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RESEARCH NOTES

Livestock Sector Composition and Factors Affecting Its Growth

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I

INTRODUCTION

Livestock sector plays an important role in generating income and employment, augmenting income of marginal farmers and landless labourers and in meeting nutritional requirement. Farmers in general in India follow mixed crop and livestock farming system because of strong linkage between these two. Beside land owning households, livestock are also reared by a large number of other households, most of which belong to poorer sections of the society. Because of this, livestock wealth in India is more egalitarian, compared to land, and hence it is found to promote equity and livelihood security. Livestock formed a major component of poverty alleviation strategy of the Government of India (Datt and Sundharam, 2007; Government of India, 1982). Another attractive feature of livestock sector in the country is that significant employment and income generated by this activity accrues to women which has its own social gains (Choudhary, 1995 and Government of India, 2007a).

Domestic demand for livestock products is rising at a fast rate and export demand is also increasing. Demand for livestock products during 11th Five Year Plan is envisaged to grow at an annual rate varying from 3.2 to 4.7 per cent for various products (Government of India, 2007b). On the supply side, India has a very large population of livestock but productivity is very low.¹ The main reasons for this are poor feeding, low quality of animals and inadequate veterinary facilities. Other factors which affect livestock productivity and output growth are related to infrastructure, output marketing, institutions and price incentives. In order to meet the rising demand for livestock products, and to harness the potential of this sector, there is a need to understand the structure of livestock sector, and, factors that affect growth of livestock output. In this backdrop the paper examines the changes in the composition of livestock sector, analyses the factors affecting growth of livestock output and explores ways and means to achieve the targeted growth rate in livestock output.² The paper is organised into seven sections including Introduction. Methodology used in the study is presented in Section II. The third section discusses

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the importance of livestock in Indian economy, and, growth and composition of livestock output are dealt in Section IV. Section V estimates and analyses the factors affecting livestock output at the national level and simulates effect of various factors to achieve the targeted growth rate. The current status of livestock infrastructure is discussed in Section VI. The last section provides conclusions and policy implications.

II

METHODOLOGY

The paper uses trend growth rates, ratios, regression analysis and a simple simulation method. Regression analysis is used to analyse and estimate the effect of various factors on livestock output. It was hypothesised that livestock output over a period of time has been affected by quality of herd, infrastructure for output marketing, veterinary facilities, availability of fodder, institutional factors like membership of dairy co-operatives and technology. The effect of these various factors on livestock output was estimated for the period 1980-81 to 2004-05 on the basis of the following functional relationship:

$$VOL = f(\text{In-milk bovine, number of artificial inseminations performed, number of veterinary institutions, surfaced road length, per capita income, membership of dairy co-operatives, area under fodder, and rainfall}).$$

Ratio (per cent) of in-milk bovine in total population of female bovines was taken as a measure of herd quality. The higher this ratio, the lower the share of unproductive animals and higher the output. Artificial insemination is meant primarily to improve the quality of offspring. It was hypothesised to affect with a time lag. Veterinary institutions are crucial for health care and treatment against animal diseases. Roads affect in more than one way, most significantly by providing market outlets for milk and other livestock products. The role of dairy co-operatives in mobilisation of small dairy producers and mopping up marketed surplus at remunerative prices is well known and hardly requires any elaboration. This variable was measured by taking the ratio of members of dairy co-operatives to total number of livestock holdings. Area under fodder crops was used to represent availability of green fodder for livestock. Per capita income in the country represents the impact of demand side factors in promoting livestock output. Year to year variations in livestock output are also assumed to be affected by deviation in rainfall from normal rainfall. Rainfall refers to the amount of rain received from June to September as a percentage of long run average rainfall.

Most of the explanatory variables were highly correlated with each other, which created serious problem of multi-collinearity. Therefore, various combinations and specifications of variables were tried to arrive at satisfactory results.

The functional relationship was estimated by taking log of dependent variable as well as all the explanatory variables. As the paper used time series data we also had to handle the problem of autocorrelation. A very large number of test runs were tried which were evaluated against the following criteria:

- (a) Consistency of sign of regression coefficient with *a priori* expectations,
- (b) Impact of multi-collinearity on significance of estimates,
- (c) Severity of autocorrelation.

