CHAPTER: II
REVIEW OF LITERATURE

A wide-ranging review of literature is a rather critical part of any scientific inquiry either general or specialized relevance to the particular area and given research problem. A broad range of reviews provide the base to the finding of the research and aid to choosing appropriate statistical/econometric techniques which are applied in the research field. In-depth examination of different kinds of literature enables the researcher to appraise, encapsulate, compare and contrast, and correlate various studies that are directly related to the current research. In this line, accentuate is supposed to be made on the reliability of earlier findings as well as theoretical and methodological contributions to a particular topic and help to resolve the conflicts among seemingly paradoxical previous studies.

In a composing review of the literature, it is noteworthy that it does not account new or original experimental but rather a supportive argument for justifying and endorsing the research outcome. Therefore, present reviews of literature are compiled in a way to provide the general idea, conceptual framework and different approaches that would be considered depending upon kind of objectives underpinning the study. As the literature having a direct bearing on different aspects of the present study is limited, the references having little or indirect bearings are also reviewed. By and large, related frameworks of review of literature concerned with the objectives are mentioned here.

2.1 Pace and pattern of growth in livestock population.
2.2 Growth and instability in production and productivity of livestock products.
2.3 Composition changes and export dynamics of different agricultural product from India.
2.4 Competitiveness and export determinants of agricultural commodities.
2.1 Pace and pattern of growth in livestock population

Tysdel and Gali (2000) examined the trends and developments in India’s livestock industry. They pointed out that human population doubled between 1961 and 1997 while cattle, sheep, buffaloes and goats population increased by 195 per cent, 41 per cent, 80 per cent and 98 per cent, respectively during the same period. The tremendous change was noticed in chicken population which rose by 400 per cent and pigs increased in number by 200 per cent. Even so, between 1961 and 1997, the annual population growth rates of human and livestock were 2.06 and 2.44 per cent, respectively. Livestock numbers grew at a faster rate than the human population in India in the period 1961-1997. Over time, the growth rates in total cattle numbers have not changed significantly. From 1960 to 1979, the growth rate in total cattle population was 0.11 per cent per annum and for the period 1980-1997 their growth rate was slightly higher at 0.27 per cent per annum. In case of buffalo population from 1960 to 1979, the growth rate was around 0.57 per cent per annum, for the later period the growth rate increased to 0.82 per cent per annum. Over the time, growth rate in buffalo population increased. The growth rate in sheep and goat numbers increased at the rate of 0.5 per cent and 0.8 per cent per annum. Over the years, the goat population has been increasing at a faster rate than sheep population. Total poultry population reported for 1997 is around 570 million birds. The rate of growth of poultry after 1980 is unprecedented for India and reported to be around 4.3 per cent per annum. India’s pig population is low and it was around 15 million but unlike the growth rates for all other livestock, the rate of growth in numbers of pigs in India was 1.4 per cent per annum.

Birthal (2002) studied the technological changes in Indian livestock subsector. He estimated that crossbred cattle population increased more than indigenous cattle population. Crossbred cattle increased at 5.6 per cent annually while indigenous cattle noticed at 0.5 per cent growth rate during 1982 to 1992. It indicated that a gradual substitution of indigenous cattle by crossbreds. The reasons for slow growth in indigenous stock were low milk yield and decreasing demand for draught animals. The population of improved poultry grew at an annual rate of about 9 per cent more than double that of indigenous poultry. In addition, the disposal value of buffalo was found to be higher unlike the cattle because there are fewer restrictions on buffalo slaughter. The populations of crossbred sheep and pigs also grew faster than their indigenous sheep and goat population.
Birthal and Rao (2002a) found that India possesses one of the largest livestock populations in the world. They concluded that the population of different species was found increasing although poultry, pigs, goats, and buffalo had grown at a faster rate compared to other species during 1982-1992. On the contrary, population of draught animals observed negative and decelerating trend particularly small ruminants. Growth rate in sheep population had shown declining trend.

Kumar and Pant (2002) studied the status and technological possibilities for goat improvement in India. The results showed that goat population increased faster than other livestock species during 1972 to 1997. The annual growth rate of goat population during this period was 2.7 per cent followed by buffalo (1.9%), sheep (1.2%) and cattle (0.97%). The goat population increased from 47.2 to 115.3 million but sheep population remained at 50.8 million which were held by poor households mostly in arid, semi-arid and mountain regions. Goat is adaptable to different agroclimatic conditions and survives even in extreme climate; therefore its population has spread across India mainly in Bihar and West Bengal, Rajasthan, Maharashtra, Madhya Pradesh and Uttar Pradesh. Sheep population revealed positive and negative trends.

Kumar et al. (2007a) studied the performance of livestock sector in North-Eastern Region (NER) of India. The findings showed that NER had 11.9 million bovines, 4.5 million ovines, 3.8 million pigs and 36.1 million poultry birds in 2003 which comprised about five per cent of the total bovines, three per cent of ovines and seven per cent of poultry birds in India. Pig population increased over years in NER constituting around 28 per cent of total pig population in India. Between 1992 and 2003, the population of bovines declined significantly at 1.8 per cent per annum, on another hand, at the same time poultry population increased considerably at 2.2 per cent per annum. The bovine population declined only in Assam, while in other NE states, it remained stagnant or increased. Besides, the pattern of adoption of cross-bred was found significantly different in these states. The percentage share of crossbred in cattle population was found significantly lower in the NER than at national level. The growth of livestock sector was found slower in the NER compared to the national level.

Kumar and Singh (2008) assessed the livestock production in India under different agro-ecological regions between 1992 and 2003. It was observed that cattle population has declined in all the regions, but this decline was restricted to the
indigenous cattle because of faster decline in the male population, whose role in agricultural operations has diminished owing to budding mechanization. Among cattle, the population of crossbred increased at a considerably higher rate in all the regions except for irrigated region, signifying the substitution of low yielding inferior animals with high yielding animals. Rainfed region registered utmost an annual growth of about 8.07 per cent in the crossbred cattle population. The buffalo population increased in all the regions except in the coastal region but its growth was slower than that of crossbred cattle except in the irrigated region. In the rainfed region, all livestock units such as cross breed cattle, sheep, pig and poultry, buffalo except indigenous cattle registered positive growth. Crossbreed sheep population was noticeably augmented in the arid region at an annual growth rate of 45.93 per cent. The pattern of intra-regional variations for the adoption of crossbreds revealed that the adoption of crossbred cattle in 41.4 per cent of the districts was less than 5 per cent, while in 31.7 per cent of the districts; the proportion of crossbred in total cattle was more than 20 per cent. Such intra-regional variation was even prominent in the arid and rainfed regions. Such variation was profound in all the species except poultry.

Kumar et al. (2009) found that livestock and poultry were major enterprises which provided a supplementary source of income for Andaman farmers. They found that after the tsunami, there was a drastic decline in the average population of cattle, buffalo, goat, broiler and duck. Although, highest decline in average population per household was noticed in indigenous poultry from 59.87 to 10.58 between pre-tsunami and post-tsunami periods and in monetary value, the loss was Rs 5296 in indigenous poultry, followed by Rs 4700 in adult cattle, and Rs 2433 in adult buffalo.

Paul and Chandel (2010) in their study pointed out that population of crossbred and indigenous cattle in North-Eastern states was 3.46 per cent and 5.66 per cent of the country. The highest number of cattle population both crossbred and indigenous was found in Assam i.e. 444 thousand and 7999 thousand while the lowest was in Mizoram i.e. 9 thousand and 27 thousand. Buffalo population was lower compared to cattle population in all the North-Eastern state. However, buffalo population in N.E. states contributed merely 0.86 per cent of total buffalo is in India.

