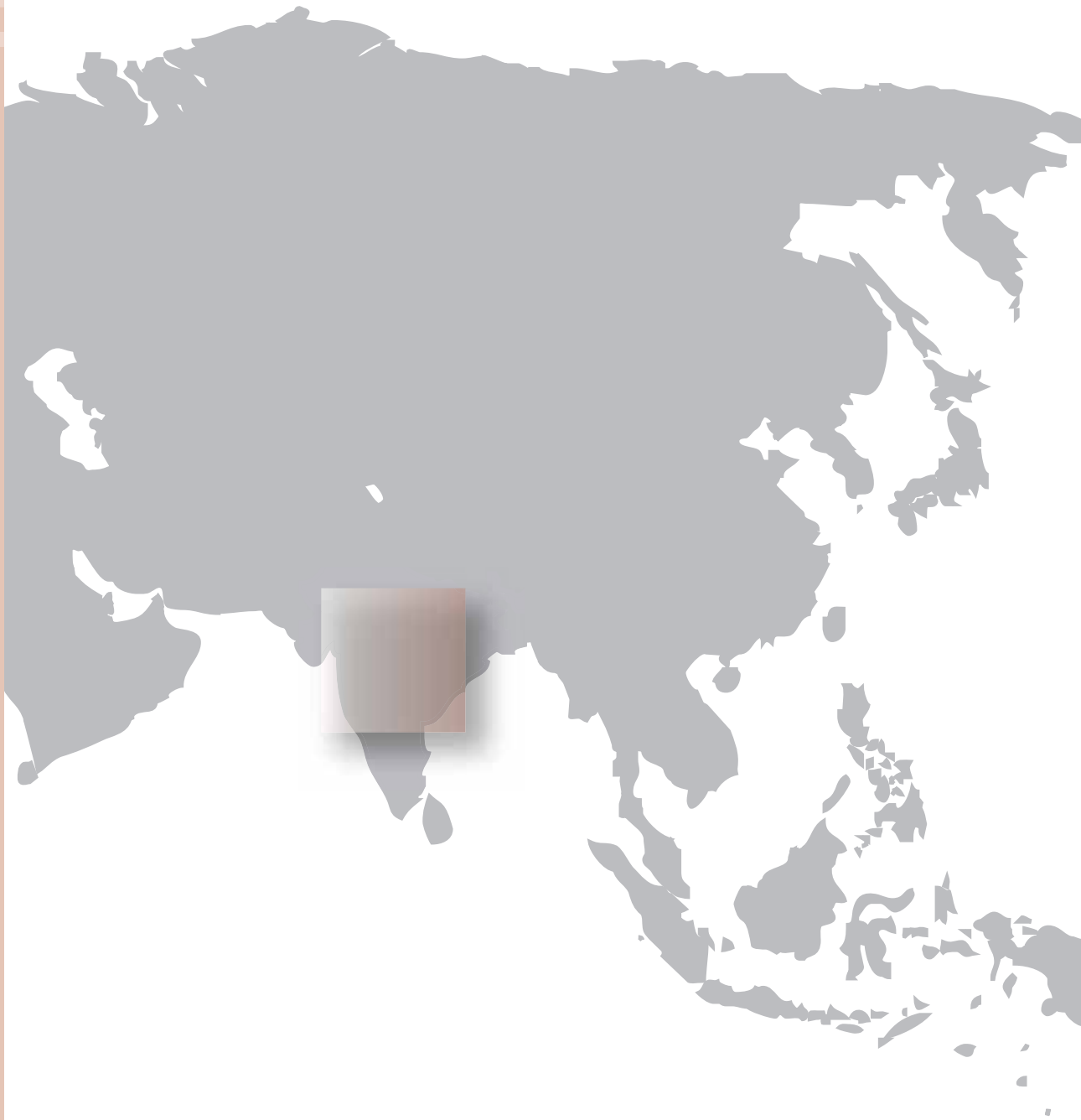


INDIA

Poultry sector country review



Poultry sector country review

This review is based on the following report:
The structure and importance of the
commercial and village based poultry systems in India

Das Kornel

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Foreword

The unprecedented widespread outbreaks of Highly Pathogenic Avian Influenza (HPAI) that occurred in many countries in Asia, Europe and Africa since 2003 have been asking for rapid and active response on a national, regional and international level. The HPAI crisis had to be addressed worldwide at the source, which is the poultry population.

The main danger of this disease, like others, lies in the way in which humans interact with and handle the production, distribution, processing and marketing of live poultry and poultry products. The direct and indirect socio-cultural and economic impacts of disease outbreaks influence policy measures and disturb markets, causing the loss of assets. There are strong negative impacts on the livelihoods of rural communities for all producer groups including small holders. Assessment and guidance on measures along the poultry chain for a safe poultry production is therefore of great importance. Specific consideration should be given to strategies and measures that ensure a sustainable pro poor supporting approach and development.

Better understanding of the specific situations of the different poultry sectors and the related market chains will help to develop appropriate disease control measures and improve biosecurity.

This review is part of a series of Country Reviews that are commissioned by the Animal Production Service (AGAP) of the Food and Agriculture Organization of the United Nations (FAO) for the Socio-Economics, Production & Biodiversity Unit of the Emergency Centre for Transboundary Animal Disease of FAO (ECTAD).

This review is intended as a resource document for those seeking information on the poultry sector at national level. It is not exhaustive. Some topics are only partially covered or not covered at all and the document will be supplemented and updated on an ongoing basis. Contributions and feedback are welcome by the author(s), FAO/AGAP and FAO/ECTAD Socio-Economics, Production & Biodiversity Unit¹.

The original report by M. Das Kornel was edited by Ms Jenny Schwarz in September 2008 and has been supplemented with data from the FAO statistical database (FAOSTAT), the World Bank and the United Nations Population Division.

¹ For more information visit the FAO website at: www.fao.org/avianflu/en/farmingsystems.html or contact either Philippe Ankers or Olaf Thieme, Animal Production Officers Email: Philippe.Ankers@fao.org and Olaf.Thieme@fao.org Food and Agriculture Organisation, Animal Health and Production, Viale delle Terme di Caracalla, 00153 Rome, Italy

Contents

Foreword	i
Acronyms and abbreviations.....	iv
CHAPTER 1	
The country in brief.....	1
CHAPTER 2	
Profile of the poultry sector	3
2.1 National poultry flock.....	3
2.2 Geographical distribution of poultry flocks.....	4
2.3 Production	6
2.4 Consumption	10
2.5 Trade	13
2.6 Prices	14
CHAPTER 3	
Poultry production systems	16
3.1 Background information	17
3.2 Sector 1: Industrial and integrated production.....	18
3.3 Sectors 2 and 3: Other commercial production systems.....	20
3.3.1 Breeding stocks and hatching eggs	20
3.3.2 Broiler meat	20
3.3.3 Hen table eggs	20
3.3.4 Other species	20
3.4 Sector 4: Village or backyard production	20
3.4.1 Chickens.....	21
3.4.2 Other species	26
3.5 Poultry value chain analysis.....	26
3.5.1 Day-old chicks.....	26
3.5.2 Chicken meat	26
3.5.3 Table eggs	27
3.5.4 Other species	28
CHAPTER 4	
Trade, marketing and markets.....	29
4.1 Domestic market.....	29
4.2 Import.....	29
4.3 Export	29
4.4 Slaughtering facilities	29
4.5 Poultry feeds	29

CHAPTER 5	
Breeds	30
5.1 Exotic breeds.....	31
5.2 Local breeds.....	31
CHAPTER 6	
Veterinary health, public health, biosecurity measures	32
6.1 Highly pathogenic avian influenza.....	32
6.2 Other major poultry diseases	33
6.3 Biosecurity measures.....	34
CHAPTER 7	
Current policies, legal framework	35
CHAPTER 8	
Analysis	36
8.1 Current strengths and weaknesses of the poultry sector	36
8.2 Prospects of the poultry sector over the next five years	36
ANNEX I	
Who is who (contact list)	37
ANNEX II	
List of major projects – poultry sector	38
ANNEX III	
Bibliography.....	40
ANNEX IV	
Maps	44

Acronyms and abbreviations

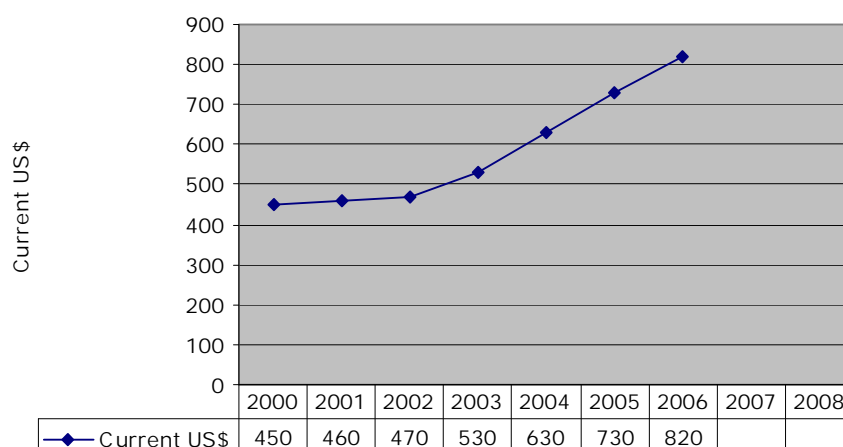
AHD	Animal Husbandry Department
BYP	Backyard Poultry
CARI	Central Avian Research Institute
DANIDA	Danish Development Assistance
Deshi	Indigenous or Native
FAO	Food and Agriculture Organisation
FCR	Feed Conversion Rate
GDI	Gender Development Index
GDP	Gross Domestic Product
GOI	Government of India
H5N1	Avian influenza of hemagglutinin subtype 5 and neuraminidase subtype 1
HPAI	Highly Pathogenic Avian Influenza
HSADL	High Security Animal Disease Laboratory
ICAR	Indian Council of Agricultural Research
IMF	International Monetary Fund
J & K	Jammu & Kashmir
NABARD	National Bank for Agriculture and Rural Development
NAFED	National Agriculture Federation
NCDC	National Cooperative Development Corporation
ND	Newcastle Disease
NDDB	National Dairy Development Board
NECC	National Egg Coordination Committee
NGO	Non-Government Organisation
NSSO	National Sample Survey Organisation
OIE	Organisation of Animal Health
PPLP	Pro-Poor Livestock Policy Programme
RD	Ranikhet Disease (ND and RD are one and the same)
SHG	Self Help Group
SLDP	Small Holder Livestock Development Project
STEP	Support to Training and Employment Programme for Women
UK	United Kingdom
UT	Union Territories
VOP	Value of Output production
WHO	World Health Organisation

Chapter 1

The country in brief

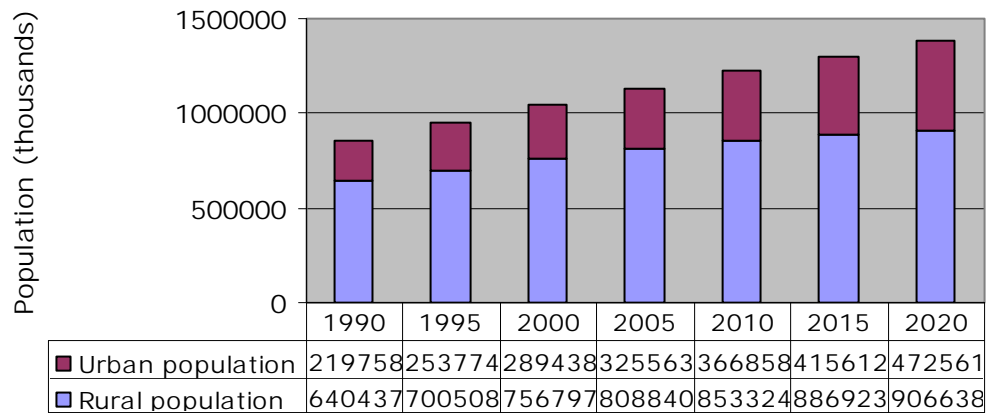
Country:	India	
Location:	Southern Asia, bordering the Arabian Sea and the Bay of Bengal, between Burma and Pakistan	
Population, total:	1,109,811,147 (2006)	Source: World Bank, August 2008
Population, growth rate:	1% (2006)	Source: World Bank, August 2008
Economy group:	Lower middle income	Source: World Bank, August 2008

FIGURE 1: Gross national income (GNI) per capita
(Atlas method, current US\$)



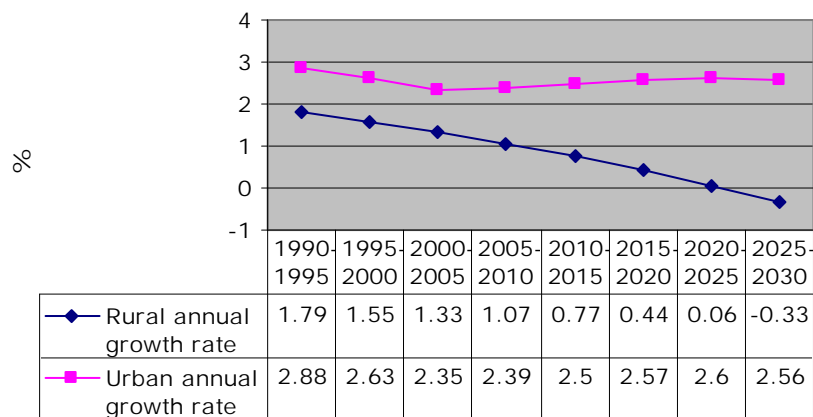
Source: World Bank, August 2008

FIGURE 2: Demographic profile



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2006 Revision and World Urbanization Prospects: The 2007 Revision, <http://esa.un.org/unup>, September 2008

FIGURE 3: Annual population growth rates

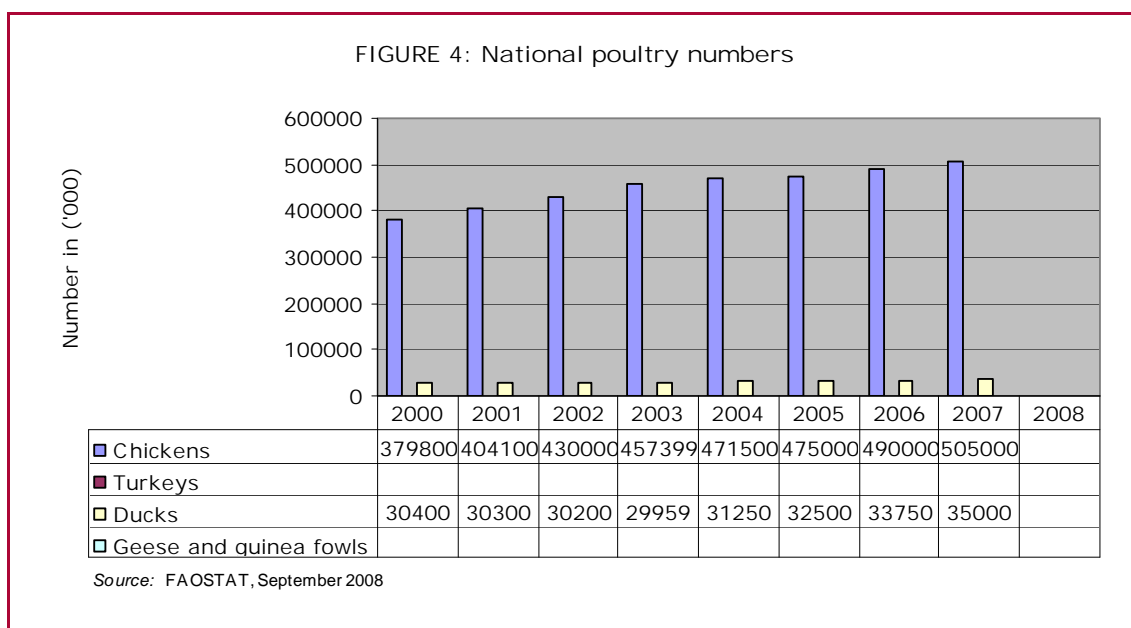


Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2006 Revision and World Urbanization Prospects: The 2007 Revision, <http://esa.un.org/unup>, September 2008

Chapter 2

Profile of the poultry sector

2.1 NATIONAL POULTRY FLOCK



An alternative source (the All India Livestock Census) states the figures given in Table 1, with the total poultry population increasing from 348 million in 1997 to 489 million in 2003. A rapid increase took place in the population of improved fowls compared to indigenous fowls, although this population has also been increasing. In 2003, indigenous fowls including ducks constituted 55% of the total poultry population.