Out of a large set of estimated equations we have chosen the one which satisfied the above criteria and in which all the variables, considered relevant for growth of livestock output, were statistically significant at 1, 5 or 10 per cent level.

The estimates of elasticity of livestock output were used to develop different scenarios for achieving the targeted growth rate in output.

III

IMPORTANCE OF LIVESTOCK IN INDIAN ECONOMY

Historical trend shows that livestock constituted about 17 per cent of the total agricultural output in the country during the first decade of era of planned development. During 1960s the share of livestock dropped by 2 percentage points (Table 1). It is interesting to observe that with the onset of green revolution technology, which primarily focused on crop sector, the share of livestock in total agricultural output started increasing. The livestock share increased from below 15 per cent during 1969-70 to 17.28 per cent by 1979-80 and, in the next ten years witnessed further increase to the level of 21.5 per cent. It seems that the spread of green revolution technology turned out to be more favourable to growth of livestock sector than crop sector. The performance of livestock sector continued to be better than the crop sector during the economic reforms period, which raised the share of livestock in agriculture output close to one-fourth during 1990s. The trend during 2000-01 to 2005-06, shows that livestock would soon raise its share to 30 per cent of agricultural output.

TABLE 1. IMPORTANCE OF LIVESTOCK IN INDIAN ECONOMY

Period (1)	Share in agricultural output (2)	Share in total gross domestic product (3)
1950-51 to 1959-60	16.70	N.A.
1960-61 to 1969-70	14.67	N.A.
1970-71 to 1979-80	17.28	N.A.
1980-81 to 1989-90	21.50	5.47
1990-91 to 1999-2000	24.80	5.88
2000-01 to 2005-06	27.24	4.48

Source: Various issues of *National Accounts Statistics*, Central Statistical Organisation, Government of India, New Delhi.

Data on gross domestic product (GDP) of livestock sector is available only from 1980-81 onwards. This shows that livestock contributed 5.47 per cent of GDP of the country during 1980s. The share increased to 5.88 per cent during 1990s but then dropped to 4.48 per cent in the recent years. The results presented in Table 1 show that after 1971 livestock output, though it has grown at a faster rate as compared to crop sector, its growth turned out to be lower than growth rate of total GDP of the country in the recent years.

IV

GROWTH AND COMPOSITION OF LIVESTOCK OUTPUT

Livestock products are broadly divided into five categories, namely (a) milk, (b) meat, (c) poultry, (d) dung and (e) wool and hair. Another component of livestock growth is increment in stock. The estimated growth rates in value of these products since 1950-51 are presented in Table 2.

TABLE 2. GROWTH RATE OF VALUE OF LIVESTOCK OUTPUT AT 1999-2000 PRICES

Period (1)	<i>(per cent/year)</i>						
	Milk group (2)	Meat group except poultry (3)	Poultry meat +eggs (4)	Wool and hair (5)	Dung (6)	Increment in stock (7)	Total (8)
1950-51 to 1959-60	1.035	0.764	3.650	0.604	0.889	16.293	1.422
1960-61 to 1969-70	0.841	1.232	-1.459	0.427	-0.769	-3.672	0.408
1970-71 to 1979-80	4.644	1.664	6.882	1.854	1.621	2.883	3.917
1980-81 to 1989-90	5.471	3.864	8.259	3.629	1.281	3.110	4.913
1990-91 to 1999-2000	4.280	2.606	4.143	3.978	0.427	11.413	3.787
2000-01 to 2005-06	3.332	3.003	4.468	0.619	3.267	9.221	3.554

Source: Same as in Table 1.

Lowest growth in output of livestock sector was experienced during 1960-61 to 1969-70 which was a mere 0.41 per cent per annum. The growth rate witnessed big upsurge during 1970s when it reached 3.92 per cent which coincided with the first decade of Operation Flood Programme. Acceleration in growth continued during the 1980s but growth rate slowed down during 1990s and after 2000.

