



Impact of infrastructure and public investment on development of livestock sector in Jammu & Kashmir-India

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(Received February 03, 2024; accepted April 19, 2024)

ABSTRACT

Considering the crucial role of institutional support in the livestock growth, an attempt was made to analyze the development of livestock sector in relationship with public investment in livestock sector and selected infrastructure variables in J&K. Livestock sector has shown a significant growth and has increasingly contributed to the state gross domestic product over the years. Government has been pro-active with towards the development of livestock sector with various schemes; however, the public investment has experienced a deceleration and its intensity has reduced over the years. The stock of animal health institutions has increased though their density has remained almost stagnant. Livestock productivity model was development to quantify the impact of public sector investment, infrastructure and other variables on livestock productivity. The estimates of the model revealed that public investment in livestock sector and infrastructure variables including animal health infrastructure have significant contribution in the growth of livestock productivity. The study concluded with an emphasized upon the creation of necessary infrastructure and the reversal of the declining trend of investment to this sector among other policy options suggested for the sustained growth of livestock in the territory.

Key words: Infrastructure, livestock, public investment, veterinary institutions

Livestock capital is distributed more or less equitably compared to land resources (Kumar and Singh, 2008) and its contribution in the livelihood security has significantly increased over the years. Animal domestication could ensure livelihood security of landless labourers and poor population (Birthal, Joshi, Kumar, 2010; Baba, Wani, Zargar, 2011) owing to their labour-intensive nature. Besides providing food for human population, draught power /organic inputs for crops, raw material for manufacturing sector and food for human population (Kitalyi et al., 2005), it has been playing a vital role in maintaining balance in agricultural ecology (Sere and Steinfeld, 2006; Hahn, Riederer and Foster, 2009; Singh, Kumar, and Singh, 2005). Determined by raising economic status, the consumption and demand for animal-based production has increased both in urban and rural areas of the country (Kumar, 1996; Gandhi and Mani, 1995). Policy support for the transformation of livestock sector to resolve with consumers' choice and producers' interests are largely demanding. These transitions are possible with the active interventions of government and institutions. It implies a wide market driven potential in this sectors which need to be tapped for which creation of enabling environment is essential. Among various development initiatives taken by institutions, the creation of animal health infrastructure is highly pertinent for sustained livestock development.

The capital overhead in the form of essential infrastructure is considered pre-condition for any growth process (Munnell, 1990). Strong association between economic growth and infrastructure have been brought out by number of studies (Pinstrup Andersen and Shimokawa, 2006; Sawada, 2000, Calderon and Chong, 2004, ADB et al., 2005), also a plenty of studies highlighted role of physical and institutional infrastructure as significant determinants of agricultural output growth (Datta and Ravallion, 1998) and in upscaling of commercial value in this primary sector (Jaffee and Morgan, 1995). Public spending has significant influence on

development of livestock sector in particular (Baba, 2018). Varying levels and kinds of institutional interventions and policy environment determine the differential growth performance of this sector across states/regions.

Domestication of animals vary across regions and it figures as an enterprise of age-old mixed farming and livelihood substitutes in J&K, a northern mountainous erstwhile state of the country. Despite an appreciable growth in the territory's livestock sector, there are high concerns about its sustainability in consideration of modernization and shrinking Common Property Resources (CPRs). Towards this, an understanding of various institutional interventions including existing stock of infrastructure and its role is imperative to bring in required reforms in existing public approaches towards livestock economy in Jammu & Kashmir Union Territory.

MATERIALS AND METHODS

The present study is mainly based on chronological data obtained from various publications including Livestock Census reports (DES a, various issues) and Basic Animal Husbandry Statistics (DES b, various reports) of Directorate of Economics and Statistics, Ministry of Agriculture & Farmers Welfare, GoI, and Digest of Statistics, Plan Documents, Planning Department (PDD, various issues), Government of J&K, Directorate of Economics & Statistics, Government of J&K, (DES c, various issues).

Compound growth rates were estimated to examine the growth in various development indicators relating to the livestock sector.

