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CHAPTER - I

INTRODUCTION

1.1 Introduction:

Modern agriculture is highly technical and capital oriented. In India 80% percent of the farmer are small holders. Agriculture should be supplemented with subsidiary occupation such as dairy farming, poultry farming and fisheries etc.

In India where 72 percent population living in rural areas and agriculture is their major source of livelihood and their economy has depended on agriculture. So it is always says that the agriculture sector is backbone of Indian economy. Rural families may have a hectare of land, and such a small piece of size of land is not having enough irrigation facilities and utilized of day dependant and natural vagaries. This dry farming cannot produce enough food required for the maintenance of his family while income from crop production is seasonal dairying provides a stable and year round income. The small farmer and the landless laborer are more after than not victims of money lenders and natural calamities, draying as a subsidiary source of income is real to most of these weaker group in society.

This study is concerned with agriculture geography, and agriculture geography is the main branch of human geography. Study is mainly concentrated on dairy farming specified area in Osmanabad district.
1.2 History of Dairy Farming:

The domestication of cattle and the use of their milk for human food had begun somewhere in Asia of Northeast Africa between 6000 B.C. and 8000 B.C. before a cow was domesticated. It was probably hunted by primitive man. Over the year the cow has been used as a best of burden and has been a source of food and object of worship a source of sacrificial offering and a subject of mythology. Cow’s milk and its product have been used for food, sacrificial offering, cosmetics and mendicants’. The oldest written records of man are believed to go back Sumerians of Mesopotamia in approximately 6000 B.C. Dairying was highly developed at that time. A mosaic frieze is one of the oldest buildings berthed in the Euphrates. Valley shows the milking of the cows from behind the pouring of milk through a strainer into a vessel and the essence of two attendants wearing fleece petticoats that we believed to have been the dress of priests and priest king. The frieze dates back at least 3100 B.C.

The people of India were raiser of cattle as early as 2000 B.C. Butter was used as a food as a holy offering to the gods. Butter was change into Ghee. The cow at that time was considered as holy. Egyptian records dating back nearly to 3000 B.C. indicate that milk butter and cheese were used extensively. Cow as were milk from the side instead of from behind as was done. By the Sumerians however the calves were placed in from of the cows during milking. Greek and Roman records to back approximately 1550 B.C. and 750 B.C. respectively and in both areas milk came from goats, In Rome came from sheep. In both countries butter was used in different ointment and mendicants but not as a food. Butter was used as a food by
some people in Europe, but it was used extensively until eight century when it becomes an important food in Norway.

Reference to cattle and milk are frequently made in the Old Testament and the New Testament alike. The old statement has forty references to cattle milk and milk products were very desirable foods and are mentioned at least fifty times. Palestine is referred to approximately twenty times as “land flowing with honey”.

History of the beginning dairy industries in the world:

The major development in the dairy farming from the beginning of Christian cry to the middle 1850 accrued in Europe most of currently imported dairy cattle breeds in the United States and Europe originated there. Cattle were first imported into the western hemisphere with Columbus second voyage: The four claves and into heifers were taken either to Cuba or to South America. There were no cattle in North America prior to this time. The Spanish expedition headed by Coronado brought approximately 150 head of cattle of North America. Some of the cattle, in North America, some of the cattle presently in the Southwest probably originated from this importation.

The first important of cattle by settlers of what is now the United State occurred in the James town colony in 1611, cattle were not brought over by the pilgrims on the mayflower, the first cattle arrived in Plymouth colony in 1624. During first winter more than half of the 100 men that arrived on the mayflower died of malnutrition. Some historians contend that some of these deaths could have been avoided if dairy cattle had been presented. The first two cattle importations were followed by many more.
After cattle population was established, cattle moved westwards with the pioneers to all parts of what is now the United States.

The dairy industries from colonial times to the mid of 1850s was based primarily on family cows; most families had one or two cows that supplied milk for the immediate family. Only a relatively small amount of milk and milk product was sold. Milk was available for consumers were of two types. The major portion came from cows fed with a cheap byproduct of liquor distillery. It was produced under unsanitary conditions and contained various amounts of added water. Other milk came from dairy farmers who kept cows in rural areas. This milk was dipped from one large container into a receptacle supplied by the consumer. Milk produced and sold did not have to meet any health regulations nor permits of license were required of the distributors of milk in these early days.

The first shipment of milk accrued in 1841 between orange countries. New York and New York City is allowing farmer to ship fluid milk and orange as much as 80 miles to market. Refrigeration was not used in the early days, so the time that milk could be kept in shipment was received and distributed by deters later, milk receiving stations were established in rural areas, either by dealers independent shippers or co-operative group from farmers.²

In India Dairy industry start in India at the end of 19th century with a few private farm. The military dairy farms were started in Colonial areas. This farms were first to cross Indian cows with imported bulls. Before independence there where 60 percent farms with thousand of crossbreed cows. Modern dairy plant first started in at Kolkata in private sector, which
was the capital of India. As well as the co-operative society act was passed in 1904 and first co-operative established at Allahabad in 1913 by defense department. Military dairy farms to ensure the supply of milk and butter to colonial army, Polson a private dairy at Aanand collected milk from milk producers through middle men process it and then send the milk to the Mumbai. Then in 1946 Kaira District co-operative milk union registered in Gujarat, it was the establishment of dairy industry in India.