The growth pattern showed a lot of diversity among various components of livestock sector. Growth in milk group showed almost the same pattern as total livestock output. Milk output increased by less than one per cent a year during 1960s after which it witnessed spectacular growth rate, exceeding 4.5 per cent, for about two decades. This impressive increase in milk output started with institutional support for milk marketing and production, started in the year 1970 as part of the Operation Flood Programme. These efforts were complemented by technological

interventions for breed improvement, remunerative pricing environment for milk based on quality, and infrastructure for dairy animals.

Meat group was an exception which showed higher growth during 1960s as compared to 1950s. Further, its growth remained subdued during 1970s, when total livestock output witnessed substantial acceleration in growth. Growth rate in meat production picked up around 1980-81 as a result of phenomenal increase in buffalo meat. The main factor underlying this growth was the programme on fattening of male buffalo calves taken up under the aegis of Hind Agro Industries Limited. Poultry sector witnessed spectacular growth rate, around 7 per cent per year during 1970s, and more than 8 per cent during 1980s. Genetic improvement efforts in poultry which resulted in very sharp increase in productivity compared to traditional backyard poultry turned egg and broiler production quite profitable. This attracted lot of private investments in poultry farming and hatcheries during 1970s and 1980s supported by establishment of strong network for input provisioning, health care and marketing. Fast growth in supply of poultry led to stiff competition in the sector which severely impacted the profitability of poultry sector. As a result the growth rate just became half during 1990s compared to 1980s.

Wool and hair maintained a steady growth around 2 per cent during 1970s and around 4 per cent in 1980s and 1990s. Since the beginning of twenty first century growth rate in output of hair and wool remained below 1 per cent. One of the reasons for this is liberalisation of import of wool at a low rate of 15 per cent of duty which caused adverse impact on domestic output.

Growth rate in livestock contribution in the form of dung did not exceed 1.62 per cent till 1999-2000. In recent years lot of concern has been expressed about adverse effect of decline in organic carbon in Indian soils and declining effectiveness of inorganic fertiliser in raising crop yield without use of organic fertiliser (manures). The realisation and awareness about the benefits of organic manure for sustaining soil fertility, and consumers preference for organically produced commodities has increased in recent years. As a result, the value and use of dung has started growing at a higher rate than seen in the past, though its growth rate still lags behind the sectoral growth.

There were violent fluctuations in the incremental stock of livestock. During 1950s it increased annually by 16 per cent. This was followed by annual decline of 3.7 per cent during 1960s. Growth rate in incremental stock was modest during 1980s but after that growth was quite high and robust. These growth rates are largely determined by changes in the number and quality of livestock. During 1990s prices of all types of animals witnessed sharp increase. This itself increased the value of incremental stock and also led to better care of animals, particularly of calves, contributing to the incremental stock.

The main reasons for slowdown in total livestock output during 1990s and beyond are discussed in the next section and are presented in Table 4.

Composition of Livestock Output

Changes in the structure of livestock output can be seen from share of various livestock products in total livestock output (Table 3). Obviously, the share of various groups of products changed over time corresponding to the variation in the growth rate of output of these groups. Milk group constituted around 65 per cent of total livestock output during 1950-51 to 1959-60. Its share started increasing with the onset of green revolution. Since then, more than two-third of livestock output is contributed by milk group. Growth rate in output of crop sector during green revolution improved the availability of livestock feed and fodder which contributed significantly to improvement in livestock productivity in terms of milk, and its share in total output of livestock sector.

There has been considerable diversification towards poultry products throughout. However, there is small slowdown in the recent years. The share of meat and meat products has remained fairly stable at slightly more than 10 per cent. Poultry sector, which was behind meat group, caught up with it during early 1980s. Since then, the contribution of poultry group and meat group in value terms is almost the same. It is interesting to observe, that, though in India, bovine and ovine are not raised exclusively for meat production their meat output has maintained its pace with the growth of livestock sector. One of the reasons for this is that male calf of buffaloes which were earlier not cared for, and used to die natural death at early age due to neglect and under feeding, have been increasingly becoming important economic goods.

