-yielding, and the cattle rearing households got a major proportion of gross return of the cattle through milk yielding in the villages. The annual milk yield per household was high in the study region. The annual milk yield per household was relatively higher in less irrigated villages than in well irrigated villages. Consequently, the annual gross return of the bovine livestock per household was comparatively higher in villages with lower irrigation access. The remoteness of the villages as well as the mode of milk sale, together influenced the estimated value of milk in the villages.

Milk-yield per milch cattle primarily depended upon the bred composition of the milch cattle, along with special feed provided to them by the households. Special feed was mainly provided to the milch cattle. The expense on the special feed per milch cattle varied widely from one hamlet to another in variation of their income generation from milk sale and the economic conditions of the households. The proportion of cross-bred milch cattle to the total milch cattle, along with expenses on the special feed for milch cattle were relatively higher in villages located closer to the market centres. Hence, milk-yield per milch cattle was higher in nearer villages like Ramitay, while this was relatively lower in the more remote villages like Bimbong. Despite having local dairies in the more remote villages, the households reared large number of indigenous milch cattle because of the lower maintenance cost in rearing indigenous cattle. In the study region, all milch cattle were stall-fed to prevent their loss of energy while climbing up and down the hill slopes, thereby preventing loss of milk-yield.

The milk-yield per capita indicates the quantity of milk available for consumption and sale. The daily milk yield per capita was high in the study villages. This was higher in the villages with lower irrigation access than in the villages with higher irrigation access. In the study region, around two-thirds of the households daily sold about fourth-fifths of the total milk produced, and 96.5 per cent of the milk-sellers sold milk to consumers, vendors and co-operatives directly, while the rest sold milk in the form of processed milk products. The proportion of milk selling households to milk yielding households, the proportion of milk sold to milk yielded, and the income earned per household from the bovine livestock were relatively higher in the less irrigated villages. Along with milk availability and access to market, many households were forced to sell milk because of their impoverishment in the villages. For instance, higher proportion of milk was sold in the distant village of Sundung and in the more remote villages of Yogda and Bimbong, despite having their relatively lower quantity of daily milk availability per capita, while comparatively lower proportion of milk was sold in the nearer village of Chisopani, despite having its higher quantity of daily milk availability per capita.

The value and the income generation from one litre of milk sale depended upon the form and mode of milk sale. Although higher value was generated by selling one litre of milk in the processed form than in the milk form, limited households performed the former operation mainly in the more distant villages like Mahakaldara and Yogda because of their less access to markets. Over the whole sample, the sale price of one litre of milk to a direct consumer was relatively higher at Rs 9.8 than at Rs 7.5 and Rs 7.3 to vendors and co-operatives respectively. In the more remote villages, the ratio of the milk sale to vendors/co-operatives to the total milk sale was higher. So, the income from selling one litre of milk was relatively lower in the more distant villages than in the nearer villages. Hence, marketing imposes a constraint on dairies to be developed on a commercial line in the villages, particularly in the more remote villages.

The gross return of the bovine livestock was computed by adding the money value of milk, cow-dung, their animal rental and net sale value as well as the contribution of draught cattle on one's own cropland. The net return of the bovine livestock was performed by deducting their input costs comprising of the money value of home-raised crop residues, special feed costs and other animal husbandry costs in the forms of expenses on medical care and breeding from their gross return. The annual gross and net return as well as income per household of the bovine livestock were relatively

higher in the study region, and major proportions of these were generated from money value of milk and milk sale. These were comparatively higher in the villages with lower irrigation access than in the villages with better irrigation access. Hence, the bovine livestock, especially milch cattle, had great economic potential of diversification in the study villages, particularly in villages with lower irrigation access, although this opportunity was not equally harnessed in all the villages.

The status and economics of the bovine livestock across the holding-size categories are shown in Table 6.6.

Table 6.6: Status and Economics of Bovine Livestock across Holding-size Categories

Landholding Categories	Net Sale Value [Rs/yr.]		Ani-mal Rental [Rs/ yr.]	Contri-bution of Draught Cattle on Own Land [Rs/yr.]	Value of Cow-dung Yield [Rs/ yr.]	Milk Production and Sale of Cattle				Cost Components of the Livestock [Rs/yr.]				Net Return [Rs/yr.	Income
	Cattle	Goat/ Sheep				Yield [Lit./ yr.]	Value of Yield [Rs/ yr.]	Sale [Lit./ yr.]	Value [Rs/ Sale	Green-fodder & Straw	Others*	Feed	Special-ndry	Other Husba-[Rs/yr.]	
≤1 acre (≤0.405 ha)	10790	26400	36800	4305	90667	129575	1049271	103843	844224	78283		331711	355510	13610	439120	924714
1-3 acres	47130	40153	115840	45040	207979	292639	2314009	237068	1895155	165360		635347	795791	27220	1146432	2098778
>3 acres (>1.214 ha)	14040	15604	44080	28288	77495	101744	785275	80848	638525	51250		218773	278130	9950	406679	712249
All Land Categories	**71960**	**82157**	**196720**	**77633**	**376141**	**523958**	**4148554**	**421758**	**3377904**	**294893**		**1185831**	**1429431**	**50780**	**1992230**	**3735741**

Landholding Categories	Per Hh Net Sale Value [Rs/yr.]		Per Hh Ani-mal Rent-al [Rs/ yr.]	Per Hh Contri-bution of Draught Cattle on Own Land [Rs/yr]	Per Hh Value of Cow-dung Yield [Rs/ yr.]	Milk Production of Cattle				Per Hh Milk Sold Value [Rs/ yr.]	Per Hh Gross Return [Rs/ yr.]	Net Return		Income		House-holds [Hhs] Havi-ng Milk Sale (%)	Milk Output Sold (%)
	Cattle	Goat/ Sheep				Per Hh [Lit./ yr.]	Per Hh [Rs/ yr.]	Per Milch Cattle [Lit./ yr.]	Per Capita [Lit./ day]			Per Hh [Rs/ yr.]	Per Capi-ta [Rs/ yr.]	Per Hh [Rs/ yr.]	Per Capi-ta [Rs/ yr.]		
≤1 acre (≤0.405 ha)	102	249	347	41	855	1222	9899	1963	0.62	7964	11493	4143	768	8724	1617	*54*	*80.1*
1-3 acres	310	264	762	296	1368	1925	15224	2090	0.88	12468	18225	7542	1254	13808	2296	*68*	*81.0*
>3 acres (>1.214 ha)	334	372	1050	674	1845	2422	18697	2035	0.91	15203	22971	9683	1333	16958	2335	*81*	*79.5*
All Land Categories	**240**	**274**	**656**	**259**	**1254**	**1747**	**13829**	**2047**	**0.80**	**11260**	**16511**	**6641**	**1112**	**12452**	**2086**	***65***	***80.5***

Source: *Sample Survey*

* others incl. reproductive female and meat pig animals

Annual net sale value of cattle, goats and sheep per household increased with increasing holding-size. Annual rental income, contribution of draught cattle on one's own land, money value of cow-dung yield, money value of milk output and milk sale per household also rose with increased holding-size. Consequently, yearly return and income per household from bovine livestock as well as proportion of households involved in milk sale to total households and daily milk availability per capita increased gradually with growing holding-sizes. Hence, the perceived farm-size dependent inequality in terms of annual crop income generated per household across the holding-sizes was magnified through rearing bovine livestock. The larger farmer households diversified their farming operations through rearing bovine livestock animals for profits. However, the extent of landholding-size dependent inequality reflected in annual income per household of the bovine livestock was relatively lower than the inequality revealed in annual crop income per household. Since the smaller and medium farmer households were in more economic distress compared to the larger farmer households, the proportion of milk sale to total milk yield was comparatively higher in households with smaller holding-sizes than in households with large-sized holdings, despite having lower daily milk availability per capita in households with smaller-sized holdings.

6.3 Status, Composition and Economics of Piggery Livestock

The piggery livestock was distinct from the bovine livestock in terms of nature of feed required for pig rearing and caste barrier in pig rearing, as in rearing of small scale indigenous poultry birds. Unused, excess food of the human population and inferior crop-residue such as paddy husk were used as feed for pigs. The establishment of Small Farmer Development Agency [SFDA] between 1971 and 1972 during the Fourth Five Year Plan, catalysed for rearing livestock animals, especially pigs, in the study region.

6.3.1 Stock, Ownership, Intensity and Composition of Piggery Animals

Table 6.7 explores the stock, ownership, intensity and composition of piggery livestock in the study hamlets.

Table 6.7: The Stock, Ownership, Intensity and Composition of Piggery Animals across Villages

	The Stock [Number]			The Ownership of Piggery Livestock					The Intensity		The Composition of Piggery Livestock						
				Per Household [Hh] [Number]			Hhs Engaged [%]				Usages						Breed-ing
											Number of Animals			Proportion to Total Animals [%]			
Villages	Indige-nous	Cross-bred	Total	Indige-nous	Cross-bred	Total	Total	Cross-bred	Ani-mals Per Hec-tare NCA	Ani-mals Per 100 Popu-lation	Bree-ding Male	Repro-duc-tive Female	Meat Ani-mals & Others*	Bree-ding Male	Repro-duc-tive Fem-ale	Meat Ani-mals& Others*	Cross-bred out of Total Anim-als [%]
High Diversification Areas																	
Chisopani	2	6	8	0.08	0.24	0.32	*12*	*8*	0.62	5.2	0	0	8	*0.0*	*0.0*	*100.0*	75.0
Poshyore	10	0	10	0.40	0.00	0.40	*36*	*0*	0.77	6.5	0	4	6	*0.0*	*40.0*	*60.0*	0.0
Ramitay	3	3	6	0.12	0.12	0.24	*20*	*8*	0.48	4.2	0	0	6	*0.0*	*0.0*	*100.0*	50.0
Moderate Diversification Areas																	
Mahakaldara	1	5	6	0.04	0.20	0.24	*16*	*12*	0.54	3.8	0	0	6	*0.0*	*0.0*	*100.0*	83.3
Lamini Gaon	0	6	6	0.00	0.24	0.24	*8*	*8*	0.41	3.8	1	2	3	*16.7*	*33.3*	*50.0*	100.0
Lepcha Gaon	23	6	29	0.92	0.24	1.16	*60*	*12*	2.36	17.6	1	8	20	*3.4*	*27.6*	*69.0*	20.7
Yogda	22	0	22	0.88	0.00	0.88	*48*	*0*	1.62	13.1	1	2	19	*4.5*	*9.1*	*86.4*	0.0
Low Diversification Areas																	
Lower Gairi Gaon	2	0	2	0.08	0.00	0.08	*8*	*0*	0.18	1.4	0	0	2	*0.0*	*0.0*	*100.0*	0.0
Khawas Gaon	8	0	8	0.32	0.00	0.32	*32*	*0*	0.49	5.8	0	0	8	*0.0*	*0.0*	*100.0*	0.0
Upper Gairi Gaon	9	0	9	0.36	0.00	0.36	*32*	*0*	0.97	6.7	0	0	9	*0.0*	*0.0*	*100.0*	0.0
Bimbong	21	0	21	0.84	0.00	0.84	*72*	*0*	1.20	14.4	0	1	20	*0.0*	*4.8*	*95.2*	0.0
Sundung	7	0	7	0.28	0.00	0.28	*20*	*0*	0.61	5.3	0	0	7	*0.0*	*0.0*	*100.0*	0.0
All Villages	**108**	**26**	**134**	**0.36**	**0.09**	**0.45**	***30***	***4***	**0.86**	**7.5**	**3**	**17**	**114**	***2.2***	***12.7***	***85.1***	**19.4**

Source: *Sample Survey*

* incl. unsold piglets of less than 1 month with the numbers 6 and 5 in Lepcha Gaon and Yogda respectively

With caste barrier in rearing pigs for the households in the study region, proportion of the households rearing pigs to total households, the average pigs held per household as well as economic dependency of the sample population on piggery livestock were low in the study villages. Generally, these were relatively higher in tribal villages like Lepcha Gaon and lower in non-tribal villages like Lower Gairi Gaon, since the pigs were mainly reared by tribal households. Over the whole sample, 86.9 per cent of pig rearing households reared indigenous pigs such as *purni* and the rest reared cross-bred pigs such as Yorkshire. The management cost for rearing cross-bred pigs was higher compared to that for rearing indigenous pigs. So, with the increase in remoteness of the villages, the proportion of cross-bed pigs to total pigs declined, it even reduced to zero.