1.3 Significance of dairy farming:

Form ancient time dairy farming and peoples has been keeping milch animal and they have both purpose about animal first is that they use the bull and male buffalos to work in the field and second for milk and meat. In India dairy farming as a subsidiary occupation to the agriculture where 72 percent people are living in rural areas and Villages cannot effort to have any other business which is not connected with the land therefore fairy is the only assured business for small holders and landless laborer because dairy farming provide sustainable employment in whole year.

India with 20 percent the basic stock of world cattle the animal nutrition requirements are largely met by agriculture waste and by product whose milk production can be increased by better feeding and management. As well as dairy farming is providing employment to the 11 million people in India. In this way dairy farming is an instrument for social and economic development for marginal, landless laborer in the villages.
1.4 Milk Production of the World:

In the table no. 1.1 reveals that milk production of selected countries in the world. The total milk production in the world is 477450.9 thousand tones in the year 2001. In the selected 27 countries milk production are 509858.9 thousand tones. Share of 27 countries in the world milk production are 80.79 percent to total world production and the remaining countries production are only 19.21 percent which is the very low production countries.

Table No. 1.1
Milk Production of the World, 2001

(In Thousand Tonne)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Countries</th>
<th>Total milk Production</th>
<th>Percent of Contribution in World Milk Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>European Union</td>
<td>122000</td>
<td>25.55</td>
</tr>
<tr>
<td>2</td>
<td>Bangladesh</td>
<td>2112.01</td>
<td>0.11</td>
</tr>
<tr>
<td>3</td>
<td>India</td>
<td>83970.0</td>
<td>17.59</td>
</tr>
<tr>
<td>4</td>
<td>Nepal</td>
<td>1197.91</td>
<td>0.04</td>
</tr>
<tr>
<td>5</td>
<td>Pakistan</td>
<td>26284.0</td>
<td>5.50</td>
</tr>
<tr>
<td>6</td>
<td>Israel</td>
<td>1200.0</td>
<td>0.25</td>
</tr>
<tr>
<td>7</td>
<td>Siriya</td>
<td>1150.0</td>
<td>0.24</td>
</tr>
<tr>
<td>8</td>
<td>Turkey</td>
<td>10000.0</td>
<td>2.09</td>
</tr>
<tr>
<td>9</td>
<td>Azarbazan</td>
<td>1011.0</td>
<td>0.21</td>
</tr>
<tr>
<td>10</td>
<td>Kazakhstan</td>
<td>3600.0</td>
<td>0.75</td>
</tr>
<tr>
<td>11</td>
<td>Karzestan</td>
<td>1090.0</td>
<td>0.29</td>
</tr>
<tr>
<td>12</td>
<td>Australia</td>
<td>10870.0</td>
<td>2.28</td>
</tr>
<tr>
<td>13</td>
<td>Venuzuala</td>
<td>1300.0</td>
<td>0.27</td>
</tr>
<tr>
<td>14</td>
<td>Ubekistan</td>
<td>3692.0</td>
<td>0.77</td>
</tr>
<tr>
<td></td>
<td>Country</td>
<td>Production</td>
<td>Share</td>
</tr>
<tr>
<td>---</td>
<td>-----------</td>
<td>------------</td>
<td>-------</td>
</tr>
<tr>
<td>15</td>
<td>Korea</td>
<td>2244.0</td>
<td>0.47</td>
</tr>
<tr>
<td>16</td>
<td>Algeria</td>
<td>1377.0</td>
<td>0.29</td>
</tr>
<tr>
<td>17</td>
<td>Somaliland</td>
<td>2190.0</td>
<td>0.49</td>
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<tr>
<td>18</td>
<td>America</td>
<td>75251.0</td>
<td>15.76</td>
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<tr>
<td>19</td>
<td>Poland</td>
<td>11500.0</td>
<td>2.41</td>
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<td>20</td>
<td>Russia</td>
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<td>6.70</td>
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<td>21</td>
<td>Ukraine</td>
<td>11350.0</td>
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</tr>
<tr>
<td>22</td>
<td>New Zealand</td>
<td>12750.0</td>
<td>2.67</td>
</tr>
<tr>
<td>23</td>
<td>Brazil</td>
<td>22800.0</td>
<td>4.77</td>
</tr>
<tr>
<td>24</td>
<td>China</td>
<td>9000.0</td>
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</tr>
<tr>
<td>25</td>
<td>Japan</td>
<td>8500.0</td>
<td>1.78</td>
</tr>
<tr>
<td>26</td>
<td>Mexico</td>
<td>9700.0</td>
<td>2.03</td>
</tr>
<tr>
<td>27</td>
<td>Argentina</td>
<td>9320.0</td>
<td>1.95</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>477450.9</td>
<td>80.79</td>
</tr>
</tbody>
</table>

| Total Milk Production in the World | 586100.00 | 100 |


The share of European Union in the world milk production is 20.81 percent which is higher than all other countries. Share of India in the world milk production are 17.59 percent which is the second rank after European union, and the share of America are 15.76 percent which is the third rank in the world. Russia and Pakistan share in milk production are 6.70 and 5.50 percent. The share of Brazil and New Zealand in the world milk production are 4.77 and 2.67 then all other remain countries share in milk production are between 0.05 to 2 percent only.
1.4.1 Share of Indias Milk Production in the World:

In the table no. 1.2 and Graph no. 1.1 reveals that the growth in the world milk production and share of Indias milk production.