TABLE 3. COMPOSITION OF VALUE OF LIVESTOCK OUTPUT AT CURRENT PRICES

<i>(per cent)</i>						
Period (1)	Milk group (2)	Meat group except poultry (3)	Poultry meat and eggs (4)	Wool and hair (5)	Dung (6)	Increment in stock (7)
1950-51 to 1959-60	64.81	10.82	5.23	1.03	14.99	3.13
1960-61 to 1969-70	66.97	12.04	7.43	0.82	10.96	1.76
1970-71 to 1979-80	68.39	9.97	7.99	0.59	11.51	1.56
1980-81 to 1989-90	67.96	9.35	9.55	0.39	10.45	2.31
1990-91 to 1999-2000	68.12	10.48	10.57	0.25	8.53	2.04
2000-01 to 2005-06	68.69	10.47	9.83	0.22	7.95	2.85

Source: Same as in Table 1.

Dung, which is quite important to maintain fertility of soil, witnessed sharp drop in its share in livestock output due to very low growth rate. There could be several reasons for this. One, in the wake of rapid growth in the application of inorganic fertilisers, the importance of dung has been reduced considerably. Two, collection and stocking of dung are very time consuming and considered as inferior activities.

Increment in stock continued to contribute below three per cent of value of livestock output. The importance of wool and hair has gone down from around 1 per cent to less than 0.22 per cent during last fifty years since 1950s.

V

FACTORS AFFECTING LIVESTOCK OUTPUT

The results of regression analysis providing estimates of the effect of chosen variables like availability of fodder, quality of herd, infrastructure for output marketing, veterinary facilities, institutional factors, and technology on livestock output are presented in Table 4. All the variables included in the equation were statistically significant with level of significance varying from 0 to 8.4 per cent. Except rainfall, all other variables showed positive impact on livestock output. The strongest impact was of herd quality, measured by ratio of in-milk bovine to female bovine population. One per cent increase in share of in-milk bovine in the stock resulted in 0.41 per cent increase in livestock output.

TABLE 4. ESTIMATES OF EFFECT OF DIFFERENT FACTORS ON OUTPUT OF LIVESTOCK:
1980-81 TO 2004-05
(DEPENDENT VARIABLE: LOG (VALUE OF LIVESTOCK OUTPUT AT 1999-2000 PRICES))

Explanatory variables (1)	Coefficient (2)	Probability (3)
Intercept	2.8541	0.0023
In-milk bovine, per cent	0.4133	0.0843
Artificial inseminations done (-3)	0.2374	0.0000
Veterinary institutions (-1)	0.0743	0.0747
Surfaced road length (-2)	0.1077	0.0469
Per capita income	0.2125	0.0327
Membership of dairy co-operatives	0.1164	0.0042
Rainfall	-0.0976	0.0069
Fodder area	0.1132	0.0150
<u>Important Statistics:</u>		
R-squared	0.9987	0.0000
Adjusted R-squared	0.9979	
Log - likelihood	73.6920	
Durbin-Watson Statistics	2.2467	

Sources of basic data: *Basic Animal Husbandry Statistics, Livestock Census, Land Use Statistics, Economic Surveys*, Government of India, New Delhi.

Note: Figures in parentheses indicate lag period.

The second and third most important factors affecting output of livestock were artificial insemination and per capita income in the country. As the number of artificial insemination performed increased by 1 per cent the output of livestock sector increased by 0.24 per cent. This variable was highly significant and showed its impact with a lag of 3 years.

A 1 per cent increase in per capita income in the country leads to 0.21 per cent growth in livestock output. Elasticity of livestock output with respect to membership of dairy co-operatives and area under fodder crops was 0.11 per cent each. Similarly, a ten per cent increase in road network increased livestock output by 1 per cent. The impact was captured with lag of 2 years. The number of veterinary institutions also exerted significant influence on livestock output. The elasticity was 0.074. The impact of rainfall on livestock output was found negative. The reason for this could be that increased monsoon rainfall often causes outbreak of livestock diseases.

Growth in GDP Livestock and Associated Factors

Data on GDP and value added in livestock sector are available only from 1980-81 onwards. In order to find out what happened to growth rate in livestock GDP over time, the period after 1980-81 was divided into two equal sub-periods. This is also useful in getting insights into the impact of economic reforms and associated policy changes like increased role of private sector and trade liberalisation on livestock sector.