The households reared pigs for multiple purposes such as rearing breeding male animals, mainly cross-bred for rental income, rearing reproductive female animals for generation and sale of piglets, and rearing meat animals for selling meat. However, in the study villages, the pigs were mainly reared for

meat sale through purchasing piglets and selling the same number of animals at maturity. The reproductive female pig rearing households based on stock of reproductive female pigs, sold many piglets. Reproductive female pigs were reared by limited households in the nearer village of Lamini Gaon, in the more remote village of Bimbong and in villages like like Lepcha Gaon, which were dominated by tribal communities.

Table 6.8 shows the stock, ownership, intensity and composition of pigs across the holding-size categories.

Table 6.8: Stock, Ownership, Intensity, and Composition of Piggery Animals across Holding-size Categories

	The Stock [Number]			The Ownership of Piggery Livestock					The Intensity		The Composition of Piggery Livestock					
				Per Household [Hh] [Number]			Hhs Engaged [%]				Usages: Number of Animals			Usages: Proportion to Total Animals [%]			Breeding
Landholding Categories	Indige-nous	Cross-bred	Total	Indige-nous	Cross-bred	Total	Total	Cross-bred	Animals Per Hectare NCA	Animals Per 100 Population	Breeding Male	Reproductive Female	Meat Animals & Others*	Breeding Male	Reproductive Female	Meat Animals& Others*	Cross-bred out of Total Animals [%]
≤1 acre (≤0.405 ha)	21	4	25	0.20	0.04	0.24	*21*	*2*	1.16	4.4	0	2	23	*0.0*	*8.0*	*92.0*	16.0
1-3 acres	70	18	88	0.46	0.12	0.58	*36*	*6*	0.99	9.6	3	14	71	*3.4*	*15.9*	*80.7*	20.5
>3 acres (>1.214 ha)	17	4	21	0.40	0.10	0.50	*36*	*2*	0.47	6.9	0	1	20	*0.0*	*4.8*	*95.2*	19.0
All Land Categories	**108**	**26**	**134**	**0.36**	**0.09**	**0.45**	***30***	***4***	**0.86**	**7.5**	**3**	**17**	**114**	***2.2***	***12.7***	***85.1***	**19.4**

Source*: Sample Survey*

* incl. unsold piglets of less than 1 month with the numbers 11 only in medium holding-size category

Although the proportion of pig rearing households to total households gradually rose with growing holding-size, pig stock per household was found to be the highest in medium farmer households and was observed to be the lowest in small farmer households. Consequently, the economic dependency of the population on piggery livestock was lowest in households with small-sized holdings and highest in households with medium-sized holdings. The proportion of cross-bred pigs to total pigs and the proportion of households rearing cross-bred pigs to total pig rearing households were also lowest in small farmer households and highest in medium farmer households. Whole breeding male pigs and 82 per cent of the total reproductive female pigs were reared by households in medium-sized holdings. Consequently, the proportion of meat pigs to total pigs was comparatively higher for small and large farmers compared to the medium farmers. Hence, the motive for pig rearing was different in the holdings of small and large-sizes compared to medium-size holdings, and the accumulation motive for diversification through piggery livestock was not perceived by households in the holding-sizes.

6.3.2 Status and Economics of Piggery Livestock

Table 6.9 examines the status and economics of piggery livestock in the study villages. The annual total value addition of the piggery livestock was computed by adding the annual net sale value of pigs, unsold value of piglets and meat animals and the annual rental income of breeding male pigs. Despite having low proportion of pig rearing households to total households and thereby low pig stock per household, the annual value addition per household of the piggery livestock was high in the study region. The net return of the piggery livestock was computed by deducting the total costs of pig rearing comprising of the costs of ordinary and special feed, the slaughter cost and other costs such as expenses on vitamin, breeding cost and medical expenditure from the total value addition of pigs. The income from the piggery livestock was computed by subtracting the value of unsold piglets and meat pigs from the total value addition of piggery livestock. The annual income generation and net return per household of the

piggery livestock were low in the study villages, although value addition per reproductive female pig or per meat pig was high in the villages.

Table 6.9: Status and Economics of Piggery Livestock across Villages

Villages	Transaction of Pig Animals: Bought No./yr.	Bought Value [Rs/yr.]	Sold No./yr.	Sold Value [Rs/yr.]	Value of Unsold Piglets [Rs/yr.]	Value of Unsold Meat Pigs [Rs/yr.]	Value Addition: Breeding Male [Rs/yr.]	Others* [Rs/yr.]	Total [Rs/yr.]	Cost Components: Ordinary Feed [Rs/yr.]	Special Feed [Rs/yr.]	Slaughter Costs [Rs/yr.]	Other Costs [Rs/yr.]	Total Costs [Rs/yr.]	Net Return [Rs/yr.]	Income [Rs/yr.]
High Diversification Areas																
Chisopani	6	7100	6	33520	0	0	0	26420	26420	2880	6960	150	245	10235	16185	26420
Poshyore	10	14800	54	67200	0	0	0	52400	52400	6165	15755	450	500	22870	29530	52400
Ramitay	6	5950	6	31050	0	0	0	25100	25100	2400	6480	450	230	9560	15540	25100
Moderate Diversification Areas																
Mahakaldara	5	5200	5	27900	0	0	0	22700	22700	2640	7680	600	150	11070	11630	22700
Lamini Gaon	1	1300	20	43600	0	0	1800	42300	44100	2670	5590	150	80	8490	35610	44100
Lepcha Gaon	18	18800	100	152300	6700	9800	3600	150000	153600	12580	38836	600	1160	53176	100424	137100
Yogda	18	15500	45	84500	4500	0	1800	73500	75300	10120	16880	2200	590	29790	45510	70800
Low Diversification Areas																
Lower Gairi Gaon	2	1600	2	6800	0	0	0	5200	5200	960	1320	0	45	2325	2875	5200
Khawas Gaon	8	7950	5	22400	0	13486	0	27936	27936	3840	5760	760	280	10640	17296	14450
Upper Gairi Gaon	9	7650	8	32200	0	3350	0	27900	27900	4800	9600	150	251	14801	13099	24550
Bimbong	20	17650	30	76400	0	0	0	58750	58750	12730	11415	2830	435	27410	31340	58750
Sundung	8	7500	6	29500	0	11514	0	33514	33514	3360	8400	600	340	12700	20814	22000
All Villages	**111**	**111000**	**287**	**607370**	**11200**	**38150**	**7200**	**545720**	**552920**	**65145**	**134676**	**8940**	**4306**	**213067**	**339853**	**503570**

Villages	Transaction of Pig Animals: Per Hh Bought No./yr.	Per Hh Sold No./yr.	Share of Piglets to Total Animals Sold [%]	Share of Piglets to Total Animals Sold Value[%]	Total Value Addition: Per Hh [Rs/yr.]	Per Capita [Rs/yr.]	Share of Meat Pig Animal [%]	Share of Reproductive Female Animal [%]	Value Addition Per Meat Pig Animal [Rs/yr.]	Value Addition Per Reproductive Female Animal [Rs/yr.]	Net Return: Per Hh [Rs/yr.]	Net Return: Per Capita [Rs/yr.]	Income: Per Hh [Rs/yr.]	Income: Per Capita [Rs/yr.]
High Diversification Areas														
Chisopani	0.24	0.24	*0.0*	*0.0*	1057	170	*100.0*	*0.0*	4403	0	647	104	1057	170
Poshyore	0.40	2.16	*88.9*	*68.0*	2096	342	*30.5*	*69.5*	2667	9100	1181	193	2096	342
Ramitay	0.24	0.24	*0.0*	*0.0*	1004	176	*100.0*	*0.0*	4183	0	622	109	1004	176
Moderate Diversification Areas														
Mahakaldara	0.20	0.20	*0.0*	*0.0*	908	146	*100.0*	*0.0*	4540	0	465	75	908	146
Lamini Gaon	0.04	0.80	*75.0*	*41.5*	1764	276	*44.0*	*51.9*	3880	11450	**1424**	**223**	1764	276
Lepcha Gaon	0.72	4.00	*89.0*	*64.1*	6144	931	*33.0*	*64.6*	3900	12413	4017	609	5484	831
Yogda	0.72	1.80	*66.7*	*32.0*	3012	448	*59.2*	*38.4*	2973	14450	1820	271	2832	421
Low Diversification Areas														
Lower Gairi Gaon	0.08	0.08	*0.0*	*0.0*	208	37	*100.0*	*0.0*	2600	0	115	21	208	37
Khawas Gaon	0.32	0.20	*0.0*	*0.0*	1117	202	*100.0*	*0.0*	3492	0	692	125	578	105
Upper Gairi Gaon	0.36	0.32	*0.0*	*0.0*	1116	208	*100.0*	*0.0*	3100	0	524	98	982	183
Bimbong	0.80	1.20	*33.3*	*9.8*	2350	402	*87.2*	*12.8*	2563	7500	**1254**	**215**	2350	402
Sundung	0.32	0.24	*0.0*	*0.0*	1341	252	*100.0*	*0.0*	4189	0	833	156	880	165
All Villages	**0.37**	**0.96**	***66.9***	***32.3***	**1843**	**309**	***63.4***	***35.3***	**3405**	**11471**	**1133**	**190**	**1679**	**281**

Source: *Sample Survey*

* incl. reproductive female and meat pig

Generally, the annual value addition, net return and income generation per household of the piggery livestock were relatively higher in tribal villages like Lepcha Gaon and lower in non-tribal villages like Lower Gairi Gaon. Because of more productiveness of reproductive female pigs in terms of value

addition and income generation, these were comparatively higher in reproductive female pig rearing villages like Poshyore than in other villages. Over the whole sample, the average meat produced from matured cross-bred meat pigs was 90kgs compared to the 64kgs produced from indigenous matured pigs, and the price of pork varied between Rs 60-70 per kg in the villages. In nearer villages like Lamini Gaon, the households reared higher proportion of cross-bred meat pigs to total meat pigs, and so, the annual value addition per meat pig was comparatively higher in these villages compared to villages like Bimbong, located farther away from the market centres. Hence, the piggery livestock, especially reproductive females, had great economic potential of diversification in the villages, especially in the reproductive female pig rearing villages. However, because of caste barrier in rearing pigs, such potential was not properly harnessed by the households in all the villages.

Table 6.10 shows the status and economics of the piggery livestock across the holding-size categories.

