Chapter I

INTRODUCTION

India, with 288.03\(^1\) million bovine stock, has more than 20 percent of the world’s total bovine population. In fact, it has as many cattle and buffaloes as Europe and USSR jointly have. Livestock, thus, play a vital role in Indian economy. Next to agriculture, animal husbandry is the most important economic activity in the rural areas. But what is not very well known is the complementary nature of the bovine stock in general and cattle stock in particular in the context of agricultural technology available in the country. The 192 million or nearly 20 percent of the world’s cattle population is almost, uniformly distributed along side the human population all over India. About 50 percent of the Buffalo stock of the world is very skewdly distributed in different regions of the country. The whole cattle stock is constituted of 29 identifiable breeds though highly intermixed are predominantly Zebu cattle\(^2\). This variety is related to the draught requirement of the agricultural sector. Of the buffalo population, 10 breeds are identified and their quality is related to the milk yielding capacity.

Though India accommodates nearly 20 percent of the total bovine stock of the world, its total grassland is limited to less than 0.5 percent of the world and the bovine stock heavily depends on crop residue. Among the

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1 As per Indian Livestock Census, 1992.

2 Zebu Cattle: Humped indigenous cattle of Asia ad East Africa of several breeds good for draught uses.
crops, cereals yield the least amount of total digestible nutrients (TDN) and still lower amount of digestible crude protein (DCP) which directly affect the quality of bovine stock. With the above fact remaining more or less stable it is not surprising that the quality of Indian bovine stock is very poor when compared to other countries particularly Americas, Europe and Oceana. But even then the role of bovine economy in the primary sector stands out in many ways. It has been complementary in draught power use and very essential supplementary uses in the form of providing animal protein, manure, raw materials for industries and also the most important source of energy for rural sector.

It will not be appropriate to compare the importance of animal husbandry and more so of the productivity of bovine stock with crops merely on the basis of the latter’s superiority in terms of quantum availability of the food-grains. The quality of food, in no case, could be compared with the quality for which we have to primarily depend on animal husbandry and dairying to provide the essential amino-acids which otherwise could not be obtained from cereals and pulses consumed. According to the current estimates, the per capita availability of protein-food lags far behind as compared to cereals. Since the availability of pulses is staggering low and the cultivation is relatively less profitable the case for animal husbandry and dairying to convert the surplus cereals to much needed animal protein makes more sense. Besides, the draught power requirements stand undiminished in view of limited mechanisation, low energy availability and a surplus labour economy. The third and a very important product of the bovine stock is the
manure and raw materials of the fallen and slaughtered ones which have ever increasing value for agriculture and industries respectively. But unfortunately due importance for a holistic development of the sector has not been given as far as research and planning are concerned. Unlike mechanised agricultural sector, animal husbandry is positively labour intensive and more useful for landless and small farmers in the rural areas. The present study is intended to go a long way in highlighting the above phenomena which will help to understand bovine economy and its capacity of employment generation in rural sector.)

REVIEW OF LITERATURE

An agricultural society is characterised by a complex relationship between land, human beings and animals. Increasing demand for food for the growing human population has generated a competition for land between human being and animals. Efforts have been made to work out the optimum or desirable number of bovine population to produce maximum balanced nutrition for human population from crop and animal origin. In recent years, scholars have also examined the problems and prospects of developing dairying as an instrument of economic change in rural areas. Attempts have also been made to study the composition of bovine population in terms of type, sex and utility. There have also been studies on the production and cost functions relating to milk production from bovines.

Though three aspects of the economy stand out in terms of number of
animals required as draught power in agriculture, the requirement of milk and the quantum and quality of raw materials salvaged from fallen and slaughtered cattle, most studies tend to explain the dairying in terms of operation flood. However, at least a few critical studies in the operation flood aroused a lot of interest to go further into the topics of number, quality and need of the bovine stock in a holistic way, the following studies have been reviewed in the context of the current research.

Studies on Surplus Cattle

A number of economists have attempted to show that India has surplus cattle, albeit most of them have failed to provide any estimation of such surplus. Even, where ever some estimation of surplus cattle has been presented, they appear to be vague and unscientific.