There is a clear deceleration in growth rate of livestock output after 1992-93 (see Table 5). The growth rate dropped from 4.54 per cent during 1980-81 to 1992-93 (Period I) to 3.44 per cent during 1993-94 to 2005-06 (Period II). In order to find out the reasons for the slowdown in the growth rate of livestock output, we estimated the growth of various factors related to livestock output for the above two periods (Table 5). This includes variables included in the estimating equation in Table 5 and also some other variables considered to be related to livestock output but could not be included in the estimating equation for various reasons.

TABLE 5. ANNUAL GROWTH RATE IN LIVESTOCK OUTPUT AND ASSOCIATED FACTORS

Particulars (1)	(per cent)	
	1980-81 to 1992-93 (2)	1993-94 to 2005-06 (3)
Value of livestock output	4.539	3.441
Cross bred cows	8.082	5.205
Membership of dairy co-operative societies	14.060	4.152
Artificial inseminations done	6.368	5.379
Veterinary institutions	3.086	2.198
Number of veterinarians	5.799	0.770
Terms of trade	1.191	-0.341
Fodder area	0.286	2.647
In milk bovine percentage	0.873	0.962
Food grains + oilseeds production	3.251	0.898
Per capita Income	2.763	4.399
Surfaced road	5.828	2.510

Source: Computed from various issues of *Basic Animal Husbandry Statistics*, and Economic Surveys, Government of India, New Delhi.

Growth rate in number of cross-bred cows reduced from 8 per cent during 1980-81 to 1992-93 to 5.2 per cent in 1993-94 to 2005-06. Membership of dairy co-operatives increased annually by 14 per cent in the first period and the growth rate declined to 4.15 per cent in the second period. There was also slowdown in the growth rate of artificial inseminations performed, and veterinary institutions set up in the country after 1992-93. The number of veterinarians, to provide health and breeding services, increased by close to 6 per cent during 1980-81 to 1992-93 and after that the growth rate plummeted to less than one per cent.

Terms of trade for livestock sector improved in the first period but deteriorated in the second period. Rate of annual increase in surfaced road also declined sharply after 1992-93. All these variables showed positive impact on livestock output (Table 4) and slowdown in their growth contributed towards slowdown in livestock output growth. Only two variables, having positive impact on livestock output, showed improvement (i.e., increase in growth rate); these were, area under fodder crops and per capita income in the country. However, production of food grains and oilseeds, which are major ingredients for livestock feed, showed very sharp deceleration in their growth rates after 1992-93.

Achieving Targeted Growth

The Eleventh Plan envisages 6 per cent growth rate in livestock sector output in order to achieve 4 per cent growth rate in agriculture. Here we explore the possibilities of achieving the targeted growth rate of Eleventh Plan and also discuss two other growth scenarios in the light of recent experience. These possibilities are presented in Table 6.

TABLE 6. ACHIEVING TARGETED GROWTH OF 11TH PLAN FOR LIVESTOCK OUTPUT

Source of growth/ factor (1)	Elasticity of output (2)	(per cent)					
		Scenario I		Scenario II		Scenario III	
		Factor growth rate (3)	Output growth rate (4)	Factor growth rate (5)	Output growth rate (6)	Factor growth rate (7)	Output growth rate (8)
In-milk bovine, per cent	0.413	0.96	0.40	1.51	0.62	0.96	0.40
Artificial inseminations done (-3)	0.237	5.38	1.28	8.43	2.00	5.38	1.28
Veterinary institutions (-1)	0.074	2.20	0.16	3.44	0.26	4.40	0.33
Surfaced road length (-2)	0.108	2.51	0.27	3.93	0.42	5.02	0.54
Per capita income	0.213	4.40	0.93	6.89	1.46	7.50	1.59
Membership of dairy co-operatives	0.116	4.15	0.48	6.50	0.76	8.30	0.97
Fodder area	0.113	2.65	0.30	4.15	0.47	2.65	0.30
Total			3.83		6.00		5.40

Note: Figures in parentheses indicate lag period.