Shah and Dave (2010) examined the regional trends and pattern in milk production and drivers for future growth in Gujarat from 1990-91 to 2008-09. They found that there was a positive appreciation in all the categories of milch
animals, but the rate of appreciation in the cross-bred cows and buffaloes was far outpaced than in the local cows. The annual growth of local cows had declined in north, central, Saurashtra, south region and state as a whole. There was a shift in the composition of local cows from 39 per cent to 29 per cent during this period. The share of buffaloes improved from 59 per cent in 1990-91 to 63 per cent in 2008-09. The population of cross-bred cows increased from 6 per cent to 18 per cent. The cross-bred cow's contribution in a total milch population of Gujarat increased from 1.81 per cent to 7.15 per cent in 2008-09. Therefore, the proportion of cross-bred cows increased notably during this period mainly due to gradually shifting of local cows to buffaloes and it happened at the all-India level also. Region-wise, Saurashtra region had contributed 43 per cent of local cows followed by the southern region (30%). The northern and central regions have shown a lower proportion of local cows. But the population of cross-bred cows increased significantly in the northern and southern regions. The growth rate buffalo population was the highest in northern part and lowest in central region which suggested further reorganization in the favour of buffaloes and cross-bred cows.

Kumar et al. (2012a) reported that livestock population in the Himachal Pradesh increased marginally from 49.89 lakh heads in 1982 to 52.17 lakh heads in 2007. However, its structure has transformed evidently. The population of buffaloes and goats increased, a decline was observed in the cattle and sheep population. In addition, the number of poultry birds depicted an impressive increase from 4.61 lakh in 1982 to 8.09 lakh in 2007, recording 75.41 per cent increase. Conversely, the sheep population had declined from 21.86 per cent (10.92 lakh) to 17.27 per cent (9.01 lakh) in total livestock population.

Reddy et al. (2012) studied the livestock development in Andhra Pradesh. They reported significant growth in the cattle, buffalo, sheep and goat population between 2003 and 2007. The cattle, buffalo, sheep, goat and poultry population increased by the annual growth of 4.46 per cent, 5.36 per cent, 21.53 per cent, 49.77 per cent and 5.37 per cent, respectively. They argued that this growth was mainly due to the demand for milk and meat. Moreover, cattle were used for both milk and draught purpose while buffaloes were grown widely for milk production. Sheep and goat were reared by poor communities mainly to fulfil the demand for meat as its demand was higher than milk.
Fateh Muhammad (2013) studied the livestock population in Sindh Province of Pakistan and found that total estimated number of cattle, buffaloes, sheep and goats was 32 million heads and around 141 million poultry birds during the year 2010. The number of cattle, sheep, and goat was higher in Tharparkar district when compared with other districts as it were completely a desert area where livestock was the only source of livelihood. Shikarpur, Larkana, Badin, Khairpur and Nusheroferoze districts had the highest number of buffaloes whereas Mirpurkhas, Karachi, Thatta, Hyderabad and Ghotki had the highest the amount of poultry population. Cattle and Buffaloes grew at a faster rate due to high demand for milk in the urban areas.

Lubungu et al. (2013) reported that livestock population in Zambia was amplified during the period from 2001 to 2008. In 2001, the population of livestock was estimated at 1.5 million cattle, 1.2 million goats, 492,000 pigs, and 51,000 sheep which increased about 2.8 million cattle, 2.4 million goats, 1 million pigs, and 157,000 sheep by 2008. However, such augmentation was unevenly distributed. More explicitly, livestock populations increased in Southern and Central provinces although remained stagnant in Eastern, North-Western, and Lusaka provinces. About half of the cattle, more than a third of the goats, and 40 per cent of the sheep were found in the Southern province, while Eastern province accounted for more than 60 per cent of all pigs. In case of Luapula, Lusaka, North-Western, and Copperbelt provinces possessed low populations of all livestock species.

Borah and Halim (2014) studied the dynamics and performance of livestock and poultry sector in India. They found that India’s share in world population is 57.69 per cent, 14.66 per cent and 16.74 per cent in world total population of buffalo, cattle, and goat, respectively. The livestock growth was increasing owing to an alternative source of income, employment and for security aspects. Buffalo and goat population was nearly doubled while poultry population has increased more than threefold during 1982 to 2007. However, pig population had negative growth (-4.74) during this period. During inter census period of 2003-2007, cattle, sheep and poultry population increased at a growth rate of 1.83, 3.87 and 7.33 per cent, respectively.

Singh et al. (2014) examined the changes in livestock population in Uttar Pradesh during 1992-2007. The population of crossbred cattle especially of females increased notably in both the rural and urban areas. Therefore, significant growth in the crossbred population provided ample scope for marketing of cattle. The
buffalo population also grew but at a slower rate. On the other hand, the population of indigenous male as well as female cattle declined.

Sserunjogi and Lokesha (2014) studied the growth trends in the livestock sector in North-Eastern Karnataka among four major divisions, viz. Gulbarga, Belgaum, Mysore and Bangalore using livestock census data for the years 1977, 1983, 1990, 1997, 2003 and 2007. The upshot revealed that the Gulbarga division registered the highest growth in poultry population i.e. 45.9 per cent during Period-I (1977-83), 41.9 per cent during Period-II (1983-90), 109.7 per cent during Period-III (1990-97), 50.2 per cent during Period-IV (1997-03) and 52.4 per cent during Period-V (2003-07). The growth trends for cattle and buffaloes population showed a positive but declining trend among all the four divisions and state as a whole. Division-wise, growth in goat and sheep population showed a declining trend across the different censuses. In Gulbarga division, goat population registered a growth of -13.9 per cent during Period-II and -8.1 per cent during Period-IV, while sheep population grew at the rate of 6.2 per cent during Period-II and -6.9 per cent during Period-IV. In the case of pig population, growth has gradually decreased. However, a decline was the highest in Bangalore from 4.7 per cent during Period-III to -64 per cent during Period-V.

2.2 Growth and instability in production and productivity of livestock products

Tysdell and Gali (2000) reported that the growth rates in livestock population (except chickens and pigs) were modest; however livestock production in India has expanded at a much faster rate than livestock populations indicating significant increases in production per animal. Production of beef and veal and buffalo meat in India has increased more than threefold since 1961. The compound annual production growth rates were significant and above one for beef and veal, pig, chicken meat, buffalo meat, and lamb, but not for goat meat, because it is the most expensive meat of all meats in India and the demand for goat meat is high. From 1961 to 1979, the production growth rates are 1.16 per cent for beef and veal, 0.93 per cent for buffalo meat. For 1980-1997 period, the reported production growth rates of meat were approximately equal to 1.4 per cent for both sectors of bovine industry. Milk production in India exceeded 71 MT in 1997, representing 13 per cent of world milk productions mainly due to positive and steady rate of growth of milk production,
an increase in its milking animals and improved productivity per animal. Besides, the lactating efficiency and milk yield of cows and buffaloes was improved, however, buffalo milk yields was increasing faster than that of cows.

Birthal (2002) found that milk production of cattle and buffalo increased at the annual growth rates of 5.2 per cent and 4.4 per cent respectively during 1972 to 1997. Besides, annual growth in productivity of cattle and buffalo raised at 3.2 per cent and 1.9 per cent, respectively. The share of cattle and buffalo in total milk production was found around 61 per cent and 44 per cent to the output growth. It was worth mentioning here that productivity raised faster than production indicated milk growth become productivity-centred. It was due to increase in the population of crossbreeds with high milk yielding capacity. Average milk yield of a crossbred was around 3.5 times higher than an indigenous cow. Despite this, yield gap was noticed between obtainable and realized yield. In the eastern and north eastern states, milk yield was abysmally low even below national average. In addition, egg and poultry meat production increased at the rate of 5.6 per cent annually while total meat production grew at 4.2 per cent due to higher animals slaughtered. Yet meat productivity was low. Average egg yield of an improved layer was found more than double than an indigenous layer.