Table 6.10: Status and Economics of Piggery Livestock across Holding-size Categories

	Transaction of Pig Animals				Value of	Value of	Value Addition			Cost Components						
	Bought		Sold		Unsold	Unsold	Bree-	Oth-		Ordi-	Spec-	Slau-	Other	Total		
Landholding Categories	No. /yr.	Value [Rs/ yr.]	No. /yr.	Value [Rs/ yr.]	Piglets [Rs/ yr.]	Meat Pigs [Rs/ yr.]	-ding Male [Rs/ yr.]	-ers* [Rs/ yr.]	Total [Rs/ yr.]	-nary Feed [Rs/ yr.]	-ial Feed [Rs/ yr.]	-ghter Costs [Rs/ yr.]	Costs [Rs/ yr.]	Costs [Rs/ yr.]	Net Return [Rs/yr.]	Income [Rs/ yr.]
Upto 1 acre (≤0.405 ha)	27	27550	53	123750	0	7912	0	104112	104112	14920	25010	1200	961	42091	62021	96200
1-3 acres (0.405-1.214 ha)	66	66350	207	408770	11200	25776	7200	379396	386596	39655	93451	5810	2800	141716	244880	349620
above3 acres (>1.214 ha)	18	17100	27	74850	0	4462	0	62212	62212	10570	16215	1930	545	29260	32952	57750
All Land Categories	**111**	**111000**	**287**	**607370**	**11200**	**38150**	**7200**	**545720**	**552920**	**65145**	**134676**	**8940**	**4306**	**213067**	**339853**	**5035**

	Transaction of Pig Animals					Total Value Addition									
	Per Hh Bou- -ght	Per Hh Sold	Share of Piglets to Total Animals	Share of Piglets to Total Animals	Per Hh	Per Capita	Share of Meat Pig Ani-	Share of Repro- -ductive Female	Value Addi- -tion Per Meat Pig	Value Addition Per Repro- -ductive Female	Net Return		Income	
Landholding Categories	No. /yr.	No. /yr.	Sold [%]	Value[%]	Sold [Rs/ yr.]	[Rs/ yr.]	-mal [%]	Animal [%]	Animal [Rs/yr.]	Animal [Rs/yr.]	Per Hh [Rs/ yr.]	Per Capita [Rs/ yr.]	Per Hh [Rs/ yr.]	Per Capi- -ta [Rs/ yr.]
Upto 1 acre (≤0.405 ha)	0.25	0.50	*56.6*	*23.1*	982	182	*76.0*	*24.0*	3164	12500	585	108	908	168
1-3 acres (0.405-1.214 ha)	0.43	1.36	*73.4*	*39.1*	2543	423	*56.1*	*42.0*	3615	11607	1611	268	2300	383
above 3 acres (>1.214 ha)	0.43	0.64	*37.0*	*10.0*	1481	204	*87.9*	*12.1*	3040	7500	785	108	1375	189
All Land Categories	**0.37**	**0.96**	***66.9***	***32.3***	**1843**	**309**	***63.4***	***35.3***	**3405**	**11471**	**1133**	**190**	**1679**	**281**

Source: *Sample Survey*

* incl. reproductive female and meat pig animals

The annual purchase and sale of pigs per household as well as value addition, net return and income generation of the piggery livestock per household and per capita were highest for medium farmer households and lowest for small farmer households, mainly because of relatively more reproductive female pigs reared by the households on an average in the holdings of medium-size than by the households in the holdings of small and large-sizes. Consequently, the proportion of piglet sale to total annual sale of pigs was highest in medium farmer households and lowest in large farmer households. The annual value addition per meat pig was also highest in households with medium-sized holdings mainly because of comparatively greater proportion of cross-bred pigs to total pigs and highest annual feed cost of Rs 1729 per matured pig in this category of households. This was lowest in households with large-sized holdings mainly because of lowest annual feed cost of Rs 1275 per matured pig for these households despite having comparatively greater proportion of cross-bred pigs to total pigs in these households compared to the small farmer households. However, the annual value addition per reproductive female gradually declined with growing holding-size. Hence, the economic potential of

diversification through piggery livestock was relatively more harnessed by households in the medium-sized holdings compared to the others, and it was least captured by households in smallholding-size.

6.4 Status, Composition and Economics of Poultry Livestock

The poultry birds are distinctive from other livestock components in terms of multiple yardsticks such as nature of feed, life-span of the animal, time requirement for rearing, the asset embodiment in the animal, the purpose of rearing, especially for indigenous birds, and supply management of output for exotic poultry birds. The bovine animals are sold in emergency such as bad crop year when relatively larger amount of money is needed, whereas the indigenous poultry birds are sold in emergency for multiple times in a year during the lean period of income for fulfilling routine expenditure, starting from meat birds to egg producing bird when necessary. Thereby the poultry birds function as insurances in true sense. The contribution of the indigenous poultry birds to crop cultivation activities is limited owing to the provision of low proportion of total manure, while they are dependent on crops for feeding like as piggery livestock. While the indigenous poultry birds are mainly reared for meeting the family need of eggs and meat, the exotic poultry birds are commercially reared for earning income. With the shift of the consumption patterns from red meat to white meat and from vegetable foods to non-vegetable foods, especially eggs and chicken meat because of increasing purchasing power, the importance of the poultry livestock has grown rapidly.

6.4.1 Stock, Ownership and Composition of Poultry Birds

The stock, ownership and composition of the poultry livestock in the study villages have been explored in Table 6.11. In terms of considerably higher stock of indigenous chicken birds per household and greater proportion of households were involved in rearing indigenous chicken birds compared to the exotic chicken birds, the poultry birds in the villages are broadly termed as indigenous chicken birds. However, the stock of poultry birds, particularly exotic chicken birds, were altered over time, since they were supply responsive and frequent transaction of such birds occurred during a year. Because of the necessity of market-purchased inputs and more market access as well as financial backup and skill for rearing exotic chicken birds, very limited households in the villages located closer to the market centres like Ramitay, Chisopani, Lepcha Gaon and Poshyore, reared exotic chicken birds of 50 as a batch at once and multiple batches per annum for meat. The households in the more remote villages, like Bimbong, did not rear exotic poultry birds mainly because of their limited access to market. With limited water storage source such as ponds, few households reared ducks and geese on a smaller scale in selected villages, mainly in villages with better irrigation access. However, the proportion of households rearing indigenous poultry birds to total households and stock of indigenous poultry birds per household were high in the study region. Over the whole sample, the stocks of indigenous and total chicken birds per household were 7.8 and 9.1 respectively against only 0.06 for indigenous ducks and geese. Because of caste barrier in rearing indigenous poultry birds in the study region, the proportion of the households rearing poultry birds to total households, the stock of indigenous as well as total poultry birds per household were relatively higher in villages, like Lepcha Gaon, which are dominated by tribal communities and lower in non-tribal villages, like Mahakaldara.

The indigenous poultry birds were reared for both meat and eggs in the villages, although the geese were reared only for eggs. Generally, the indigenous female chicken birds laid eggs after crossing 5.5 months, but over the whole sample 22 such birds did not lay eggs and thereby were used as meat birds. After crossing 1.5 years, the egg laying birds did not produce eggs, and thereby they were used as meat birds. The egg laying purpose was thus predominant than meat generation purpose in indigenous chicken bird rearing in the villages. In the hamlets, the proportion of indigenous egg laying chicken birds to the total indigenous chicken birds was comparatively higher than the proportion of meat birds to the total indigenous chicken birds. Over the whole sample, the proportion of indigenous egg laying birds to the total indigenous poultry birds was 23.5 per cent. The proportion of egg laying chicken birds to

Table 6.11: Stock, Ownership and Composition of Poultry Livestock across Villages

Villages	The Stock [Number]						The Composition of Indigenous Poultry Birds [Number]								Engagement of Hhs [Number]			
	Chicken					Indige-nous Birds	Laying Birds			Meat Birds			<5 Months & Others*		Total Poultry	Indige-nous Poultry/ Chicken#	Exotic Chicken	Duck
	Indige-nous	Exotic*	Total	Duck/ Geese$	Total Birds		Total	Chicken	Duck/ Geese	Total	Chicken	Duck	Total	Chicken				
High Diversification Areas																		
Chisopani	98	48	146	0	146	98	36	36	0	17	17	0	45	45	12	11	1	0
Poshyore	273	100	373	5	378	278	53	52	1	25	24	1	200	197	22	22	2	1
Ramitay	204	100	304	2	306	206	60	59	1	25	24	1	121	121	21	20	2	1
Moderate Diversification Areas																		
Mahakaldara	83	0	83	2	85	85	29	27	2	10	10	0	46	46	10	10	0	0
Lamini Gaon	236	0	236	0	236	236	47	47	0	20	20	0	169	169	15	15	0	0
Lepcha Gaon	349	150	499	0	499	349	73	73	0	30	30	0	246	246	25	25	3	0
Yogda	177	0	177	0	177	177	39	39	0	15	15	0	123	123	16	16	0	0
Low Diversification Areas																		
Lower Gairi Gaon	174	0	174	4	178	178	61	58	3	14	13	1	103	103	17	17	0	2
Khawas Gaon	204	0	204	0	204	204	23	23	0	13	13	0	168	168	20	20	0	0
Upper Gairi Gaon	156	0	156	0	156	156	61	61	0	21	21	0	74	74	21	21	0	0
Bimbong	167	0	167	6	173	173	36	34	2	19	18	1	118	115	19	19	0	2
Sundung	211	0	211	0	211	211	39	39	0	12	12	0	160	160	22	22	0	0
All Villages	**2332**	**398**	**2730**	**19**	**2749**	**2351**	**557**	**548**	**9**	**221**	**217**	**4**	**1573**	**1567**	**220**	**218**	**8**	**6**

Villages	The Ownership of Poultry Birds										The Composition of Indigenous Poultry Birds						Meat Birds out of Total Poultry Birds [%]
	Per Household [Hh] [Number]						Hhs Engaged [%]				Chicken		Duck/Geese		Total		
	Chicken					Indige-nous Birds	Total Poultry	Indige-nous Poultry/ Chicken#	Exotic Chicken	Duck	Laying Birds [%]	Meat Birds [%]	Laying Birds [%]	Meat Birds [%]	Laying Birds [%]	Meat Birds [%]	
	Indige-nous	Exotic*	Total	Duck/ Geese$	Total Birds												
High Diversification Areas																	
Chisopani	3.92	1.92	5.84	0.00	5.84	3.92	*48*	*44*	*4*	*0*	*36.7*	*17.3*	*0.0*	*0.0*	*36.7*	*17.3*	*44.5*
Poshyore	10.92	4.00	14.92	0.20	15.12	11.12	*88*	*88*	*8*	*4*	*19.0*	*8.8*	*20.0*	*20.0*	*19.1*	*9.0*	*33.1*
Ramitay	8.16	4.00	12.16	0.08	12.24	8.24	*84*	*80*	*8*	*4*	*28.9*	*11.8*	*50.0*	*50.0*	*29.1*	*12.1*	*40.8*
Moderate Diversification Areas																	
Mahakaldara	3.32	0.00	3.32	0.08	3.40	3.40	*40*	*40*	*0*	*0*	*32.5*	*12.0*	*100.0*	*0.0*	*34.1*	*11.8*	*11.8*
Lamini Gaon	9.44	0.00	9.44	0.00	9.44	9.44	*60*	*60*	*0*	*0*	*19.9*	*8.5*	*0.0*	*0.0*	*19.9*	*8.5*	*8.5*
Lepcha Gaon	13.96	6.00	19.96	0.00	19.96	13.96	*100*	*100*	*12*	*0*	*20.9*	*8.6*	*0.0*	*0.0*	*20.9*	*8.6*	*36.1*
Yogda	7.08	0.00	7.08	0.00	7.08	7.08	*64*	*64*	*0*	*0*	*22.0*	*8.5*	*0.0*	*0.0*	*22.0*	*8.5*	*8.5*
Low Diversification Areas																	
Lower Gairi Gaon	6.96	0.00	6.96	0.16	7.12	7.12	*68*	*68*	*0*	*8*	*33.3*	*7.5*	*75.0*	*25.0*	*34.3*	*7.9*	*7.9*
Khawas Gaon	8.16	0.00	8.16	0.00	8.16	8.16	*80*	*80*	*0*	*0*	*11.3*	*6.4*	*0.0*	*0.0*	*11.3*	*6.4*	*6.4*
Upper Gairi Gaon	6.24	0.00	6.24	0.00	6.24	6.24	*84*	*84*	*0*	*0*	*39.1*	*13.5*	*0.0*	*0.0*	*39.1*	*13.5*	*13.5*
Bimbong	6.68	0.00	6.68	0.24	6.92	6.92	*76*	*76*	*0*	*8*	*20.4*	*10.8*	*33.3*	*16.7*	*20.8*	*11.0*	*11.0*
Sundung	8.44	0.00	8.44	0.00	8.44	8.44	*88*	*88*	*0*	*0*	*18.5*	*5.7*	*0.0*	*0.0*	*18.5*	*5.7*	*5.7*
All Villages	**7.77**	**1.33**	**9.10**	**0.06**	**9.16**	**7.84**	***73.3***	***72.7***	***2.7***	***2.0***	***23.5***	***9.3***	***47.4***	***21.1***	***23.7***	***9.4***	***22.5***