**Table No. 1.2**

Total Milk Production in the World 1985-2004 in Million Tonne

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Year</th>
<th>Total Milk Production in Million Tonne</th>
<th>Yearly Growth Rate</th>
<th>Share of Indias Milk Production in the World</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1985</td>
<td>50430</td>
<td>—</td>
<td>8.7</td>
</tr>
<tr>
<td>2</td>
<td>1986</td>
<td>507.4</td>
<td>0.67</td>
<td>9.1</td>
</tr>
<tr>
<td>3</td>
<td>1987</td>
<td>507.2</td>
<td>-0.03</td>
<td>9.2</td>
</tr>
<tr>
<td>4</td>
<td>1988</td>
<td>522.3</td>
<td>2.97</td>
<td>9.3</td>
</tr>
<tr>
<td>5</td>
<td>1989</td>
<td>529.1</td>
<td>1.30</td>
<td>9.7</td>
</tr>
<tr>
<td>6</td>
<td>1990</td>
<td>541.9</td>
<td>2.41</td>
<td>10.1</td>
</tr>
<tr>
<td>7</td>
<td>1991</td>
<td>534.5</td>
<td>-1.36</td>
<td>10.9</td>
</tr>
<tr>
<td>8</td>
<td>1992</td>
<td>526.7</td>
<td>-1.45</td>
<td>11.9</td>
</tr>
<tr>
<td>9</td>
<td>1993</td>
<td>527.2</td>
<td>0.09</td>
<td>11.6</td>
</tr>
<tr>
<td>10</td>
<td>1994</td>
<td>513.6</td>
<td>-2.45</td>
<td>11.9</td>
</tr>
<tr>
<td>11</td>
<td>1995</td>
<td>540.7</td>
<td>5.21</td>
<td>12.4</td>
</tr>
<tr>
<td>12</td>
<td>1996</td>
<td>542.9</td>
<td>0.40</td>
<td>12.9</td>
</tr>
<tr>
<td>13</td>
<td>1997</td>
<td>551.0</td>
<td>1.49</td>
<td>13.2</td>
</tr>
<tr>
<td>14</td>
<td>1998</td>
<td>559.8</td>
<td>1.59</td>
<td>13.2</td>
</tr>
<tr>
<td>15</td>
<td>1999</td>
<td>568.7</td>
<td>1.58</td>
<td>13.5</td>
</tr>
<tr>
<td>16</td>
<td>2000</td>
<td>578.1</td>
<td>1.65</td>
<td>13.5</td>
</tr>
<tr>
<td>17</td>
<td>2001</td>
<td>586.1</td>
<td>1.37</td>
<td>13.5</td>
</tr>
<tr>
<td>18</td>
<td>2002</td>
<td>600.5</td>
<td>2.45</td>
<td>13.9</td>
</tr>
<tr>
<td>19</td>
<td>2003</td>
<td>609.1</td>
<td>1.43</td>
<td>13.9</td>
</tr>
<tr>
<td>20</td>
<td>2004</td>
<td>612.1</td>
<td>0.49</td>
<td>14.0</td>
</tr>
</tbody>
</table>

Yearly Average Growth Rate: 1.04

Graph No. 1.1: Share of India's Milk Production in the World 1985-2004 in Million Tonne
In the year 1985 the world milk production was 504 million tones, and in 2004 it is increased up to 612.1 million tones. This growth has been increased up to 108 million tones. Therein share of India in world milk production are in 1985 it was 8.7 percent, in 1995 it was 12.4 percent, and in 2000 it was 13.5 percent and in 2004 it is increased up to 14.0 percent. This growth has been increased averaged 5.3 percent.

During 1985 to 2004 growth in milk production are in the world has been increased up to 21.44 percent. Milk production in India has also increasing with similar to the world milk production.

1.5 National Dairy Development Board (NDDB):

The National Dairy Development Board is an institution of national importance set up by an act parliament of India. The main office is located in Anand, Gujarat with regional offices throughout the country. NDDB subsidiaries include mother dairy of Delhi.

National dairy development Board was founded by Dr. V. Kurien and Dr. Amrita Patel is the current Chairman of the national dairy development board Aanand in Gujarat. The national dairy development board was establish in 1965 fulfilling desire of the late Prime Minister of India Lal Bahadur Shastri do extent the success of the Kaira co-operative milk producers union (Amul) to other parts of India.