More than 50 years back, the Royal Commission on Agriculture (RCA) devoted a whole chapter of its report to a wide ranging discussion of animal husbandry in India covering such questions as: whether or not had India an excessively large cattle population; the extent to which the requirements of draught power conditioned the number and type of bovines held by farmers; the relative role of cows and buffaloes as milch animals etc. Much later while evaluating the agricultural policy in South Asia Gunnar Myrdal (1968) pointed out that one of the cheapest and most promising way

to increase the area available for effective cultivation would be to reduce the number of farm animals. Uncontrolled pasturing is one of the factors responsible for the low quality and efficiency of domesticated animals. He has supported the view that, "the same number of animals could be much better nourished on tilled fodder crop commanding only a fraction of the acreage now under pasture".

K.N. Raj (1969)⁴ has analysed the expected share of female animals in the total stock of bovines and concluded that, "it might be difficult to achieve a significant reduction of bovine population in the country without major technological and institutional changes in agriculture.

Whyte and Mathur (1968)⁵ pointed out that the required acreage can be transferred from food and cash crops to fodder production without reducing the economic returns to the farmer in rupees per acre and also without reducing the total production of food and cash crops within a milk procurement area. They have observed that if a farmer has combination of food crop varieties, good cultivation and good animals, fodder crops become competitive with any of the food and cash crops of India in terms of cash return or profit per acre in the form of milk at current prices, especially under conditions of more intensive and irrigated agriculture.

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S.N. Mishra (1978) has analysed the problem of bovine numbers, keeping in view the draught power function of bovines as well as their significance as producer of milk and meat. He concluded that cows in India are surplus not only in relation to working bullock stock but with respect to feed supply also. Mishra has insisted on the positive policy of cattle slaughter. In his opinion the cattle slaughter is a continuous adjustment mechanism. He thinks that the need for slaughter has acquired added importance with the expansion of exotic cross breeding of cattle. He advocated the re-allocation of land in favour of animal production with a plea that such re-allocation would increase the overall efficiency of agriculture in terms of output of food per unit of land. His thesis is based on several assumptions, which may not be quite realistic. For example, he has calculated that animals produce 60 percent more calories per hectare of land and nearly 2.5 times more protein than crops. The production of milk and meat involves conversion of crops into animal products. Efficiency of such conversion in terms of proteins and calories was reported by K.E. Howshborger (quoted by L. Ramchandran, 1977) at 25 and 17 percent in dairy cattle and 4 and 3 percent in beef cattle, respectively. Mishra has considered the protein and calorific values of fodder crops instead of the nutritive value of the foods of animal origin. His thesis that a diversion of area from crops to livestock is socially desirable is not tenable for this flaw in his analysis. His views on sacred cow concept against slaughter over economic usefulness are not supported by any empirical or logical evidences.

L. Ramachandran (1977)\textsuperscript{7} has analysed India's food problem from a different view point. The problem of optimum allocation of resources between crop farming, dairy farming and other animal food production has been discussed with respect to maximisation of the net availability of food for human consumption. His analysis is based on the relative requirement of land for the production of various vegetables and animal foods on the basis of availability of protein in them. He has concluded that it is more economical to depend on vegetables even for the supply of protein. He opines that any attempt to increase milk production without a massive killing of uneconomic animals and improving the quality of animals is bound to result in a serious shortage of food grains. This analysis, though sound, is unacceptable for policy formulation as it dictates the composition of food for every one.

K.N. Nair (1979)\textsuperscript{8} in his study of Kerala opined that cattle slaughter in Kerala has resulted in the success of cross breeding and the raising of the milk production and a change in bovine composition in terms of buffalo-cattle. K.N. Raj (1979)\textsuperscript{9} also subscribes to this view. The main purpose of Nair and Raj seems to oppose the demand for ban on cattle slaughter in Kerala. But any policy formulation must be based on social cost-benefit analysis, as enhancing milk production is not the sole objective of our cattle

\begin{itemize}
\item \textsuperscript{7} L. Ramachandran, "India's Food Problem - A New Approach", Allied Publishers, Bombay, 1977.
\end{itemize}
development programmes. It may not be reasonable to treat cow unproductive simply on the basis of milk yield, without giving due weightage to its contribution in the form of male progeny.