Source: *Sample Survey*

* exotic breeds poultry birds are reared for meat purpose only and its stock changes over month; $ only one household rears 2 indigenous breeds laying geese in Mahakaldara; and # incl. such indigenous breeds female chicken (>5 months, but are not laying)

total indigenous chicken birds was relatively higher in the non-tribal villages, like Chisopani, and lower in the tribal villages, like Poshyore, mainly because the higher caste people did not eat chicken meat, though they ate eggs.

The stock, ownership and composition of poultry birds across the holding-size categories are in Table 6.12.

Table 6.12: Stock, Ownership, and Composition of Poultry Livestock across Holding-size Categories

Landholding Categories	The Stock [Number]						The Composition of Indigenous Poultry Birds [Number]								Engagement of Hhs [Number]			
	Chicken						Laying Birds			Meat Birds			<5 Months & Others*					
	Indige--nous	Exotic*	Total	Duck/ Geese$	Total Birds	Indige -nous Birds	Total	Chic--ken	Duck/ Geese	Total	Chic--ken	Duck	Total	Chic--ken	Total Poul--try	Indige--nous Poultry/ Chic--ken#	Exotic Chic--ken	Duck
≤1 acre (≤0.45 ha)	621	148	769	0	769	621	167	167	0	66	66	0	388	388	73	72	3	0
1-3 acres	1332	250	1582	11	1593	1343	318	312	6	117	115	2	908	905	115	114	5	4
>3 acres (>1.214 ha)	379	0	379	8	387	387	72	69	3	38	36	2	277	274	32	32	0	2
All Land Categories	**2332**	**398**	**2730**	**19**	**2749**	**2351**	**557**	**548**	**9**	**221**	**217**	**4**	**1573**	**1567**	**220**	**218**	**8**	**6**

Landholding-Categories	The Ownership of Poultry Birds										The Composition of Indigenous Poultry Birds						Meat Birds out of Total Poul--try Birds [%]
	Per Household [Hh] [Number]						Hhs Engaged [%]				Chicken		Duck/Geese		Total		
	Chicken										Lay--ing Birds [%]	Meat Birds [%]	Lay--ing Birds [%]	Meat Birds [%]	Lay--ing Birds [%]	Meat Birds [%]	
	Indige--nous	Exo--tic*	Total	Duck/ Geese$	Total Birds	Indige--nous Birds	Total Poul--try	Indige--nous Poultry/ Chic--ken#	Exo--tic Chic--ken	Duck							
upto 1 acre (≤0.405 ha)	5.86	1.40	7.25	0.00	7.25	5.86	*68.9*	*67.9*	*2.8*	*0.0*	*26.9*	*10.6*	*0.0*	*0.0*	*26.9*	*10.6*	*27.8*
1-3 acres (0.405-1.214 ha)	8.76	1.64	10.41	0.07	10.48	8.84	*75.7*	*75.0*	*3.3*	*2.6*	*23.4*	*8.6*	*54.5*	*18.2*	*23.7*	*8.7*	*23.0*
above 3 acres (>1.214 ha)	9.02	0.00	9.02	0.19	9.21	9.21	*76.2*	*76.2*	*0.0*	*4.8*	*18.2*	*9.5*	*37.5*	*25.0*	*18.6*	*9.8*	*9.8*
All Land Categories	**7.77**	**1.33**	**9.10**	**0.06**	**9.16**	**7.84**	***73.3***	***72.7***	***2.7***	***2.0***	***23.5***	***9.3***	***47.4***	***21.1***	***23.7***	***9.4***	***22.5***

Source: *Sample Survey*

* exotic breeds poultry birds are reared for meat purpose only and its stock changes over month; $ only one household rears 2 indigenous breeds laying geese in medium holding-size category; and # incl. such indigenous breeds female chicken (>5 months, but are not laying)

With increased holding-size, the proportion of the households rearing indigenous chicken birds, ducks and total poultry birds to total households rose gradually. Consequently, the stock of indigenous chicken birds, ducks and total indigenous poultry birds per household increased steadily with growing holding-size. The large farmer households did not rear exotic poultry birds and the small farmer households did not rear ducks.

The proportion of households rearing exotic chicken birds to total households and the stock of exotic chicken birds per household were higher in households with medium-sized holdings. So, the stock of total chicken birds and poultry birds per household was highest for medium farmer households and lowest for small farmer households. Although the indigenous poultry birds were reared mainly for eggs by the households in all holding-size categories, the proportion of egg laying birds to total indigenous poultry birds decreased gradually according to holding-sizes.

6.4.2 Economics of Poultry Farming

The status and economics of the poultry livestock in the study villages have been analysed in Table 6.13. The value and income of the poultry birds were generated through sale of meat birds and chicks, egg production and sale, and manure generation. Because of commercial rearing of exotic chicken birds of multiple batches during a year, purchase and sale of such birds per household was high, and this was relatively higher than purchase and sale of indigenous chicken birds per household in villages, like Ramitay, where the households reared the exotic chicken birds. The sale of indigenous chicken birds per household was also high in the villages, and this was comparatively higher than purchase of these birds per household, since most households developed indigenous chicks based on their own past stock.

Table 6.13: Poultry Holdings in the Study Villages

Villages	Annual Transaction of Poultry Birds: Bought: Number: Total	Bought: Number: Indige-nous	Bought: Values [Rs]: Total	Bought: Values [Rs]: Indige-nous	Sold: Number: Total	Sold: Number: Indige-nous	Sold: Values [Rs]: Total	Sold: Values [Rs]: Indige-nous	Egg Yield: No./yr.	Egg Yield: Rs/yr.	Hhs Consum-ption of Own Meat Birds [Rs/yr.]	Value of Manure from Exotic Birds [Rs/yr.]	Value Addition: Total [Rs/yr.]	Value Addition: Indige-nous [Rs/yr.]	Costs: Total [Rs/yr.]	Costs: Indige-nous [Rs/yr.]
High Diversification Areas																
Chisopani	510	10	7840	340	670	210	69050	6950	5376	20160	2400	1120	83906	28186	69634	28434
Poshyore	1014	14	16350	350	1502	572	138645	27045	7488	28200	2810	1680	152304	55024	119516	52516
Ramitay	1363	63	22571	1571	1799	581	141885	18925	8760	32970	2400	2024	153985	50001	120490	42470
Moderate Diversification Areas																
Mahakaldara	24	24	1300	1300	221	221	9140	9140	4836	18420	1020	0	26244	26244	24340	24340
Lamini Gaon	17	17	455	455	578	578	23420	23420	6768	25380	6540	0	52176	52176	32854	32854
Lepcha Gaon	1500	0	24000	0	1672	272	180700	12700	10512	39420	4545	2520	201910	55390	161143	60643
Yogda	0	0	0	0	708	708	23840	23840	5352	20070	1920	0	42525	42525	32308	32308
Low Diversification Areas																
Lower Gairi Gaon	0	0	0	0	213	213	14885	14885	8616	32670	2130	0	48687	48687	39428	39428
Khawas Gaon	31	31	745	745	370	370	10970	10970	3312	12420	1320	0	22240	22240	26534	26534
Upper Gairi Gaon	0	0	0	0	61	61	7885	7885	8784	32940	2640	0	43179	43179	40980	40980
Bimbong	10	10	370	370	1105	1105	32315	32315	4620	17379	740	0	44973	44973	45984	45984
Sundung	0	0	0	0	470	470	18270	18270	5616	21060	2160	0	39287	39287	36673	36673
All Villages	**4469**	**169**	**73631**	**5131**	**9369**	**5361**	**671005**	**206345**	**80040**	**301089**	**30625**	**7344**	**911415**	**507911**	**749884**	**463164**

Villages	Net Return: Total [Rs/yr.]	Net Return: Indige-nous [Rs/yr.]	Income: Total [Rs/yr.]	Income: Indige-nous [Rs/yr.]	Egg Yield: Per Hh [Rs/yr.]	Egg Yield: Per Capita [No/Mon-th]	Value Addition: Per Hh: Total [Rs/yr.]	Value Addition: Per Hh: Indige-nous [Rs/yr.]	Value Addition: Per Capita: Total [Rs/yr.]	Value Addition: Per Capita: Indige-nous [Rs/yr.]	Net Return per House-hold [Hh]: Total [Rs/yr.]	Net Return per House-hold [Hh]: Indige-nous [Rs/yr.]	Income: Per Hh: Total [Rs/yr.]	Income: Per Hh: Indige-nous [Rs/yr.]	Income: Per Capita: Total [Rs/yr.]	Income: Per Capita: Indige-nous [Rs/yr.]	Propor-tion of Egg Sold [%]
High Diversification Areas																	
Chisopani	14272	-248	28810	15410	806	2.89	3356	1127	541	182	571	-10	1152	616	186	99	*50.0*
Poshyore	32788	2508	61391	32791	1128	4.08	6092	2201	995	360	1312	100	2456	1312	401	214	*30.7*
Ramitay	33495	7531	54794	30854	1319	5.10	6159	2000	1077	350	1340	301	2192	1234	383	216	*41.4*
Moderate Diversification Areas																	
Mahakaldara	1904	1904	12400	12400	737	2.58	1050	1050	168	168	76	76	496	496	79	79	*37.7*
Lamini Gaon	19322	19322	32097	32097	1015	3.53	2087	2087	326	326	773	773	1284	1284	201	201	*43.7*
Lepcha Gaon	40767	-5253	57010	13510	1577	5.31	8076	2216	1224	336	1631	-210	2280	540	346	82	*5.3*
Yogda	10217	10217	31160	31160	803	2.65	1701	1701	253	253	409	409	1246	1246	185	185	*51.4*
Low Diversification Areas																	
Lower Gairi Gaon	9259	9259	33125	33125	1307	5.13	1947	1947	348	348	370	370	1325	1325	237	237	*61.0*
Khawas Gaon	-4294	-4294	10765	10765	497	2.00	890	890	161	161	-172	-172	431	431	78	78	*18.2*
Upper Gairi Gaon	2199	2199	24085	24085	1318	5.46	1727	1727	322	322	88	88	963	963	180	180	*50.0*
Bimbong	-1011	-1011	34537	34537	695	2.64	1799	1799	308	308	-40	-40	1381	1381	237	237	*43.4*
Sundung	2614	2614	18270	18270	842	3.52	1571	1571	295	295	105	105	731	731	137	137	*10.5*
All Villages	**161531**	**44747**	**398444**	**289004**	**1004**	**3.72**	**3038**	**1693**	**509**	**284**	**538**	**149**	**1328**	**963**	**222**	**161**	***36.9***

Source: *Sample Survey*

Thus, annual purchase and sale of poultry birds per household were relatively higher in villages where exotic chicken birds were reared than in villages where no such birds were reared. Generally, the net sale of indigenous poultry birds per household was relatively higher in tribal villages.