That success combined of wisdom and energy of farmers with professional management to successfully capture liquid milk and milk product markets while supporting farmer investment with input and services. The major success of this mission was achieved through the World
Bank financed operation flood, which lasted 26 years from 1970 to 1996 and was responsible for making India the world largest producers of milk. This operation was started with the objective of increasing milk production fair prices for consumers.

Farmer and women empowerment:

NDDB empowered millions of small and marginal farmers through village dairy co-operative. Amul pattern societies across the country made farmer rich in terms of tangible intangible wealth.

As per year 2001 census population of Indias are 102.7 million where 49.6 million are female inhabitants i.e. 48 percent total population consist of woman for sustainable economic and social development to take place in any country. It is necessary that people participate in the necessary economic and social process. The National dairy development board of India an apex development organization initiated by government of India to replicate successful white revolution movement amongst small farmer by affirmative action empowered women and made them involved in socio-economic activities. Maximizing farmer profit and productivity through effort is the hallmark of the Aanand Pattern.

Aanand Pattern:

Aanand pattern is an integrated co-operative structure that procured process and markets produce supported by professional management producers, their own business policy adopt modern production and marketing and receive that they can individually neither afford nor manager.
The Aanand pattern is an integrated co-operative were professionals are accountable to leaders elected by producers, the institutional infrastructure village co-operatives. Dairy and cattle feed plant state and national marketing is owned and controlled by farmers Aanand pattern co-operative have progressively landed producers directly with consumers.³

Three tier structure:

Aanand pattern has been implemented through following three tier structures

I. The village society:

An Aanand pattern village dairy co-operative society farmed by milk producers any producers can become a DCS member by buying a share and committing to sell milk only to the societies. Each DCS has milk collection center where member take milk every day. Each, member milk is tested for quality with payment based on the percentage of fats. At the end of each year a portion of the DCS profit is used to pay Bonus each member.

II. The district union:

A district co-operative milk producer union is buy dairy co-operative societies. The unions buy all the societies milk. Then process and market fluid milk and product most union also provides arrange of input and services to DCS and their members, animals feed veterinary care, artificial insemination to sustain the growth of milk production and co-operative business.

1.6 Role of Dairy Farming in Indian Economy:

In India dairy farming is recognized as an instrument for social economic development. The nations milk supply comes from millions of
small milk producer dispersed throughout the rural areas. The animal nutritional requirement are largely met by agriculture waste and by product, so landless labourer, small farmer are accepting as subsidiary occupation to agriculture because dairying providing a sustainable and stable income in a year.

In India with 20 percent of world cattle is in a unique position whose milk production can be increased by better feeding and management. In 1999-2000 the total milk production was 13.60 percent in total world milk production as per report of FAO. In 1968 dairy production was 21.2 million tones and now in 2001 it is 84.6 million tones. In 1968-69 milk availability of per person per day was 112 gm. And now it is 226 gm. PPPD. Dairy farming providing employment to 11 million farmer and annually dairy production income is 8.50 million rupees.⁵

1.7 Share of Agriculture Sector and Livestock Sector in GDP:

Table No. 1.3: Share of Agriculture and Livestock Sector in GDP 1999-2008

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP (Total) Rs.</th>
<th>GDP (Agriculture)</th>
<th>GDP (Livestock Sector)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rs.</td>
<td>% Share</td>
<td>Growth in Percent</td>
</tr>
<tr>
<td>1999-00</td>
<td>1786526</td>
<td>409660</td>
<td>22.93</td>
</tr>
<tr>
<td>2000-01</td>
<td>1925017</td>
<td>408932</td>
<td>21.24</td>
</tr>
<tr>
<td>2001-02</td>
<td>2097726</td>
<td>442464</td>
<td>21.09</td>
</tr>
<tr>
<td>2002-03</td>
<td>2261415</td>
<td>425521</td>
<td>18.82</td>
</tr>
<tr>
<td>2003-04</td>
<td>2538170</td>
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<td>19.03</td>
</tr>
<tr>
<td>2004-05</td>
<td>2877701</td>
<td>501415</td>
<td>17.42</td>
</tr>
<tr>
<td>2005-06</td>
<td>3282385</td>
<td>567897</td>
<td>17.30</td>
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<tr>
<td>2006-07</td>
<td>3779385</td>
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<td>16.54</td>
</tr>
<tr>
<td>2007-08</td>
<td>4320892</td>
<td>718278</td>
<td>16.62</td>
</tr>
</tbody>
</table>