TABLE 1:
Poultry population in India (millions)

Census year	Indigenous fowl	Improved fowls	Indigenous ducks	Improved ducks	Total
1997	188.36	127.06	30.92	13.0	347.61
2003*	238.21	219.19	29.96	2.5	489.01

Source: All India Live Stock Census
*- State/Union Animal Husbandry Departments

2.2. GEOGRAPHICAL DISTRIBUTION OF POULTRY FLOCKS

TABLE 2:
Distribution of poultry 1997 and 2003 (number in '000)

State	FOWLS						DUCKS						OTHERS		TOTAL POULTRY	
	Indigenous		Improved		Total		Indigenous		Improved		Total		1997	2003	1997	2003
	1997	2003	1997	2003	1997	2003	1997	2003	1997	2003	1997	2003				
Andhra Pradesh	26078	27996	36887	73989	62965	101985	356	201	34	28	390	229	41	65	63396	102278
Arunachal Pradesh	1013	1424	174	187	1187	1611	86	69	18	7	104	76	2	56	1292	1743
Assam	11298	12074	1262	2584	12560	14658	4922	5782	675	1104	5597	6886	52	120	18210	21664
Bihar	16063	10148	539	2672	16602	12820	3239	913	49	43	3288	956	0	135	19890	13911
Chhattisgarh	4176	4995	2319	3010	6495	8005	163	121	13	11	176	132	100	44	6771	8181
Goa	269	209	519	356	788	565		1		0.19	0	1.19	0	0	790	566
Gujarat	3023	3362	4208	4738	7231	8100	3	29	1		4	29	1	24	7236	8153
Haryana	2000	872	7200	12738	9200	13610	21	3	5	1	26	4	1	6	9225	13619
Himachal Pradesh	379	207	485	559	864	766		0		0	0	0	1	0	865	767
J. & Kashmir	3606	3529	1425	1796	5031	5325	424	213	85	23	509	236	16	6	5557	5568
Jharkhand		12366		1099		13465		903		30	0	933		31		14429
Karnataka	11798	9601	9510	15975	21308	25576	38	10	40	4	78	14	13	4	21399	25593
Kerala	11024	7736	5884	3256	16908	10992	872	501	171	160	1043	661	445	563	18397	12216
Madhya Pradesh	5734	7613	1518	4063	7252	11676	6	13	1	6	7	19	2	9	7261	11705
Maharashtra	25148	22583	10159	15310	35307	37893	49	38	8	6	57	44	28	31	35392	37968
Manipur	1468	1426	966	957	2434	2383	332	272	261	262	593	534	28	24	3055	2941
Meghalaya	1994	2625	107	137	2101	2762	47	56	3	3	50	59	0	0.2	2152	2821
Mizoram	1083	785	211	329	1294	1114	9	6	4	2	13	8	0	2	1307	1125
Nagaland	1551	1730	812	943	2363	2673	41	65	39	52	80	117	0		2444	2789
Orissa	13452	12910	4112	3977	17564	16887	623	590	25	20	648	610	224	114	18435	17611
Punjab	11022	981		9792	11022	10773	0	2	0	4	0	6	0	0.46	11022	10779
Rajasthan	2588	2829	1810	3356	4398	6185	5	4	2	1	7	5	1	1	4406	6192

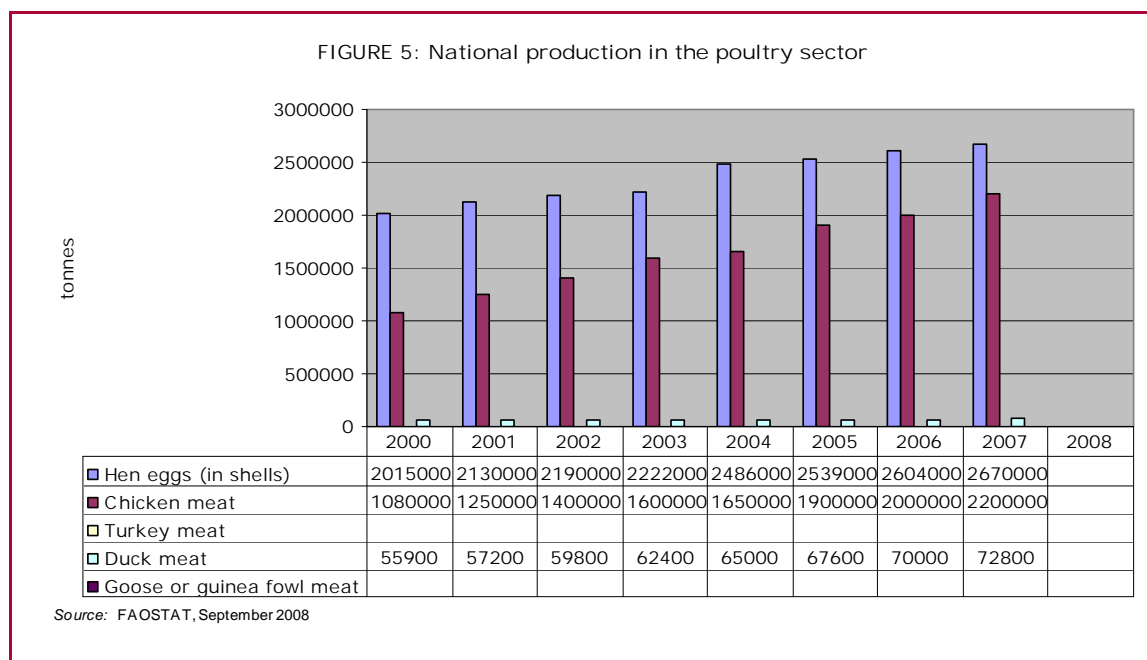
TABLE 2:
Distribution of poultry 1997 and 2003 (number in '000)

State	FOWLS						DUCKS						OTHERS		TOTAL POULTRY	
	Indigenous		Improved		Total		Indigenous		Improved		Total		1997	2003	1997	2003
Year	1997	2003	1997	2003	1997	2003	1997	2003	1997	2003	1997	2003	1997	2003	1997	2003
Sikkim	169	214	51	106	220	320	2	1	0	0.17	2	1.17	0		221	322
Tamil Nadu	14350	46367	21442	39753	35792	86120	681	186	34	61	715	247	4	224	36511	86591
Tripura	2456	1910	221	361	2677	2271	852	676	25	25	877	701	42	85	3595	3057
Uttar Pradesh	7253	6311	4417	4951	11670	11262	282	279	115	115	397	394	49	62	12116	11718
Uttaranchal	425	492	529	1475	954	1967	11	13	6	3	17	16	0	2	971	1984
West Bengal	7488	33984	9445	9716	16933	43700	4816	16413	11353	514	16169	16927	207	28	33309	60656
A. & Nicobar	587	673	151	184	738	857	62	64	0	3	62	67	0	6	801	931
Chandigarh	1	12	293	140	294	152					0	0.01	10	0	304	152
D. & N.Haveli	81	81	330	25	411	106					0	0.1	0	0.07	411	106
Daman & Diu	23	26	0	2	23	28	1	1	0		1	1	0	0.39	24	29
Delhi	631	3	16	455	647	458	0	0.37	0	0.24	0	0.61	0	0.2	647	459
Lakshadweep	45	49	31	80	76	129	2	1	1	10	3	11	0	6	79	146
Pondicherry	88	82	28	124	116	206	3	33	0	2	3	35	1	3	121	244
All India	188364	238206	127061	219193	315425	457399	17948	27459	12968	2500	30916	29959	1268	1654	347611	489012

Source: Basic Animal Husbandry statistics, 2006

The native and improved fowl populations were highest for Andhra Pradesh (AP) on both dates. Other states with large populations of indigenous poultry were Maharashtra, Tamil Nadu and West Bengal. Improved fowls were more numerous in Maharashtra, Tamil Nadu and Karnataka after Andhra Pradesh. The population of desi fowls increased by 8.3% per annum from 188.36 million in 1997 to 238.21 million in 2003. During the same period, the population of improved fowls increased by 15.19% per annum from 127.06 million in 1997 to 219 million in 2003. The population of desi ducks increased from 17.95 million to 27.45 million, whereas the population of improved ducks declined to 2.50 million (almost 89%) from 12.97 million during this period.

2.3 PRODUCTION



The poultry sector is growing at a much faster rate than any other element of the crop and livestock sector. Within the poultry sector, broiler production is growing faster than egg production. About 66.7% of the total output (in value form) from poultry is realized from the poultry meat sector and only 33.3% from egg production.

The growth of the Indian poultry sector from 1961 to 2006 is shown in Table 3, which indicates the significant growth in total egg and broiler production along with per capita availability.

TABLE 3:
Indicators of the growth and development of the poultry sector in India

Year	Egg production (millions)	Egg production (thousand tonnes)	Per caput Availability in number	Broiler production (millions)	Chicken meat production (thousand tonnes)	Per capita availability (grammes)
1961	2881	170	7	n/a	81	176
1971	5340	n/a	10	4	121	220
1980	12500	n/a	18	30	179	266
1990	23300	n/a	28	190	412	620
1996	27187	1282	30	665	665	700
1997	27496	1549	29	596	596	620
1998	28680	1611	30	710	710	720
1999	29476	1611	30	n/a	820	820
2000	30447	n/a	32	1250	1080	820
2001	36632	2013	36	n/a	1250	1060

TABLE 3:
Indicators of the growth and development of the poultry sector in India

Year	Egg production (millions)	Egg production (thousand tonnes)	Per caput Availability in number	Broiler production (millions)	Chicken meat production (thousand tonnes)	Per capita availability (grammes)
2002	38729	n/a	38	1400	1400	1330
2003	39823	n/a	39	n/a	1600	1500
2004	40403	n/a	40	n/a	1650	1530
2005	45201	2492	42	2000	1900	1730
2006	46166	n/a	42	n/a	n/a	n/a

Source: FAOSTAT and Ministry of Agriculture, GOI & Watt Poultry Statistical Year Book, 1998 and 1999, Executive guide, 2006

Poultry Meat Production

India is the fifth largest producer of poultry meat in the world after USA, China, Brazil and Mexico (Executive guide, 2006). Poultry meat production increased from 81 thousand tonnes in 1961 to 1900 thousand tonnes in 2005. Poultry meat production increased by 8.7% and 6% per annum during the eighties and nineties (Mehta et al. loc cit.). In a recent study, Fairoze et al. loc cit reported a growth a rate of 13.9% for poultry meat for the period 1995 to 2005.

Broilers are major source of poultry meat in the country. Broiler production, which was merely 4 million in 1971, increased to 1250 million in 2000 and 1400 million in 2002. Fairoze et al. reported production of 1563 million broilers during the year 2006, with the average production being 130.2 million per month.

Private sector contract farming systems and the vertical integration of broiler enterprises have played a major role in this spectacular growth, especially in southern and western India. The expanding role of poultry integrators has contributed to declining poultry consumer prices by lowering production and marketing costs. Significant numbers of smallholder broiler producers are involved in contract farming and thus survive the competition from large farms.

TABLE 4:
Broiler production per month in India (2005)

Area/State	Total Production (Millions)	Broiler Production under contract (Millions)	Production under contract (%)
Tamil Nadu	18.5	16.5	90
Karnataka	7.4	6.5	87
Andhra Pradesh	16.0	9.5	60
Maharashtra	11.0	8.5	73
Gujarat	2.6	0.9	35
West Bengal	14.7	3.0	20
North India	30.0	2.0	6.66
Other areas	30.0	1.0	3.33
Total	130.2	47.9	36.78

Source: Soundararajan, B (2005) President, All India Poultry Breeders Association in Poultry Vision-2010, All India Poultry Breeders Association, Coimbatore.

India's poultry production base is huge. However, the processing level is very low at around 6% for poultry meat. Hence, there is immense potential for investment in the food processing industry sector (GOI, 2008). (<http://www.indiainbusiness.nic.in/industry-infrastructure/industrial-sectors/food-process.htm>)

Tamil Nadu, Andhra Pradesh, West Bengal, Maharashtra, Karnataka and Punjab are the major broiler producing states of the country. The Coimbatore-Salem belt of Tamil Nadu is in the forefront of broiler production of the country. 75% of the broilers produced and consumed in this region come from integrated farms. The Pune-Nasik-Mumbai belt in Maharashtra is another prominent area in broiler production through integrated farming.

Integration and contract growing of broilers is spreading rapidly in Hyderabad and Bangalore. Only 10% of the total broilers in north and eastern region are produced through contract farming.

There have been major changes in the structure and size of broiler farms during last two and half decades. Not only has the numbers of farms raising broilers increased, but there has also been a significant increase in sizes. A typical broiler farmer used to raise only a few hundred broilers per cycle; whereas now it has increased to 10 to 20 thousand for a weekly cycle as a result of which the total capacity has increased. Production practices have also modernized. The body weight which was achieved at 8 weeks of age during the eighties is now realized in 35 to 40 days of age and the FCR has improved from 2.5 to less than 2.0.

Egg Production

India is the 3rd largest producer of eggs in the world (46.17 billion eggs 2005-06) and the growth rate for egg production was 6% between 1980 and 2000. Andhra Pradesh is the leading state for in egg production followed by Tamil Nadu, Punjab, Maharashtra and West Bengal, which together produce 71% of the total.

Detailed estimates of egg production from indigenous and improved fowls and ducks along with the distribution of indigenous and improved layers and ducks are presented in Tables 5 and 6 for the years 1999-2000 to 2005-06. The number of indigenous layers remained more or less static whereas there was a significant increase in the number of improved layers from year to year. In contrast, the number of indigenous duck layers increased from year to year with no increase in improved duck layers (Table 6).

TABLE 5:
Detailed estimates of egg production from deshi and improved layer chickens
(from 1999/00 to 2005/06)

Year	No. of indigenous fowl layers (000)	Avg. Yield/ annum (nos)	Egg Prod. (00,000)	No. of Improved layers (000)	Avg. yield/ annum	Egg Prod. (00,000)	Total egg prod. (00,000)
99-00	80484	104.96	88255	81990	237.30	196175	284430
00-01	89434	97.69	87370	104133	237.51	259166	346536
01-02	90350	98.34	88852	111495	237.51	278539	367391
02-03	92711	98.9	91690	114200	249.96	285450	377140
03-04	80713	103.94	83896	11645	253.99	298810	382706
04-05	80719	110.06	88824	129694	260.92	338399	427223
05-06	81282	111.65	90835	133799	258.29	345647	436482

Source: State /Union territory Animal Husbandry Department. &: Basic Animal Husbandry Statistics, 2006-AHS Series-10, GOI

TABLE 6:
Detailed estimates of egg production from deshi and improved layer ducks (all india)
from 1999/00 to 2005/06

Year	No. of indigenous duck layers (000)	Avg. Yield/Annum (nos)	Egg Prod. (lakh nos.)	No. of Improved duck layers (000)	Avg. yield/annum	Egg Prod. (00,000)	Total egg prod. (00,000)
99-00	11142	117.0	13080	611	182	1114	14194
00-01	11480	112.0	12879	729	161	1172	14051
01-02	11569	108.0	12489	959	132	1270	13759
02-03	12329	109.0	13458	985	129	1271	14729
03-04	12673	107.0	13531	849	161	1369	14900
04-05	12897	100.0	12843	741	170	1267	14110
05-06	13080	102.0	13333	686	172	1180	14513

Source: State /Union territory Animal Husbandry Department.& Basic Animal Husbandry Statistics,2006-AHSSeries-10,GO

It is worthwhile mentioning that the productivity of commercial hybrid layers has increased significantly over the years. The average annual egg yield of 260 eggs in 1980 has gone up to 320 in recent years. All the commercial hybrid layers stocks available in the country conform to this production range. However, there is great variation in the management practices in different regions as a result of which the performance of the hybrid layers is not same across all farms and all regions (See Table 7). So the average annual egg yield for commercial hybrid layers averaged over all states was 258.29 (Table 5). The average annual egg yield declined both for indigenous and improved duck layers in the reference period from 117 to 102 eggs in indigenous and from 182 to 172 eggs in improved duck layers (Table 6).