The table presents growth rate in livestock output resulting from the growth rate in factors whose elasticity estimates are presented in Table 4. First, the scenario assumes “business as usual” approach in which factors related to growth of livestock sector increase at the same rate as witnessed during 1992-93 to 2004-05. This gives growth rate in livestock output by 1.28 per cent due to increase in artificial insemination, 0.93 per cent due to increase in per capita income and 0.48 per cent due to increase in membership of dairy co-operatives. The contribution of improvement in bovine composition, expansion in area under fodder, and development of road network and veterinary institution is estimated to be 0.40, 0.30, 0.27 and 0.16 per cent respectively. The contribution of all these factors sum up to 3.83 per cent, implying, that, if growth drivers for livestock sector increase at the same rate as seen in the recent years, the growth rate in livestock output would remain below 4 per cent.

The second scenario has a target growth rate in livestock output of 6 per cent. With uniform increase in factors affecting livestock output, this scenario requires that bovine composition improves by 1.51 per cent per year and the number of veterinary institutions increase by 3.4 per cent per annum. The growth rate required in the number of artificial inseminations, membership of dairy co-operatives and per capita income varies between 6.5 to 8.4 per cent.

The third scenario is built to reflect some realism in the rate of increase in the factors underlying livestock sector growth. Here it is assumed that progress in improvement in bovine composition, artificial insemination and area under fodder would take place at the same rate as seen during the last 12 years but the number of veterinary institutions and development of road network would progress at double the rate seen in the recent past. The rationale for this is that there is lot of emphasis on strengthening livestock infrastructure and expanding road network during 11th Plan which can help in higher rate of increase in these two variables. Per capita income in this scenario is assumed to increase by 7.50 per cent per year which is based on recent growth in Indian economy. This scenario gives 5.4 per cent growth rate in livestock output which looks more reasonable than the second scenario.

VI

STATUS OF LIVESTOCK INFRASTRUCTURE AND OTHER VARIABLES

In order to find out the scope for improvement in infrastructure and growth of other variables related to livestock output, it is pertinent to know their current status. Veterinary facilities in the country are quite poor. One veterinary centre caters to as many as 9328 livestock. It is distressing to note that even the small number of veterinary centres is not equipped by trained veterinary professionals - in several cases one veterinarian work in more than one centres. There is one veterinarian for 12623 livestock (Table 7). This figure is more than double the NCA recommendation of one veterinarian for every 5000 livestock for effective delivery (National

Commission on Agriculture, 1976). This shows that it is not possible to reach a large number of livestock in times of need.

TABLE 7. STATUS OF INFRASTRUCTURE AND OTHER VARIABLES RELATED TO PERFORMANCE OF LIVESTOCK, 2005-06

Particulars (1)	Level (2)
Livestock served per veterinary institute	9328
Livestock served per veterinary person	12623
Artificial insemination performed per 1000 milch animals	318
Adult female bovines per A.I. Centre	1566
In- milk bovine (per cent)	12.52
Cows – cross-bred (per cent)	20.94
Milch animals–cross-bred (per cent)	11.60
Ratio of dairy co-operative members to livestock holdings (per cent)	9.85
Milk processing capacity as per cent of milk output	39.46
Fodder area per bovine (ha)	0.039
Livestock export to GDP ratio (per cent)	3.918
Livestock import to GDP ratio (per cent)	1.41

Source: Computed from various issues of *Basic Animal Husbandry Statistics, Livestock Census, Land Use Statistics*, Government of India, New Delhi; *Monthly Statistics of Foreign Trade*, DGCIS, Government of India, Kolkata.

Facilities for artificial insemination (AI) are more abundant than veterinary facilities. There is one AI centre for the population of 1566 adult female bovines. In terms of their services about 32 AI's are performed for every 100 milch animals.

About one-fifth of our cattle population is now cross-bred cows and 80 per cent are indigenous. This shows that there is immense scope to raise livestock (milk) output by expanding cross breeding of cows, as productivity of cross-bred is found to be much higher than indigenous cows (Babu, 1995).

The role of dairy co-operatives in mopping up milk surplus of small producers and in providing marketing channel for milk is well known. These co-operatives have been working very successfully and effectively in some states. However, their reach is still very low, as less than 10 per cent of total livestock farmers are their members.