Livestock growth model: Structural form and specifications: To quantify the influence of infrastructure and government investment on livestock productivity growth, Livestock Growth Model of structural form at equation (I) has been development and estimated to confirm a hypothesis that infrastructure and investment variables positively affect livestock productivity.

$$LVG = f(AHIF, ROAD, VEL, BANK, PBI, HLD, RLIT, CI, LVS, U) \text{ ----- (I)}$$

where,

LVG	=	Livestock productivity (=Net livestock domestic product/Adult cattle unit (Rs/ACU))
AHIF	=	Animal health infrastructure (No./ACU)
ROAD	=	Density of quality road (km/000sqkm of geographical area)
VEL	=	Villages electrified (%)
PBI	=	Public investment in livestock sector (Rs/ACU)
BANK	=	Bank branches density (no./10000 ha of cultivated area)
HLD	=	Average land holding (ha)
RLIT	=	Rural literacy rate (%)
CI	=	Intensification of crops (%)
LVS	=	Density of livestock (no./ha of cultivated area)
U	=	Error term

Productivity is a better analytical framework for studying the effect of the infrastructure and institutional support in the livestock sector, hence, livestock productivity has been endogenized in equation I with a number of exogeneous variables. The exogeneous variables specified in the model could be categorized into three groups: (i) the four rural infrastructure variables, viz., animal health infrastructure, roads, village electrification and bank have been specified in the model, (ii) public investment as a measure of direct institutional support and (iii) input variables including average holding size, cropping intensity, rural literacy, and livestock density. Although a number of independent variables were attempted, however, only those variables finds their place in the final model which provided best fit to estimates.

RESULTS AND DISCUSSION

Status of livestock economy: The state net domestic product in JK union territory experienced a 2.13-fold increase and reached to Rs 143586 crore in 2019-20 (Table 1). Between these years, there has been a 2.5-fold increase in livestock based net domestic product earned from Rs. 3379 crore (2010-11) to Rs 8337 crore (2019-20). While the per cent contribution of agricultural sector to territory's increase declined over the years, the contribution of livestock sector to state income has remained stagnant at 5.8 per cent since 2015. The contribution of livestock sector to the domestic product generated in agricultural sector has appreciably increased by 5 per cent. The scenario appears to be more encouraging when domestic product taken at constant prices after deflation 2010-11 prices. It indicates presence of wide potential in livestock sector, which is to be tapped with the support of supply and demand side factors. Since the livestock is seen to be relatively more equitably distributed, the sustained growth of this sector could be instrumental in the eradication of poverty from rural areas of the territory.

Table 1. Livestock in the state economy (Rs in Cr.)

Particulars		2010	2015	2019	Δ since 2010
Nominal	LVNDP	3379	5713	8337	4958
	LVNDP as % of AGNDP	30.1	31.4	35.9	5.8
	LVNDP as % of SGNDP	5.0	5.8	5.8	0.8
	AGNDP	11227	18188	23204	11977
	SGNDP	67274	98409	143586	76312
Real	LVNDP	3379	4529	5266	1887
	LVNDP as % of AGNDP	30.1	37.2	40.2	10.1
	LVNDP as % of SGNDP	5.0	5.6	5.4	0.4
	AGNDP	11227	12163	13104	1877
	SGNDP	67274	80602	98029	30755

LVNDP = Livestock net domestic product, AGNDP = Agricultural net domestic product and S NDP = State net domestic product, and Real series is at 1980-81 prices

Institutional Interventions in Livestock development: Livestock development schemes/programmes: Various state and central supported schemes have been launched from time to time for the steady growth of livestock sector in the territory. Presently five main schemes are ongoing for the development of livestock sector. The National Livestock Mission had an inception with objectives of productivity enhancement, employment generation, strengthening infrastructure and entrepreneurship development at farms. The scheme has better pay off in respect of bio-security, automation, creation of slaughterhouses in rural areas, development of minor livestock and livestock insurance. The Fodder-Feed Development sub-mission could address feed resources scarcity issues. Development and conservation of indigenous breeds was systematically taken up in Rashtriya Gokul Mission. In August 2010, the scheme of Livestock Health and Disease Control was launched to contain, prevent, and control the zoonotic and serious animal diseases. These interventions raise animal productivity by manifolds and has ensured their comforts as well.