Above table no. 1.3 shows that in 1999-2000 the GDP (Gross Domestic Production) of India was 1786526 crore and share of agriculture sector in GDP are 22.93 percent and share Livestock sector in 5.30 percent GDP. In 2000-20001 GDP was 1925017 crore rupees and the share agriculture sector and livestock sector are 21.24 percent and 5.44 percent in this year and GDP increased by 138491 crore but share of agriculture sector decreased by -1.69 percent and share livestock sector increased by -0.14 percent. In 2001-2002 GDP increased by 172709 crore total GDP was 2097726 crore. The share of agriculture sector is 21.09 percent and share of livestock sector is 5.21. In this year share of agriculture sector is decreased by -0.15 percent and share of livestock sector is also decreased by -0.23 percent. In 2002-2003 GDP was 2261415 crore which is increased by 163689 crore and the share of agriculture sector in GDP was 18.82 percent which is decreased by -2.27 percent and share livestock sector was 5.08 percent which is also decreased by -0.13 percent. In 2003-2004 GDP was 2538170 crore which is increased by 276755 crore and share of agriculture sector in GDP 19.03 percent which is increased by 0.21 percent and share of livestock sector in GDP 4.66 percent which is decreased by -0.42 percent. In this year share of agriculture sector firstly increased but share of livestock sector are continuously decreasing. In 2004-05 GDP was 2877701 crore which is increased by 339531 crore and share of agriculture sector in GDP was 17.42 percent which is decreased by -1.61 percent share of livestock sector in GDP was 4.73 percent which is increased by 0.07 percent. In 2005-06 GDP was 3282385 crore which is increased by decreased by 404684 crore and share of agriculture sector in GDP 17.30
percent which is decreased by -0.12 percent. In 2006-07 the GDP was 3779701 crore which is increased by 497316 crore and share of agriculture sector in GDP is 16.54 percent and which is decreased by -0.76 percent and share of livestock sector 4.37 percent which is also decreased by -0.21 percent. In 2007-08 GDP was 4320892 crore which is increased by 541507 crore and share of agriculture sector. In GDP is only 16.62 percent which is increased by 0.08 percent and the share of livestock sector in GDP 4.40 percent which is increased by 0.03 percent in the 2007-08.

After the study of share of agriculture sector and livestock sector in Gross domestic production we find that since 1999 to 2008 share of agriculture and livestock sector continuously decreasing, because growth in Industrial sector and service sector are more than agriculture sector which has been continuously increasing today also. Share of agriculture and livestock sector in GDP decreased by 6.31 Percent and 0.09 Percent during the 1999 to 2008.

1.8 Development of Dairy Farming during Five Year Plan:

Ancient time dairy farming has been done only for family purpose. At that time, there has been no availability of milk collection, transportation and chilling centers at that time the dairy business has been neglected.

But now rapidly growth in population industrialization and urbanization so the demand of milk and milk product has been increasing and so government has been concentrated on the dairy business as a source of economic development. The government had been started to development of dairy farming through five year plan.
In the first five year plan (1951-56) 160 million rupees expended for the dairy development and animal husbandry. In this plan 146 AI centers, 650 veterinary hospitals, 25 dairy farms has been started, as well as notional dairy research institute established in the Karnal in 1995 (Hariyana) and in all the country dairy development concentrated through 496 rural development.

In the second five year plan (1956-61) 344 million rupees expended for the animal husbandry and dairy business as well as integrated animal development programme, 36 dairy farms, 670 advances in fertilization centers, 1900 veterinary hospitals as well primary milk producer co-operative societies had been established in this plan.

In the third five year plan (1961-65) 770 million rupees expended dairy farming has been stated in co-operative sector, national dairy development board has been established in Aanand in Gujarat crossbreeding programme has been implemented in this plan.

In fourth five year plan (1967-74) 1542.6 million rupees to increase the milk production. As well as operation flood programme has been implement in 1970 and the supervision by Dr. V. Kurien. To produce, the high milking cows through, crossbreeding to establish village primary milk producer co-operative societies. As well as milk collection, chilling and processing has been increased in this plan total 3300 primary milk producer co-operative societies and 4000 artificial insemination centres had been working in this plan.

In fifth five year plan (1974-79) 3189.8 million rupees expended for established of 100 milk processing centers in the country. As well as
buffalo’s milk share has been increased, animal feed and fodder production has been increase during the plan period.

In sixth five year plan (1980-85) 8025.1 million rupees has been expended to the support the primary milk producer co-operative societies in rural areas. As well transportation network, milk chilling and processing plant has been build up. As well as in 148 urban centers connected with the milk supplying these period total PMPCS increased up to 34500 and its membership were 36.6 lakhs in this plan.

In seventh five year plan (1985-90) 12033 million rupees expended on dairy development and animal husbandry. The rupees had been used to support landless laborer, marginal farmers, primitive people, and economically back word people to provide subsidy to buying milch animals, and fodder development and to increase per capita milk availability as well as during this period all co-operative dairy farms are economically supported to increase milk production.

In Eighth five year plan (1992-97) 28383.2 million rupees has been expended for the dairy farming. During these period privatization and globalization, as well as use to advance technology and efficient management, and the co-operative milk producer societies has been economically supported by the national dairy development board.

In ninth five year plan (1997-2002) during this plan 1965 million rupees has been expended for the development of dairy farming. Dairy business has been planned as a view of global agreement and open economic policy. As well as in this period to emphasize the quality of milk productions are export to foreign countries. 28.1 percent rupees, expended
on veterinary facilities, 24.6 percent expended on dairy development, 20.2 percent, expended on mart production, 7.7 percent animal husbandry development, 4.5 percent on fodder development, 4.5 percent sheep and goat development, 4 percent rabbit development. During these five plan to emphasize of modernization create the employment and economic development to endures of dairy business in globalization and free economy.