The most crucial contribution of the indigenous poultry birds was laying eggs. In both number and value terms, the annual egg production per household was high in the study villages. With higher proportion of egg laying chicken birds to the total indigenous chicken birds in tribal villages, annual egg production per household and monthly availability of eggs per capita were relatively higher in these villages and

lower in non-tribal villages. The households mainly reared these laying birds for consumption of eggs at home in the hamlets. Despite having relatively lower egg production in the less irrigated villages, mainly because of their greater economic distress, the proportion of egg sale to total egg production was relatively higher in these villages than in the villages with better irrigation access. The eggs were mainly sold to vendors at cheaper price in the more remote villages, while these were mostly sold to consumers directly at higher price in villages located closer to the market centres.

The value addition of the indigenous poultry birds was computed by adding their net sale value and the value of egg production and meat birds consumed at home, while that of the exotic chicken birds was calculated by adding their net sale value and the value of manure generation. The net return of the poultry birds was obtained by deducting their total rearing costs comprising of expenses on grain and special feed and other expenses such as veterinary expenses like vitamin cost, along with transport costs from their value addition. The annual value addition of the poultry birds per household was high, while their net return was low in the study region. These were relatively higher in villages where the households reared exotic chicken birds than in villages where the households did not rear exotic chicken birds. On a smaller scale of operation of the indigenous chicken birds, the annual value addition and net return of the indigenous poultry birds per household were almost half and one-thirds respectively compared to those of the total birds in the study region. The annual value addition and net return of the indigenous poultry birds per household were relatively higher in tribal villages. With the dominance of young birds over the total birds, the net return of indigenous poultry birds was negative in selected villages, like Chisopani. Nevertheless, only 8 households reared exotic chicken birds, but they contributed 44.3 per cent of total value addition of the poultry birds over the whole sample. Hence, in the villages, indigenous poultry birds played important roles in smoothing the consumption in the households, although their economic potential of diversification was low in most villages. Conversely, the economic potential of diversification of exotic poultry birds was high, but it was harnessed by very limited households in the nearer villages.

The income from the indigenous poultry birds was computed by adding net sale value of these birds and sale value of eggs, while that of the exotic poultry birds was obtained by subtracting the value of manure generated by these birds and total costs of rearing from their value addition. The annual income of the poultry birds and of the indigenous poultry birds per household was high in the study villages. The income of the poultry birds per household was relatively higher in villages, like Lepcha Gaon, where the households reared exotic chicken birds. The income of the indigenous poultry birds per household was comparatively higher in villages located at a distance from the market centres. Hence, for meeting emergency expenses, indigenous poultry birds played crucial roles in the villages, particularly in the more remote villages.

The status and economics of the poultry livestock across the holding-size categories have been shown in Table 6.14. The large farmer households did not rear exotic chicken birds, and the proportion of exotic chicken bird rearing households to total households was relatively higher in medium-sized holdings than in smallholding sizes. So, the annual transaction of total poultry birds per household was highest in households with medium-sized holdings and lowest for smaller farmer households. Thus, the annual value addition and income of the poultry birds per household and per capita were highest in medium farmer households and lowest in large farmer households.

The annual value addition, income generation and egg production of the indigenous poultry birds per household were also highest in households with medium-sized holdings, while these were lowest in households with small-sized holdings. However, the proportion of egg sale to total egg production and the annual net return of total poultry birds per household decreased gradually with growing holding-size. The households in the holdings of small-size were more efficient in rearing poultry birds compared to the households in other holding-sizes.

Table 6.14: Poultry Activities across Farm-size Categories

Landholding Categories	Annual Transaction of Poultry Birds: Bought: Number: Total	Bought: Number: Indige-nous	Bought: Values [Rs]: Total	Bought: Values [Rs]: Indige-nous	Sold: Number: Total	Sold: Number: Indige-nous	Sold: Values [Rs]: Total	Sold: Values [Rs]: Indige-nous	Egg Yield: No./ yr.	Egg Yield: Rs/ yr.	Hhs Consum-ption of Own Meat Birds [Rs/yr.]	Value of Manure from Exotic Birds [Rs/yr.]	Value Addition: Total [Rs/ yr.]	Value Addition: Indige-nous [Rs/ yr.]	Costs: Total [Rs/ yr.]	Costs: Indige-nous [Rs/ yr.]
≤1 acre (≤0.405 ha)	1571	71	25470	1970	2904	1524	233560	61060	25128	94230	7610	2800	305619	153819	237454	129254
1-3 acres	2865	65	47251	2251	5394	2766	401390	109230	44232	166635	17365	4544	529798	278094	442047	263527
>3 acres (>1.214 ha)	33	33	910	910	1071	1071	36055	36055	10680	40224	5650	0	75999	75999	70383	70383
All Land Categories	**4469**	**169**	**73631**	**5131**	**9369**	**5361**	**671005**	**206345**	**80040**	**301089**	**30625**	**7344**	**911415**	**507911**	**749884**	**463164**

Landholding Categories	Net Return: Total [Rs/ yr.]	Net Return: Indige-nous [Rs/ yr.]	Income: Total [Rs/ yr.]	Income: Indige-nous [Rs/ yr.]	Egg Yield: Per Hh [Rs/ yr.]	Egg Yield: Per Capita [No/ Mon-th]	Value Addition: Per Hh: Total [Rs/ yr.]	Value Addition: Per Hh: Indige-nous [Rs/ yr.]	Value Addition: Per Capita: Total [Rs/ yr.]	Value Addition: Per Capita: Indige-nous [Rs/ yr.]	Net Return per House-hold [Hh]: Total [Rs/ yr.]	Net Return per House-hold [Hh]: Indige-nous [Rs/ yr.]	Income: Per Hh: Total [Rs/ yr.]	Income: Per Hh: Indige-nous [Rs/ yr.]	Income: Per Capita: Total [Rs/ yr.]	Income: Per Capita: Indige-nous [Rs/ yr.]	Propor-tion of Egg Sold [%]
≤1 acre (≤0.405 ha)	68165	24565	132534	91734	889	3.66	2883	1451	534	269	643	232	1250	865	232	160	*39.9*
1-3 acres	87751	14567	223529	154889	1096	4.03	3486	1830	580	304	577	96	1471	1019	245	169	*36.7*
>3 acres (>1.214 ha)	5616	5616	42381	42381	958	2.92	1809	1809	249	249	134	134	1009	1009	139	139	*30.7*
All Land Categories	**161531**	**44747**	**398444**	**289004**	**1004**	**3.72**	**3038**	**1693**	**509**	**284**	**538**	**149**	**1328**	**963**	**222**	**161**	***36.9***

Source: *Sample Survey*

Hence, off-farm diversification through poultry birds was not followed for profits, rather the farm households reared these birds as a coping strategy, and the households in the medium-sized holdings harnessed more of the opportunity of rearing poultry birds compared to the others.

6.5 Contribution of Livestock to Economics and Environment

With relatively shorter growing season and lower income generation from crop cultivation activities in the hill region, the livestock plays crucial roles in generating year-around stable income and employment opportunities to the hill farmers. Because of relatively less work burden in livestock operation and confinement of most processes of livestock activities in home domain, the women and the old people can participate in such operation. A greater part of the rural hill economy thus runs based on dairy activities. Although different livestock components fulfil specific needs of the rearing households, because of relative dominance of cattle over the total livestock population, the income and employment generation contribution of cattle is higher compared to other livestock components. The recycling of internal farm resources is possible through livestock. The fodder dependent livestock such as cattle create positive effects on the environment through provision of manure, while they also generate negative influence on the environment by depleting forest vegetation. With differences in fodder availability and economic stress over space and household strata, the economic contribution of livestock is expected to vary between the hamlets and household strata.

6.5.1 Distribution, Composition and Diversity of Livestock

After discussing about the livestock components separately, an attempt has been made to analyse the whole livestock. Table 6.15 analyses the distribution, composition and diversity of the livestock in the study villages. The number of livestock animals in cattle equivalent units [CEUs] per household was high in the study region. The livestock in CEUs per household were comparatively higher in villages located farther away from the market centres than in villages located closer to the market centres.

Table 6.15: Distribution of Livestock Holding in the Study Villages

Villages	Stock of the Animal Husbandry [CEUs*]					Livestock Distribution [%]					Livestock Composition [%]				Diversity Indices	
	Cattle	Goat/ Sheep	Pig	Poul- -try	Total	Cattle	Goat/ Sheep	Pig	Poul- -try	Total	Cattle	Goat/ Sheep	Pig	Poul- -try	Barry Index [B.I.]	Composite Entropy Index [C.E.I.]
High Diversification Areas																
Chisopani	44.87	2.8	2.00	0.730	50.400	*6.5*	*5.8*	*6.0*	*5.3*	*6.4*	*89.03*	*5.56*	*3.97*	*1.45*	0.203	0.245
Poshyore	62.69	5.8	2.50	1.890	72.880	*9.1*	*12.1*	*7.5*	*13.8*	*9.3*	*86.02*	*7.96*	*3.43*	*2.59*	0.252	0.293
Ramitay	57.11	5.0	1.50	1.530	65.140	*8.3*	*10.4*	*4.5*	*11.1*	*8.3*	*87.67*	*7.68*	*2.30*	*2.35*	0.224	0.264
Moderate Diversification Areas																
Mahakaldara	57.97	4.3	1.50	0.425	64.195	*8.4*	*9.0*	*4.5*	*3.1*	*8.2*	*90.30*	*6.70*	*2.34*	*0.66*	0.179	0.213
Lamini Gaon	49.35	9.2	1.50	1.180	61.230	*7.1*	*19.2*	*4.5*	*8.6*	*7.8*	*80.60*	*15.03*	*2.45*	*1.93*	0.327	0.338
Lepcha Gaon	51.46	4.5	7.25	2.495	65.705	*7.4*	*9.4*	*21.6*	*18.2*	*8.3*	*78.32*	*6.85*	*11.03*	*3.80*	0.368	0.402
Yogda	68.65	0.6	5.50	0.885	75.635	*9.9*	*1.3*	*16.4*	*6.4*	*9.6*	*90.76*	*0.79*	*7.27*	*1.17*	0.171	0.200
Low Diversification Areas																
Lower Gairi Gaon	65.23	5.0	0.50	0.890	71.620	*9.4*	*10.4*	*1.5*	*6.5*	*9.1*	*91.08*	*6.98*	*0.70*	*1.24*	0.165	0.195
Khawas Gaon	76.27	2.7	2.00	1.020	81.990	*11.0*	*5.6*	*6.0*	*7.4*	*10.4*	*93.02*	*3.29*	*2.44*	1.24	0.133	0.176
Upper Gairi Gaon	58.16	2.9	2.25	0.780	64.090	*8.4*	*6.1*	*6.7*	*5.7*	*8.1*	*90.75*	*4.52*	*3.51*	1.22	0.173	0.216
Bimbong	62.36	1.5	5.25	0.865	69.975	*9.0*	*3.1*	*15.7*	*6.3*	*8.9*	*89.12*	*2.14*	*7.50*	1.24	0.200	0.235
Sundung	38.08	3.6	1.75	1.055	44.485	*5.5*	*7.5*	*5.2*	*7.7*	*5.7*	*85.60*	*8.09*	*3.93*	2.37	0.259	0.299
All Villages	**692.20**	**47.9**	**33.50**	**13.745**	**787.345**	***100***	***100***	***100***	***100***	***100***	***87.92***	***6.08***	***4.25***	***1.75***	**0.221**	**0.264**