Dhas (2002) studied the milk production technology and its impact on dairying in Tamil Nadu. He concluded that both exotic and crossbred animals were high yielding and economical to maintain. Furthermore, there was almost no share of exotic and cross breeds whose yield was less than 1 kg of milk while indigenous cows were mostly found in the lower milk yield levels. The productivity of buffalo was 60 per cent higher than a cow. This difference was, however, declining due to faster growth in cattle yield. The productivity of cows and buffalo was 3.3 kg and 3.5 kg respectively in 1995-96. Milk production increased to 3791 thousand tonnes with an annual growth rate of 7.2 per cent that comprised 60 per cent cow milk and 40 per cent buffalo milk. In nutshell, differential growth pattern and shifts in the composition of milk production were noticed during the period.

Khan et al. (2002) examined the productivity of Sheep in India. There were 57 breeds of sheep and majority of Indian sheep were nondescript due to indiscriminate breeding and intermixing of breeds. They found that wool yield (0.9 kg per annum) was 60 per cent less than the world average (2.4 kg per annum). Due to low productivity, India imported about 50 million kg of wool (both apparel and carpet
types) to meet the requirements of the industry. The main causes included low productivity of sheep, poor exploitation of the genetic potential of the native stock, inadequate feed resources, nutritional deficiency, heat stress, poor health monitoring, and inadequate marketing and credit support to sheep owners. Furthermore, about 65 per cent of wool was produced from the north western region which is suitable for apparel and finer carpets while southern peninsular region produced about 20 per cent.

Singh et al. (2002) studied the technological developments in the poultry sub-sector. The production of total eggs and broiler eggs during 1950 to 2000 showed noticeable growth. The per capita availability of eggs was also raised considerably mainly due to growing population and per capita income push up higher demand for eggs and poultry meat. This higher growth was primarily governed by the application of modern technologies and growth of commercial poultry farming. Despite this, adoption is still slow in the unorganized sector. There were certain impediments such as higher cost of inputs resulting in low profitability, fluctuating market trends, several myths included that the egg from the indigenous fowl is more nutritious than that of commercial hybrids and also true for the meat. Besides, illiteracy, lack of awareness, and religious taboos were other major causes for slower adoption of poultry technologies. Increasing literacy and credit availability encouraged poultry sectors. Despite this, backyard poultry played crucial role as more than 100,000 families reared indigenous fowl ranging from 5-250 birds.

Chandel and Malhotra (2006) studied the livestock systems and their performance in poor endowment regions of India. In these contexts, they estimated the total milk production and the productivity per female bovine (cows and buffalos) per day for each livestock system. The end result showed that buffalo was the highest milk-producing livestock system not only because of the higher population but also due to the highest milk productivity. The buffalo based livestock systems (buffalo, cattle-buffalo-goat) possessed 33 per cent of the bovine population which contributed 44 per cent of the milk production with the productivity of 3.77 lit/day in buffalo and 2.60 lit/day for cattle-buffalo-goat system. While the share of all other livestock systems to the milk production was less than their share in the bovine population. The milk productivity in this livestock system was lower than the overall average i.e. 2.46 lit/day. Therefore, it summarized that most of the cattle were indigenous and less
productive which was suggested to improve by enhancing the milk productivity through recuperating the breed of bovine and its nutritional intake.

Steinfeld et al. (2006) examined the livestock production in different production systems in the developing world. They found that ruminant productivity diverged noticeably in developing countries than in developed ones. In grazing systems, worldwide beef production per head averaged at 36 kg/head/year, but productivity for developing countries was only 29 kg/head/year. Despite the vast majority of the mixed rainfed ruminant population in developing country, they accounted for less than half of production worldwide. In fact, beef productivity in these regions averaged 26 kg/head, as opposed to 46 kg/head at world level, and their milk production represented only 22 per cent of the world total. Across all systems, developing regions accounted for half of the world’s beef production, 70 per cent of mutton production and about 40 per cent of milk production. However, the pork production in developing countries showed the other way around. The developed countries and Asia together accounted for over 95 per cent of the world’s industrial pork production.

Kumar et al. (2007a) estimated the production and productivity of livestock in North-Eastern regions (NER). Total milk production in NER increased from 928 thousand tonnes in TE 1993-94 to 1088 thousand tonnes in TE 2003-04. Additionally, there was a considerable variation in growth rates of milk production across states in the NER ranging from 0.56 per cent in Assam to 10.7 per cent in Tripura. In Meghalaya, milk production connoted declining trends at an annual rate of 1.3 per cent. Such variability caused repercussion of milk availability. The per capita milk availability in NER had declined and below the recommended level of per capita milk consumption of 220 g/day. The per capita availability of eggs in NER states had gone down from 24 in TE 1993-94 to 22 in TE 2003-04. Egg production had increased at an annual growth rate of 2.1 per cent in the NER and at 5.7 per cent at an all-India level during the same period. The average productivity of crossbred cattle in milk in India was 6.5 liters per day but in NER, it was 4.7 litres per day. They found low productivity of animals in Assam which is major milk producing state compared to other NE states, except Sikkim and Tripura. The state of affairs was poorer in the case of milk productivity of local cattle and buffalo. The average productivity of local cattle and buffalo was less than half of the national average. Likewise, the
productivity of desi and improved poultry birds in terms of egg/annum/bird was quite lower in NER than at national level.

Birthal (2008) measured the growth in livestock production in India during 1982-83 to 2004-05. He worked out that milk production increased from 36 million tonnes in 1982-83 to 93 million tonnes in 2004-05 at an annual growth rate of 4.3 per cent. During this period, meat production almost doubled, from 3 to 6 million tonnes. Rapid growth occurred in poultry sector - poultry meat and egg production grew at an annual rate of 12.3 and 5.7 per cent, respectively. Poultry meat increased from 0.16 million tonnes to 1.72 million tonnes and egg production increased from 11454 million to 45201 million during 1982-83 to 2004-05. The major drivers behind such progress were improvements in genetic potential of animals (crossbred/improved species), feed and fodder supply and animal health services caused faster growth possible in dairy and poultry production.

Kamalzadeh et al. (2008) studied the livestock production system and trends in the livestock industry in Iran. They summarized that production of milk, red meat, poultry meat, and eggs increased during 2002 to 2009 by 7.19, 3.14, 7.92 and 5.37 per cent annually. Sheep and goats constituted the major basis of livestock production and produced about 53 per cent of the red meat. The average milk productivity has improved greatly i.e. about 29 kg per cow since last 25 years.

Soliman (2009) examined the present situation and future perspective of buffalo production in Africa, particularly in Egypt. The study worked out that even though there was a steady growth rate in the number of milking animals, the percentage of milking buffaloes in the total stock has decreased from about 46 per cent to 42 per cent during 1991 to 2007. The growth in buffaloes total milk production increased at a rate of 5.8 per cent annually during the same period. The average annual milk yield per head increased from 957 kilograms in 1991 to about 1394 in 2007, i.e. at an annual growth rate of about 3 per cent. So far as meat production was concerned, buffalo share in total red meat production has decreased from 47.5 per cent in 2000 to 42 per cent in 2007, even though buffalo meat supply has increased at annual growth rate of 3.9 per cent, i.e. from 167 thousand tons in 1991 to 270 thousand tons in 2007. The decline in red meat share in the national meat production is mainly due to faster growth of other meat types.

Shah and Dave (2010) investigated that milk production of local cows and buffalo was almost doubled while cross-bred cows registered almost a seven-fold
increment during 1990-91 to 2008-09. The share of buffaloes in total milk production remained constant at 66 per cent in 1990-91 and declined marginally in 2008-09. The share of cross-bred cows in milk production increased more than proportionately due to decline in the share of local cows and buffaloes. So far as region-wise performance was concerned, a proportionate share of cross-bred cows in the southern region increased from 10 to 34 per cent during this period. The similar increasing trend was noticed in another region also. Moreover, buffaloes and crossbred cows positively contributed to the growth in milk production. However, growth rate was marginally slow in the case of local cows.