Public development investment in livestock sector: Annual public development expenditure to any sector is crucial for pushing it towards significant growth. Public investment in livestock sector goes for sheep husbandry, animal husbandry, milk & milk products cooperative federation and sheep product development board. Drastic changes were observed in the support of institutions towards the development of livestock sector in the territory since 1980-81. The government investment to this sector increased steadily up to mid-2000's, however, lately an unfavourable decline was experienced in it. Public investment in livestock sector as a percentage of total agricultural investment increased to 11.29 per cent in 1995-96 from 10.69 per cent in 1980-81, however, later its proportion has reduced to just 6.3 per cent in recent years. Similarly public livestock investment has reduced to a fraction of 0.34 per cent of state's total public expenditure in all the economy sector (Table 6). It appears that this sector has not received due attention in the form of public investment. The public investment to this sector has to be enhanced in consideration of importance of building of necessary infrastructure for effective post-

harvest management, technological breakthroughs for livestock development, and strengthening marketing network, etc.

Table 2. Public investment in livestock sector in J&K (Rs in lakhs)

Year	Livestock			
	Nominal	Real	% of Agr.	% of TSI
1980-81	371	371	10.7	2.2
1985-86	485	353	7.6	1.8
1990-91	1310	615	11.3	2.0
1995-96	1635	561	11.2	1.5
2000-01	2285	641	6.9	1.3
2005-06	3260	773	7.3	0.9
2010-11	2426	498	5.2	0.4
2015-16	3398	609	6.8	0.3
2019-20	2468	431	6.3	0.3

TSI = Total investment in all the sectors, and Real series is at 1980-81 prices

The figures of public livestock investment were divided into 02 periods for comparison and for each periods compound growth rates were calculated separately. The estimates of compound growth indicated a discouraging trend (Table 3). The public livestock investment grew at an annual rate of 12 per cent during period-I, and its growth was higher compared to the growth of total agricultural investment. However, during 1999-2019 period, public livestock investment has decelerated at an annual rate of 0.34 per cent while total public investment in all sector has experienced an increase at 9.51 per cent per annum. The scenario of public investment in real term is yet more gloomy. The declining growth of public livestock investment has to be stopped and reversed if we intend to achieve the desired growth in this economic sector.

Table 3. Growth of public investment in fisheries sector (CGR %)

Period	Nominal			Real		
	Livestock	Agriculture	All sectors	Livestock	Agriculture	All sectors
1980-1999	11.84*	10.08*	12.90*	5.15*	3.39*	6.21*
	(0.88)	(0.55)	(0.35)	(0.88)	(0.59)	(0.30)
1999-2019	-0.34	1.86	9.51*	-3.22	-1.02	6.63*
	(1.66)	(1.01)	(0.69)	(1.67)	(1.00)	(0.66)
1980-2019	4.81*	6.78*	10.81*	0.29	2.26*	6.28*
	(0.69)	(0.45)	(0.24)	(0.58)	(0.35)	(0.18)

Figures with parentheses indicate standard errors, *Denotes significance at 0.05 or better probability levels And Real series is at 1980-81 prices

Intensity of public livestock investment *vis-a-vis* in agricultural sector indicated that the investment intensity in livestock sector has been much lower compared to agricultural sector. Intensity of investment in livestock sector has declined between 1980-81 and 2019-20. The intensity of investment in this sector needs to be doubled in first phase to achieve its long lead positive impacts.

Infrastructure in livestock sector: In consideration of an essential role of livestock economy in the upliftment of the rural masses, both forward as well as backward linkages are emphasized to be strengthened. This possibility can be achieved by the creation of basic infrastructure in animal health.

Table 4. Intensity of public investment in fisheries sector *vis-a-vis* agricultural sector

Year	Livestock	Agriculture
2010-11	0.7	4.2
2011-12	0.9	3.8
2012-13	0.5	2.3
2013-14	0.2	2.0
2014-15	0.4	1.8
2015-16	0.5	2.5
2016-17	0.4	2.1
2017-18	0.3	1.8
2018-19	0.3	1.9

The stock of existing stock of animal health infrastructure in the territory of J&K is discussed as:

- a) *Growth of veterinary institutions:* The capital stock in the form of veterinary/health institutions is an essential physical capital endowed in J&K. Animal health institutions in absolute figures has increased by nearly 4 times from 1186 (1985-86) to 2167 (2018-19). However, these institutions in density terms have remained almost stagnant (Table 5) and there were only 26 institutions to treat one lakh domestic animals. Except for Tehsil veterinary units, all the institutions have increased in number over the years. Veterinary institutions have shown a good progress by treating a greater number of animals over the years (Table 6). Significant progress was seen in the provision of services including artificial insemination and vaccination of animals through these institutions. Better facilities at these institutions with logistics and building of competence of workforce associated therein, are very crucial.