TABLE 7:
Region wise contribution (in percentage) of eggs from indigenous and improved fowl layers

Year	Type of layers	Regions					Total
		South	East	North East	West	North	
1997	Deshi layers	34	20	11	20	15	100
2003	-do-	39	29	9	17	6	100
1997	Improved	58	11	3	15	13	100
2003	-do-	60	8	3	13	16	100

Source: State /Union territory Animal Husbandry Department & Basic Animal Husbandry Statistics,2006-AHS Series-10,GOI

Domestic fowl layers raised in both traditional backyard production and the intensive system of production accounted for 93% of total eggs produced whereas ducks accounted for 7% in the year 1999-2000. The contribution of ducks to total egg production reduced from 7% to 5% in 2001 and increased again to 6% in 2005-06.

The traditional backyard sector contributed 33% of the total eggs produced during the year 1999-2000. Its contribution declined thereafter and was 27% in 2001, 26% between 2001 and 2003, 22% in 2004-05 and 23% in 2005-06 (Table 8). This was mainly due to the increased placement of improved layers from year to year whereas there was no such increase in the placement of indigenous fowl layers. There was also a decline in the placement of improved ducks and a decline in production both for indigenous fowl and indigenous duck layers.

TABLE 8:
Contribution of indigenous fowls and ducks to egg production

Year	No. of eggs produced by indigenous fowls	Percentage of total from fowls	No. of eggs produced by indigenous ducks	Percentage of total from ducks	Contribution of indigenous fowl and ducks to total egg production percent
99-00	88255	31	13080	92	33
01-01	87370	25	12879	92	27
01-02	88852	24	12489	91	26
02-03	91690	24	13458	91	26
03-04	83896	22	13531	91	24
04-05	88824	21	12843	91	22
05-06	90835	21	13333	92	23

Source: State/Union territory Animal Husbandry Department.& Basic Animal Husbandry Statistics,2006-AHSSeries-10,GOI

An estimate of egg production for the different states is presented in Table 9. Andhra Pradesh was the leading state in egg production followed by Tamil Nadu, Punjab, Maharashtra and West Bengal. These five states contributed 60% of the total eggs produced in the country in the year 1997-98. The contribution of these states to the total egg production of the country is increasing over the years and reached 71% in 2004-05 and 2005-06.

TABLE 9:
Egg production of five top egg producing states (Lakh Nos.)

Year	State						Percentage of country total
	AP	Maharashtra	Tamil Nadu	Punjab	West Bengal	Total	
97-98	57516	27663	32168	29103	26341	172791	60
98-99	59248	29377	35866	26300	26532	177323	60
99-00	63450	30619	38454	27819	26713	187055	61
00-01	118000	30985	39294	29640	26920	244839	67
01-02	133151	31942	42242	29613	27101	264049	68
02-03	148622	32950	36222	31306	27490	276590	69
03-04	149928	33755	37836	30681	28204	280404	69
04-05	158040	34362	63948	36800	28877	322027	71
05-06	164534	35227	62225	35200	29637	326823	71

Source: State /Union territory Animal Husbandry Department.& Basic Animal Husbandry Statistics,2006-AHSSeries-10,GOI
Source: Basic Animal Husbandry Statistics,2006-AHS Series-10,GOI

2.4 CONSUMPTION

Per capita consumption of eggs and poultry meat is 42 eggs and 1730 gms poultry meat per annum which is relatively low. There is considerable variation in per capita consumption between rural and urban areas and also across the region.

Poultry meat Consumption

As a result of increased poultry meat production, the annual per capita consumption has increased from 126 g in 1961 to 1730 g in 2005. Per capita consumption of poultry meat is about 4 kg for southern states, almost 3 times that of the national average.

Figure 6.a and 6.b: Poultry meat (in average calories/capita/day) (in kg/capita/year)

This information has not yet been sourced

Availability and consumption of eggs

Per capita availability of eggs varied considerably among the regions. The per capita availability of eggs was 96.70 eggs for the southern states comprising of Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, Lakshyadeep, Pondicherry and Andaman Nicobar island in 2001. It was 20.43 eggs for the northern region which included Himachal Pradesh, Haryana, Rajasthan, J&K, Punjab, Uttar Pradesh, Uttaranchal, Chandigarh and Delhi; 21.57 eggs for the eastern region comprising West Bengal, Bihar, Jharkhand, Orissa and north eastern states and 21.50 eggs for the western region comprising Chhattisgarh, Goa, Gujarat, Madhya Pradesh, Maharashtra, Dadra & Nagar Haveli and Daman & Diu.

TABLE 10:
Per capita availability of eggs during 1997-98 to 2005-06

Sl. No.	States/UTs	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06
1.	Andhra Pradesh	82	83	87	151	175	190	192	199	193
2.	Arunachal Pradesh	28	32	8	8	8	8	8	8	33
3.	Assam	20	19	19	19	19	19	19	19	26
4.	Bihar	19	18	18	8	9	9	9	9	10
5.	Chhattisgarh	-	-	-	34	37	37	38	40	39
6.	Goa	84	84	86	92	85	83	83	10	10
7.	Gujarat	10	10	10	7	7	7	9	9	9
8.	Haryana	34	34	37	50	51	58	59	65	69
9.	Himachal Pradesh	13	14	14	13	14	13	13	13	15
10.	Jammu & Kashmir	55	54	57	55	60	60	61	57	58
11.	Jharkhand	-	-	-	20	23	24	23	24	25
12.	Karnataka	37	39	39	37	38	37	32	32	32
13.	Kerala	69	68	67	62	63	41	39	36	38
14.	Madhya Pradesh	24	25	22	11	10	13	15	14	14
15.	Maharashtra	31	32	33	31	33	33	34	34	34
16.	Manipur	31	32	33	31	33	33	36	36	40
17.	Meghalaya	38	38	38	37	39	40	39	39	39
18.	Mizoram	34	40	51	31	33	33	34	34	35
19.	Nagaland	25	26	27	27	27	33	33	36	41
20.	Orissa	21	22	18	19	23	24	25	32	41
21.	Punjab	129	115	119	119	122	126	123	144	141
22.	Rajasthan	10	10	10	10	11	11	12	11	11
23.	Sikkim	34	31	17	17	18	19	23	25	24
24.	Tamil Nadu	56	61	64	61	68	57	59	99	100
25.	Tripura	33	36	34	32	19	30	31	32	32
26.	Uttar Pradesh	5	5	5	5	5	4	5	5	5
27.	Uttaranchal	-	-	-	10	11	10	21	21	20

TABLE 10:
Per capita availability of eggs during 1997-98 to 2005-06

Sl. No.	States/UTs	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06
28.	West Bengal	36	35	35	33	34	33	34	34	35
29.	A & N Islands	126	157	172	155	158	156	165	133	125
30.	Chandigarh	25	20	24	19	19	24	27	27	20
31.	D & N Haveli	15	19	17	14	15	17	18	20	12
32.	Daman & Diu	21	30	24	19	11	10	9	5	4
33.	Delhi	5	4	4	3	3	2	2	2	2
34.	Lakshadweep	113	105	117	126	134	136	176	172	183
35.	Pondicherry	10	10	10	9	10	9	10	10	9
36.	India	30	30	32	36	38	39	40	42	42

Source: Basic Animal Husbandry Statistics, 2006-AHS Series-10,GOI

Only a small fraction of the total eggs produced are used by the confectionary industry and bakeries. Another small percentage of the total eggs are also used for manufacture of egg powder and the rest of the eggs are consumed as table eggs.

The increase in production has increased per capita availability of eggs from 7 eggs in 1961 to 42 eggs in 2006, which is low given that the recommendation is 180 eggs per capita. The per capita availability of eggs during the year 1997-98 to 2005-06 according to states is presented in Table 10. Per capita availability increased from year to year for Andhra Pradesh, Harayana, Punjab, Lakshadweep and Tamil Nadu, whereas it declined or remained static for all other states including Union territories. Per capita availability of eggs was highest for Punjab (129) followed by A & N island (126), Lakshadweep (113) and AP (82) in 1997-98. In 2005-06, the per capita availability was highest for Andhra Pradesh (193 eggs) followed by Lakshadweep (183), Punjab (141), A&N (125) islands and Tamil Nadu (100).

Kumar and Birthal, (2004) have shown increased per capita egg consumption of eggs in urban as opposed to rural India (Table 11).

TABLE 11:
Per capita consumption of poultry products in different income classes

Location	Eggs (nos/annum)	
	1983	1999-2000
Rural	5.9	15.1
Urban	16.0	26.9

Source: Kumar and Birthal (2004)

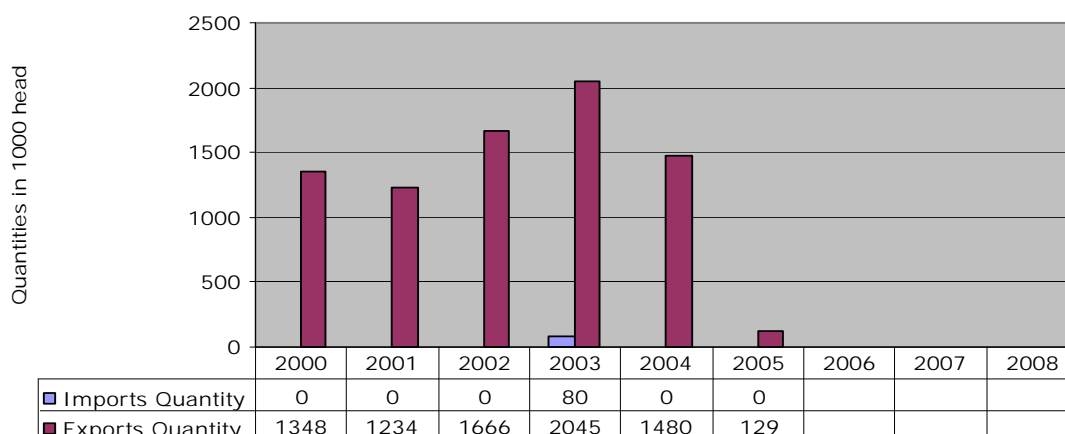
Per capita consumption is significantly determined by average capita income (Cranfield et al., 1998). Per capita consumption of eggs in India is rising fast in regions where urbanization and rapid income growth are taking place.

Figure 6.c and 6.d: Eggs (in average calories/capita/day) (in eggs/capita/year)

More recent information has not been sourced.

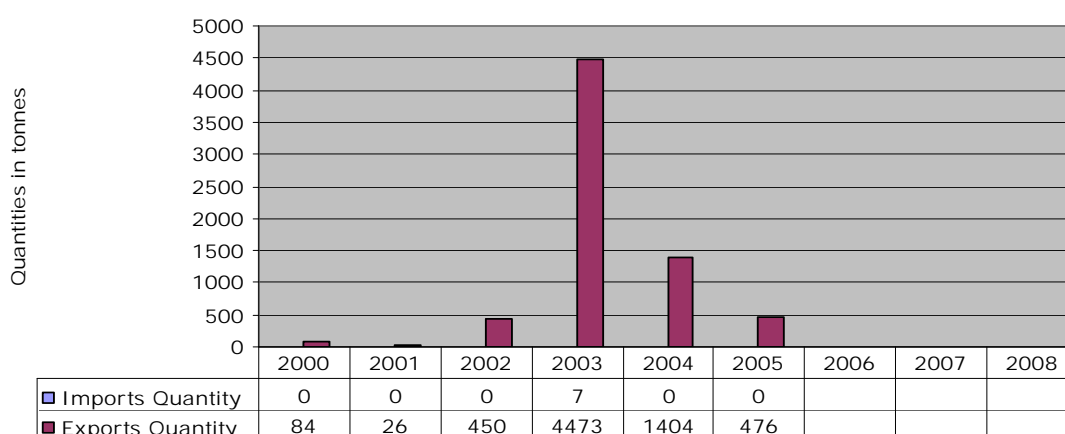
2.5 TRADE

FIGURE 7.a: Import/Export of live chickens (up to 185 g. only)



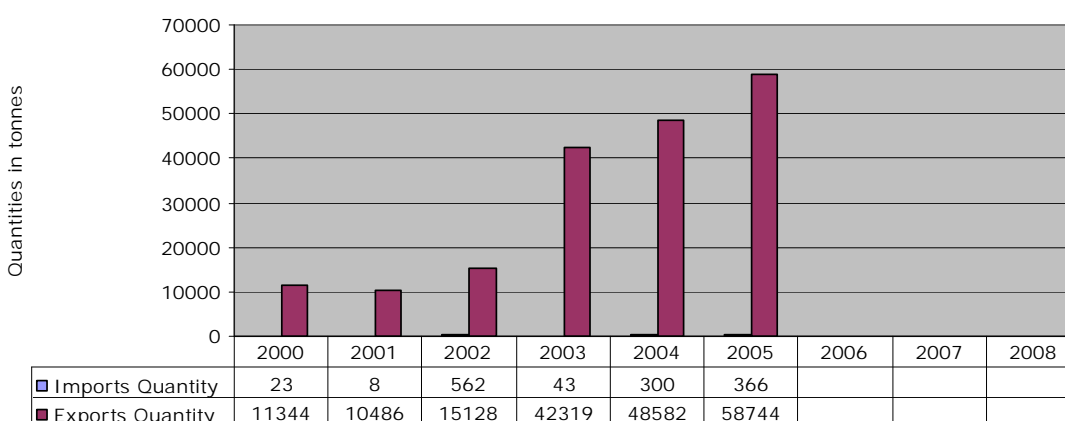
Source: FAOSTAT, September 2008

FIGURE 7.b: Import/Export of chicken meat



Source: FAOSTAT, September 2008

FIGURE 7.c: Import/Export of hen eggs (with shells)

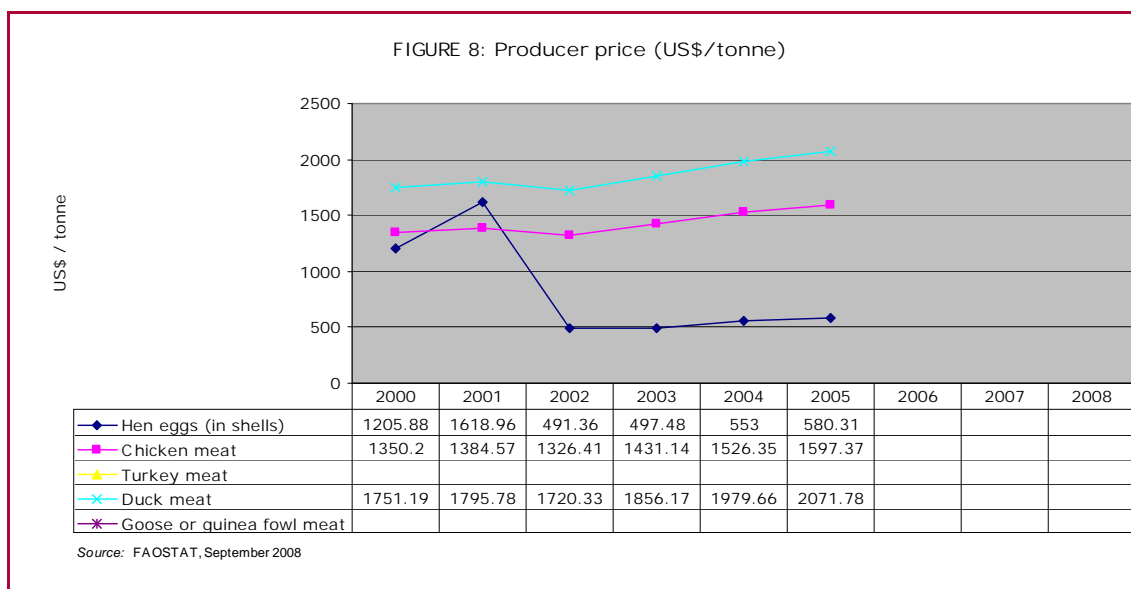


Source: FAOSTAT, September 2008

Figure 7.d: Import/Export of poultry feed and feed ingredients (maize, soybeans)

This information has not yet been sourced.