In tenth five year plan (2002-07) 58.933 million rupees expended on agriculture and agro base industry. During these plan the emphasize to increase milk production per cows and buffalo’s as well as to increase clean and quality milk production and to emphasize to increase exporting of milk product.

In this way during the five year plan the milk production has been increased, as well as primary milk producer co-operative societies and its membership population also increased. Milk supplying network has been development in advance milk chilling and processing centers also increased and dairy farming developed in the above five year plan.

1.9 Operation Flood Programmer:

The National Dairy Development Board was founded in 1965 it rested on the operation flood programme which was conceived by national dairy development board and endorsed by the government. Operation flood is a unique approach to dairy development during the 1970s dairy commodity surpluses were building up in Europe and Dr. Veraghese Kurien the founding chairman chairman of NDDB, saw in those surpluses both a threat and an opportunity. The threat was massive exports of low-cost dairy
product to India. Operation flood organized the potential of the European surpluses as an investment in the modernization of India dairy industry. With the assistance of the world food programme, food aid, in the form of milk powder and butter oil was obtained from the countries of the European Economic Community (EEC) to finance the programme.

Operation flood is a programme designed to develop dairying by replicating the Aanand model for dairy development, which has stood the test of time for almost half century. Operation flood programme has been implemented in three phases:

The first phase of operation flood was launched in 1970 following an agreement with the world food programme which undertook to provide as aid 126000 tones of skim powder and 42000 tones of butter oil to finance the programme.

The programme involved organizing dairy co-operative at the village level; creating the physical and institutional infrastructure for milk collecting processing, marketing and production enhancement services at the union level and establishing dairy in India’s major metropolitan centers. The main thrust was to set up dairy co-operatives in India’s best milk sheds, linking them with the four main cities of Mumbai, Kolkatâ, Delhi and Cheenai in which a commanding share of the milk markets was to be captured. In achieving that goal, the first phase of operation flood laid the foundation for India’s modern dairy industry, an industry that would ultimately meet the countries need for milk and milk product.

The second phase was the programme implemented between 1981 and 1985. Designed to build on the foundation laid in the first phases and
raised this to some 136 milk shed linked to over 290 urban markets. The seed capital rose from the sale of EEC gift product and World Bank loan had created by end 1985, a self sustaining system of 43000 village’s co-operative covering 4.25 million milk producer milk powder productions went up from 22000 tonnes in the pre-project year to 140000 tonnes in 1989.

The third phase programme had implement between 1985 to 1996 and aims at ensuring that the co-operative institutions become self sustaining with an investment of 360 million from the world bank, commodity and cash assistance from the EEC and NDDB own internal resources, the programme envisages substantial expansion of the dairy processing and marketing facilities, and extended milk procurement infrastructure increased outreach of production enhancement activities and professionalization of management in the dairy institutions.⁶

In this way operation flood may be considered the central event of twentieth century dairying in India. An analysis of the lesson learned through the implementation of the programme should be useful for those involved in formulation of dairy development policies and programmes for the developing nations of Asia and Africa.

As well as the network of co-operative institutions, created through the operation flood programmes. Now comprises 70000 dairy co-operative societies in 170 milk sheds encompassing 8.4 million milk producer families. Average milk procurement by these co-operatives has now reached some 12.3 million kg per day of which 8.2 million liters are marketed as liquid milk, while the remainder in converted into product such as milk product
milk capacity of approximately 15.6 million liters per day. Chilling capacity of 6.5 million liters per day and milk powder production capacity of 726 tons per day have been established through the programme.7

One of the challenging aspects of dairy development in a tropical and subtropical country is the movement of milk over long distances. In operation flood, this has been made possible through the operation of about 140 instated rail milk tankers each with a capacity of 40000 liters. Supplement by another 25 rail tankers of 21000 liter capacity. Approximately 1000 other insulated road milk tankers operate throughout the country as well.8

A number of programmer and policies have been played a role in this success certainly the introduction of modern technology both at the farmer level and in the processing of milk and product has been important. It has demonstrated how food aid can be used to enhance domestic production if administered with care. Some of the dairy plants set up by NDDB during the implementation of operation flood are based on latest technology and are comparable to those in advance countries.

Finally most important, operation flood has demonstrated that India’s rural population process enormous energy. Initiative and wisdom all that was needed an opportunity to control the resource that it had created with the talent, resources and experience that emerged.

1.10 Objectives of the Study:

It has been already discussed that the dairy farming plays an important role in the economy of the country. An objective analysis and rational assessment of the present status of dairy farming at different
hierarchies form national to district level necessary. The geographical study of dairy farming involved the application of various geographic concepts and principles. All geographic primitives are made to apply to the dairy farming in Osmanabad district a geographical study which has been undertaken with the following objectives.

1) General objective of the present study is to trace the development of dairy farming in Osmanabad district. Its spatial and temporal characteristics feature. The study is conducted at three different hierarchies.

   a) Milk supply unions  
   b) Primary milk producers cooperative societies and  
   c) The individual milk producers  

2) To study the Environment factors both physical as well as cultural responsible for the development of the dairy farming in the district.