Wani and Wani (2010) analyzed the average productivity of lactating and milch animals in different agro-climatic zones of Jammu & Kashmir. The results revealed that there was not a noticeable difference between the average productivity of lactating and milch buffaloes of Zones JK-1 and JK-2. However, average productivity for lactating and milch cross-bred cows in Zones JK-1 and JK-3 was higher than in zones JK-2 and JK-4. The same trend was observed for local cows of different zones. The variation in milk production was mainly governed by the adoption of modern animal husbandry practices in Zones JK-1 and JK-3. Low production of crossbred cows in JK-2 and JK-4 might probably be attributed to the late adoption of crossbred cows, scarce feed resources and inclement weather conditions of the zone. Low productivity of crossbred and local cows in Zone JK-2 might be due to the paucity of feed and fodder as livestock concentration per household was higher in the zone. The average daily milk yield per lactating and milch goat was higher in Zones JK-1 and JK-2 than JK-3 and JK-4 which might be due to favourable environment for efficient goat production.

Baba et al. (2011) studied the dynamics and sustainability of livestock sector in Jammu & Kashmir. The temporal changes in terms of livestock products revealed that the total milk production in the state had gone up from 1167 thousand tonnes in 1997 to 1485 thousand tonnes in 2005. The increase in state milk production was accompanied with its increasing per capita availability from 347 g/day in 1996 to 359 g/day in 2006, however, growth rate was found positive but non significant. Meat production had increased up to 26.61 thousand tonnes in 2006 but the growth rate of per capita availability showed a declining trend at -1.65 per cent annually and found significant. The total wool production and its per capita availability had significantly increased since 1997. Egg production in the state showed an increase of about 6264
lakh eggs from 1997 to 2005. The compound growth rate of egg production were found positive and significant \( i.e. \) 2.35 per cent annually. On the other hand, annual growth rate of total wool production was 4.49 per cent and rate of per capita availability was 2.20 per cent which were positive and significant.

Kumar \textit{et al.} (2012) carried out the study on performance livestock economy of Himachal Pradesh. The outcome enumerated that the total milk production increased from 404 thousand tonnes in 1984-85 to 1102 thousand tonnes in 2010-11 at the growth of 3.46 per cent per annum. In the case of egg production, it increased from 337 lakh to 1020 lakh at the annual rate of 3.56 per cent during this period. On the contrary, in wool production, the growth performance was not vigorous and for meat production, it was found negative and non-significant. The average cow milk yield in the state increased from 1.38 kg to 2.54 kg during the past two decades at an annual growth rate of 2.72 per cent. For buffaloes, the growth rate was observed to be negative and non-significant. Similarly, it was positive but non-significant in case of goat.

Fateh Muhammad (2013) made an attempt to examine the status of livestock production in Sindh province. The economic growth of livestock in Pakistan has been positive and encouraging during the last six years. The annual growth has increased with the faster trend from 2007-08 onwards. The annual growth in 2006-07 was 2.5 per cent which increased to 4.2 per cent in 2007-08 whereas, it was 3.5 per cent in 2008-09. The estimated growth in the year 2010 was 4.1 per cent which might have been affected by the recent floods, yet the overall country-wide economic growth of the sector was found positive and encouraging. In addition, the productivity of poultry has grown with the increase in yield as well as in production per unit of time. Poultry yield was 0.718 kilogram per bird in 1980, which has increased to 1.14 kilogram per bird in 2004 owing to specialized breeds for broilers.

Wani \textit{et al.} (2014) studied the value chains for livestock products in Himalayan Mountains from Jammu and Kashmir. They reported that milk production in Jammu and Kashmir increased from 340 thousand tonnes in 1984-85 to 1565 thousand tonnes in 2008-2009 which further boost up at around 2200 thousand tonnes in 2014-15 at a growth rate of 4.43 per cent annually. Furthermore, Crossbred cows contributed 57 per cent, followed by buffaloes (19\%), local cows (18\%) and goats (6\%) in the total milk production. Wool production increased from 41.42 lakh kg to 93.58 lakh kg during 1994 to 2014. The CAGR of wool production was found 3.98
per cent during this period. With regards to the meat production, it zoomed up from 242 lakh kg in 2004 to 320 lakh kg in 2014. The growth rate of meat production was noticed 3.24 per cent annually. Sheep and goat shared more than three-fourths in total meat and the rest was accounted for by poultry meat.

Sserunjogi and Lokesha (2014) examined the growth pattern in milk, eggs, and meat production among the four major divisions i.e. Gulbarga, Belgaum, Mysore and Bangalore in Karnataka. The outcome publicized that milk production in the state was the highest (7.1%) during the period I (1995-96 to 2000-01). However, it tremendously declined to 0.6 per cent per annum during period II (2001-02 to 2011-12). A similar trend has been observed across all the divisions, except the Mysore division which showed an improvement in milk production. Cows’ milk production exhibited a better growth than that of buffaloes across the divisions and the state as a whole. During the entire study period (1995-96 to 2011-12), cow milk registered a significant growth rate of 2.8 per cent per annum while buffalo milk production registered a growth of -0.8 per cent per annum. The Gulbarga division registered the highest growth in egg production of improved hens (13.7%) as well as in total egg production (11.78%). With regards to total meat production, it was declined sharply from 17.3 per cent to 3.0 per cent in Mysore division while at the state, it declined from 4.1 per cent per annum during the period I to 2.54 per cent in period II.

Hellin et al. (2015) made an attempt to analyze the growth of the Indian poultry industry. The results revealed that egg production increased by 5.39 per cent during 2003 to 2012. Among Asia, the growth rate in China, Pakistan, and Philippines was 2.37, 5.63 and 4.06 per cent, respectively during the same period. In Asia, India had the second rank after China whose production was boosted up, however, annual average eggs production was higher in China i.e. 28.24 million MT. Moreover, India ranked second next only to China in Asia in poultry meat production but ranked third in annual growth rate which was 6.80 per cent during 2003-12 after Nepal (11.67%) and Pakistan (9.30%). Average per capita supply increased in India to around 2.37 kg/ year while in china it increased at the rate of 18.47 per cent during 2009 to 2011. Surprisingly enough that this higher growth of Indian poultry sector was mainly by the virtue of maize production which is widely used as a feed component in the poultry industry. Maize is the chief poultry feed component contributing around 60-65 per cent. Poultry sector in India had grown by 141.7 per cent while at the same time maize grain production increased by 93.4 per cent during
The transformation of backyard poultry is stimulated mainly due to economic growth and consumption causing poultry sector in India into a vibrant agribusiness.

Sejian et al. (2016) made an attempt to study the impact of climate change in livestock productivity. They found that climate change caused reduction in the milk yield as well as quality, declined in fat content and chain fatty acids, solid-non-fat (SNF), and lactose contents and increased palmitic and stearic acid contents were certain implications. It reduces the body weight, average daily gain, changes body condition and declined overall animal performance under heat stress. Moreover, the incidence of diseases became more prone in warmer and wetter environment. Therefore appropriate technology and research and development efforts for the breeding program are crucial to minimizing the ill effect of climate change.

2.3 Composition changes and export dynamics of different agricultural product from India

Birthal and Rao (2002a) concluded that India’s contribution in the world trade of livestock products was very low. The share of livestock export in total export and agricultural export had increased by 1.1 per cent and 6.2 per cent during triennium ending 1980-82 to 1996-98. In value term, livestock product exports were raised to Rs 13500 million per annum. Among livestock export, meat and its products are the chief livestock products shared 90 per cent of the total export earnings from the livestock subsector. Owing to liberalization, export performance of livestock products has improved. Since the last couple of years, livestock imports such as milk, hides, and skins have declined abruptly. The share of livestock import in total import and agricultural import declined up to 0.1 per cent and 1.5 per cent during this period. Around 95 per cent of livestock imports in the total value of livestock imports were because of hides and skins. It is worth mentioning here that all the demand of milk is fulfilled by domestic production. On the contrary, the livestock sector is criticized due to negative externalities such as overgrazing and greenhouse gas emissions, yet it is crucial to provide benefit to millions of farmers.