2.6 PRICES



The wholesale price index for eggs, chicken and commodities for the years 1996-97 to 2005-06 is presented in the table below (Table 12).

TABLE 12:
Wholesale price indices for eggs and chickens from 1996 to 2006

Year	Eggs	Chicken	Commodities
96-97	124.3	126.7	127.2
97-98	136.6	122.2	132.8
98-99	130.7	129.9	140.7
99-00	137.0	121.4	145.3
00-01	140.0	118.5	155.7
01-02	141.5	116.6	161.3
02-03	137.3	102.4	166.8
03-04	134.8	91.6	175.9
04-05	136.7	84.5	187.3
05-06	139.2	80.9	195.6

Source: Office of the Economic Advisor, Min. of Commerce & Industry. www.eaindustry.nic.in

There has been a massive increase in the wholesale price index of eggs during the last 10 years from 124.3 in 1996/97 to 139.2 in 2005/06, with the average annual increase being 1.49%. The price indices for poultry meat declined from 126.7 to 80.9 during the same 10 years, with an approximate decline of 4% per year. This was primarily due to the adoption of integration and contract growing, as well as the improvement in management practices and automation in most areas of production. The price index for other commodities increased significantly during the 10 year period from 127.2 in 1996/97 to 195.6 in 2005/06, with the average increase in the price index being 6.84% per year.

The wholesale price of live chicken for Guwahati, Delhi, Chennai and Kolkota from January, 2001 to December 2005 was studied. The prices quoted were for a quintal (one thousand kilograms) of live poultry in all places except Delhi market, where broilers are sold in scores, with 1 score equal to 20. The study revealed that Chennai market is cheapest among the four areas for which data were available, whereas it was most expensive in Guwahati market. The trend remained consistent in all 5 years of the study. The wholesale

prices declined in Chennai and Kolkata markets, whereas it increased in Guwahatti and Delhi market.

The retail prices for chicken and eggs for Nasik, Delhi, Chennai, Lucknow and Kanpur were studied from January, 2002 to March, 2007. Nasik appeared to be the most expensive compared to the other centres, followed by Lucknow and Delhi markets. Chennai and Kanpur were the cheapest markets.

Figure 9 Consumer price (US\$/tonne)

More detailed information has not been sourced.

Chapter 3

Poultry production systems

TABLE 13:
FAO classification of poultry production systems

Sectors (FAO/definition)	Poultry production systems			
	Industrial and integrated	Commercial		Village or backyard
		Bio-security		
		High	Low	
Sector 1	Sector 2	Sector 3	Sector 4	
Biosecurity	High	Mod-High	Low	Low
Market outputs	Export and urban	Urban/rural	Live urban/rural	Rural/urban
Dependence on market for inputs	High	High	High	Low
Dependence on goods roads	High	High	High	Low
Location	Near capital and major cities	Near capital and major cities	Smaller towns and rural areas	Everywhere. Dominates in remote areas
Birds kept	Indoors	Indoors	Indoors/Part-time outdoors	Out most of the day
Shed	Closed	Closed	Closed/Open	Open
Contact with other chickens	None	None	Yes	Yes
Contact with ducks	None	None	Yes	Yes
Contact with other domestic birds	None	None	Yes	Yes
Contact with wildlife	None	None	Yes	Yes
Veterinary service	Own Veterinarian	Pays for veterinary service	Pays for veterinary service	Irregular, depends on govt vet service
Source of medicine and vaccine	Market	Market	Market	Government and market
Source of technical information	Company and associates	Sellers of inputs	Sellers of inputs	Government extension service
Source of finance	Banks and own	Banks and own	Banks and private ²	Private and banks
Breed of poultry	Commercial	Commercial	Commercial	Native
Food security of owner	High	Ok	Ok	From ok to bad

Sector 1: Industrial integrated system with high level of biosecurity and birds/products marketed commercially (e.g. farms that are part of an integrated broiler production enterprise with clearly defined and implemented standard operating procedures for biosecurity).

Sector 2: Commercial poultry production system with moderate to high biosecurity and birds/products usually marketed commercially (e.g. farms with birds kept indoors continuously; strictly preventing contact with other poultry or wildlife).

Sector 3: Commercial poultry production system with low to minimal biosecurity and birds/products entering live bird markets (e.g. a caged layer farm with birds in open sheds; a farm with poultry spending time outside the shed; a farm producing chickens and waterfowl).

Sector 4: Village or backyard production with minimal biosecurity and birds/products consumed locally.

² Money lenders, relatives, friends, etc.

3.1 BACKGROUND INFORMATION

India has one of the fastest growing economies in the world after the USA and China, with a GDP growth of 9.4% (2006/07). Over 72% of India's population lives in rural areas and of that, 58% depend on agriculture and associated activities for their livelihoods. Over the last two decades, agricultural growth barely exceeded 3% per year. Comparatively, the animal husbandry sub-sector within agriculture is showing good growth and poultry production has emerged as one of the key segments of the livestock economy. The total value of the poultry sector is 162 billion rupees in 2005/06, which accounted for 10.5% of the total value of livestock output and 2.6% of the agricultural sector as a whole. More than three million people directly or indirectly depend on this sector for income and employment. Poultry production systems in India are characterised by the simultaneous existence of the traditional extensive system of backyard production and the modern intensive system of production. In both the production systems, chickens are the most popular followed by ducks, accounting for more than 99 percent of the total poultry population. Other domesticated avian species like guinea fowls, geese, quails, pea fowls etc are used only for meat production and account for less than 1%.

The poultry sector has grown from a backyard activity into a major commercial activity in four and half decades, but the backyard poultry sector of rural India still makes up 52% (2003) of the total fowl population and 6.2 % of ducks. This sector contributes 23% (2005-06) of the total eggs produced. There has been a significant change in the ownership and size of backyard poultry within the last decade and it declined by 7% between 1991 and 2003. India's food basket is changing rapidly in favour of high-value food products, including animal products. Between 1993-1994 and 1999-2000, per capita consumption increased by 26% for milk and 29.7% for meat. The increase was most rapid for the consumption of poultry products; 82% for poultry meat and 50% for eggs. The expanding demand for livestock products is creating an opportunity for producers to enhance their income. Nevertheless, there is an apprehension in the sector, because the global trade in livestock products is highly distorted. Some developed countries provide huge support to livestock and poultry production, which adversely affects export prospects and poses a threat to domestic production. In the context of poultry, India is not a major player in global trade, either as an exporter or importer.

TABLE 14:
Value of output share and growth in poultry sector in India

Year	Poultry meat	Eggs	Poultry total	Livestock total	Total crop & Livestock
Value of output in billion rupees (at 1999-2000 prices)					
TE 1981-82	32	16	48	616	2950
TE 1991-92	64	32	96	966	3965
TE 2005-06	108	54	162	1536	6192
Share in total crop and livestock VOP (percent)					
TE 1981-82	1.1	0.5	1.6	20.9	100.0
TE 1991-92	1.6	0.8	2.4	24.4	100.0
TE 2005-06	1.7	0.9	2.6	24.8	100.0
Compound Annual Growth Rates (percent)					
1980/81-1989/90	8.4	7.9	8.3	4.9	2.8
1990/91-1999-00	4.2	4.1	4.1	3.8	3.2
2000-01-2005-06	4.6	4.1	4.5	3.6	5.0
1980/81-2005-06	5.0	5.2	5.1	4.0	3.1

Source: Ministry of Statistics and Programme Implementation, Government of India <http://mospi.nic.in/>

The poultry sector grew at the rate of 5.1% per annum during the years from 1980/81 to 2005/06 (1999-2000 prices). The sector got significant impetus during the eighties with a growth rate of 8.3% (in 1999-2000 prices). The sector grew at a much faster rate thereafter than any other components of crops and livestock. Within the poultry sector, broiler production has, by and large, been growing faster than egg production. In terms of share of total agricultural VOP, broiler production (1.7%) has been found to be much ahead of egg production (0.9%).

Growing population, rapid urbanization, rising disposable income and changing consumption patterns have expanded the demand for high value food commodities. Among them, the demand for poultry is expanding rapidly since poultry meat is one of the best sources of high quality protein with less fat. It is also comparatively cheaper than other meat and accepted by all, irrespective of caste and religion, unlike beef and pork.

3.2 SECTOR 1: INDUSTRIAL AND INTEGRATED PRODUCTION

The intensive/industrial system of poultry production has become very popular in India. The production technologies followed and consequently the production and productivity co-efficients have been comparable to those of America and the rest of the industrialised world.

However, some variations can be observed across the regions due to climatic factors, economic status and level of entrepreneurship. Most of the poultry farms operating the intensive system of poultry production are located in suburban and peri-urban areas.

Although a major proportion of poultry eggs and meat is still produced on independent farms, vertical integration and contract growing have become very popular in the southern and western regions of the country for broiler production. This is helping to lower the average cost of production and reduce the producer retail margin, thus making it available to consumers at a cheaper price. (Ramaswami et al.2005)
(<http://www.isid.ac.in/~planning/workingpapers/dp05-01.pdf>)

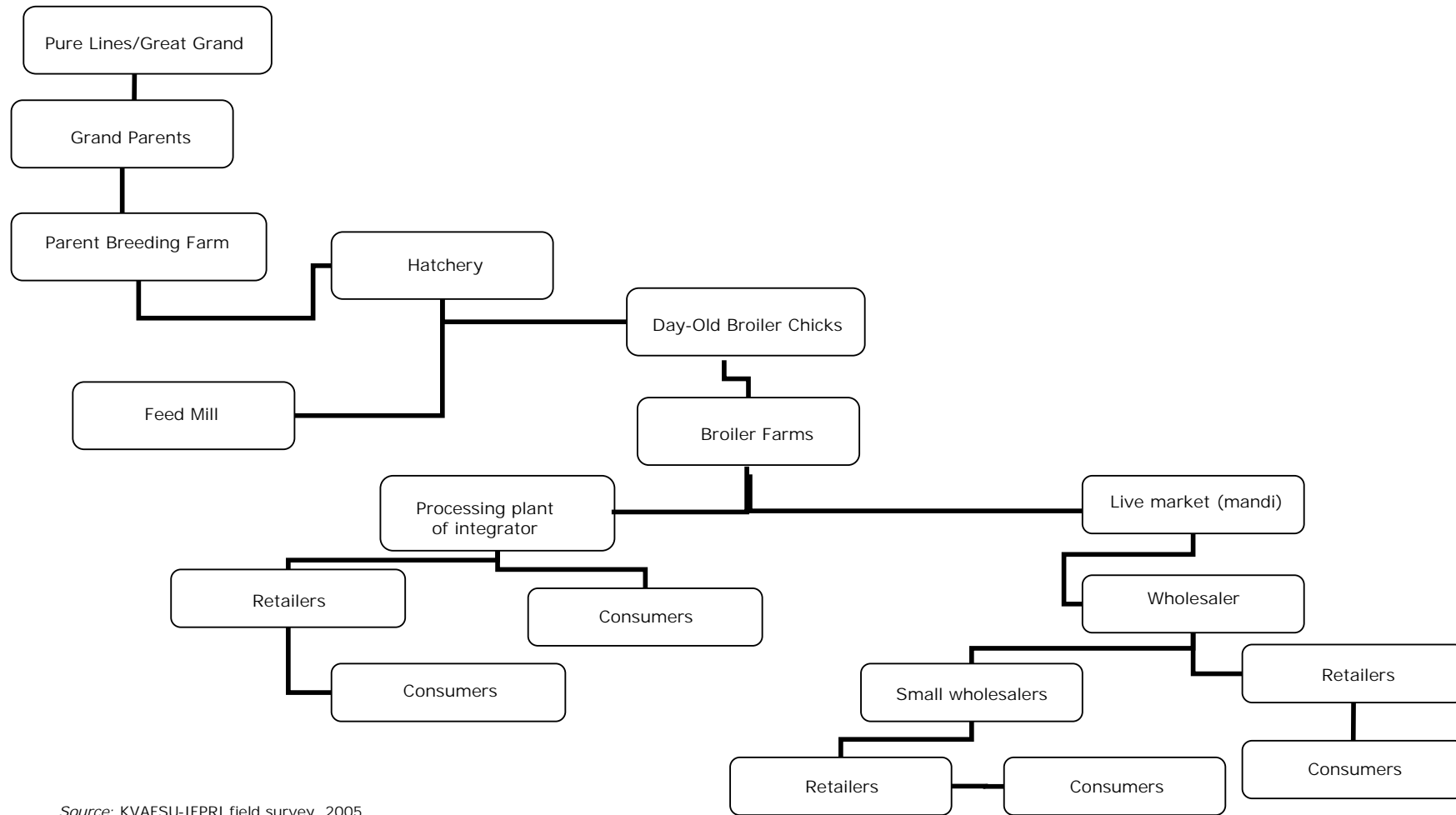
Vertical integration includes all aspects of production inputs, including veterinary services. Some integrators have also expanded their operation to the retail market to attain price leadership and influence over the wholesale-retail margin. Most of the big integrators sell the bulk of their produce as live birds on the wholesale market and a small proportion are sold on the retail market. There are a number of small and partially integrated farms, which usually omit one or more inputs.

An example of integrated poultry farming in Karnataka State is given in Figure 10 below. Poultry integrators have been expanding most rapidly in southern India, particularly in the Coimbatore area of Tamil Nadu, where, reportedly, large integration now accounts for about 75% of production and consumption. Integrations have also recently become more prevalent in western India, including Pune, Nashik, and Mumbai, where they now account for about 35% of production and consumption. Smaller, independent and partially integrated producers control poultry production in eastern and northern regions. Arambag hatchery, Kolkota is a major integrator operating in the eastern region of the country.

The major integrators and contract growers operating in the southern and western region of the country include Venkateswara, Suguna, Pioneer, Diamond Riverdale, Star chick, Gold chick, Godrej real gold, Godrej agro vet, Santhi, Peninsula, Skylark and Komarla. Some of these integrators are also selling their processed chicken products in brand names like Venkateswara with brand name Venky, Godrej-Realgold, Lifeline-Tenderchicken, Nutri-Freshchicken, and Skylark-Nutririch.