3) To study the important changes in the Socio-Economic infrastructure of the district brought about by dairy farming and to study the impact White Revolution on the economy of the region under study.

4) To study the development of the dairy unions in the district and to study their progress during a period of the decades (1981-2001).

5) To study the impact of the operation flood programme on the progress of dairying in the district.

6) To make suggestions to future development of dairy farming on the basis of the analytical frame work.
1.11 Research Methodology:

Research in common parlance refers to a search for knowledge. Once can also define research as “A scientific and systematic search for pertinent information on a specific topic.” In fact, research is an art of scientific investigation. The advance Learner’s Dictionary of current English lays down the meaning of research as “A careful investigation of enquiry specially through search for new facts in any branch of knowledge”\(^9\) Redman and Mory define “research as a systematized effort to gain new knowledge”, some people consider research as a movement, a movement from the known to the unknown. It is actually voyage of discovery. We all possess the vital instinct of inquisitiveness for when the unknown confront us, we wonder and out inquisitiveness makes us probe and attain full and fuller understanding of the unknown. This inquisitiveness is the mother of all knowledge and the method, which man employs for obtaining the knowledge of whatever the unknown, can be termed as research.\(^10\) According to Clifford woody “Research comprises defining and redefining problems, formulating hypothesis or suggested solution collecting, organizing and evaluating data, making deduction, and reaching conclusion to determine whether fit the formulating hypothesis”.\(^11\) D. Slesigner and M. Stephenson in the encyclopedia of social sciences define research as “The Manipulation of things, concepts or symbols for the purpose of generalizing to extend correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an act.”\(^12\)
In short, the search for knowledge through objective and systematic method of finding solution to a problem is research. Some major types of research are as follows:

1.11.1 Descriptive vs. Analytical Research:

Descriptive research includes survey and fact finding enquiries of different kind. The major purpose of descriptive research is descriptive of the state of affairs as it exists at present. In social science and business research we quite often use these types of research. The main characteristic of this method is that the researcher has no control over the variables; he can only report what has happened or what is happening.

1.11.2 Applied vs. Fundamental Research:

Research can either be applied research or fundamental research. Applied research aims at finding a solution for an immediate problem facing a society or an industrial or business organization as well as fundamental research is mainly concerned with generalization and with the formulation of a theory. Gathering knowledge for knowledge's sake termed pure or basic research this research concern with natural phenomenon and human behavior.

1.11.3 Quantitative vs. Qualitative Research:

Quantitative research is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity. Qualitative research is concerned with qualitative phenomenon. These types of research, aims at discovering the underlying motives and desires, using in depth interview for the purpose. Qualitative research is concerned especially human behavior.
1.11.4 Conceptual vs. Empirical Research:

Conceptual research is that related to some abstract ideas or theory. It is generally used by philosophers and thinkers to develop new concepts or to reinterpret existing ones. Empirical research relies on experience or observation alone often without due regard for system and theory. It is data based research coming up with conclusions which are capable of being verified by observation or experiment.¹³

Selected subject for research is concerned with analytical research in this types researcher has to use facts or information already available and analyze these to make a critical evaluation of the material. The selected subject “Dairy Farming in Osmanabad district: A Geographical Study” analyze on the present material such as Annual Report of District milk union, Annual Report of Government Milk Scheme District gazetteer, so many other report which related study would be use for analyze the subject.

1.12 Period of Study:

For the present dairy farming in Osmanabad district: a geographical study, period of the study 1981 to 2001 (20 years), 1981, 1991 and 2001 is considered. As well as livestock census in 1978 (12\textsuperscript{th} livestock census), 1987 (14\textsuperscript{th} livestock census) and 1997 (16\textsuperscript{th} livestock census) in Osmanabad district has been used to present tahsilwise spatial and temporal variation of milch animal, animals in milk and total bovines in Osmanabad district.
1.13 Data collection:

The task of data collection begins after a research problem has been defined. There are two types of data collection which has been analyze these method are as follows.

1.13.1 Primary data:

Primary data are those which are collected a fresh and for the first time and thus happen to be original in character. The primary data collected through observation of the study region, depth interview of Dairy development officers, Board of Directors of District milk union, and president of District milk producer co-operative societies, member of primary milk producer co-operative societies and non member. As well as questionnaires fill up from the milk producer, president of District Milk union, and Board of Director of primary milk producer co-operative societies in villages.

1.13.2 Secondary data:

Secondary data means data that are already available, which have been already collected and analyzed by someone else. The secondary data collected through annual report of the (ODMPCUO) district milk union, Annual record of dairy development officer in the district, annual record of animal husbandry office in the district, primary milk producer co-operative societies, Osmanabad district gazetteer and annual socio-economic review of Osmanabad district. Livestock census of India, as well as livestock census of state and Osmanabad districts, Osmanabad district statistical abstract, daily news paper, research articles, reputed magazines, research journal, report of national dairy development Board, report of state dairy
development Board, and government publication related with research study has been used as secondary data.