Long back the Royal Commission on Agriculture had referred to this vicious circle of excessive numbers of cattle and low productivity. Subsequently, several writers, V.M. Dandekar (1969)\(^\text{10}\) and Heston (1971)\(^\text{11}\) also confirmed this view irrespective of the extent of surplus. They feel convinced that Hindu religious prejudice against cow slaughter stood in the way of more efficient use of resources. On the other hand, Azizul Haque (1939) and Fahimuddin (1962)\(^\text{12}\) in their more detailed analysis sought to explain the exact nature of surplus in terms of demographic pressure, feed supply and the agro-climatic conditions. On the contrary Harris (1966)\(^\text{13}\) arguing from an anthropologists perspective, was of the view that, "the irrational noneconomic and exotic aspects of the Indian cattle is greatly over emphasised at the expense of the rational and mundane interpretation." In his view the existing bovine stock of India is a product of evolutionary adaptation in which a shifting constellation of ecological factors, competition between human beings and animals and technological conditions play a crucial role.


Micro Level Studies

An alternative approach adopted by researchers has been the economic evaluation of prevalent production and marketing patterns. Most of these studies have relate to either on input-output relationship at the farm level or have examined the economic impact of organisational and technological innovations in the dairy sub-sector. In recent studies the emphasis has shifted on analysing the problems and possibilities of developing dairying as an instrument of social and economic upliftment of weaker sections in the rural areas. T.A. Ramsubban and S.K. Goel (1958)\textsuperscript{14} made a study of the cost of milk production in Delhi Villages in 1961-62. The study reveals that cost of milk production declines with increase in the level of production. The study concludes that under Indian conditions, as dry animals are kept in the farm the cost of milk production is higher than the price received by the farmer.

S.P. Dhondyal and Parmatma Singh (1965)\textsuperscript{15} examined the cost of milk production on the basis of land holding size and species used. It is found that all households suffered loss in case of cows whereas only farms having 6-8 hectares of land earn some profit in case of buffaloes. But small farmers make profit from dung covering the feed cost. It appears from the study that the buffalo is comparatively more profitable than cow for milk. V.S. Vyas and K.M. Choudhury (1970) in their study for Mehasana District of Gujarat have also supported the above view.

\textsuperscript{14} M.M. Jain, Op. Cit., p. 5.
\textsuperscript{15} M.M. Jain, Op. Cit.
N.S. Jodha and K.M. Choudhary (1968) in their study for Bikaner District of Rajasthan find that cost of milk production generally decreases with increase in herd size. They also observe seasonal variations in cost of production and revealed that with respect to total cost involved dairying is profitable in monsoon and winter but a liability in summer.

The Studies mentioned above show that the cost of milk production and profitability of dairying are subject to change with season, place, size of herd, and size of land holding. All these studies however, have adopted an industrial approach whereas an estimation of return to the family labour would have been more appropriate.

Dairying as an Instrument of Economic Upliftment of the Rural Poor

An alternative approach in farm level investigations highlights the problems and possibilities of making dairying an instrument of social and economic upliftment of the weaker sections in the rural areas. The potentiality has been evaluated on the basis of five main parameters, namely:

(i) Possession of Milch animals.
(ii) Milk yield per animal.
(iii) Marketable surplus.
(iv) Cost of production.
(v) Contribution of dairy enterprise to the household income.