Source: *Sample Survey*

* for aggregation and composition purposes, different animals categories are converted into an standard unit known as Cattle Equivalent Unit [CEU] using the following conversion factor: 1 for indigenous cow, 1.19 for cross-bred cow, 1.26 for bull, 0.4 for young cattle, 0.1 for each unit of goat/sheep, 0.25 for each unit of pig, and 0.005 for each unit of poultry (*Saleth, 1997; Gertler, 2000*)

The aggregate livestock animals and cattle in CEUs per household were relatively higher in villages, like Khawas Gaon, where the extent of cropland was also higher, while these were lower in villages, like Sundung and Lepcha Gaon, with lower extent of cropland. With more integrality of cattle with crops than other livestock components and no caste barrier in rearing cattle, the variability in cattle stock per household between the hamlets was comparatively lower than the variability in the stocks of other livestock components. The cattle were dominant over the total livestock population in CEUs in the study region, and the livestock diversity was low in the study villages. With more dominancy of cattle over the total livestock in CEUs in less irrigated villages, their livestock diversity measured in terms of both the entropy and Berry indices was relatively lower than in well irrigated villages.

Table 6.16 shows the ownership, composition and diversification of the livestock animals across the holding-size categories.

Table 6.16: Livestock Holding across Farm-size Categories

Landholding Categories	Stock of the Animal Husbandry [CEUs*]					Livestock per Household [CEUs*]					Livestock Composition [%]				Diversity Indices	
	Cattle	Goat/ Sheep	Pig	Poul- -try	Total	Cattle	Goat/ Sheep	Pig	Poul- -try	Total	Cattle	Goat/ Sheep	Pig	Poul- -try	Barry Index [B.I.]	Composite Entropy Index [C.E.I.]
upto 1 acre (≤0.405 ha)	163.12	14.2	6.25	3.845	187.415	1.54	0.13	0.06	0.036	*1.77*	*87.04*	*7.58*	*3.33*	*2.05*	0.235	0.276
1-3 acres (0.405-1.214 ha)	383.57	24.6	22.00	7.965	438.135	2.52	0.16	0.14	0.052	*2.88*	*87.55*	*5.61*	*5.02*	*1.82*	0.228	0.271
above 3 acres (>1.214 ha)	145.51	9.1	5.25	1.935	161.795	3.46	0.22	0.13	0.046	*3.85*	*89.93*	*5.62*	*3.24*	*1.20*	0.187	0.228
All Land Categories	**692.20**	**47.9**	**33.50**	**13.745**	**787.345**	**2.31**	**0.16**	**0.11**	**0.046**	***2.62***	***87.92***	***6.08***	***4.25***	***1.75***	**0.221**	**0.264**

Source: *Sample Survey*

The holding of fodder-dependent livestock animals such as cattle, goats and sheep per household as well as total livestock in CEUs rose gradually with holding-size. However, fodder non-dependent livestock such as pigs and poultry birds per household were highest for medium farmer households and lowest for

small farmer households. Hence, the smaller farmer households overcame the limited green fodder by rearing relatively more fodder non-dependent animals. With increased holding-size, the proportion of cattle, goats and sheep to total livestock animals in CEUs increased gradually, while the proportion of poultry birds to total livestock in CEUs decreased gradually. However, the proportion of pigs to total livestock in CEUs was highest in households with medium-sized holdings and lowest in households with smallholding sizes. Consequently, the livestock diversity measured in terms of both Berry and entropy indices gradually decreased with increased holding-size.

6.5.2 Economics of Livestock

Table 6.17 examines the differences in the status and economics of the livestock in the study villages. The net return of the livestock was calculated firstly ignoring the wage cost in livestock rearing, since the opportunity cost of a substantial part of labourforce involved in livestock rearing was zero in the study region. The net return of the livestock was also calculated by subtracting the wage cost of the livestock and adding the value of minor manure generated by the livestock excluding cattle to the former calculation. The annual value addition and income generation of the livestock per household as well as net return for both computations were high in the study villages. Generally, these were relatively higher in villages with lower irrigation access. Hence, the livestock played a complementary role in the relatively poor performance of the crop cultivation activities in the villages, especially in the less irrigated villages.

The contribution of the cattle to total value addition and income generation of the livestock was dominant in the villages. This was relatively higher in villages, like Lepcha Gaon, with better irrigation access. This was comparatively lower in tribal villages than in non-tribal villages. Conversely, because of caste barrier in rearing pigs and poultry birds, their contribution to total value addition and income generation of the livestock was relatively higher in tribal villages and relatively lower in non-tribal villages. The economic potential of diversification through cattle rearing prevailed in the villages, particularly in villages with lower irrigation access, while such potential through pig rearing was confined in limited villages, especially in the tribal villages.

Table 6.17: Livestock Activities in the Study Villages

	Annual Value Addition											Annual Net Return*					
	Composition [Absolute] (Rs)				Total [Rs]			Composition [%]				Composition [Absolute] (Rs)					Total Per
Villages	Cattle	Goat/ Sheep	Pig	Poul- -try	Total	Per Hh	Per Capita	Cattle	Goat/ Sheep	Pig	Poul- -try	Cattle	Goat/ Sheep	Pig	Poul- -try	Total	Hh [Rs]
High Diversification Areas																	
Chisopani	354784	5430	26420	83906	470540	18822	3036	*75.4*	*1.2*	*5.6*	*17.8*	184703	-2569	16185	14272	212591	8504
Poshyore	274024	10640	52400	152304	489368	19575	3198	*56.0*	*2.2*	*10.7*	*31.1*	148296	2762	29530	32788	213375	8535
Ramitay	497305	15115	25100	153985	691505	27660	4836	*71.9*	*2.2*	*3.6*	*22.3*	329416	613	15540	33495	379064	15163
Moderate Diversification Areas																	
Mahakaldara	589297	11516	22700	26244	649757	25990	4165	*90.7*	*1.8*	*3.5*	*4.0*	412518	-1103	11630	1904	424948	16998
Lamini Gaon	599745	17300	44100	52176	713321	28533	4458	*84.1*	*2.4*	*6.2*	*7.3*	434062	-5416	35610	19322	483578	19343
Lepcha Gaon	214615	9280	153600	201910	579405	23176	3512	*37.0*	*1.6*	*26.5*	*34.8*	113731	2719	100424	40767	257641	10306
Yogda	419198	420	75300	42525	537444	21498	3199	*78.0*	*0.1*	*14.0*	*7.9*	254880	-873	45510	10217	309734	12389
Low Diversification Areas																	
Lower Gairi Gaon	551387	6490	5200	48687	611763	24471	4370	*90.1*	*1.1*	*0.9*	*8.0*	345528	-1301	2875	9259	356361	14254
Khawas Gaon	265169	2336	27936	22240	317681	12707	2302	*83.5*	*0.7*	*8.8*	*7.0*	166060	1442	17296	-4294	180505	7220
Upper Gairi Gaon	572188	7340	27900	43179	650608	26024	4855	*87.9*	*1.1*	*4.3*	*6.6*	392409	-2569	13099	2199	405137	16205
Bimbong	360061	1450	58750	44973	465234	18609	3187	*77.4*	*0.3*	*12.6*	*9.7*	261223	98	31340	-1011	291650	11666
Sundung	162435	5640	33514	39287	240876	9635	1811	*67.4*	*2.3*	*13.9*	*16.3*	106935	-305	20814	2614	130058	5202
All Villages	**4860208**	**92957**	**552920**	**911415**	**6417500**	**21392**	**3583**	***75.7***	***1.4***	***8.6***	***14.2***	**3149759**	**-6501**	**339853**	**161531**	**3644642**	**12149**

Villages	Annual Net Return* Composition [%] Cat-tle	Goat/ Sheep	Pig	Poul-try	Annual Income Generation Composition [Absolute] (Rs) Cattle	Goat/ Sheep	Pig	Poul-try	Total [Rs] Total	Per Hh	Per Capita	Composition [%] Cat-tle	Goat/ Sheep	Pig	Poul-try	Annual Net Return** Total [Rs] Per Hh	Per Capita	Per Animal (CEUs)
High Diversification Areas																		
Chisopani	*86.9*	*-1.2*	*7.6*	*6.7*	208615	5430	26420	28810	269275	10771	1737	*77.5*	*2.0*	*9.8*	*10.7*	3559	574	1765
Poshyore	*69.5*	*1.3*	*13.8*	*15.4*	176671	10640	52400	61391	301102	12044	1968	*58.7*	*3.5*	*17.4*	*20.4*	3747	612	1285
Ramitay	*86.9*	*0.2*	*4.1*	*8.8*	353660	15115	25100	54794	448669	17947	3138	*78.8*	*3.4*	*5.6*	*12.2*	8833	1544	3390
Moderate Diversification Areas																		
Mahakaldara	*97.1*	*-0.3*	*2.7*	*0.4*	511039	11516	22700	12400	557655	22306	3575	*91.6*	*2.1*	*4.1*	*2.2*	11282	1808	4394
Lamini Gaon	*89.8*	*-1.1*	*7.4*	*4.0*	496460	17300	44100	32097	589957	23598	3687	*84.2*	*2.9*	*7.5*	*5.4*	15021	2347	6133
Lepcha Gaon	*44.1*	*1.1*	*39.0*	*15.8*	147151	9280	137100	57010	350541	14022	2124	*42.0*	*2.6*	*39.1*	*16.3*	5214	790	1984
Yogda	*82.3*	*-0.3*	*14.7*	*3.3*	341224	420	70800	31160	443604	17744	2640	*76.9*	*0.1*	*16.0*	*7.0*	8086	1203	2673
Low Diversification Areas																		
Lower Gairi Gaon	*97.0*	*-0.4*	*0.8*	*2.6*	395221	6490	5200	33125	440036	17601	3143	*89.8*	*1.5*	*1.2*	*7.5*	7494	1338	2616
Khawas Gaon	*92.0*	*0.8*	*9.6*	*-2.4*	160668	2336	14450	10765	188219	7529	1364	*85.4*	*1.2*	*7.7*	*5.7*	2514	455	767
Upper Gairi Gaon	*96.9*	*-0.6*	*3.2*	*0.5*	455551	7340	24550	24085	511526	20461	3817	*89.1*	*1.4*	*4.8*	*4.7*	9430	1759	3678
Bimbong	*89.6*	*0.0*	*10.7*	*-0.3*	282974	1450	58750	34537	377711	15108	2587	*74.9*	*0.4*	*15.6*	*9.1*	6946	1189	2482
Sundung	*82.2*	*-0.2*	*16.0*	*2.0*	113550	5640	22000	18270	159460	6378	1199	*71.2*	*3.5*	*13.8*	*11.5*	953	179	535
All Villages	***86.4***	***-0.2***	***9.3***	***4.4***	**3642784**	**92957**	**503570**	**398444**	**4637755**	**15459**	**2589**	***78.5***	***2.0***	***10.9***	***8.6***	**6923**	**1160**	**2638**

Source: *Sample Survey*

*excl. of green fodder costs in terms of wage costs of cutting it; and ** incl. wage cost and the value of manure generated by the livestock

Table 6.18 shows the status and economics of livestock rearing across the holding-size categories.