Table 5. Veterinary institution across provinces of J&K (No.)

Institution	1982-83		1988-89		1992-93		1997-98		2003-04		2007-08		2012-13		2018-19	
	No.	D	No.	D	No.	D	No.	D	No.	D	No.	D	No.	D	No.	D
Tehsil units	48	1.0	48	0.9	44	0.6	39	0.4	37	0.4	36	0.4	35	0.4	36	0.4
Veterinary dispensaries	172	3.6	306	5.6	302	4.1	302	3.5	311	3.4	325	3.4	318	3.4	225	2.7
Mobile dispensaries	24	0.5	51	0.9	56	0.8	56	0.6	56	0.6	45	0.5	50	0.5	62	0.7
First aid Centres	91	1.9	163	3.0	139	1.9	120	1.4	145	1.6	175	1.8	206	2.2	184	2.2
Intensive Cattle Dev. Centres	417	8.8	438	8.0	401	5.4	297	3.4	349	3.8	354	3.7	460	4.9	308	3.7
Livestock	111	2.3	146	2.7	153	2.1	155	1.8	179	2.0	245	2.5	300	3.2	228	2.7
Frozen Semen Centres	40	0.9	100	1.8	118	1.6	118	1.4	116	1.3	141	1.5	147	1.6	113	1.4
Others	283	6.0	607	11.1	665	9.0	560	6.4	597	6.5	765	7.9	537	5.7	1011	12.2
Total	1186	25.0	1858	34.1	1878	25.3	1646	18.9	1790	19.5	2086	21.6	2053	22.0	2167	26.0

Note: D is the density (no. per lakh of animals)

Technological gap: The adoption of exotic animals and replacement of indigenous ones could be an important option for enhancing the yield levels of livestock and mainly sheep and cattle. (Kumar and Singh, 2008). In order to get an idea about the level of adoption of cross animal, the number of cross-bred animals as percentage

of their total population was estimated and presented in Table 7. In 2019, cross-bred cattle comprised 55.41 per cent compared to their adoption (25.94%) in 1992.

Table 6. Status of veterinary services provided in J&K

Year	Animals treated (lakhs)	Animal treated per veterinary institute	Animal vaccinated / veterinary institute
1980	16.74	1760	1424
1985	31.56	1836	1251
1990	29.51	1765	3359
1995	28.45	1793	1783
2000	45.73	2607	4160
2005	34.98	1940	5687
2010	61.29	2892	7263
2015	53.04	2952	9096
2018	52.01	3022	9199

In this span, the percentage of cross-bred sheep has raised to 48.28 per cent from 40.59 per cent. Since the adoption of cross-bred animals has reached to around 50 per cent, indicating a huge potential to be tapped for enhancing productivity of livestock sector.

Table 7. Level of adoption of cross-bred animals in J&K (%)

Species	1992	2019	Difference
Cattle	25.94	55.41	29.47
Sheep	40.59	48.28	7.69

Growth of livestock products and Demand-Supply gaps: As a result of number of supporting factors including institutional intervention, there has been a significant increase in the output from livestock population as evident from the increase in the production of livestock-based products (Table 8). There has been an increase in the total milk production from 11.67 lakh tonnes to 26.25 lakh tonnes from 1997 to 2019 and the increase was primarily due to productivity gains, which is in consonance with adoption of cross-bred animals.

Table 8. Growth of output from livestock sector (1997 to 2006)

Year	Milk		Meat		Wool	
	Production	PCA	Production	PCA	Production	PCA
1997	1167	347.23	NA	NA	4616	501.3
2000	1321	365.21	26.29	7.27	5583	563.4
2005	1400	345.37	27.00	6.66	7400	666.3
2010	1609	358.20	30.97	6.89	7382	599.7
2015	2273	460.98	75.08	15.22	6866	508.2
2019	2625	496.91	95.01	17.99	7811	539.7
CGR (%)	3.42*	1.37*	6.40*	4.37*	1.93*	-0.12
SE	0.25	0.27	0.87	0.89	0.27	0.25

CGR = Compound growth rates, SE = Standard errors, PCA= Per capita availability (g/capita)