On the basis of some studies undertaken during the sixties in Gujarat, Maharasra, Andhra Pradesh and Haryana, the National Commission on Agriculture (1971) concluded that 70 to 75 percent of the households possessing cattle, according to the size of land-holding in different areas of the country belong to the category of small and marginal farmers. They are already keeping milch animals to supplement their income. Thus, dairying, by and large, is a small man's business. It has been reported that compared to agricultural land, the ownership of milch animals is less unevenly distributed. It is a favourable situation that can be exploited to a great advantage in any anti-poverty programme. A study about the possession of milch animals has been conducted by B.K. Ganguly and S. Gopal (1979) under the aegis of National Dairy Development Board (NDDB) in 1975 and 1978 in 18 milksheds in different parts of the country. The results show that two extreme groups, the big households and landless households in Indian milksheds are somewhat better off than small farmers, so far as milch animals and milk production is concerned. There are marked regional variations in the possession of milch animals. This study also confirms that about three fourth of the households possessing milch animals belong to the weaker sections in rural areas.


Potentiality of dairy development through weaker sections have also been emphasised on the study of Khaira district of Gujarat. It shows that mostly people from the lower strata of the community have benefitted as a result of milk cooperatives. They have the highest propensities to produce and sell milk, buy buffaloes or land out of their own savings.

A.R. Melville (1974)\(^{19}\) has emphasised that to develop dairying as an instrument of change, a small farmer must be able to sell his surplus milk everyday and the price received must be fair and adequate to attract and interest him in dairying profession. G.S. Kamat (1977)\(^{20}\) also emphasised on the market oriented dairy development. In his opinion it can alone ensure success of dairy units whether they are in public, private or co-operative sector. There is a great need to institutionalise milk trade from the stage of production to marketing.

Other Studies

In addition to the above studies, some researchers have tried to identify wide ranging factors and the composite role of livestock in economic development. Harbans Singh and E. N. Moore (1972)\(^{21}\) in their work have

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given a vivid description of Indian livestock with information of breeding, feeding, management and disease control and marketing of all livestock product. Raymond Crotty (1980)\textsuperscript{22} in his study of the Bovines of the world has tried to find out the role of cattle and Buffaloes on economic welfare and development. He is especially concerned with explaining the poor contribution of cattle to the objectives in less developed countries. Unlike the above M.S.Kataria (1982)\textsuperscript{23} is his study on Haryana finds that India has quite a large number of potentially rich breeds of bovines. His hypothesis is that cross breeding of these breeds with European breeds is quite logical, keeping an eye on the growing market of milk in India. Shanti George (1985)\textsuperscript{24} in her pioneering study on operation flood of India has been very critical of many aspects of Indian Dairy policy. She concludes that the emphasis of operation flood on high speed, high cost and discontinuous development through imported, technology is detrimental to India’s dairy economy and that less expensive indigenous alternatives are better suited to local needs and conditions. R.C. Mascarenhas (1988)\textsuperscript{25} has a different story to tell as obvious from his empirical work on rural development. His balanced analysis of NDDB’s success on rural development is based on studies from Karnataka and Gujarat. He focusses on replicating small scale

\begin{itemize}
\item \textsuperscript{22}R. Crotty, "Cattle Economics and Development", OXFORD & IBH, New Delhi, 1980.
\item \textsuperscript{23}M.S. Kataria, "Geography of Indian Livestock and White Revolution", Visal, Kurukshetra, 1982.
\item \textsuperscript{24}S. George, "Operation Flood - An Appraisal of Current Indian Dairy Policy", Oxford, New Delhi, 1985.
\end{itemize}
projects, such as the Anand type co-operatives on a large scale as attempted through operation flood. M. Doornbos, F.V. Dorsten, M. Mitro and P. Terhal (1990)\(^{26}\) in their study on India’s operation flood focus on the processes of social and economic change which are associated with operation flood, thus relating the programmes targets and achievements to broader questions of interest to development planners and scholars all over the world. The authors examined the co-operative structures of India which has been built up under the programme, AMUL, and critically analysed its performance in the framework of its aim of self sufficiency. In addition to the above the work provides a critical review of the existing fields of rural impact studies devoted to operation flood.