The contract farming system is becoming popular as it allows farmers to improve management with family labour, whilst saving expenditure on various inputs. Under a production contract, the integrators supply major inputs like day-old chicks, feed, veterinary care, pharmaceuticals and biological and technical services. They are also responsible for the disposal of live broilers. Integrators bear all the input and output price risk and share the production risk with the broiler producer. However, the grower does not share any benefits from increasing output prices, although they supply the labour, infrastructure and management skills needed for production. They receive a growing fee per bird based on performance such as FCR, harvest recovery and average live weight. They get additional remuneration on superior performance standards set in the contract. If the performance is below standard, a corresponding amount per bird is subtracted from the contract fee (Fairoze et al.2006).

FIGURE 10: An example of integrated poultry farming in Karnataka, 2005



Mehta et al. (loc cit.) reported the existence of 1 lakh layer farms and an equal number of broiler farms under the intensive system of production. About 70% of these were small with bird strength varying from 3,000-10,000 per farm and medium-scale (10,000-50,000). Only 10% were large farms with bird numbers ranging from 50,000 to 400,000. The remaining 20% were marginal farmers with units up to 3,000 birds. However, Fairoze et al. loc cit. in Karnataka state study have shown that 65.5% of broiler farms have less than 3,000 birds. At present layer farms with less than 40,000 are not a viable proposition. Due to an increase in feed prices and labour costs, small farmers are unable to compete with large farmers.

Contract farming for egg production has not developed in the same way as that for broiler production. Egg powder processing plants are limited in number, and strict production and sanitary regulation enforcement as per the European Union standards to India in 1996 (Mehta et al. 2003) led to a decline in the number of egg contract farmers and the closure of the initiative. During the last 3/4 years, export-oriented egg powder plants have started to upgrade sanitary standards and contract farming layers are now emerging again to a limited extent.

3.3 SECTORS 2 AND 3: OTHER COMMERCIAL PRODUCTION SYSTEMS

3.3.1 Breeding stocks and hatching eggs

This information has not yet been sourced.

3.3.2 Broiler meat

This information has not yet been sourced.

3.3.3 Hen table eggs

This information has not yet been sourced.

3.3.4 Other species

This information has not yet been sourced.

3.4 SECTOR 4: VILLAGE OR BACKYARD PRODUCTION

The rural family poultry or village poultry system is known as backyard poultry in India. Sonaiya et al. (1996) classified family poultry production systems as free range, backyard and small-scale intensive, based on the productivity of eggs per hen on annual basis.

Backyard poultry keeping is a centuries old tradition. The knowledge base of rural and tribal people centre around local poultry breeds and has been developed by the community/tribe over the years. Backyard poultry production is used by weaker sections of society as insurance against crop failure, for ready cash and to ensure basic economic returns and the empowerment of women and children. Hence, Backyard poultry is inherently pro-poor. Coloured plumage domestic fowls are preferred by rural and tribal people for socio-cultural purposes and ceremonial offers (Rangnekar and Rangnekar, 1999 and Kornel, 1999). Poultry has few religious taboos attached to it.

Indigenous fowls are preferred for backyard poultry production. Duck raising is popular only in coastal states like West Bengal, Orissa, Andhra Pradesh, Tamil Nadu and Kerala besides Assam and Tripura chickens still take priority in these areas.

Backyard poultry is a low input-low output system with fast returns. It has survived the rapid expansion of commercial poultry development and indeed complements it. The major constraints to backyard production are losses from mortality due to diseases and predators. Newcastle disease (RD) is the most feared and it virtually wipes out village flocks. There is a need to support the backyard smallholder poultry sector with research and capacity building, including the development of thermostable vaccines against major diseases and service delivery models that will be in the interests of the poor.

This sector also needs access to credit and the related policy support. The Government of India has developed a concept paper with a strategy for developing the backyard poultry sector for the purposes of poverty alleviation, food security, food production, employment generation and the empowerment of poor women. Recently, the Government of India strongly recommended the development of the backyard poultry sector in the Cooperative marketing format for the upcoming 11th Five year Plan.

3.4.1 Chickens

Land ownership and backyard poultry keeping

It is evident that agriculture is dominated by smallholders but that the bulk of the landholdings rests with a small proportion of affluent landholders (Table 15). Smallholders are struggling to earn a livelihood by cultivating a small piece of land and thus many are looking for alternative or supplementary income sources on and off the farm (Birthal et al., 2006). They as a group control 81% of indigenous poultry; against a 44% share in land (Table 15). The results above clearly indicate that poultry distribution is more skewed towards small farm households. Between 1981-82 and 2002-03, the dependence and share of sub-marginal and marginal farm households increased for poultry, while medium and large farm households including landless households witnessed a significant decline in their shares.

TABLE 15:
Distribution of rural households; share in land area; percentage distribution of poultry

Years	Landless (<0.002ha)	Sub- marginal (0.002- 0.5ha)	Marginal (0.5-1.0ha)	Small (1.0- 2ha)	Medium (2.0- 4.0ha)	Large (>4.0ha)	Total
Number of households (Million)							
81-82	24.5 (26.1)	26.6 (28.4)	12.0 (12.8)	13.6 (14.5)	9.9 (10.6)	7.3 (7.8)	93.9 (100.0)
91-92	25.4 (21.8)	39.1 (33.6)	17.1 (14.7)	16.5 (14.2)	11.3 (9.3)	7.0 (6.0)	116.4 (100.0)
02-03	47.2 (31.9)	49.4 (33.4)	20.3 (13.8)	16.6 (11.2)	9.2 (6.2)	5.1 (3.5)	147.8 (100.0)
Share in land area (percent)							
81-82	0.0	4.1	7.6	16.7	23.5	48.1	100.0
91-92	0.0	5.4	10.1	18.6	24.2	41.7	100.0
02-03	0.0	10.9	13.2	20.1	21.4	34.4	100.0
Size of land holding (ha)							
81-82	0.0	0.18	0.75	1.46	2.81	7.84	1.26
91-92	0.0	0.17	0.74	1.41	2.69	7.50	1.08
02-03	0.0	.025	0.73	1.37	2.62	7.53	0.76
Poultry (percent)							
81-82	7.1	33.0	15.8	17.9	15.1	11.1	100
91-92	6.4	37.0	17.9	19.0	14.4	5.3	100
02-03	4.3	43.6	20.2	16.8	6.6	8.4	100

Source: (i) GOI. 1982. NSS 37th round report on Land and Livestock holding (ii) GOI. 1992. NSS 48th round data on Land and Livestock holding. (iii) GOI. 2002-03. NSS 59th round report on Livestock Ownership across Operational Land Holding Classes in India. (From Birthal et al.2006)

On average, 14.3% of rural households own poultry (2002-03) compared to 21.1% in 1991-92. The proportion of poultry owners, as expected, was least among landless households at 4.7% (GoI, 1992 & 2002). The drastic decrease in household ownership since 1981-82 suggests that the landless are becoming detached from poultry. There could be a number of reasons for this, including their lack of resources to invest and the total family being employed in wage labour.

Size of landholdings and scale of poultry production

On average, there were 888 poultry for every 100 owner households in 2002-03 (Table 16). The size of landholding seemed to influence the scale of poultry production, with the scale of poultry holdings kept by the landless households being much smaller compared to that of large farm households. Further, between 1991-92 and 2002-03, there was a decline of 48% in poultry kept by the landless and 24% by medium land classes, while for other classes there was an increase, the maximum being for the large landholders.

TABLE 16:
Average number of birds per 100 owner households

Year	Landless	Sub Marginal	Marginal	Small	Medium	Large	All
Poultry							
91-92	641	701	783	816	1138	1029	790
02-03	366	794	876	1025	867	3311	888

Source: (i) GOI. 1992. NSS 48th round unit level data on land and livestock holding. (iii) GOI. 2002-03. NSS 59th round report on livestock ownership across operational land holding classes in India.

On the whole, it can safely be concluded that this recent trend has contributed to the overall decline in smallholder backyard poultry population at the national level.

Backyard Poultry Production by Region

Table 17 shows the proportion of households raising poultry and the average number of poultry birds owned by 100 households by region. It indicates that about 14% of all households raised backyard poultry in 2003. The proportion of households with poultry units was higher in the northeastern states comprising of Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura where 47% to 77% rural households maintained poultry in 2002-03. The average number of birds per 100 households was higher in northeastern states. Among other states, backyard poultry was found to be popular in Jammu & Kashmir, West Bengal, Kerala and Orissa. Backyard poultry production was found to be least popular in the north and western states of India like Punjab, Haryana, Gujarat, Rajasthan, Uttar Pradesh and Himachal Pradesh. The average number of birds per household is very low in these states (124/100 households).

There have been significant changes in the ownership and size of backyard poultry units during the last decade. At a country level, between 1991 and 2003, the proportion of households owning backyard poultry declined by 7%. Interestingly, the declining trend prevailed throughout the country except in Manipur, Tripura and Assam. In other northeastern states it declined at a faster rate compared to other states. There was also a rapid decline in Kerala, Madhya Pradesh and Andhra Pradesh. The decline in ownership was also accompanied by a reduction in unit size (number of birds owned per households). On average, unit size declined by about 10%. However, Bihar, Himachal Pradesh, Karnataka, Kerala and Maharashtra experienced over 50% reduction in unit size.

TABLE 17:
Percentage of households owning backyard poultry (1991 & 2003)

State/Household category	Percent of households owning poultry		Average number of poultry per 100 households	
	1991	2003	1991	2003
Andhra Pradesh	23.63	14.40	122.93	76.81
Assam	67.44	67.90	668.70	720.39
Bihar	17.29	10.20	163.85	79.08
Gujarat	10.21	6.00	75.67	52.17
Haryana	4.60	1.70	24.66	361.43
Himachal Pradesh	7.51	3.70	39.37	19.35
Jammu & Kashmir	31.56	38.90	282.43	552.32

TABLE 17:
Percentage of households owning backyard poultry (1991 & 2003)

State/Household category	Percent of households owning poultry		Average number of poultry per 100 households	
	1991	2003	1991	2003
Karnataka	19.97	12.20	138.97	69.82
Kerala 1992	47.32	24.70	396.57	148.80
Madhya Pradesh	20.34	10.30	131.79	107.58
Maharashtra	18.30	13.00	191.73	84.44
Orissa	27.34	23.90	217.84	151.16
Punjab	3.99	3.20	35.04	137.57
Rajasthan	3.63	4.00	33.14	23.89
Tamil Nadu	16.69	11.20	106.63	107.47
Uttar Pradesh	4.52	3.20	27.95	15.61
West Bengal	49.54	32.60	366.64	226.68
Manipur	42.50	58.30	622.75	960.79
Meghalaya	82.26	67.30	1324.52	895.28
Nagaland	91.56	76.70	1260.09	1102.54
Sikkim	72.55	47.20	720.67	380.56
Tripura	43.68	50.40	487.00	441.26
India	21.10	14.30	166.55	124.02

Source: NSSO & Land, livestock agric. Implement in households of operational holding .Report No.408.(1997).Livestock ownership across operational land holding classes in India 2002-03;NSSO Report No.493(59)/18.1/1.NSSO Publication ,2006.

Backyard Poultry Husbandry Systems

Birds raised in the backyard production system generally scavenge for their feed requirements, with some households providing home grown grains and kitchen waste as a supplement. The recurring input costs are thus very low or negligible.

Housing is provided only at night and during adverse weather conditions. Separate housing is rare when the unit size is small; poultry share the same household facilities and are kept in bamboo baskets/cardboard boxes to prevent predation during night. Large flocks are housed separately. Locally available cheap materials are used for the construction of poultry houses.

The flock size of backyard poultry units is usually small but varies greatly from family to family depending upon their affluence and availability of scavenging area. Each unit can have 5-200 birds, including adults, growers and chicks.

Backyard Poultry Production Characteristics

Broodiness in hens is common and essential for hatching eggs in backyard poultry. Eggs are usually obtained in 3 to 4 clutches of 10 - 20 eggs per clutch. Broodiness increases the duration of pauses and indigenous hens therefore lay a small number of eggs varying from 40 eggs to 110 eggs during the year. Egg size is usually small, ranging from 34 to 50 grams and mostly tinted or brown in colour. Poultry raised in this system are lighter and are thus able to fly to escape predation. The average mature weight of hens does not exceed 1.5 kg and that of cocks 2.0 kg. They mature late and the average age at first egg is about 7 months.

In most regions it is a seasonal occupation and fits in well with farm activities. The backyard poultry system focuses mainly on meat production rather than the production of eggs. Consequently, most of the eggs produced are used for hatching, with only a few eggs being consumed by the family or sold. The returns are very low from egg sales, compared to the sale of birds.

In Orissa, each household produces on average 92 eggs; in summer 47% percent and in winter 26% of eggs are consumed (Subrahmanyam and Murthy, 2006). In regions with a high ambient temperature like Tamil Nadu and Rajasthan, the hatchability of eggs is low (Conroy et al. 2005 and Danida, Pudukottai), but in general the hatchability varies from 40 to 90%. Low hatchability is attributed to the high ambient temperature of summer, cracking of egg shells and deficient nutrition.

In the tribal belts of Orissa, Jharkhand, Chhattisgarh, Madhya Pradesh and Andhra Pradesh, cock fighting is a popular sport. Fighting cocks fall under the special breed category; they are raised with care and sold at very high prices, ranging from Rs 500 (US\$12.67) to Rs 3000 (US\$76.05) per cock of around one year old.

Backyard Poultry Economics

Backyard poultry keeping makes a significant contribution to family income. Subrahmanyam and Murthy (loc cit) studied the economics of backyard poultry production in Orissa state. They reported an annual income of Rs.2199 (US\$ 55.74) per family from backyard poultry. A study undertaken in the DANIDA sponsored project Koraput, covering 318 families in 25 villages suggested that the threshold value of hen unit per family corrected for mortality increased from 2.79 to 4.01 birds. This is a significant increase. The average yearly consumption of bird per family also increased from 12.39 to 19.85 birds and the number of birds sold increased from 11.65 to 41.96. The sale proceeds from poultry increased from Rs.441.00 (US\$11.17) to Rs2222.09 (US\$56.32) (Kornel and Brunse, 2002). The number of hens per unit household is the best indicator to measure the impact of poultry development in villages (Kornel, 2006). Tribal farmers and other breeders of Hansli and Hazari breeds of native poultry in Mayurbhanj district of Orissa maintain 2 to 8 hen units with followers of more than 200 per family and earn a minimum of Rs.15, 000 (US\$380.25) annually from sale of cocks. The family consumption is more than 50 birds per annum. They confidently claim that if losses from ND were reduced, a family could live on poultry keeping alone.

In another study in Udaipur in Rajasthan, it was seen that the main reason for keeping poultry was home consumption and entertainment of guests (Conroy loc cit.).

Mortality losses in Backyard Poultry

Newcastle Disease (ND), also known as Ranikhet Disease (RD), is endemic all over the country except for in the North-eastern states. It is the main killer disease for backyard poultry and often wipes out entire backyard poultry units. Rangnekar and Rangnekar (loc cit.), in Western India, Kornel et al., 2003 in Orissa; Mohapatra, 2003 in Madhya Pradesh reported similar findings. Fowl pox in chicks, predation in some regions (Conroy loc cit.) and parasitic diseases also cause high mortality and morbidity in poultry. Subrahmanyam and Murthy (loc cit.) reported 22.5% annual mortality for backyard poultry flocks in Orissa.

Veterinary services for Backyard poultry

Poultry biologicals are produced both in the public and private sector whereas the production and sale of pharmaceuticals is entirely in the hands of the private sector. The role of the private sector in health care for animals and poultry is also increasing.