Table 6.18: Livestock Economics across Farm-size Categories

Landholding Categories	Annual Value Addition Composition [Absolute] (Rs) Cattle	Goat/ Sheep	Pig	Poul-try	Total	Total [Rs] Per Hh	Per Capita	Composition [%] Cattle	Goat/ Sheep	Pig	Poul-try	Annual Net Return* Composition [Absolute] (Rs) Cattle	Goat/ Sheep	Pig	Poul-try	Total	Total Per Hh [Rs]
upto 1 acre	1191833	26400	104112	305619	1627964	15358	2846	*73.2*	*1.6*	*6.4*	*18.8*	765806	-1562	62021	68165	894429	8438
1-3 acres	2722197	47953	386596	529798	3686544	24254	4033	*73.8*	*1.3*	*10.5*	*14.4*	1762162	-1252	244880	87751	2093540	13773
above 3 acres	946178	18604	62212	75999	1102992	26262	3616	*85.8*	*1.7*	*5.6*	*6.9*	621791	-3686	32952	5616	656673	15635
All Land Categories	**4860208**	**92957**	**552920**	**911415**	**6417500**	**21392**	**3583**	***75.7***	***1.4***	***8.6***	***14.2***	**3149759**	**-6501**	**339853**	**161531**	**3644642**	**12149**

Landholding Categories	Annual Net Return* Composition [%] Cat-tle	Goat/ Sheep	Pig	Poul-try	Annual Income Generation Composition [Absolute] (Rs) Cattle	Goat/ Sheep	Pig	Poul-try	Total [Rs] Total	Per Hh	Per Capita	Composition [%] Cat-tle	Goat/ Sheep	Pig	Poul-try	Annual Net Return** Total [Rs] Per Hh	Per Capita	Per Animal (CEUs)
upto 1 acre	*85.6*	*-0.2*	*6.9*	7.6	898314	26400	96200	132534	1153448	10882	2017	*77.9*	*2.3*	*8.3*	*11.5*	4236	785	2396
1-3 acres	*84.2*	*-0.1*	*11.7*	4.2	2050825	47953	349620	223529	2671927	17578	2923	*76.8*	*1.8*	*13.1*	*8.4*	8000	1330	2775
above 3 acres	*94.7*	*-0.6*	*5.0*	0.9	693645	18604	57750	42381	812380	19342	2664	*85.4*	*2.3*	*7.1*	*5.2*	9810	1351	2546
All Land Categories	***86.4***	***-0.2***	***9.3***	**4.4**	**3642784**	**92957**	**503570**	**398444**	**4637755**	**15459**	**2589**	***78.5***	***2.0***	***10.9***	***8.6***	**6923**	**1160**	**2638**

Source: *Sample Survey*

* excl. of green fodder costs in terms of wage costs of cutting it ; and ** incl. wage cost and the value of manure generated by the livestock

The annual value addition, income generation and net return of the livestock per household were high in all holding-size categories, while these rose gradually with growing holding-size. Hence, accumulation motive of diversification through the livestock was present in households with large-sized holdings.

Agricultural diversification through the livestock, especially fodder-dependent livestock, generated greater economic benefits for larger farmer households than for smaller farmer households. So, landholding-size dependent economic inequalities among the farming households were increased through rearing livestock animals. The annual value addition and income generation per household of the fodder-dependent livestock were 1.9-2 and 1.2-1.3 times higher respectively for large farmer households compared to the small and medium farmer households, whereas those of the fodder non-dependent livestock were 1.6-1.7 and 1.6-1.8 times higher respectively in households with medium-sized holdings than in households with small and large-sized holdings.

Hence, the fodder non-dependent livestock had the potential to reduce farm-size dependent economic inequalities among the farming households. The annual value addition, net return considering wage cost and income generation per household of the livestock were 1.7-2.3 and 1.1-1.2 times higher respectively for large farmer households compared to small and medium farmer households, whereas those of crop cultivation activities were 2.9-3.1 and 1.7-2.1 times higher respectively for households in large-sized holdings compared to the households with small and medium-sized holdings. Hence, landholding-size dependent inequalities within rural asset and income distribution in mountain areas were mitigated slightly by the participation of the farmers in livestock rearing, especially rearing of the fodder non-dependent livestock.

6.5.3 Caste and Community Profile of Livestock Activities

The caste barrier in rearing all livestock components, except cattle, in the region limited the diversification options for the households. The household participation rate in rearing the livestock and the economics of the livestock across the caste and sub-community strata of the households in the study region have been analysed in Table 6.19.

Table 6.19: Livestock Holding by Castes & Communities across Study Region

		LIVESTOCK OWERSHIP										*VALUE ADDED*		*NET RETURN*		*INCOME*	
Caste/ Communities	House-holds	All Cattle	[%]	Cross-bred Cattle	Goats/ [%]	Sheep	[%]	Pigs	[%]	Poultry Fowls	[%]	Total Value -added [Rs/yr]	VA per House -hold [Rs/yr]	Net Return [Rs/yr]	NR per House -hold [Rs/yr]	Total Income [Rs/yr]	Income/ House -hold [Rs/yr]
Caste-group																	
SC/ST	122	106	*86.9*	63	*51.6*	51	*41.8*	55	*45.1*	112	*91.8*	2282539	18709	595717	4883	1600788	13121
Non-SC/ST	178	159	*89.3*	117	*65.7*	87	*48.9*	36	*20.2*	108	*60.7*	4134961	23230	1481267	8322	3036967	17062
Sub-Community																	
Brahmin/Chettri	79	69	87.3	63	79.7	41	51.9	2	2.5	34	43.0	2107147	26673	825785	10453	1499281	18978
Non-Brahmin/Chettri	221	196	88.7	117	52.9	97	43.9	89	40.3	186	84.2	4310353	19504	1251199	5662	3138475	14201
All Farm Households	**300**	**265**	**88.3**	**180**	**60.0**	**138**	**46.0**	**91**	**30.3**	**220**	**73.3**	**6417500**	**21392**	**2076984**	**6923**	**4637755**	**15459**

Source: *Sample Survey*

The proportion of cattle rearing households to total households varied marginally between the caste or sub-community breakdown of the households, while the proportion of cross-bred cattle rearing households to total households and the proportion of the households rearing all other livestock components varied widely between the caste or sub-community breakdown of the households. The household participation rate in rearing the total cattle, cross-bred cattle as well as goats and sheep were relatively greater for non-SC/OBC households. However, the household participation rate in rearing pigs and poultry birds was relatively higher for SC/ST households. The proportion of involvement of the households in rearing cross-bred cattle as well as goats and sheep was relatively higher for the Brahmin and Chettri households compared to the non-Brahmin/Chettri households. Generally, the opposite was true in case of household participation rate in rearing pigs and poultry birds. Hence, ethnicity also played crucial roles in the choice of livestock and diversification options for the mountain

farm households. However, with relatively greater stock of milch cattle per household for non-SC/OBC households, their annual value addition, net return and income generation per household of the livestock were relatively higher than those for SC/ST households. For the same reason, these were comparatively higher for the Brahmin and Chettri households.

6.5.4 Mandays Generation in Livestock

The employment generation of the livestock was distinctive from that of the crop cultivation activities in terms of requirement for regular labour hours instead of labour mandays, family labour-based operation, light work burden in most livestock activities and relatively more involvement of women, children and aged people compared to men and workers in livestock activities. Table 6.20 explores the employment generation of the livestock in the study villages. Over the whole sample, the households on an average provided 3.36 hours a day for the livestock operations, of which 41.7 and 11.6 per cent were provided by women and children respectively for green fodder collection, although the women and children supplied work hours for other livestock activities. The annual labour mandays generation per household of the livestock was high in the villages. This was relatively higher in tribal villages and lower in non-tribal villages.

Table 6.20: Work Generation through Livestock Activities in Study Villages

	Annual Mandays Generatied from Livestock Activities											
	Mandays Generated from Rearing of					Total	% Share of Mandays				Wage Costs	
Villages	Cattle	Goats/ Sheep	Pigs	Poultry	Total	Mandays per HH	Cattle	Goats/ Sheep	Pigs	Poultry	for Livestock [Rs/yr.]	% Wage Cost to Total Costs [%]
High Diversification Areas												
Chisopani	2601	502	150	408	3660	146	*71.1*	*13.7*	*4.1*	*11.1*	126283	*27.3*
Poshyore	2418	798	363	452	4031	161	*60.0*	*19.8*	*9.0*	*11.2*	124222	*24.4*
Ramitay	3080	639	240	813	4771	191	*64.5*	*13.4*	*5.0*	*17.0*	161749	*28.1*
Moderate Diversification Areas												
Mahakaldara	2897	593	225	141	3857	154	*75.1*	*15.4*	*5.8*	*3.7*	145391	*31.8*
Lamini Gaon	1802	776	151	132	2861	114	*63.0*	*27.1*	*5.3*	*4.6*	111732	*25.6*
Lepcha Gaon	2144	662	794	411	4011	160	*53.5*	*16.5*	*19.8*	*10.2*	133324	*24.2*
Yogda	3125	46	648	173	3992	160	*78.3*	*1.1*	*16.2*	*4.3*	110971	*24.7*
Low Diversification Areas												
Lower Gairi Gaon	3034	616	60	233	3943	158	*77.0*	*15.6*	*1.5*	*5.9*	171969	*31.9*
Khawas Gaon	2327	308	240	130	3005	120	*77.4*	*10.2*	*8.0*	*4.3*	120195	*34.9*
Upper Gairi Gaon	3194	342	240	249	4025	161	*79.4*	*8.5*	*6.0*	*6.2*	172792	*33.4*
Bimbong	3125	228	976	274	4603	184	*67.9*	*5.0*	*21.2*	*5.9*	122557	*30.2*
Sundung	1414	776	210	160	2560	102	*55.3*	*30.3*	*8.2*	*6.2*	109323	*38.1*
All Villages	**31162**	**6285**	**4297**	**3575**	**45318**	**151**	***68.8***	***13.9***	***9.5***	***7.9***	**1610507**	***29.1***

Source: *Sample Survey*

Hence, the labourers, especially the women labourers, allocated a substantial proportion of their daily work effort on livestock rearing. Because of relatively higher household participation rate in cattle rearing as well as greater hour requirement for managing a cattle animal compared to other animals, the cattle dominantly contributed to total labour mandays generation of the livestock in the study region. With relatively higher feed and fodder costs of the livestock, the share of wage cost out of its total costs was low in the villages. With higher proportion of indigenous animals to total animals in the villages located at a distance from the market centres, the share of wage cost out of its total costs was relatively higher in these villages and lower in the nearer villages.

6.5.5 Crop-Livestock Interface

In mixed farming systems, the crop and livestock are interrelated to each other in terms of input need. The livestock provide manure and draught power for crop cultivation activities, and the livestock depend on the crops for fodder and food grain. Table 6.21 examines the extent of the crop-livestock interdependence in the study region. The bullocks were the main source of draught power in most of

the study villages, while they were absent at sample farms in less irrigated villages mainly because of their relatively higher land-gradients and lower cropping activities. The relative bullock availability was high, while the absolute availability was low in the villages. With comparatively more crop cultivation activities in villages with better irrigation access, the relative bullock availability was higher and conversely the absolute availability was lower in these villages than in villages with lower irrigation access. In both per household and per hectare terms, the manure availability was high in the villages. With comparatively higher cattle stock in the more distant villages, their absolute manure availability was higher than that in villages located closer to the market centres. The relative manure availability was higher in less irrigated villages than in well irrigated villages. Hence, the availability of bullock and manure was not responsible for the lower cropping intensity in the study villages with lower irrigation access.