Dhas (2002) studied the breed composition of milch animals in Tamil Nadu. The outcome of the study revealed that high-yielding breeds accounted 21 per cent followed by native-pure breed (14 per cent) and indigenous breeds (65 per cent) of the cattle population. On the contrary, high-yielding buffalo contributed around
18 per cent and 82 per cent which concluded that the distribution of both high yielding cattle and buffalo was found low. In the composition of total cattle population, the share of crossbreeds was marginally changed while no change was found in the composition of the buffalo population. In absolute term, reduction was noticed in the exotic, native-pure, and indigenous, buffalo while crossbred cattle population increased. Furthermore, crossbred cattle were largely adopted comparing to graded buffalo. This was mainly because of more focus on cross breed cattle for milk production and less attention paid to buffalo. Moreover, advanced breeding and feeding technologies had changed in the composition of milch animals by milk yield levels, lactation, and productivity levels.

Mahadevaiah et al. (2005) analyzed the stability analysis of raw cotton export markets using Markov chain for the period 1981-82 to 1998-99. It was palpable that China emerged the only stable importer of Indian cotton, as reflected by the high probability of retention that increased from 0.0832 to 0.3155 which inferred that the share of import by China increased from 8.32 per cent during the pre-reforms period to 31.55 per cent during the post-reforms period. Japan and Korea had depicted low probability retention of 0.0979 and 0.2026, respectively during the pre-reforms period which reduced to almost zero during the post-liberalization period, indicating that they were the unstable importers of Indian cotton. The transition probabilities for Bangladesh, Germany, Indonesia and UK were found as zero in both the periods, indicating instability in India’s exports to these countries. In addition, China, gained from UK and Bangladesh with a high probability of 0.9279 and 0.8864, respectively. Japan had zero probability of retention of its own share of imports of Indian cotton but is likely to gain 65 per cent from Korea, 25 per cent from other countries and 9 per cent from China.

Birthal et al. (2006) reported that there had been sharp increase in export demand particularly for high-value agricultural commodities. This export demand is more in developing countries than in developed countries. The livestock products such as dairy, eggs, meat and its product grown at a faster rate than fishery product in India compared to China, Bangladesh, Pakistan, Vietnam and Indonesia during 1990-2000. The growth rates were around 33 and 15 per cent per year for dairy, and eggs & meat products, respectively. This showed the India’s relative export performance to other countries for dairy and eggs products.
Kumar et al. (2007b) observed that after 1985, livestock exports exceeded imports sizeably. The share of livestock exports in the agricultural exports increased from 3.22 per cent in TE 1982 to 7.44 per cent in TE 2006, which was more than double. The share of livestock exports in livestock GDP had increased up to 2.39 per cent in 2006. Since 1988, bovine meat emerged as an important component of the livestock export which had registered the highest annual growth of about 27 per cent, followed by eggs (21.37 per cent), swine meat (23.04 per cent), dairy products (15.33 per cent) and poultry meat (13.91 per cent) during 1980-2006. This was mainly because of WTO policy, reforms in the EXIM policies, removal of quantitative restrictions on exports and attention by the government to the livestock sector. Export varied from country to country over the period, like UAE imported 50 per cent of bovine meat from India in TE 1982, but later Malaysia emerged as its top importer of bovine meat, followed by the Philippines. Besides, the disturbing issue for Indian livestock export destinations was that India has not been able to make a dent in export to the developed countries, where it can realize higher per unit value. Its exports mainly concentrated to the neighboring South Asian, East Asian, and Middle East countries.

Rajarajan et al. (2007) studied the trade direction of dairy products during pre and post liberalization period. They reported that SAARC (37%), OPEC (35%) and East European countries (8.76%) were major destinations for dairy products during pre-liberalization while export shifted to OECD including European Union (EU), North America and Asia-Oceania after post-liberalisation era. By the virtue of quality improvement and competitiveness, India is now able to export to developed countries. There had been also a shift in import trade direction. In the pre-liberalisation period, OECD countries were the major sources of import contributing to 54 per cent of the total dairy imports, however, it has declined during post liberalization. Furthermore, imports were highly scattered and over the period country had been importing from smaller countries on the contrast, exports were concentrated to major trade block which contributed 90 per cent in post-liberalisation period.

Kumar (2009) found that India is a fifth largest exporter of bovine meat in the world. None of the livestock products from India contributes even 1 per cent to the world export except bovine meat and eggs. This confirms that Indian livestock export is still meagre in world livestock trades. There were greater decline shown in the case of import of dairy products in India. Its share declined from 11 per
cent to 0.4 per cent TE 1982 to TE 2007 in world livestock trade. Therefore, there are greater possibilities to increase India’s share in the world livestock trade. So far as the composition of livestock export was concerned, in monetary terms, livestock exports increased US $ 81 million to US $ 828 million from TE 1982 to in TE 2007. Bovine meat alone contributed 70.5 per cent of the total foreign exchange earnings from the livestock sector. Beef export which is ban on cattle is slaughtering except two states principally because of socio-cultural and religious factors. The contribution of dairy products, eggs and other edible animal products (swine meat, sheep meat, and poultry meat) in total livestock export earning was 0.13, 2.2 and 0.14 per cent, respectively in TE 2007. Among dairy products, skimmed milk powder was the largest component of dairy exports. Moreover, eggs export shown increasing trend after 1988 due to commercialization and later on complete removal of the excise duty had seen positive impact on production and exports. Under the liberalized regime, yet it is a larger concern to the allocation of land for meat processing plants.

Singh (2010) studied the projection of potato export from India during 1997-2007 to 2005-06 and found that Nepal and Sri Lanka were most reliable and stable importers of potatoes, encompassing more than 50 per cent of the probability of retaining import shares from India. Sri Lanka was a most stable destination for India’s potato exports as reflected by the high probability of retention of 0.84 which means the probability that Sri Lanka retains its share from one period to another period was 84 per cent. Sri Lanka lost its 9 per cent share to UAE, 1 per cent share to Singapore and 6 per cent share to other countries. However, it gains 18 per cent share of Nepal, 78 per cent of UAE, 45 per cent of Malaysia and 22 per cent share of other countries.

Angles et al. (2011) made an attempt to test out the direction of trade of turmeric export from India during the period from 1974-75 to 2007-08. The results on transitional probability matrix found that USA was not a stable importer of Indian turmeric despite the quantity imported by the USA was higher. The USA would lose its share of 42.28 per cent to the UAE, 25.88 per cent share to Japan and 24.87 per cent share in other countries. On the other hand, USA gained considerable share from Japan (83.89 %). The UK and Iran were found to be one of the stable importers because it retained its original share of around 35.20 per cent and 41.88 per cent over the period. It lost its major share of 32.77 per cent to Iran and 25.60 per cent to UAE. Moreover, they predicted the export up to 2020 and the results showed that projected market share will likely to be declined to less extent from 2007-08 to 2020-21.
Ramachandra (2012) employed the Markov chain for changes in the composition of livestock population in Karnatak and analysis revealed that buffaloes in milk (65%) and indigenous milch cows (75%) were having the highest stability in the state, during the period 1995 to 2011. Crossbred cows in milk, indigenous cows in milk and crossbred milch cows retained nearly 19, 48 and 46 per cent of their previous period's population in that order. The crossbred cows in milk lost nearly 67 per cent of its population to crossbred milch cows and 13 per cent to buffaloes in milk, respectively. A shift in the population from indigenous cows in milk to indigenous milch cows to the tune of 40 per cent and from crossbred milch cows to crossbred cows in milk to an extent of 52 per cent was observed.