C.M. Mohan (1989)\(^{27}\) in his study of Dairy management in Andhra Pradesh concludes that efficient management of finances and improving the sales through better procurement would make the dairy economically viable to serve the needs of the society. P.S. George and K.N. Nair (1990)\(^{28}\) in a study of livestock economy of Kerala dealt with diverse issues of the sectors, like breeding, cattle holdings, labour use in cattle keeping, milk production, cattle transaction etc. and found that the adoption of crossbreeding has become widespread in the state and fairly uniform across all size of


\(^{27}\) C.M. Mohan, "Dairy Management in India - A Study in Andhra Pradesh", Mittal, Delhi, 1989.

holdings. Franco and Chand (1991)\textsuperscript{29} in their work for tribal dairy co-operatives (TDC) in south Gujarat found that the role of the TDC has been positive, in general, but the decentralised and extensive model has not been very successful. It has helped a small section without the power being felt at the highest level of the co-operative structure.

On the other hand, S.N. Mishra and R.K. Sharma (1990)\textsuperscript{30} in their latest study of the entire gamut of bovine economy have again affirmed the already proved general picture of Indian cattle and buffaloes. They have studied the salient features of bovine economy in two different phases i.e. (1951-66) and (1966-90). In general, the first phase is identified with development of indigenous stock through feeding, disease control and veterinary cover. The second phase is marked by cross breeding. The study emphasised that bullocks continue to be the predominant source of energy for traction and rural transport in India. The entire stock composition of bovine population of India is controlled more or less by the above fact. Mechanisation, wherever has occurred, has not replaced the expected number of bullocks. Among the major constraints, poor fodder availability and inadequacy of the same are the major ones which confirm the fact of surplus livestock situation. The composition is, however, slowly growing in favour of milk production and buffaloes. The study, however, emphasised on the unsteady policy towards livestock development and inadequate investment in


this sector of economy which fell short of its percentage share in the GNP of the country.

STATEMENT OF THE PROBLEM

The above review shows that focus of these studies has been mainly on dairying and largely in states of Gujarat, Karnataka and Haryana etc. whereas bovine population in India plays a very complex role in her entire agricultural economy. The sample size in these studies had been very small and they were carried out in the area of special cattle development projects. The other important aspect of study is the question of surplus cattle. Though, the pressure of Indian cattle population has been given cognisance by scholars, there is no general agreement on its extent. The attempts to estimate the total number of surplus cattle at the national level have completely ignored the spatial variations, where some areas may have a deficit as well. Thus, these studies suffer from several limitations and their recommendations may not be adequate for formulating a meaningful policy for animal husbandry.

Secondly, comparative economics of milk production technology and draught requirement with buffaloes, and cows, and crossbred cows also remains to be examined in different agro-climatic regions and in different environmental conditions. Little effort has been made to determine the labour absorption capacity of the livestock enterprises.
The present study is pursued to fill some of the above gaps. While bringing out the regional problems of the animal husbandry sector it will also examine the planning and implementation aspects of animal husbandry which will help in understanding the bovine sector of the economy in broader national perspectives.

OBJECTIVES OF THE STUDY

1. To study the spatial pattern of the structure of bovine stock in different environmental niche.
2. To study the availability of fodder resources at different agro-climatic regions.
3. To evaluate the structure of draught power in agriculture in different agro-climatic regions.
4. To study the pattern of milk production and its relationship with raising draught livestock.
5. To find profitability of bovine economy at household level.
6. To study the role of dairying in rural development through generation of employment and milk production.

HYPOTHESES TO BE TESTED

1. Milch bovines and better quality breeds of bovine stock are confined to less humid regions and poor non-descript cattle are found in the high humid regions of India.
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1. Milch bovines and better quality breeds of bovine stock are confined to less humid regions and poor non-descript cattle are found in the high humid regions of India.

2. Draught is still the predominant economic use of bovine stock and this requirement affects the entire structure of farm stock and total stock size depends on the size of operational land holding.

3. Yield of milk is directly related to the availability of nutrients and careful rearing of milch bovines by females of the households.

4. Any bovine stock is always profitable at the individual farm house level.

5. Dairying in rural areas is employment generative for the households of landless, small and marginal farmers and help in socio-economic development of the rural areas.

DATA BASE

Both secondary and primary sources of data have been used for the present study.