Most of the vaccines produced are cold chain dependent. The rural backyard poultry sector needs thermostable poultry vaccines as well as small dose vials for effective utilisation in villages. Australian researchers have developed thermostable ND vaccines which are popular in Africa and south-East Asia (Alders et al., 2001; Spradbrow, 1993-94); however, Indian scientists are of the opinion that the highly virulent Velogenic strain of NDV is a constraint. Indian Veterinary Research does claim to have developed a killed ND vaccine, but it is not yet available in government outlets.

The backyard poultry sector has an inadequate health support system, especially in the less developed areas of the country. It has been observed through pilot projects that training village youths in poultry vaccination and management contributes significantly to the productivity of backyard poultry (Kornel, 2003; Ramdas and Ghotage, 2004; Kornel et al. 2006).

Marketing of Backyard poultry

The sale of village birds is the responsibility of women. Birds raised in the backyard sector are sold as live birds in numbers rather than by weight in nearby weekly markets. At these markets there are consumers who buy poultry directly from producers and there are middlemen who buy and do the bulk of their business in lucrative urban markets.

Indigenous poultry meat and eggs from the backyard system fetch a premium price; 25-100% more than the price of farm bred chickens. Poultry traders in cities and towns in Orissa, Chhattisgarh, Madhya Pradesh, Andhra Pradesh and others regularly import indigenous poultry from distant weekly markets because of the high demand for them in niche markets. The demand is so high in these markets that exotic coloured birds are sold as indigenous poultry. In Central India, most poultry are sold at the onset of the monsoon.

The role of credit in the Backyard Poultry sector

The bank credit systems, including the National Bank for Agriculture and Rural Development credit support, are skewed towards the commercial poultry sector at present. The rural poor have limited or no access to credit facilities from public institutions and poor farmers therefore depend upon village moneylenders who charge interest rates as high as 10% per month. In order to support the backyard poultry sector, the lending policy needs to be redefined so that the needs of the poor for credit to acquire birds, construct shelter and purchase equipment are taken into account.

The share of livestock in agricultural credit stands at only 5.8% (NABARD Annual report).

The existence of backyard poultry alongside commercial production

Although the output from the backyard poultry production of eggs and meat is very small compared to that of the modern intensive system of production, backyard poultry production continues today even after four and half decades of industrial poultry production.

The rapid expansion of large industrial poultry production units with significant economies of scale has raised concerns about the sustainability of backyard poultry production models. However, there are many who point out that commercial poultry farms may not necessarily be a constraint for backyard poultry since there is significant scope for market segmentation and product differentiation. Both the systems do not compete but rather complement each other in efficient utilization of locally available resources and the provision of job opportunities and economic and food security. The indigenous bird demand is growing and is being replaced by coloured exotic birds, now representing a significant 5% to 7% of the total broilers produced, especially in the Eastern and North-east states in India.

Government Support to Backyard Poultry Development

The role of government is critical to the success of the rural poultry sector. The Government of India has developed a concept paper with a strategy for developing the sector (<http://www.dahd.nic.in/poultryconcept.htm>). Recently the Government of India strongly recommended the development of Backyard poultry in Cooperative marketing format for the upcoming 11th Five year Plan (Planning commission, 2006). (http://www.planningcommission.nic.in/plans/planrel/app11_16jan.pdf)

Backyard Poultry Sector Vision and Policy

The primary focus of research and development efforts in the public sector for the poultry sector is to support private sector intensive production, although some research is also being carried out into known Indian poultry breeds of poultry and the development of low technology birds for the rural farming community. The public sector has given support to poultry disease control in the country, but in future this needs to be a public and private partnership.

The backyard poultry sector of rural India represents 52% of the total fowl population and 6.2% of ducks (2003). It contributes 23% (2005-06) of the total number of eggs produced; although declining this is still significant. Backyard poultry farming is environmentally friendly and energy independent in comparison to the commercial poultry sector and this will be an important consideration in the current energy climate.

Governments have refocused their aim to improve the living conditions of the poor people and backyard poultry has been highlighted as a dependable entry point with good development potential. This fact is well documented in Bangladesh and to some extent in India with various donor initiatives, particularly the livestock support arena.

Thus it is important that the backyard poultry sector receives adequate support from policy and that women-centered poultry programmes are implemented to achieve results.

It should be noted that backyard poultry production systems are complex and that improvements should be introduced with caution. It is also important to remember that interventions will only be sustainable if they tie in with the limited physical and economical resources of rural households. Farmers have to become more market oriented and required the organisational support that was given to the dairy sector.

The control of poultry diseases (particularly zoonotic diseases) by the private and public sector should also be a key priority for the sector.

3.4.2 Other species

This information has not yet been sourced.

3.5 POULTRY VALUE CHAIN ANALYSIS

3.5.1 Day-old chicks

This information has not yet been sourced.

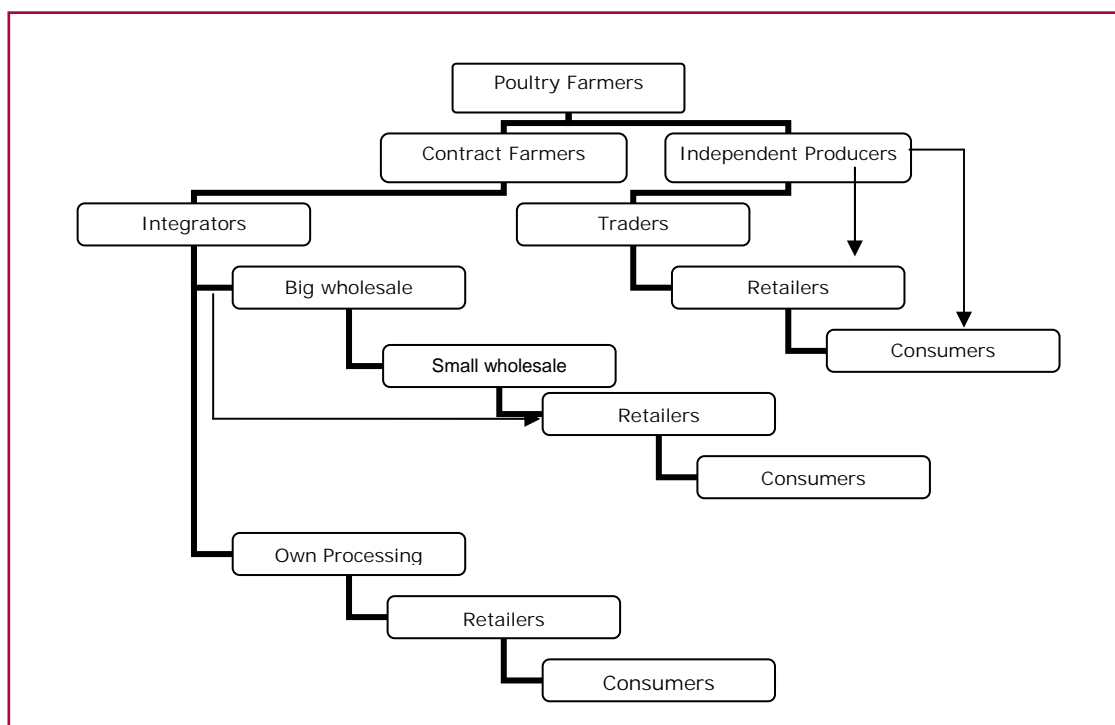
3.5.2 Chicken meat

Almost 90% of broilers produced are sold as live birds through the wholesale market. Of the remaining 10%, a fraction are sold in the retail market as live birds and the remaining birds are processed in automatic and semi-automatic dressing plants to be sold as frozen whole chicken, cut up parts and further processed products.

Broiler marketing is more complex than egg marketing and there is no organization like NECC at national level (see 3.5.3). In some areas there are regional broiler associations who declare the farm gate price for broiler sales, but on the whole in most areas of the country, broiler marketing is in the hands of large traders and commission agents. Ghazipur market in Delhi and Crawford market in Mumbai are examples of this marketing system. Middlemen are the links between producer and consumer. In this system wholesalers /distributors sell the live broilers to retailers, who in turn dress the birds and sell to the consumers. The broilers are slaughtered in an unhygienic way by the retailers on street corners and at road sides. However, Indian customers prefer the wet meat production system to be sure that the slaughter conforms with their religious faith.

In big cities and centres, processed poultry and poultry products are usually sold in retail stores or specialized stores. This system of marketing is gaining popularity. Products are more hygienic and branded products are usually sold at higher price than unbranded products.

The marketing channel for broiler farms in Karnataka State is given in Figure 11.



Refrigeration facilities are highly inadequate, and as a result live broilers are sent from the point of production to the point of distribution in specialised trucks. This results in variable loss of 5-10% due to stress depending upon the distance between these points. It also affects weight. Processed poultry products are very rarely sent long distances as poultry meat is highly perishable.

3.5.3 Table eggs

Eggs are sold in grocery stores and in other stores at retail markets in cities and towns. They are also gaining more access to village markets. Although eggs are perishable, they are stored and transported fairly long distances either by trucks or by trains in trays from point of production to point of consumption. The loss in transit may be as high as 2-5%.

Egg marketing in the country is well organized. The National Egg Coordination Committee (NECC) is the largest single egg producers association in India and is the lead player in egg marketing and promotion. In the past two decades, NECC has played a significant role in the improvement of the poultry industry in general, and of the egg industry in particular. It has achieved this through various programmes such as market intervention, price support operations, egg promotion campaigns, consumer education, market research, rural market development and liaison with the government on vital issues concerning the industry. ([Indiawww.e2necc.com/necc-beginning.html](http://indiawww.e2necc.com/necc-beginning.html))

The NECC declares the farm gate price of table eggs to prevent middle men controlling the prices and to ensure that farmers receive a fair price. Middle men however control the trade of egg marketing and siphon most of the profit margin in most states.

The NECC functions through a 3 tier democratic structure; Executive Committee, Zonal Committees and Local Committees. Egg producers and hatcheries dealing with egg type stocks contribute @ 6 and 4 paisa for maintenance, growth and development of the NECC.

Egg consumption in India varies according to seasons; consumption declines during summer and during Hindu festivals. In this situation, the NECC provides assistance to store surplus eggs in the cold storages of Agro Corpex India Ltd, which is owned and managed entirely by poultry farmers.

The National Agriculture Federation (NAFED) controls egg marketing in Delhi. NAFED renders various services like egg handling, their distribution and delivery to buyers, bearing the cost of spoilage, operational overheads and interest charges. Traders in Punjab, Haryana and Uttar Pradesh follow the NAFED rate for egg marketing.

3.5.4 Other species

This information has not yet been sourced.

Chapter 4

Trade, marketing and markets

4.1 DOMESTIC MARKET

Table 18: Distribution of markets

This information has not yet been sourced.

4.2 IMPORT

This information has not yet been sourced.

4.3 EXPORT

This information has not yet been sourced.

4.4 SLAUGHTERING FACILITIES

This information has not yet been sourced.

4.5 POULTRY FEEDS

Most growers in India follow the NRC standards for the formulation of layer and broiler rations to optimize production and growth. The poultry ration is maize dependent, and in future, the availability and price of maize and soybeans will dictate the price of poultry and poultry products on the market.

Chapter 5

Breeds

Public Sector and genetic stocks development for village poultry production

Due to their superior adaptability to local geographic and climatic conditions, indigenous demotic fowl have been the mainstay of the rural poultry production system to date. Although they can be raised with no or little inputs, they have poor growth and low productivity. Sarkar and Bell, 2006 are of the opinion that when some management interventions can greatly improve the potential of indigenous birds. Similar views have been expressed by Singh and Johari, (1990) and Singh (2001) from their experiences in Aseel and other breeds in India. Ayyagiri (2001) opined, 'Scavenging hens in the rural poultry production system remained neglected and have not been subjected to any genetic improvement to enhance their production performance as they received very little scientific attention'. This is because the backyard poultry sector has been overshadowed by the commercial sector in the National poultry development policy and vision and as therefore been allocated inadequate funds.

In order to improve the productivity of this system, research efforts are currently underway to develop high yielding varieties of coloured birds. During the last decade, a number of chicken varieties like Gramapriya, Vanaraja, Giriraja, M-Bro, CARI-Nirbheek, UPCAR, Hit CARI, Gram Lakshmi, CARI Shyama etc. have been developed by ICAR Institutions, Regional Poultry farms of the Government of India and Agricultural Universities to promote poultry production in rural areas. Gramapriya variety is used for the production of eggs, whereas Vanaraja and Giriraja are both used for the production of eggs and meat. However, Vanaraja and Giriraja are popular for meat purposes. Gramapriya layers lay about 150 eggs annually, whereas Vanaraja birds lay about 120 eggs. Dual purpose exotic breeds as well as indigenous germplasm available in the country have been used for developing the above breeds. These birds are categorised as 'low input technology' birds and most are recommended for backyard poultry production.

The introduction of crossbred and exotic birds has resulted in the decline of age at first egg and increase in egg production per hen (Sah et al., 1985); however, these birds cannot be raised under the no input system, further broodiness is lacking and mortality is high if management is not optimum. (Amine et al., 1992). Ramappa et al. (2000) and Ramappa (2002) developed Giriraja, a synthetic coloured exotic broiler breed and later, the breed was infused with 6.25% indigenous bird inheritance. Field surveys by NGOs like MYRADA and others indicate that it attained 1.2 kg body weight at 8 weeks of age with F.C.R. of 2.4 under free range conditions. They laid 140-150 eggs per annum. Khan (2000) showed that two breed combinations of exotics were not popular in villages of central India, because of higher adult body weight and lower egg production. Their performance under the semi-scavenging system indicates that though they have improved productivity potential in terms of egg and meat, their performance is reduced but surpasses that of the indigenous breeds. They are poor scavengers and not able to cope with predation. As the hens lack broodiness, an assured supply of chicks depends on infrastructure and hatcheries. This was the experience in ILDP, Koraput and Chhattisgarh tribal villages.

Keggfarms, a Delhi based commercial poultry breeder is the only known private sector promoting backyard poultry in North-East and Eastern India.

Eastern Uttar Pradesh, West Bengal, parts of Orissa, Bihar, Jharkhand, Chhattisgarh, Karnataka, Andhra Pradesh and Kerala are the states where coloured synthetic bird demand is growing. A study was carried out in the selected districts of Uttar Pradesh and W. Bengal by Rao and Reddy and it was concluded that a unit of 20 coloured synthetic dual purpose birds provides an average income of around Rs.250 per month and net surplus of Rs. 2873(US\$72.8), Rs. 2905(US\$73.64), and Rs. 2938(US\$74.47), for years I, II and III respectively.

(www.nabard.org/FileUpload/DataBank/TechnicalDigest/ContentEnglish/issue6td-6.pdf -)

5.1 EXOTIC BREEDS

Specialized breeds are used for the production of egg and meat. Vencob broilers marketed by Venkateswara hatcheries account for 60% of the total broilers produced in the country. Further, the availability of Cobb chicks is good due to large network of Venkateswara hatcheries. Other broiler breeds available include Ross, Hybro, Hubbard, Arboracres, Avian and Anak etc. Cobb broilers are well known for their adaptability to Indian climatic conditions. Babcock layers are the most popular and account for more than 80% of total layers. The other layers available on the market are Hyline, Bovans, Hisex, Lohman etc.

5.2 LOCAL BREEDS

India is the origin of jungle fowls, from which all modern domestic breeds of chicken have been developed. Based on phenotypic characteristics and production performance, more than 20 Indian breeds of poultry have been identified and characterised. These include chicken breeds like Aseel, Ankaleshwar, Busra, Brown Desi, Chittagong, Daothagir, Dhenki, Chagus, Haringhatta Black, Kadaknath Kalasthi, Kashmir faverolla, Miri, Lolab, Naked Neck, Punjab Brown, Tellicherry, Titri, Teni, Nicobari, and Duck breeds like Indian Runner, Nageswari, Sythet Mete, Chara, Chembeti etc. Some major breeds like Assel, Kodkhnath and Miri have been studied and the former two breeds in particular have been studied in great detail by the Central Avian Research Institute, Izatnagar and Project Directorate on Poultry, Hyderabad (Singh, 2001). Recently a number of other breeds of indigenous chickens have been identified and characterized in Orissa. Attempts are currently being made to study the difference among them at molecular level. The safe conservation of selected populations of indigenous breeds is vital.