Kususma and Basavaraj (2014) employed the Markov chain approach to export stability and trade direction during 2000-01 to 2010-11. The results of Transitional Probability Matrix (TPM) pointed out that that Saudi Arabia was found to be most stable market which had 100 per cent retention probability. On the contrast, Bangladesh and Nepal were two most unstable markets with the zero per cent retention. Moreover, U.A.E and UK retained 71 per cent and 51.62 per cent of its share. Additionally, they had projected the export up to 2013-14. The projected share of U.A.E, Bangladesh and Nepal would increase up to 50.8 per cent, 8.6 per cent and 8.1 per cent for 2013-14.

Rampaul (2014) studied the direction of trade of Indian dairy industry using Markov Chain approach during the period from 1999 to 2010. The result revealed that USA, Egypt, Nepal, Saudi Arabia, Morocco, and Yemen had gained during the period while Bangladesh and Philippines showed a declining share. The diagonal of the transitional probability matrix (TPM) measured the retention percentage of an importing country which is the proportion of its market share from last year that is retained in this year. Based on TPM, it was found that during the period 1999–2010, Bangladesh averaged a retention percentage of 62, while other countries average were 47. Moreover, UAE lost 44 per cent of its market share to the USA, and 55.9 percent to the rest of the other countries combined which indicated that Indian export shifted from UAE to the USA. The Philippines lost its entire previous share to Bangladesh, while USA and Yemen lost 100 per cent of their share to the rest of the other countries. So, it signified that majority of importers was not enable to retain their previous shares. Bangladesh emerged as one of the stable
importers of Indian dairy products as reflected in the high probability of retention at 0.616.

Pandian et al. (2015) examined the trade direction of swine meat in India during 2006-07 to 2012-13. They anticipated that the growth of export of meat and meat products were very higher compared to other livestock products. The results of transition probability matrix pointed out that India could not preserve its previous export of Swine meat to Thailand, France, Vietnam and Bhutan during the study period. Nearly 93 per cent of the Thailand's share of Swine meat imports from India was lost to Vietnam Soc Rep and the remaining 8 per cent was lost to Bhutan. In the case of export, India could not retain its previous export of Swine meat to Netherland, Belgium and Italy during the study period. India's previous Swine meat import from the other countries was retained to the level of only 15 per cent during the current period. However, other countries have a higher probability to gain 100 per cent of the market share of Italy alone.

Staal (2015) studied the export of Indian livestock since 1995 and he found that though India is the world largest milk producer, trade in dairy products remains relatively small, although recent years have seen strong growth in demand for dairy products, estimated by some at 6-8 per cent annually. Increases in the quota for duty-free milk powder imports have resulted in higher powder imports. Bovine meat production also increased. The export of buffalo meat increased recently owing to low local demand, this made the country the world’s largest bovine meat exporter since 2012.

Gunabhagya et al. (2016) measured trade direction of Indian fish products from the period 1990-91 to 2013-14 using Markov chain analysis. It was concluded that South East Asia has been the most stable market among the major importers of Indian fish products as reflected by the higher probability of retention of 0.85 i.e., the probability of which South East Asia had retained its import share is 85 per cent over the study period. Thus, South East Asia was the most reliable and loyal importer. The USA and the European Union have shown probability retention of 0.75 and 0.75 respectively, which retained its import share of 75 per cent each. Japan had shown the least retention probability of 0.36 which has only retained 36 per cent of its share in import. On another hand, Japan has lost 55 per cent of its share to China, whereas it has gained as less as 16 per cent share from the same country. The USA has lost 24 per cent share to the European Union and has gained 11 per cent share
from China. South East Asia has retained its share of 85 per cent and has also gained 44 per cent from other countries.

2.4 Competitiveness and export determinants of agricultural commodities

Mattson *et al.* (2001) conducted the study to examine the effects of different factors on the flow of Canadian livestock and meat exports to the United States. The results suggested that CUSTA agreement has positively influenced the flow of beef and live cattle from Canada to the United States. The value of coefficient was 1.03 per cent in live cattle imports and 0.34 per cent was attributed to CUSTA. The coefficient on the dummy variable in the live hog was found to be 0.095 per cent, indicated that hog imports from Canada had positively influenced 0.095 per cent annually. The variable such as real exchange rate showed positive influence on Canadian exports to the United States. Because it is quite common to say that Canada increases exports to the United States as the U.S. dollar appreciates relative to the Canadian dollar. The results of various coefficients disclosed that if real exchange rate increases by 1 per cent than Canadian beef exports to the United States increase by 3.7 per cent, cattle exports increase by 1.0 per cent, and hog exports increase by 0.6 per cent. The coefficient was found negative and non-significant in the pork. The price difference between two countries had significant influence on live cattle and pork exports from Canada to the United States. When the U.S. price advantage increases by 1 per cent, Canadian live cattle and pork exports to the United States increase 0.17 per cent and 0.24 per cent. However, the price difference was not found to have a significant effect on beef or live hog imports from Canada.

Sharma and Gulati (2003) studied trade liberalization, market reforms and competitiveness of Indian dairy sector. They estimated Nominal Protection Coefficient (NPC) and Effective Protection Coefficient (EPC) for SMP, butter, Ghee/butter oil and recombined milk over the period 1975-2000. The level of NPCs estimated at shadow exchange rate for all the four dairy products, namely SMP, butter, butter oil and recombined milk are well above unity. Based on world dairy prices, NPC would increase up to 15 per cent which showed that India is competitive in SMP but uncompetitive in the case of butter, butter oil/ghee, and recombined milk. The NPCs of SMP have declined at a much faster rate in the recent years compared to butter and butter oil and the reason for this differential pattern is high export subsidies on fat based products by the EU and the USA due to less demand for these products in
the developed countries. The estimates of EPCs conform to the same pattern as NPCs. The price competitiveness of dairy sector mainly relies on the exchange rate, world price and domestic price.

Singh (2004) studied the determinants influencing the livestock export. He cited that determinants such as population growth, per capita income, rapid urbanization, increased per capita consumption of livestock products in rural and urban areas, reduction in transportation cost and exchange rate were the major determinants influenced the export of various livestock products. The international prices of several livestock products declined globally after the WTO period. However, in India domestic prices measured in WPI of meat, fish and egg were substantially higher than the world market prices during 1994-95 to 2002-03. This concluded that Indian product had a lesser competitive advantage in the world market. In addition, Developed countries provide massive subsidies for dairy products but due to budget constraints, such huge subsidies are not possible in India. Indian livestock export can be increased if the production and trade related distortions are eliminated.

Edwards and Alves (2005) examined the South Africa’s export performance in the context of demand and supply relationship. They pointed out that export demand is positively affected by foreign income and the price of competing foreign goods, but is negatively affected by the foreign price of domestic exports. The quantity of exports supplied was found as a positive function of its own price and a negative function of the domestic price index and variable costs. As export sales become profitable relative to domestic sales, firms shift production towards the export market. Infrastructure cost was found to have negative effect on export supply. Foreign prices, domestic prices and the exchange rate had a positive and significant impact on export as a 1 per cent increase in the relative price of exports is estimated to raise average manufacturing export volumes by 1.8 per cent to 2.5 per cent in the long-run. Domestic price inflation causes a real appreciation of the currency and hence a decline in export performance.

Bardhan (2007) studied the trade performance in livestock and livestock products in India. He measured the export performance ratios (EPR) for various livestock products during the 1980-81 to 2002-04. The results revealed that India enjoyed comparative advantage particularly in meat and meat preparations and eggs. Although, EPR had shown declining trend whereas in eggs, it was increasing. On the contrary, country lost comparative advantage in live animals after 1986-88.
Besides, EPR for the exports of hides and skin, animal fats, hairs and wool and offals found lower indicating a lack of comparative advantage and hence trade competitiveness. The certain determinants influencing the India’s export of livestock products showed that the coefficients of international prices were negative for chicken meat implying that due to lack of price-competitiveness, India does not reap the benefits of an increase in world prices of chicken meat. There was a positive relationship between India’s export and world prices for skimmed milk export but value did not found significant. On the other hand, there was a negative relationship between the producer’s prices and the exports of all livestock products which indicated that increase in the domestic price of livestock products would reduce their exports. So, there is a need to remove the trade related distortions under WTO regime.