The secondary sources are from the publications of Agricultural statistics and Livestock Census of Ministry of Agriculture. Informations from the publications of states and districts and also from local bodies have been
STUDY REGION AND METHODOLOGY

To bring out a typical representative aspect of Indian bovine economy, two diversely opposite agro-climatic regions i.e. the states of Rajasthan and Orissa have been selected for the present study.

For a detailed study four districts, two each from each state have been selected on the basis of the objective criteria of number of bovines per hectare of pasture land, bovine density and location quotients for cattle and buffaloes.

The selected districts with index values of criteria adopted and the agro-climatic regions in which they are located, are given below:

Table 1.1

<table>
<thead>
<tr>
<th>States</th>
<th>Districts</th>
<th>B/H</th>
<th>B/A</th>
<th>LQ_c</th>
<th>LQ_B</th>
<th>Agro-climatic Regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rajasthan</td>
<td>Alwar</td>
<td>11.97</td>
<td>1.07</td>
<td>0.77</td>
<td>1.71</td>
<td>Central Plateau and Hill Regions</td>
</tr>
<tr>
<td></td>
<td>Barmer</td>
<td>0.25</td>
<td>0.07</td>
<td>1.23</td>
<td>0.30</td>
<td>Western Dry region</td>
</tr>
<tr>
<td>Orissa</td>
<td>Balasore</td>
<td>9.20</td>
<td>1.66</td>
<td>1.30</td>
<td>0.07</td>
<td>East Coastal Plains and Ghat Regions</td>
</tr>
<tr>
<td></td>
<td>Phulabani</td>
<td>0.58</td>
<td>0.48</td>
<td>1.12</td>
<td>0.64</td>
<td>Eastern Plateau and Hill Regions</td>
</tr>
</tbody>
</table>

Note: B/H Number of bovines per hectare of pasture where pasture includes forest cover, fallow land and permanent pastures.

B/A Bovines per hectare of land i.e. Density.

LQ_c & LQ_B represent Location Quotients for Cattle and Buffaloes with respect to the country as whole.
The selected districts of Alwar and Barmer in Rajasthan and Balasore and Phulabani in Orissa fall into four different agro-climatic regions. They also represent higher and lower categories of density as well as location quotients for cattle and buffaloes in the states.

A MODEL OF THE NETWORK OF THE STUDY AREA

[Diagram]

INDIA

Rajasthan

Alwar

Laxmangarh

Lilee

Kafanwara

Thanagazi

Kasba

Bangdoli

Barmer

Siwana

Padradi

Maodi

Sheo

Orissa

Balasore

Simulia

Pandu

Markona

Chandbali

Karanpokhani

Phulbani

Boud

Gamharipadar

Baunsuni

Daringbadi

Sraniketa

Sulumuha

Terabadi

20
In the absence of the availability of any data below district level for bovine stock from secondary sources, the next best alternative of level of irrigation is considered for the unbiased selection of 2 tehsils from each of the districts. In this respect the tehsil with the highest and lowest irrigated areas have been considered. The field study has been conducted in these tehsils selecting sample villages and households through purposive and stratified random sampling techniques.

Table 1.2

Heirarchy of Study regions

<table>
<thead>
<tr>
<th>States</th>
<th>Districts</th>
<th>Tehsils</th>
<th>Villages</th>
<th>Number of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORISSA</td>
<td>Phulabani</td>
<td>Daringbadi</td>
<td>Sraniketa</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sulumuha</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Terabadi</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Bond</td>
<td>Gamharipadar</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Baunsunji</td>
<td></td>
<td></td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Bond</td>
<td>Gamharipadar</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Baunsunji</td>
<td></td>
<td></td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Bond</td>
<td>Gamharipadar</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Baunsunji</td>
<td></td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>Balasore</td>
<td>Chandbali</td>
<td>Karan Pokhari</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Simulia</td>
<td>Pandu</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Markona</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>RAJASTHAN</td>
<td>Barmer</td>
<td>Sheo</td>
<td>Sheo (kasba) + villages</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sheo (kasba) + villages</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>Siwana</td>
<td>Padradi</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maodi</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Alwar</td>
<td>Thanagazi</td>
<td>Kasba</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bangdoli</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Laxmangarh</td>
<td>Kafanwara</td>
<td></td>
<td>25</td>
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<tr>
<td></td>
<td></td>
<td>Lilee</td>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>
The primary data was generated by surveying 406 households in the order of more or less 50 households per tehsil representing nearly same size of samples to deal with nearly 65 variables of socio-economic, agricultural and bovine stock data.