The native breeds are closely associated with the backyard poultry system and play a greater role in the livelihoods of the poor. An assured supply system of chickens of modern breeds to rural and less developed areas in the country is not imminent, which means the existing traditional system and indigenous poultry breeds will continue to be relevant.

In the poultry industry, five industrial breeders, all owned by trans-national corporations, dominate the world industrial egg market and six trans-national breeders dominate the world industrial broiler market. The genetic base for industrial poultry is described as "exceedingly narrow" and "vulnerable to genetic disaster" (Crawford cited by Mason and Crawford 1993). It is thus the opinion of many that indigenous poultry genetics is a very valuable asset of nature which requires conservation.

The Indian Council of Agricultural Research, State Governments of Chhattisgarh, Madhya Pradesh and a few private breeders are keeping small flocks of Kadaknath breed of chicken whereas Andhra Pradesh NGOs, private groups and tribal communities still maintain the Assel Breed.

Large scale culling in the case of an HPAI (Highly Pathogenic Avian Influenza) outbreak will have a significant impact on the population. The safe conservation of a selected population of indigenous breeds will be vital to save these from extinction. Indigenous poultry will continue to be the main supplier of food and livelihood to many communities for the foreseeable future.

Chapter 6

Veterinary health, public health, biosecurity measures

6.1 HIGHLY PATHOGENIC AVIAN INFLUENZA

In the recent past, India witnessed HPAI in Central Indian States in the organized poultry sector. The first case of HPAI was confirmed on farms of Navapur in Maharashtra state on 18th February 2006. Later it appeared in the states of Gujarat, and in few places in Madhya Pradesh. The Government of India - with the help of State governments - effectively controlled the disease and prevented infection to human beings by destroying the affected, exposed and all poultry in risk zones through the application of bio-security measures.

HPAI was diagnosed during July 2007 on a small farm near Imphal in Manipur state. This was postulated to be a transboundary transmission of infection. Although there is no evidence of human infection so far due to HPAI in the country, all contact persons in Manipur outbreak villages were administered with anti-viral drugs under medical supervision as a precautionary measure. They were subsequently found to be negative to HPAI titer.

In the state of W.Bengal (on the border with Bangladesh) the first case of HPAI was confirmed in January 2008. During the period, Bangladesh was experiencing an active outbreak of HPAI. The W. Bengal HPAI was initially reported from backyard poultry and was soon noticed in 13 districts of the state. The state government deployed 273 Rapid Response Teams and culled 40.03 lakh poultry, recorded 1.33 lakh fowl mortality and destroyed 14.91 lakh eggs to control the disease. (pib.nic.in/release/rel_print_page.asp?relid=36174) The loss estimated for W. Bengal was Rs. 700 Crores (175 million dollars.) (GoI 11 Feb 08 <http://pib.nic.in/release/release.asp?relid=35223>) The W. Bengal HPAI outbreak was extensive due to the involvement of a large backyard poultry system, the simultaneous outbreak in Bangladesh and the porous border.

To date, vaccination of poultry with HPAI vaccine has been avoided. India has developed a homologous killed H5N1 vaccine; the immune response is good with a protection rate of over 90% in vaccinated birds claimed (Pradhan and Prasad 2007 and <http://www.hindu.com/2006/07/18/stories/2006071800730900.htm>)

So far, poultry disease surveillance throughout the country along with immediate disease diagnosis of suspected outbreaks coupled with the institution of bio-security measures have been the key effective elements in control and prevention of HPAI infection. The quick response shown by media, departments of human health, general administration and veterinary services together with private sector has been effective in controlling the HPAI outbreaks.

HPAI is proving very expensive to both farmers and Government. It is vital to take into account the cost and social impacts of diseases with a zoonotic dimension such as this one. During the Central India HPAI out-break in 2006, a total of 10.44 lakh birds were culled from the affected areas and the Government paid the compensation for birds culled in operation. (http://india.gov.in/sectors/agriculture/feed_fodder_development.php.)

It is estimated that the poultry industry in India suffered a loss of over 1200 Crores (US\$3.042 billion) in the 2006 outbreak in Maharashtra. (<http://www.hindu.com/thehindu/holnus/008200704301021.htm>)

The economic loss in the commercial sector due to HPAI is very high whereas in backyard poultry the risk posed to human health is of greater concern. (www.fao.org/AG/againfo/programmes/en/pplpi/docarc/pb_hpaiindustrialrisks.html). Otte et al. (2006) studied the HPAI outbreak in Thailand during 2004 and concluded that backyard flocks are at significantly lower risk compared to commercial scale operations of broiler, layer chickens or quail. (http://www.fao.org/AGg/againfo/projects/en/pplpi/docarc/rep-pai_biosecurity.pdf)

Extensive backyard systems increase the likelihood of a faster spread of HPAI. Village poultry production has no effective bio-security measures and the likelihood of infection depends on the challenges like the prevalence of HPAI in surrounding regions, farms and wild birds.

WHO officials specifically blamed backyard animal operations for the development of the H5N1 virus mutations and its spread to humans. Many experts are urging to accelerate the transformation of traditional poultry production systems and regional live animal markets to one of large-scale confinement animal feeding operations from the point of view of bio-security. On the other hand, there is a school of thought which believes that in the face of an outbreak, it is the high density bird farms which are more at risk.

Of the three major HPAI outbreaks in India, two appeared from organized farms and one was from backyard poultry; and in two cases it was suspected that transboundary infection was present. It can still be concluded that as long as poultry remains an intrinsic part of households and farms close to habitats bird flu will continue to emerge. Hence it is critical that the disease needs immediate attention and best practice to deal with outbreaks should be put in place. (<http://www.fao.org/avianflu/en/index.html>)

6.2 OTHER MAJOR POULTRY DISEASES

Efficient health coverage is essential for optimising the production and productivity of the organized commercial sector as well as the rural small holder backyard poultry sector. In India, the commercial sector has a well organised poultry health care system, particularly in the major private breeding companies. There are also established and sophisticated laboratories for the diagnosis of poultry diseases in the major poultry production pockets of Pune and Namakkal of South India. The rural poultry sector is supported by the public sector; it suffers from weak linkages and a poor health delivery system.

The prevention of disease entry to achieve good poultry health has been one of the basic policies of the Government of India. Effective quarantine laws and their implementation have so far prevented the entry of many exotic diseases into the country.

Based on disease surveillance information, poultry diseases are grouped into conventional, emerging, re-emerging and exotic diseases. Amongst emerging diseases, Avian Influenza tops the list and is an OIE listed disease. The management of highly contagious, zoonotic diseases of poultry and exotic diseases of major concern is the responsibility of the High Security Animal Disease Laboratory (HSADL) of the Indian Veterinary Research in Bhopal. The HSADL, Bhopal has a bio-safety level 4 facility. In addition, the networks of Government Poultry Diagnostic Labs are available in each state to constantly monitor outbreaks and emerging diseases. In recent years, the Government of India has further strengthened the initiative by establishing Regional Animal Disease Diagnostic Laboratories in Kolkota (Eastern zone), Pune (Western zone), Jallandhar (North Zone), Bangalore (Southern Zone) and Guwahati (North-east Zone). The Centre for Animal Disease Research and Diagnosis of Indian Veterinary Research Institute, Izatnagar (<http://dahd.nic.in/livehealth.htm>) is the nodal agency to these regional labs.

Even with strict quarantine regulations in place, the risks from porous Indian borders and disease transmission from wild and migratory birds do exist; therefore birds in sanctuaries - especially during migratory seasons - are monitored and periodically screened.

In order to improve the competitiveness of the smallholder backyard sector there is a need to devise ways and means for women, as the pivot behind the backyard poultry system, to be taken into account in development plans and strategies in the sector.

An effective disease control strategy with a sustainable service delivery system is a crucial factor. The immunisation of village poultry against Newcastle disease and Fowl pox in villages has the proven potential to double present poultry production (Kornel, 2004) and Udo et al. (2006) have shown that net returns can increase by 218% compared to the base situation in Kenya. Thus improved household food security through backyard poultry production and marketing is well established among vulnerable Below Poverty Line groups.

For regularly updated information on the status of notifiable and other transboundary poultry diseases, please refer to:

The FAO Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases available at www.fao.org/ag/againfo/programmes/en/empres/home.asp

The OIE World Animal Health Information Database (WAHID) available at www.oie.int

6.3 BIOSECURITY MEASURES

Live bird markets are common practice in India and they pose a risk of recirculation of poultry pathogens such as HPAI and potential source of exposure for human beings from live birds.

India is planning to integrate preparedness for pandemics like that of HPAI into national disaster management structures. It has also stressed the need for committing to a national policy for bio-security in commercial production drawing upon the expertise of FAO, OIE and World Bank. Another important element that is being considered is the introduction of bio security measures into household poultry production.

Chapter 7

Current policies, legal framework

The Government of India in its policy decision has granted the status of 'agriculture' to 'poultry' in all states of India to boost growth, but very few so far have instituted this in their states. A draft National Poultry Policy, 2005 envisages the policy and strategy for the country (mahavet.mah.nic.in/NationalPoultry.pdf).

Chapter 8

Analysis

8.1 CURRENT STRENGTHS AND WEAKNESSES OF THE POULTRY SECTOR

Poultry production in India benefits from competitively-priced domestic or imported corn and soybeans. The price structure for maize and soybeans is one essential element for future poultry industry growth in India. The improvement of infrastructure and the cold chain is also essential to enhance poultry processing and marketing and ensure the supply quality products to consumers.

The backyard poultry sector: opportunities and challenges

According to Dolberg, 2001, poultry production activities can be used as a learning process since one activity alone is not sufficient to lift a family out of poverty. There is therefore a need to have an enabling environment that will provide opportunities and make it possible for beneficiaries to establish a small poultry enterprise, to minimize the risks and to take the next step out of poverty by adopting another income generating activity. However, the sale proceeds from backyard poultry and the protein supplementation in terms of meat and egg to poor families is significant. The role of backyard poultry in poverty alleviation, food security, employment generation, gender empowerment and gender equity is well documented (Gueye, 2000).

There is still scope to improve the income from the sector. The backyard poultry sector represents the basis on which a sustainable, well adopted semi-commercial sub-sector could be progressively developed (Branckaert and Gueye, 1999).

However, at present the backyard poultry sector in India is not well organised. Past initiatives such as the distribution of cockerels and subsidised chick supply to farmers did not give encouraging results as these activities were not sustainable in terms of technical and institutional mechanisms.

There is a need to focus development efforts in smallholder poultry, with research and capacity building including the development of thermostable vaccines against major diseases, and the promotion of service delivery models that will be in the interests of the poor.

8.2 PROSPECTS OF THE POULTRY SECTOR OVER THE NEXT FIVE YEARS

This information has not yet been sourced.

Annex I

Who is who (contact list)

This information has not yet been sourced.

Annex II

List of major projects – poultry sector

Recognizing the potential of the backyard poultry sector as a tool to alleviate poverty, the government of India has renewed efforts to improve it. The State Animal Husbandry Departments are implementing a centrally sponsored scheme and central sector schemes. There is also a proposal to provide direct assistance to farmers.

Research is being undertaken by the Government of India, the Indian Council of Agricultural Research (ICAR) and some Agricultural universities.

The State Governments/UTs created State Poultry Farms in the 50s, and recently Central Government allocated sufficient funds to strengthen the infrastructure of these farms to enhance the production and supply of quality chicks to rural poultry farmers. These farms will maintain only the parent stock of low-input technology birds duly identified by the Government of India. The pattern of assistance is 80% GOI share and 20% State share. The State Government is expected to ensure health coverage, marketing, extension and training of smallholders. The scheme has been operating for the past 6 years.

States with a major backyard poultry presence have a high density of families living Below the Poverty Line (BPL) and have low livestock production growth. These states therefore need support in service delivery, training and extension to farmers. This assistance is missing for backyard poultry development. In addition, the policy has not taken into consideration local poultry genetic resources and advocates exotic and derivative birds for smallholders.

Support to Training and Employment Program for Women (STEP) - a scheme of the Department of Women & Child Development - have initiatives in Kerala, Orissa and other states with limited backyard poultry (10,000 families each). The programme is women-centered and has a flexible training and extension component.

International donor agencies like DANIDA and several others have given support to improving livelihoods through backyard poultry production in India. Jensen (2000) and Dolberg (2003) have described a semi-scavenging poultry development model developed and adopted by Bangladesh that provides a good example of how poultry can have an impact on the empowerment of the poorest women and on poverty reduction.

Successful backyard poultry production programmes include the DANIDA assisted Integrated Livestock Development Project in Orissa, Tamil Nadu and Chhattisgarh. The objectives were the same for three of the projects but in Tamil Nadu, the approach to the target group was through NGOs, whereas in Orissa and Chhattisgarh it was led by Government Departments. The former worked through women's groups and the latter through village committees. One of the main elements was raising awareness amongst target groups on backyard poultry, exposure visits and training in poultry keeping as well as in small broiler farms. A young man and a woman from each of the villages in all the project areas were trained in poultry vaccination like RD and Fowl pox, delousing and administration of anthelmintics. The project teams created an enabling environment and facilitated other institutions and linkages necessary for obtaining inputs, credits and services at village level.

The impact assessment showed a significant increase in new families adopting poultry and an increase in the poultry population due to decreased morbidity and mortality. It has been shown that training village youths in poultry vaccination and poultry management have made the difference (Kornel, loc cit., Rajarethinam, 2004). Similar views have been expressed by Ramdas and Ghotage (loc cit.) from their initiative in AP and Maharashtra.

The training of youth in veterinary first aid - including poultry vaccination - has since been adopted in all Gram panchayats of Tamil Nadu with the assistance of DANIDA.

While reviewing the work done so far and the roles of various other departments/agencies in the poultry sector, it was observed that there are many development programmes for rural farmers, women, tribals and other vulnerable sectors of society where poultry keeping is a component. NABARD and NCDC are re-financing many poultry projects and, although recently these projects have been trying to incorporate all major inputs and services like feed, health care, and training etc, follow-up and constant interaction are lacking.

Further, the programmes implemented by different agencies are not complementary and at times have over-lapping objectives. Therefore, there is a need to dovetail and coordinate all poultry development projects to work towards a common goal of strengthening all the spheres of backward and forward linkages and Research and Development associated with this sector.

Annex III

Bibliography

Alders, R. G., Fringe, R. and Mata, B.V. (2001) Characteristics of the 1-2 Live thermostable New Castle Disease Vaccine Produced at INIVE ACIAR proceedings of the SADC planning workshop New castle Disease control in village chickens, Maputo, 6-9 March, 2000.

Amine, M.R., Hoque, M.M, Islam, Q.M.S., Khan, M.M.R. 1992. The performance of crossbred and indigenous chicken under scavenging system in Bangladesh J. Anim. Sci. 21, 77-88.

Ayyagari, V. (2001) Genesis, Development and Propagation of Vanaraya and Grampriya Germplasm for Rural Poultry Production. Ibid p.7-14.

Basic Animal Husbandry Statistics (2006), AHS Series – 10. Government of India, Ministry of Agriculture, Department of Animal Husbandry, Dairying & Fisheries, Krishi Bhavan, New Delhi.