Kumar et al. (2007b) pointed out that India has the competitive advantage in the production of different livestock products except for poultry meat. Producer prices of buffalo meat in India were lower than the international prices during 1982 to 2006. India had the price advantage in bovine meat, mutton, pork, and eggs; and in bovine meat production it was highly competitive. Although in milk, the producer’s price of milk gives some control to India, the cost of milk processing erodes its advantage, as dairy products are exported mainly in the processed form.

Rajarajan et al. (2007) studied the dairy products competitiveness during 1982-2001 by NPC and Revealed Comparative Advantage (RCA). They found that NPC was more than unity for butter and condensed milk and concluded that India was not competitive in butter and condensed milk because of higher export prices in India or low export prices in rest of world owing to subsidies. Even after reduction in export subsidies the export prices were not increased up to expectation in developed countries. Moreover, NPC value for Skimmed milk powder (SMP), whole milk powder (WMP) and ghee was lower than unity in post-liberalisation era which becomes competitive on the contrary to pre-liberalisation. The reasons were high export subsidies in developed countries, domestic protection and export restriction further distorted the global export prices which distorted the world export prices in the pre-liberalised era. RCA for ghee was found to be much higher as 857 to 2944.70 during this period whereas rest of livestock product had a value less than 100. This firmly confirmed that India can capture the whole market as it has higher comparative advantage.
Nivievs'kyi and Von (2008) studied the major determinants of dairy farming competitiveness. They employed unbalanced panel data for 2004 and 2005. The results of Hausman test were significant at 1 per cent which rejected the hypothesis of orthogonality of the random effects at the 1 per cent significance level. Therefore, the fixed-effect model was considered. The variable such as farm size, labor productivity and intensity had a positive effect on competitiveness, on the contrary, arable land per head and total subsidies received by farms had a negative effect. The distribution of Domestic Resource Cost (DRC) revealed that 20 per cent of dairy farms produced milk competitively in 2005 and DRC was found 0.49 while 22 per cent dairy farm were not competitive whose DRC value was 2.49. The value of DRC is greater than zero and less than one indicates comparative advantage while if value of Social Costs Benefit ratio analysis (SCB) is less than (greater than) one indicates that total input costs are less than (greater than) revenue and that production is (is not) competitive. The distribution of SCB was consistent with DRC distributions.

Kumar (2009) had analyzed the nominal protection coefficients (NPCs) for different livestock commodities and concluded that the Indian dairy industry has been protected from the distorted world prices. The value of NPC was found to be 1.02, 1.15, 1.17, 0.45, 2.36 and 0.76 for SMP, WMP, butter, bovine meat, poultry meat and pig meat respectively, during TE 2007. The results pointed out that butter prices were more protected than SMP and WMP meanwhile international prices of butter were heavily subsidized. Competitiveness for pig meat export had declined sharply as NPC reduced from 0.30 to 0.76 during TE 1993 to TE 2007. Besides, India does not have large competitiveness in mutton, even expanding domestic demand further restrict its export.

Srinivasan and Archana (2009) employed the gravity model in order to study the determinants influencing the Indian export. The result of Hausman test statistics rejects fixed effects model against random effects model. The coefficient of distance was found negative interpretation that greater distance reduces bilateral trade. The positive coefficient for GDP and population indicated that larger GDP and population of the trading countries higher have scope to boost the trade. The language between trading partners was also found positive and significant. The coefficient of the exchange rate was found positive but non significant for India’s export showed that increases in the exchange rate (i.e. a depreciation of the rupee) increases India’s export. On the contrast, the coefficient for import tariff imposed by other countries found negative which connoted that an increase by one per cent in import tariff caused a decline in India’s export by more than 10 percent both in fixed and random effect.
The dummy variable for Preferential trading agreements (PTA) such as Association of Southeast Asian Nations (ASEAN), Southern African Custom Union (SACU) and MERCOSUR had positive and significant influence on Indian export while the coefficient for trade agreement such as South Asian Free Trade Area (SAFTA), Bangkok Agreement and Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) had negative influence on Indian export.

Teweldemedhin and Mbai (2009) studied the determinants by gravity model for red meat trade to the Asian and African markets. The result of pooled regression was biased and therefore the fixed effect model was estimated. The variable such as trade agreements significantly influenced the Namibia’s export. Moreover, per capita GDP of importing countries and population was found positive and significant for fresh and frozen beef export, sheep and goat meat while the distance was found to have negative and significant influence on export performance. They further concluded that higher income per capita was a major gauge of larger export supply. The European Union (EU) dummy variable appeared negative and significant in all meat products and regions. The exchange rate was observed negative in most cases which connoted that appreciation in the importing country’s currency promotes exports from that country.

Hatab et al. (2010) studied the determinants of Egyptian agricultural exports using gravity model for the period 1994 to 2008. The findings revealed that a one per cent increase in GDP leads to 5.42 per cent increase in agricultural export flows. The coefficient of importer’s GDP per capita was negative which indicated that an increase in the GDP per capita of the importing country causes agricultural export to decrease, but the coefficient was not statistically significant. In contrast, the increase in GDP per capita causes exports to decrease and coefficient of this variable shows strong negative and significant sign and this is not in line with the theory. It may be due to the fact that an increase in economic growth, besides the increasing population, raises the demand per capita for all normal goods that’s why domestic growth caused a reduction in exports. The exchange volatility has a significant positive coefficient, indicating that depreciation in domestic currency against the currencies of its partners stimulates agricultural exports. Transportation costs and distance were observed negative influence on agricultural exports.

Kumar (2010) examined the determinants of export performance of livestock products. The result of gravity model revealed that domestic production had
a significant positive influence on exports of dairy products and meat products, while its effect on exports of eggs was not significant. The GDP of the importing countries had a significant and positive influence on the overall exports of livestock products from India which implies that India tends to export more livestock products with larger economies. The coefficient of GDP of the destination countries showed that India’s export will increase by 0.21 per cent as a result of one per cent increase in the GDP of the destination countries. In the same way, for dairy products and eggs, India has the propensity to increase export of dairy products and eggs by 0.32 per cent and 0.28 per cent, respectively with one per cent increase in the GDP of the destination countries. However, its effect on exports of meat products was negative, implying the importing countries tend to import fewer meat products with the increase in the size of the economy. The coefficient of GDP per capita of the destination countries had positive and significant for overall India’s livestock exports, including meat and eggs exports. One per cent increase in the GDP per capita in the destination countries, India tends to enhance livestock exports by 0.22 per cent, while its exports of meat and eggs would be increased by 0.35 per cent and 0.17 per cent, respectively. However, per capita GDP of the destination country was negatively influence on the export of dairy products from India representing that India may be prone to export livestock products with its adjacent countries.

Kumar et al. (2012b) had undertaken a study on the export of buffalo meat from India by assessing the export competitiveness and determinants of export growth of buffalo meat. They found that India has the competitive advantage in the production of buffalo meat. Producer prices of buffalo meat are lower in India than in the leading international exporting countries. The value of NPCs was 0.28 during TE 1992–93 which increased to 0.39 during TE 1995–96 and further to 0.53 during TE 1998–99. It increased to 0.53 during TE 2010–11. The results of NPC confirm the long-term sustainability of buffalo meat export from India, even during the period of global recession because of its sound cost competitiveness. The domestic production of buffalo meat, GDP of the destination countries, GDP per capita of the importing and exporting countries, distance between origin and destination countries, and the trade policy index of the destination countries have been identified as important determinants of export of buffalo meat from India. The coefficient of GDP per capita was found positive and significant which indicated that one per cent increase in the GDP per capita of the destination country, India could enhance buffalo meat export by
0.35 per cent. The variable distance was negatively significant depicted that one per cent increase in distance between India and the importing country, India’s export of buffalo meat would decrease by 0.90 per cent.