The increase in milk production has led to its increase in per capita availability. Another important animal-based product is meat and its production has increased significantly though this level of production has not fully come

up with the growing demand in the territory. Meat production per capita after declining with time has attained a rising trend and reached to 17.99 g/capita/day, though it is less than ICMR recommendations for meat consumption and we still depend upon imports from other regions of the country. Since the slaughter of cattle is banned under Ranbir Panel Code (RPC) in the J&K union territory, therefore the emphasis is on the increase in the production of meat by manifolds. As far as the production and per capita availability of other products are concerned, it has shown a good progress over the years. The growth estimates revealed that livestock-based products in quantity terms have significantly increased over the years since 1997 though the growth of per capita availability of wool was not statistically significant. Growth estimates indicated that there is a need of improvement in the production of animal-based product for the institutional support including infrastructure growth is essential.

Model Estimates: Model was developed and estimated to quantify the influence of institutional factors including infrastructure variables on the productivity of livestock sector and the estimates documented in the Table 9. The coefficients of the function revealed that the animal health infrastructure have a positive and significant impact on livestock productivity over the years in the J&K union territory. Besides other infrastructure variables including density of bank branches and rural roads are positive and significant determinants of livestock productivity. The regression estimates of roads clearly brought out an important role of this infrastructure on the enhancement of livestock productivity. Good quality roads facilitate easy transit of critical inputs and produce without any damage that in turn have a strong bearing on productivity growth. Regression coefficient of density of bank offices implies that coverage of banks has contributed to livestock productivity by extending farmers' access to capital to be spend on explicit variables.

Results revealed a crucial role of rural literacy in the growth of livestock productivity. Education is very crucial to help managers and entrepreneurs in taking rational decisions at crucial stages and domesticate livestock scientifically, which is instrumental in productivity gain in the livestock sector. Model estimates revealed cropping intensity is a positive significant determinant of productivity of livestock productivity. Intensification of farming helps in harvesting of more fodder and crop stubbles to be fed to livestock. The value of adjusted R^2 gives an idea that the specified model is a best fit. Overall results revealed that the public direct support in the form of public investment and infrastructural variables have significant impact on the growth of livestock productivity in the territory.

Table 9. Estimates of livestock growth and infrastructure regression function in J&K

Variables	Coefficient
Intercept	7.77
AHIF	0.56 *(0.11)
SROAD	0.61*(0.27)
VEL	-0.27(0.77)
BNK	1.87*(0.25)
PBI	0.11* (0.00)
HLD	-0.37 (0.31)
RLIT	1.22*(0.32)
CI	0.71* (0.11)
LVSL	-0.33 (0.29)
CBT	1.10* (0.21)
Adj R^2	0.6787

CONCLUSION

In consideration of a crucial role of the public support, this study has made an endeavour to investigate the impact of government investment in livestock sector and creation of infrastructure on livestock productivity in J&K. Livestock productivity was endogenized in a model with a set of exogenous variables including public investment, few infrastructure variables and other factors. Results revealed the deceleration of public investment in this sector and the density of animal health infrastructure was almost stagnant. The estimates of livestock productivity model revealed that government investment and infrastructure have played a significant role in the livestock productivity. Based upon findings, this study puts forth following policy options for the sustained development of livestock sector: i) To harness the untapped potential of livestock sector in the J&K union territory, the declining trend of public investment in this sector has to be reversed. It intensity has to be increased in a phased manner though we can advocate for its increase by two-folds at first instance. The government may not be able to invest in this sector to a desirable magnitude in the territory; the corporate sector including private players need persuaded to take up livestock-based activities as an enterprise. The Public-Private alliances are essential and the development subsidies to be provided by the government is expected to

encourage private sector investment in livestock project especially in the disadvantaged areas. ii) Considering a positive significant relationship between livestock productivity and infrastructure development, there are possibility for enhancing the production from this sector in the J&K territory by creating essential infrastructure including animal health logistics, rural roads and expansion of network of financial institutions. iii) Since the association of infrastructure with livestock growth is not any single procedure, but a regular practice, its growth needs to be associated with a uniform and steady expansion of this infrastructure and the collaborations with Private-Partners in huge projects could be encouraged. iv) The existing overhead has to be brought to its functional form by eradicating obstructions through regular maintenance. Moreover, we have to be considerate in the pattern of infrastructure development, which is to be uniform across the territory. v) There is a need to build capacities among different stakeholders about various government sponsored missions/schemes, which are in operation in the erstwhile state and how to get benefited from them.

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