The data collected from 406 sample households have been tabulated into 62 variables of socio-economy agriculture and bovine stock of the households. Simple statistical techniques like percentage, correlation analysis, regression analysis and test of significance have been used.

The proposed hypotheses are subjected to the following tests.

**Hypothesis I**

The information about the quality of breeds and species of bovines has been collected from households by imputing the market price of the bovine. The agro-climatic regions and available nutrients in the form of total digestible nutrients (TDN) and digestible crude protein (DCP) both are used to find out the existing relationship between the variables to understand the quality of bovines in different environment.
An Arid Landscape, Sheo, Barmer

A Landscape, Thanagazi, Alwar
Hypothesis II

From household bovine data preference for draught and/or milk in bovine stock at household level has been identified with respect to limited supply of feed stuffs. An inter-regional analysis is performed for understanding the structure of the entire bovine stock.

To understand the effect of draught requirement on the structure of bovine stock the following variables are considered:

(i) Number of Bullocks
(ii) Total Bovine Stock
(iii) Operational Land Holding

The above dependent variables i.e., Number of Bullocks and total bovine stock in a household in a given agro-climatic region have been separately correlated with the independent variable of operational land holding to understand the role of operational holding on the structure and composition of bovine stock.

Hypothesis III

To study the relationship between milk yield, nutrients and labour
input, the following variables have been considered:

(i) Average yield of milk in litres per day  
(ii) Total Digestible Nutrients (TDN)  
(iii) Digestible crude protein (DCP)  
(iv) Labour input in dairy activity

Correlation analysis, regression analyses and test of significance have been performed for different regions and aggregate samples separately.

Hypothesis IV

The profitability of bovine stock is studied on the basis of net return at individual household level and then a comparison is performed between and among the different agro-climatic regions.

Cost variable includes:

1. Capital investment:
   (a) Price of Bovines
   (b) Price of Cow shed

2. Maintenance Costs:
   (a) Feeding cost
   (b) Breeding cost
   (c) Health care cost
A Landscape, Daringbadi, Phulbani (Orissa)

Paddy harvesting, Simulia, Balasore
(d) Labour cost
(e) Any other cost

Benefit from the farm stock in terms of value includes:

(a) Draughting value in rupees
(b) Milk and Milk products value in rupees
(c) Value of cow dung in rupees
(d) Any other benefit in rupees

The model used for the analysis of profitability is as follows:

\[ NTB = TB - TC \] (In one time period)

Where

NTB - Net total Benefit
TB - Total Benefit
TC - Total Cost

The NTB is expected to be more than zero at every household level and the variation and scope for increasing the same with further investment is studied.

Hypothesis V

To study the effect of dairying on employment generation and socio-economic development of the rural areas the following variables are
considered from the household samples.

(i) Labour utilisation pattern
(ii) Consumption of milk in the rural areas
(iii) Dairying activity in the households of different regions

Correlation and regression analysis have been attempted for the purpose.

ORGANISATION OF THE STUDY

The study has been organised into seven main chapters. Chapter I is the introductory one. Chapter II reflects the structure and pattern of bovine population for the country as a whole. Chapter III is devoted exclusively to the fodder availability and nutritional level of the bovine stock. Chapter IV is constituted with the physical and socio-economic analysis of the households surveyed. Chapter V deals with the regional structure and pattern of bovine economy and its related variables. The determinants of bovine economy are dealt in Chapter VI whereas Chapter VII explains the rural development strategy through dairying and Chapter VIII contains the summary and conclusion.