Eichengreen and Gupta (2012) studied the export from India through gravity model. They observed that fixed effect model was preferred based on the result of Hausman test. The variable such as per capita income, GDP, population and foreign direct investment (FDI) inflows were positive and significantly associated with exports. However, the distance variable negatively influenced the export.

Tho (2013) analyzed the determinants of Vietnam’s exports to its forty major exporting markets from 1995 to 2011. The result outlined that exports increased as its GDP and importing countries’ GDP increased. In other words, holding all other independent variables constant, one per cent increase in Vietnam’s GDP causes 1.72 increases in Vietnam’s exports. On the contrary, transportation costs, geographic distance, were found to have a negative impact on exports. FDI was found to have a significantly negative relationship with exports. While importing countries’ GDP per capita and the Free Trade Agreements dummy variable were found to have statistically non-significant influence on exports.

Elshehawy et al. (2014) made an attempt to study the export determinants using gravity model. The results concluded that fixed and random effect were more efficient than pooled regression. In addition, Hausman test suggested that fixed effect was found efficient than a random effect. The value of $R^2$ was found to be 84 per cent in the case of fixed effects model. The variables such as Egypt’s GDP, importer’s GDP, and importer’s population were major determinants increasing the Egyptian exports. The value of coefficient of Egypt’s GDP, importer’s GDP and importer’s population were 4.01, 0.84 and 0.53 per cent, respectively which means keeping other variables constant, 1 per cent point increase in Egypt’s GDP, importer’s GDP and importer’s population will raise 4.01, 0.84 and 0.53 per cent Egypt’s total exports, respectively. The distance variable was found to be negative. On the contrary, Regional trading agreements (RTA) variable was positive and significantly affects Egypt’s exports if importer country had RTA with Egypt.

Mengistu (2014) employed the gravity model and examined the Ethiopia’s export performance with trading partners. The result of Hausman specification test suggested the random effect model preferred over fixed effect. Coefficients of per capita GDVs of importer and exporter countries, population size of
trading partners were found significant and positive. On the contrary, as expected distance had negative sign and was found statistically significant. In case of coefficients of population of Ethiopia and exchange rate between nations were negative and significant. This concluded that per capita GDP and population of importing countries directly increased in the export. The variables such as GDP of Ethiopia and importing were dropped due to collinearity problem.

Tesar (2014) studied the determinants of agricultural export for Sub-Saharan Africa. The results of panel linear regression showed that GDP of exporting, per capita GDP of importing partners and value of agricultural inputs were found positive and statistically significant coefficients. If 1 per cent increase in exporting country’s GDP will be induce 1.3 per cent increase in total agricultural export. Similarly, 1 per cent increase in the per capita GDP of importing country will increase export by 2.8 per cent. FDI inflow as percentage of GDP is positive but statistically insignificant. Coefficient of real effective exchange rate was found negative as expected may be due to that depreciating real effective exchange rate does not enhance the competitiveness of the agricultural export. The result of Hausman test rejected the random effect model and therefore fixed effect model was preferred.

Karamuriro and Karukuza (2015) studied the determinants of Uganda’s export performance. They found that nation GDP, importer’s GDP, importer’s GDP per capita, per capita GDP difference between Uganda and its trading partners, real exchange rate, official common language and contiguity had a positive and statistically significant effect on nation’s exports. Moreover, the formation of a common market for Eastern and Southern Africa and member of East African community had a significant positive effect on Uganda’s exports. On the other hand, Uganda’s GDP per capita and the distance between Uganda and its trading partners had a negative effect on Uganda’s export flows which plays a crucial role for appropriate trade policy in order to sustain the export potential that further accelerated economic growth.

Ebaidalla and Awad (2015) examined the performance of Sudanese agricultural exports among thirty-one countries over the period from 1995 to 2011. The experiential results made known that importer’s GDP and population size exert a positive and significant impact on agricultural exports. Both domestic and trading partner’s infrastructure plays a positive and significant role in enhancing exports performance. The impact of geographical distance was found to be negative and
significant on exports as expected. Moreover, Arabic-speaking countries and COMESA members have strong tendency to receive agricultural exports from Sudan. The coefficient of the bilateral real exchange rate was positive as expected but it was not significant which indicated that devaluation of Sudanese Pound encourages the agricultural exports, however, the insignificant sign may imply the failure of continuous devaluation policy. Moreover, being a member state of European Union (EU) integration has a positive and significant effect on Sudanese agricultural export that attributed to the large market of Sudanese exports in European countries.

Elsedig et al. (2015) assessed the competitiveness and comparative advantage of broiler production using policy analysis matrix (PAM) and they recapitulated that NPC of input and output for domestic broiler prices in all three i.e. small, medium and large scales were more than one. The EPC values showed that there was significant difference in the degree of policy transfer for different scale of broiler production; 0.98, 1.17 and 1.85 for large, medium and small, respectively. These results indicated that the net impact of government policy influenced broiler industry in terms of output price policy and tradable input price policy. The Domestic Resource Cost (DRC) of large, medium and small scales of broiler production were 0.27, 0.63 and 0.96 respectively. Both DRC and SCB (Social Cost Benefit) indicated that large-scale broiler production had the highest comparative advantage compared to other two scales of broiler production.

Hellin et al. (2015) examined the poultry sector revolution in India, its implications for its sustenance and the global poultry trade. India currently accounts for less than 0.4 per cent of the global trade in poultry. Poultry meat from India already has a growing market in the Middle East. India’s export of poultry products has increased from about 517,000 tonnes in 2010-11 to 578,000 tonnes in 2012-13. This has created competition for traditional exporters such as the United States and Brazil. Looking to the India’s poultry sector and its price competitiveness due to low-priced and high quality feeds, there is a need to play an active role in the global poultry trade especially with respect to exports to the Middle East. They concluded that even though there is a higher growing demand for poultry, imports has not been increased because of low-income. Higher poultry consumption is met by domestic production. Another reason for low poultry import by India is only 2-3 per cent of total poultry meat in India is sold as processed meat indicating consumers’ preference for live chicken and also inadequate processing and storage infrastructure, such as
refrigerated transport. This scenario for the live-bird market is most likely to continue to dominate in India at least for next few years.

To encapsulate the above literature and preceding research finding considering the research objectives signified that over the period, growth in the livestock population has been altered and the growth pattern in livestock population mainly focus on nationwide and few for a different divisions of the respective state. In addition, it is apparently confirmed that studies on livestock production and productivity mainly examined the regional disparities across different states of India and also among different countries. However, no systematic studies at district level are available for Gujarat state which can serve as a guideline and create a base in the understanding of overall improvement in livestock population, production and productivity over the period. Therefore, present study fills this information gap.

Literature of composition of livestock export has suggested that there has been larger shifting of export in various commodities to different countries under WTO regime particularly buffalo meat has increased noticeably. The present study therefore aims to study the export of different livestock product including meat and its products, dairy products and poultry products and further extends the study of changes in the composition of the livestock population to the district level. The foregoing review of literature connoted that application of gravity model is widely applied in international trade for measuring the export determinants. It is evidently concluded that supply of export is influenced by several determinants which mainly vary for different commodities. The certain determinants such as GDP, per capita income, distance, population, exchange rate etc. influenced the export performance. Moreover, certain additional variables are included in present studies such as the population of importing and exporting countries, trade openness and a certain dummy variable for capturing the influence on different livestock products over the period. Besides, India had observed competitive advantage on certain livestock products.