Table 6.21: Interdependence of Farming and Livestock Activities in Study Villages

	Livestock Contributions to Farming Activities											Farming Contributions to Livestock Activities					
	Annual Farm-yard Manure [kg] from					Draught Power				Fodder [kg/yr]		Feed [kg/yr.]			Fodder & Feed[kg/yr.]		
Villages	Cattle	Goat/ Sheep	Pigs	Poultry	Total Manure	Total per Hh	Total Per ha NCA	Oxen per 10ha	NCA [ha/ Ox	Straw	Other	Maize Husk$	PaddyHusk*	Mustard Residue	Total Fodder & Feed	Per Hh	Per Animal (CEUs)
High Diversification Areas																	
Chisopani	93950	1792	3000	2536	101278	4051	7834	6	1.6	36605	2359	1946	4850	60	45820	1833	909
Poshyore	125706	3712	3750	4279	137447	5498	10525	9	1.1	23523	3087	2500	2540	22	31671	1267	435
Ramitay	114300	3200	2250	4134	123884	4955	9937	8	1.2	38940	2477	2465	4120	13	48015	1921	737
Moderate Diversification Areas																	
Mahakaldara	112438	2752	2250	1205	118644	4746	10611	4	2.8	488	3585	2800	0	24	6897	276	107
Lamini Gaon	91306	5888	2250	1613	101058	4042	6939	0	–	788	3213	2382	0	13	6396	256	104
Lepcha Gaon	101394	2880	8625	5535	118434	4737	9624	11	0.9	28393	2395	2145	3350	0	36283	1451	552
Yogda	150319	384	6375	1591	158669	6347	11662	6	1.7	5918	4101	2618	630	6	13273	531	175
Low Diversification Areas																	
Lower Gairi Gaon	120481	3200	750	1956	126388	5056	11666	7	1.4	17553	3801	3180	1770	43	26346	1054	368
Khawas Gaon	139994	1728	3000	1307	146028	5841	9023	17	0.6	36435	2806	2348	4750	13	46352	1854	565
Upper Gairi Gaon	106194	1856	3375	2044	113469	4539	12196	2	4.7	5775	2417	2348	340	79	10959	438	171
Bimbong	141375	960	7875	2219	152429	6097	8689	6	1.6	3593	3510	2268	240	0	9611	384	137
Sundung	73119	2304	2625	1810	79858	3194	6958	14	0.7	28065	2423	2120	2790	16	35414	1417	796
All Villages	**1370575**	**30656**	**46125**	**30230**	**1477586**	**4925**	**9505**	**8**	**1.3**	**226073**	**36174**	**29119**	**25380**	**289**	**317033**	**1057**	**403**

Source: *Sample Survey*

* incl. maize *khosala* and pulse residue; $ incl. small portion of maize grain within maize husk

The paddy and millet straw, maize *khosala*, pulse and mustard residue were used as feeds for the bovine livestock only, while other components of crop fodder were used for all livestock components. The annual availability of straw and crop fodder per household was high in the villages. It was relatively higher in well irrigated villages than in less irrigated villages. The annual availability of crop fodder per animal (in CEUs) was also high in the villages. With more cropping activities in well irrigated villages, it was greater in these villages and lower in less irrigated villages. In less irrigated villages, the households depended more on green fodder for rearing bovine livestock and thereby they devoted extra hours for such fodder collection, which generated an additional burden on them. Hence, the crop-livestock integration was high in the villages, particularly in well irrigated villages.

Table 6.22 shows the crop and livestock interdependence across the holding-size categories. The bullock availability was highest for medium farmer households and lowest for small farmer households, since the cropping intensity gradually decreased and cropland per household rose gradually with growing holding-size. Along with gradual increase in animal stock per household, manure availability per household gradually increased, while the manure availability declined gradually with increased holding-size. The availability of crop fodder per household also rose gradually with increased holding-size. However, because of holding relatively more livestock animals in CEUs per household for large

Table 6.22: Interdependence of Farming and Livestock Activities across Farm-size Categories

	Livestock Contributions to Farming Activities									Farming Contributions to Livestock Activities						
	Annual Farm-yard Manure [kg] from					Draught Power Total		Oxen	NCA	Fodder [kg/yr]		Feed [kg/yr.]			Fodder & Feed[kg/yr.] Total	
Landholding Categories	Cattle	Goat/ Sheep	Pigs	Poultry	Total Manure	per Hh	Per ha NCA	per 10ha	[ha/ Ox	Straw	Other	Maize Husk$	Paddy Husk	Mustard Residue	Fodder & Feed	Per Hh	Per Animal (CEUs)
<1 acre	327050	9088	9375	9173	354686	3346	16400	6.0	1.7	35248	6826	5640	4240	53	52006	491	277
1-3 acres	763119	15744	28875	17589	825327	5430	9267	8.3	1.2	144700	21346	17425	16240	119	199829	1315	456
>3 acres	280406	5824	7875	3468	297573	7085	6648	7.6	1.3	46125	8002	6054	4900	117	65198	1552	403
All Land Categories	1370575	30656	46125	302301477586		4925	9505	7.8	1.3	226073	36174	29119	25380	289	317033	1057	403

Source: *Sample Survey*

* incl. maize *khosala* and pulse residue; $ incl. small portion of maize grain within maize husk

farmer households, the availability of crop fodder per animal in CEUs was highest in households with medium-sized holdings and lowest in households with small-sized holdings.

6.5.6 Ecological Implications of Livestock

The livestock created both positive and negative effects on ambient natural resources and ecology. Through the provision of manure, the livestock helped in cultivating crops, maintaining soil fertility and preventing soil erosion because of heavy rains and complex topography in the study region. However, the livestock created negative effects on forest and ecology by depleting forest and forest vegetation. Over the whole sample, the households on an average needed 90kg of green fodder and 0.68kg of leaf fodder a day for the bovine livestock. Of the total green fodder requirement, above 80 per cent was needed for the cattle, and the rest was required for the goats and sheep. For rearing one cattle animal, 28.4kg of green fodder was needed a day against the 9kg of green fodder needed a day for rearing one goat in the study region. This resulted in substantial loss of forest and forest vegetation, which in turn produced adverse effects on ecology. The goats and sheep had more adverse effect on ambient forest vegetation, while these animals contributed less to manure compared to the cattle. The goats and sheep have low economic potential in the villages. The indigenous milch cattle yielded relatively less milk than the cross-bred one. Hence, for decreasing the negative effect on local forest and ecology, the stock of such small ruminants and indigenous milch cattle need to be decreased through rearing more cross-bred cattle. In these aspects, the local livestock institutions have to come forward for the provision of artificial insemination related veterinary services and knowledge for the cattle rearing households.

Because of low management costs and skill, low requirement for market-purchased inputs and less attack of diseases on the indigenous cattle, limited contact of the farm households with local veterinary centres and financial inability for purchasing cross-bred milch cattle, the poor households in the villages, especially in the more remote villages, reared low milk-yielding indigenous milch cattle and managed them through ethno-veterinary services based on indigenous knowledge. In the study region, 92 per cent of the households used indigenous knowledge for curing diseases of livestock animals. For instances, they used dry straw, old maize *khosala*, *siltimbur* (*Linderaa neesiana)* and the leaf of *choya* for curing pneumonia and fever; cannabis, timbur (*Zanthoxylum budrunga*), black salt for curing diarrhoea; bitter buckwheat for healing bloat; hot saline water for treating mastitis; and the leaf of *khanakpa* (*Evodia fraxinifolia*), mixture of turmeric and mustard oil for curing foot and mouth diseases. However, usually they could not detect such diseases at the proper stage, and consequently through such limited knowledge, they could not cure them. For some diseases, like milk fever, they could detect the disease, but could not cure the disease based on indigenous knowledge, and consequently they would face substantial economic loss. The less access to market also acted as a constraint on selling milk and meat animals at proper price in more remote villages, and thereby reduced their economic potential of livestock rearing.

6.6 Conclusion

Agro-climatic suitability of the livestock animals and greater access to green fodder in the hill regions acted as pull factors, while the low crop-yields and necessity of crop-livestock integration in hill farming worked as push factors for rearing varieties of animals in the study villages. The household participation rate in cattle rearing and cattle stock per household were high in the villages. Relatively less proportion of the households reared goats instead of cattle for selling meat in the villages, particularly in the nearer villages. However, with caste barrier in rearing pigs and indigenous chicken birds, the household participation rate in rearing these animals was lower in the villages. With requirement for special knowledge and more market intensity in rearing exotic chicken birds, despite having their high economic potential, they were reared by few households for selling meat in the villages located closer to the market centres. Thus, the acute cattle dominancy over the total animals in cattle equivalent units [CEUs] primarily resulted in low livestock diversity in the villages.

Although the cattle were reared mainly on stall feeding for draught power, milk-yielding and manure, the milk-yielding purpose was predominant and thereby milch cattle were dominant over the total cattle population in the villages. The cross-bred milch cattle yielded much more milk than the indigenous ones. The cross-bred pigs were more productive than the indigenous pigs. The proportions of cross-bred milch cattle to the total milch cattle and of cross-bred pigs to the total pigs were relatively higher in nearer villages. The total annual value, income generation and net return of the total livestock per household were high in the villages, even higher than crop cultivation activities. In all such cases, the contribution of the cattle was higher compared to that of other livestock components in the villages. Hence, the livestock, especially milch cattle, played a complementary role to the lower value and income generation from crop cultivation in the villages.

With relatively lower value and income generation from cultivation in the less irrigated villages, cattle stock per household and proportion of milch cattle to the total cattle, and the total annual value, income generation and net return of the cattle and the total livestock per household were higher in these villages than in the well irrigated villages The opposite was true in case of annual rental income of the drought cattle holding per household as well as of livestock diversity. Despite having relatively greater participation rate and cattle stock per household in the more distant villages, because of lower proportion of cross-bred cattle to the total cattle and the lower proportion of milk sale to consumers directly to the total milk sale, milk-yield per milch cattle as well as the value and income generation per litre milk were lower in these villages than in the nearer villages. Hence, the less access to market in the more remote villages had lessened their economic potential of the livestock. With very less participation of Brahmin and Chettri households in pig and indigenous chicken bird rearing, the total value, income generation and net return of these animals per household, as well as the mandays generation from livestock were lower in the non-tribal villages than in the tribal villages.

The income, the total value and the net return of the bovine and the total livestock per household rose sharply with growing holding-size. However, for piggery livestock, these were highest in medium farmer households and lowest in small farmer households. For poultry birds, these were the highest in households with medium-sized holdings and the lowest in households with large-sized holdings. Hence, farm-size dependent inequalities within rural asset and income distribution were mitigated slightly through participation in rearing of the livestock that are not dependent upon fodder. In mixed farming systems, the crop-livestock integration in terms of dependency of crop cultivation activities upon livestock for manure and draught power, and dependency of the livestock upon crops for fodder and crop-residue, were high in the study villages. However, such integration was lower in less irrigated villages, since their bovine livestock was more dependent upon green fodder. The livestock helped in regaining soil fertility of cropland, while they produced negative effects on the environment by depleting forests and forest vegetation in the villages, especially in the less irrigated villages.