After revoking of milk and milk product order in March, 2002, a lot of private investment has come to dairy sector. By 2005-06 the country had reached capacity to process close to 40 per cent of total milk produced in the country. This is almost double the capacity available till 1992-93.

Cultivated fodder is the important source of green fodder. Recent data show that about 4 hectare area is put under fodder crops to meet requirement of 100 bovine which is quite small.

India was a net importer of livestock products till 1985-86. Afterwards, exports exceeded imports. India exports about 4 per cent of total domestic livestock production in value terms as against import to GDP ratio of 1.41. Liberalisation of trade has helped much faster growth in export as compared to the import of livestock

products. India has considerable scope to raise the export of livestock products which would help in improving the income of livestock sector.

The Eleventh Five Year Plan envisages 6 per cent growth rate in livestock output in order to achieve a target of 4 per cent growth rate in agriculture. This is almost double compared to the growth rate achieved during the recent years, but, this does not appear very high in the light of potential of livestock sector. India needs to pay serious attention to develop infrastructure for livestock sector, improve veterinary services and improve livestock composition and quality. Similarly, the income of livestock farmers needs to be improved through better connectivity of rural areas to urban centres and institutional arrangements like dairy cooperatives. Achieving these would require steep increase in public sector investment and support for livestock sector.

VII

CONCLUSIONS AND POLICY IMPLICATIONS

Livestock output in India has been growing at a faster rate as compared to crop sector. This could happen mainly due to rapid growth of milk output and poultry meat and eggs. This has helped India not only to meet the demand of rising population but also improved per capita availability, besides reducing import dependence and increase in export. Growth of minor products like wool has suffered a serious setback and India is meeting its demand through imports. Major factors that have contributed to growth of livestock sector are improvement in bovine composition in favour of productive animals, artificial insemination, spread of cross-breeding of cattle, expansion of veterinary facilities, development of road network, setting up of dairy co-operatives and favourable effect of rising income transmitted through demand. After 1992-93, the growth rate in output of most of the livestock products has slowed down which does not augur well for growing domestic and export demand for livestock products. In order to harness the potential of livestock sector and to maintain high growth of this sector there is a need to improve veterinary facilities in rural areas, improve composition and quality of bovine, and ensure better return to livestock farmers through improved market outlets, effective spread of dairy co-operatives, expansion of processing capacity and better availability of feed and fodder. If the factors affecting livestock sector increase at the same rate as experienced during 1992-93 to 2004-05 then output of livestock sector is not likely to achieve more than 4 per cent annual growth rate. In order to achieve targeted growth rate of 6 per cent in livestock output, progress in livestock infrastructure, institutional efforts and availability of livestock feed is required to be accelerated by about 50 per cent.

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NOTES

1. Average milk yield per milch animal during 2005-06 was only 2.47 kg/day.
2. Livestock output is projected to grow at 6 per cent (Government of India, 2007a).

REFERENCES

- Babu, P. Ramesh (1995), "Trends, Patterns and Effects of Diffusion and Adoption of Crossbreeding Technology: An Assessment in the Context of Kerala", *Indian Journal of Agricultural Economics*, Vol.50, No.3, July-September, pp. 294-298.
- Choudhary, V.K. (1995), "Income and Employment Opportunities under Dairy and Crop Enterprises", *Indian Journal of Agricultural Economics*, Vol.50, No.3, July-September, pp.369.
- Datt, Ruddar and K.P.M. Sundharam (2007), "Unemployment in India", *Indian Economy*, Ch. 22 p. 386, S. Chand & Company, New Delhi.
- Government of India (1976), *Report of National Commission on Agriculture*, Ministry of Agriculture and Irrigation, New Delhi.
- Government of India (1982), *Report of the Expert Group on Programmes for Alleviation of Poverty*, Planning Commission, New Delhi.
- Government of India (2007a), *Report of the Working Group on Animal Husbandry and Dairying for the Eleventh Five Year Plan (2007-2012)*, Planning Commission, New Delhi.
- Government of India (2007b), *Report of the Steering Committee on Agriculture for the Eleventh Five Year Plan (2007-2012)*, Planning Commission, New Delhi.