Birthal P.S., Taneja V.K. and Thorpe W. (eds). (2006) Smallholder livestock Production in India: Opportunities and challenges. Proceedings of an ICAR-ILRI international workshop held at National Agricultural Science Complex, DPS Marg, Pusa, New Delhi 110 012, India, 31 January-1 February 2006. NCAP (National Centre for Agricultural Economics and Policy Research) – ICAR (Indian Council of Agricultural Research), New Delhi, India, and ILRI (International Livestock Research Institute), Nairobi, Kenya. 126 pp.

Birthal, P.S., A.K. Jha and D.K. Singh. (2007) Income diversification among farm households in India, and effects on income inequality and social welfare. Working Paper 7, National Centre for Agricultural Economics and Policy Research, New Delhi.

Branckaert R. D. S. and Guèye, E. F. (2000)FAO's programme for support to family poultry production. In: Proceedings of a Workshop on Poultry as a Tool in Poverty Eradication and Promotion of Gender Equality (Dolberg F and Petersen P H, Eds.), Tune, Denmark, pp. 244-256, also at <http://www.husdyr.kvl.dk/htm/php/tune99/24-branckaert.htm>

Conroy, C., Sparks, N., Chandrasekaran, D., Sharma, A., Shindey, D., Singh, L.R., Natarajan, A., Anitha, K. (2005) Improving Backyard Poultry-keeping: A case study from India. Agricultural Research and Extension Network, Paper No. 146. AgREN.U.K.

Crawford, R.D., "Poultry Conservation: The International Situation," unpublished paper, and. See also, Ian L. Mason and Roy D. Crawford in Global Genetic Resources: Livestock (1993), p. 163-4.

Cranfield, J. A. L., Hertel, T. W., Eales, J. S. & Preckel, P.V. (1998) Changes in the structure of global food demand. Am. J. Agric. Econ. 80: 1042–1050.

Committee on World Food Security, Thirty-second Session, Rome, 30th October-4 th November 2006 (<ftp://ftp.fao.org/docrep/fao/meeting/011/j8096e.pdf>)

Committee on World Food Security, Thirty-second Session, Rome, 30th October-4 the November 2006. (<ftp://ftp.fao.org/docrep/fao/meeting/011/j8096e.pdf>)

Dolberg F. (2001). A livestock development approach that contributes to poverty alleviation and widespread improvement of nutrition among the poor. (Paper presented at the workshop "Malnutrition in Developing Countries: Generating Capabilities for Effective Community Action", IFAD September 19-20, 2001).

Dolberg, F. (2003) Review of household poultry production as a Tool in Poverty Reduction with Focus on Bangladesh and India. Pro-poor Livestock Policy Initiative. PPLPI working paper no. 6. FAO. 34 pages.

(<http://www.fao.org/ag/againfo/projects/en/pplpi/docarc/wp6.pdf>).

Draft national poultry Policy, 2005, government of India, Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries. (mahavet.mah.nic.in/NationalPoultry.pdf)

Danida, Pudukottai.Tamil Nadu, Integrated Livestock Development Project.-Annual Reports 1999.

Executive guide to World Poultry Trends, 2006. Watt Publishing Company, Mt. Morris, Illinois.

Extracted from electronic database on 'Employment and unemployment situation in India', supplied by NSSO.

Food and Agriculture Organization of the United Nations (2007). Rome, FAOSTAT database.

Fairoze Mohamed Nadeem, Achoth Lalith, K.K. Prasanna Rashmi, Tiongeo Marites M., Delgado Christopher L., Narrod Clare and Chengappa Padinjaranda G. (2006). Contract Farming of Milk and Poultry in India Project. Equitable Intensification of Market Oriented Smallholder Poultry Production in India through Contract Farming.

FAO, Rome (2007) The Global Strategy for Prevention and Control of H5N1 Highly Pathogenic Avian Influenza. (<http://www.fao.org/avianflu/en/index.html>)

Government of India, Ministry of Agriculture, Directorate of Economics and Statistics (various years). Agricultural Prices in India.

Government of India, Ministry of Agriculture, Directorate of Economics and Statistics (2003). Statistics at a Glance, <http://agricoop.nic.in/stats.htm>

Govt. of India. 2006. Level and pattern of consumer expenditure, 2004-05. National Sample Survey Organization, Ministry of Statistics and Programme Implementation, New Delhi.

Govt. of India. 2006. Some aspects of operational land holdings in India, 2002-03. National Sample Survey Organization, Ministry of Statistics and Programme Implementation, New Delhi.

Gueye, E.F., 2000. The role of family poultry in poverty alleviation, food security and the promotion of gender equality in rural Africa. *Outlook on Agriculture* 29(2): 129-136.

Government of India, Ministry of External Affairs. India in Business: Industry and Services-Food Processing. (<http://www.indiainbusiness.nic.in/industry-infrastructure/industrial-sectors/food-process.htm>)

Government of India, Ministry of Agriculture, Department of Animal Husbandry and Dairying: Development of Rural Back yard Poultry:

Concept Paper for a New Initiative (<http://www.dahd.nic.in/poultryconcept.htm>)

Government of India, 1982. NSS 37th round report on Land and Livestock holding

Government of India, 1992. NSS 48th round data on Land and Livestock holding

<http://www.fao.org/faostat/foodsecurity/>

http://www.who.int/gdgmwho/p-child_pdf/IND.pdf

Human Development Report (1992-2004 issues), United Nations Development Programme

http://www.fao.org/AG/againfo/projects/en/pplpi/docarc/rephpai_industrialisationrisks.pdf

http://www.fao.org/ag/agn/nutrition/profiles_en.stm

http://www.who.int/gdgmwho/p-child_pdf/IND.pdf

http://www.who.int/gdgmwho/p-child_pdf/IND.pdf

India gov.in INDIA: Animal Husbandry-Feed and Fodder Development.

(http://india.gov.in/sectors/agriculture/feed_fodder_development.php)

India to conduct mock drills and exercise to combat bird flu

December 6 2007 .Express News Service

(<http://www.newindpress.com/NewsItems.asp?ID=IEH20071205110620&Headline=India+to+conduct+mock+drills+and+exercise+to+combat+bird+flu&Title=Top+Stories&Topic=0>)

Jensen H.A. (2000). Paradigm and Visions: Network for Poultry Production in developing countries. Mack, S., Hoffmann, D. and Otte, J., 2005. The contribution of poultry to rural development. *World's Poultry Science Journal*, 61: 7-14.

(<http://www.cipav.org.co/lrrd/lrrd15/5/jens155.htm>)

Kornel Das and Brunse, Helege (2002) Poverty, Women, Self Help Groups and Livestock (under publication)

Kornel Das and Das B.C. (2006), Livestock Service Delivery and Poor: Community Based Livestock Health Workers. NRMPO Bhubaneswar Publication.

Kornel Das (2006) Tribal Crops - Livestock Farming Systems in South-East India. Manohar Publishers, New Delhi.

Kornel Das, (2004) Poverty Reduction in Tribal Community: Integrated Livestock Development Project in Koraput District of Orissa. (Edi) Morrenhof, J., Ahuja, V. and Tripathy, A. In Livestock Services and the Poor: Papers, Proceedings and Presentations of the International Workshop, Bhubaneswar Oct., 28-29.

Kornel Das, Biswal, A., Khuntia, A., Parida, J. And Kar, G.C. (2003). 'Status of village poultry production in Koraput District – ILDP experiences', pp. 14-26 in State level workshop: Poverty alleviation through poultry production in Orissa, 15-16 December, 2003. Bhubaneswar, Orissa. Fisheries and Animal Resources Development Department, Government of Orissa, and Indo-Swiss Natural Resources Management Programme.

Kornel Das, (2003). Village poultry production – Bangladesh model. Proceedings of State Level Workshop: Poverty Alleviation through Poultry production in Orissa. 15-16th December, Bhubaneswar, pp-42-49.

Kumar, P. and P.S. Birthal. (2004). Changes in consumption and demand for livestock and poultry products in India. *Indian Journal of Agricultural Marketing*, 18(3): 110-123.

- Khan, A.G. (2000) Breeding for Family Poultry In India. (http://193.43.36.103/ag/againfo/themes/en/infpd/documents/papers/2000/32188_KH1.DOC)
- Kornel Das (1999) Livestock and Poultry Dynamics in Tribal life-Koraput. Modern Book Depot, Bhubaneswar.
- Landes Maurice, Persaud Suresh, and Dyck. John India's Poultry Sector: Development and Prospects. (2006) Market and Trade Economics Division, Economic Research Service, U.S. Department of Agriculture, Agriculture and Trade Report WRS-04-03.
- Mehta R., (2002). RIS Discussion Papers. WTO and Indian Poultry Sector: Lessons from State Support Measures in Select Countries. Research and Information System for the Non-Aligned and Other Developing Countries.
- Mehta, R., Nambiar, R.G., Delgado, C. and Subramanyam, S. (2003) Annex II: Livestock Industrialization Project: Phase II – Policy, Technical, and Environmental Determinants and Implications of the Scaling-Up of Broiler and Egg Production in India. IFPRI-FAO project on Livestock Industrialization, Trade and Social-Health-Environment impacts in Developing Countries.
- Mohapatra S.C. (2003). Village poultry production in Africa. . Proceedings of State Level Workshop: Poverty Alleviation through Poultry production in Orissa. 15-16th December, Bhubaneswar, pp-50-55.
- Ministry of Agriculture, Government of India, Department of Animal husbandry and dairying: Animal Husbandry: Livestock Health (<http://dahd.nic.in/livehealth.htm>)
- Ministry of Commerce & Industry, Government of India. (www.eaindustry.nic.in)
- Ministry of Statistics and Programme Implementation, Government of India (<http://mospi.nic.in/>)
- NECC (National Egg Coordination Committee), (<http://www.e2necc.com/necc-beginning.html>)
- Nielsen, H. (2000) Food intake and nutrition intake among females in rural Bangladesh. Master Thesis.
- NABARD Annual Report, 2002.
- Otte, J., Pfeiffer, D., Tiensin, T., Price, L. and Sibergeld, E. (2006) Evidence-based Policy for Controlling HPAI in Poultry: Biosecurity Revisited. PPLPI, Research report.p1- (http://www.fao.org/ag/againfo/programmes/en/pplpi/docarc/rep-hpai_biosecurity.pdf)
- Prasad, R and Pradhan, H.K. (2007) Bird flu vaccine offers protection above 90%, immune response good (<http://www.hindu.com/2006/07/18/stories/2006071800730900.htm>)
- Rajarethinam, P. (2002) Pudukottai Livestock Development Project: An Alternative Service Delivery System to reach the poor. (Edi) Morrenhof, J., Ahuja, V. and Tripathy, A. In Livestock Services and the Poor: Papers, Proceedings and Presentations of the International Workshop, Bhubaneswar Oct., 28-29.
- Ramdas, Sagari, R and Ghotge, Nitya, S. (2004) Towards Sustainable Community Livestock Healthcare Delivery Systems: Issues and Options-- The ANTHRA experience. P115-140 (Edi) Morrenhof, J., Ahuja, V. and Tripathy, A. In Livestock Services and the Poor: Papers, Proceedings and Presentations of the International Workshop, Bhubaneswar Oct., 28-29.57.
- Rangnekar, S. and Rangnekar, D.V. (1999) Family Poultry Production in Tribal belt of Western India. Free Communication No. 5 INFPD/FAO electronic conference on family poultry production.
- Rao, K.R. and Reddy, C.O. (year not mentioned) Financing Rural Poultry Production activities in India. 3.0 Technical Digest Issue – 6 (www.nabard.org/FileUpload/DataBank/TechnicalDigest/ContentEnglish/issue6td-6.pdf -)
- Ramappa, B.S. 2002. "Propagation of Giriraja for Weaker Section under. Harsh Environment", paper presented at Second National Seminar on Rural Poultry (www.fao.org/ag/againfo/projects/docs/LL31.pdf -)
- Ramaswami, Bharat., BIRTHAL, P. S. and P.K. Joshi (2005) Efficiency and distribution in Contract Farming: The case of Indian Poultry growers (<http://www.isid.ac.in/~planning/workingpapers/dp05-01.pdf>)
- Ramappa, B.S., Loknath, G.R. and Nallapa, P. (2000) Research on Improved Indigenous varieties of Chicken in Developing Countries. (http://193.43.36.103/ag/againfo/themes/en/infpd/documents/papers/2000/27270_RA1.DOC)
- Sarkar, K and Bell, J.G. (2006) Potentialities of the indigenous chicken and its role in poverty alleviation and nutrition security for rural households - INFPD Newsletter. Vol.16, No.2, 2006p15-27.

- Sah, K.M., Singh, R.L., Singh, S.K., Prasad, C.M., Sharma, 1985. A comparative study on some economic characters in Desi, White Leghorn and their reciprocal crosses. *Ind. J. Anim. Sci.* 99, 78-82.
- Saleque, Md. A. (not dated) Scaling up: Critical Factors in Leadership, Management, Human Resource Development and Institution Development Building in going from Pilot Project to Large Scale Implementation: The BRAC Poultry Model in Bangladesh. Poultry as a Tool in poverty Eradication and Promotion of Gender Equality Proceedings of a Workshop.
- Saleque, Md. A. (1996), Landless women and poultry. The BRAC model in Bangladesh cited by F. Dolberg (2001) A livestock development approach that contributes to poverty alleviation & widespread improvement (<http://www.husdyr.kvl.dk/htm/php/tune96/3Mustafa.htm>)
- Singh, D. P and Johari, D.C (1990) Kadakantha the native fowl needs to be conserved. *Indian Farming March*, pp. 29-32.
- Singh, D.P. (2001) Assel of India. *Ibid.* p.90-100.
- Soundararajan, B. (2005) President, All India Poultry Breeders Association in Poultry Vision-2010, All India Poultry Breeders Association, Coimbatore.
- Size of economy based on purchasing power parity (IMF, world economic outlook database, April 2007)
- Sonaiya, E.B., Branckaert, R.D.S. and Gueye, E.F. (1996) The scope & effect of Family Poultry Research & Development.
- Spradbrow, P.B., (1993-94) Newcastle Disease in village chickens. *Poultry science review*: 5: 57-96.
- Subrahmanyam S. and Murthy C.S. (2006). Economics of Small Ruminant, Pigs and Backyard Poultry Production in Orissa. Centre for Economics and Social Studies, Hyderabad Indo-Swiss Natural Resource Management Programme, Orissa (Livestock Delivery System), Bhubaneswar.
- Towards faster and more Inclusive growth – An approach to the 11th five year plan(2007-2012) Government of India, Planning Commission, Yojana Bhavan, New Delhi, December 2006 (http://www.planningcommission.nic.in/plans/planrel/app11_16jan.pdf)
- Todd H (1998) Women Climbing out of Poverty through Credit; or what do Cows have to do with it? *Livestock Research for Rural Development*. (www.cipav.org.co/lrrd/lrrd13/5/dolb135.htm - 125k)
- The Hindu, April 30, 2007 'Genes being developed for diseases resistant chicken' (<http://www.hindu.com/thehindu/holnus/008200704301021.htm>)
- Udo. H.M.J., Asgedom A.H., Viets T.C., (2006) Modeling the impact of interventions on the dynamics in village poultry systems. *Agricultural Systems* 88 (2006) 255-269.
- Vision – 2020, Perspective Plan, CARI (1997). Central Avian Research Institute, Izatnagar, Uttar Pradesh.
www.fao.org/ag/aginfo/subjects/en/infpd/econf_bang.htm
www.hinduonnet.com/2006/08/14/stories/2006081403771200.htm
- Yadav, Yogendra and Kumar, Sanjay (2006) The Food Habits of a Nation. *The Hindu*. 14th August, 2006 (Front Page)
(<http://www.hindu.com/2006/08/14/stories/2006081403771200.htm>)

Annex IV

Maps

No maps available