Data presentation:

Written form is the main bulk supported by statistical data wherever necessary and possible cartographic diagrams, maps, chart, (Tables) photographs are other supplementary means of presentation. The data collected are very vast both theoretically and statistical and meaning fully is a hard task.

The district is divided into two revenue divisions for administrative purpose. Bhum, Paranda, Kalamb and Washi are included in Bhum Sub-division whereas Tuljapur, Omerga, Lohara and Osmanabad are included in Osmanabad Sub-division. Lohara and Washi are new formed tahsils in June 1999.

1.14 Sampling Method:

A sample design is a definite plan for obtaining a sample form a given population. It refers to the technique or the procedure the researcher would adopt in selecting items for the sample. Sample designs may as well lay down the number of items to be included in the sample i.e. the size of the sample.

For the present research study of dairy farming in Osmanabad district: a geographical study, researcher has been selecting, Osmanabad District milk producer co-operative union, in the Osmanabad district.

There are different types of sample designs based on two factors via: the representation basis and element selection technique, on the representation basis, the sample may be probability sampling or it may be
non arability sampling is non random sampling. On element selection basis, the sample may be either unrestricted or restricted when each sample so drawn is known as unrestricted sample, where as all other forms of sampling are covered under the term restricted sampling. In present research study primary milk producer co-operative societies in Osmanabad district and their members has been selected by using purposive sampling method.

Milk collection and distribution, development in milk production as well as problems in milk production and all related important issues related dairy farming studied through this sampling method.

Convenient Sampling Method has been used to select non member of primary milk producer co-operative societies. What is the opinion about the dairy farming, PMPCS, like this data obtain by using this method. As well as member of PMPCS and non member of PMPCS comparatively study has been done by this method. Finally case study method has been used to for the detail and extensively study of selected PMPCS in Osmanabad district with registered member and non member (individual milk producer) and Osmanabad district milk producer co-operative union Osmanabad and Government milk scheme in the Osmanabad district.

1.15 Review of Literature:

Selected subject for research is Dairy farming in Osmanabad District: A Geographical Study. This subject designed and presented by the review of literature. Therein Research articles, Articles in Economic Times, Maharashtra times, Lokmat times, Annual reports of National dairy development Board. As well as articles in magazines such as Godwa,
Shetkari, survey of Indian agriculture report, the economic weekly, samaj prabodhan patrika and the publish research articles in research journal and the books which has been written on the dairy farming.

According to Shrikant Kalamkar dairy, “operation flood has been implemented major National integrated dairy development programme.” The success of these programme the milk production has only 17 million tones in 1951 and now in 2006 it is averagely 109 million tones and India become a first rank milk production country in the world. In India, 1950 the milk availability of per day 124 gm. Only and now it is 246 gm. per day per person. But according to Indian council of medical research it is must to this percentage 280 gram per person per day.

According to Kalamkar “share of Agriculture sector in GDP has been decreasing but share of livestock has been increased in GDP by more than 4 percent. Nearby more than 500000 villages are involve in the dairy development programme and 70 million farmers has getting subsidiary occupation because 53 percent livestock has been belong to small and marginal farmers and their percentages in total milk production are 51 percent.”

According to Kalamkar about the dairy business in Maharashtra state they says that the Maharashtra State has six rank in milk production and their percentages are 6.92 to total milk production of India and nearby 75 lakhs employees dependant on these dairy business in the Maharashtra state. In 2005 total livestock percentages are 7.6 and therein cows are 8.8 percent, buffalos are 6.28 percent, 8.59 percents, goats are 5.03 percent and poultry are 7.76 percent. Percentages of Maharashtra state and
income from agriculture and agricultural related sectors GDP has been 34.4 percent in 1960-61 but it has been decreased by 2006-07 and share of agriculture production in GDP to be come only 15 percent but the share of livestock sector in state GDP increased till 21 percent. So the writer fills that the livestock sector has been important sector in rural economy.15

According to Kalamkar “livestock density in Maharashtra state has been 144 per 100 hectare and in 2003 it is 213 per 100 hectares sq.km.” Density has been increased in the state because they gives the three reason first the mostly area of state have dry land so the income from agriculture is very less so he turned to subsidiary occupation. Second is that network of milk cooperative societies in the step inspired for the dairy farming and National integrated rural development programme has been inspiring rural people for the dairy business.

According to Kalamkar dairy business has been playing major role in developing the rural economy especially in dry region it is helpful and subsidiary to agriculture. In the state operation flood programme has been implemented in 1970, 1980 and 1985 in three phases by the co-operation of National dairy development board. The integrated cattle development project and the integrated dairy development project have been implemented in the state for to be increased the milk production. In 2003 Maharashtra state has been first rank in milk co-operative societies in the country, and nearby 16.5 percent milk co-operative societies in the state to total milk co-operative in India. In 1970 operation flood programme firstly has been implemented in two districts only Jalgaon and Kolhapur and then implemented in 19 districts in 1985 Yavatmal, Gadchiroli, Ratnagiri and
Sindhudurg in this district Programme has been included by giving 100 percent subsidies. As well as to increase the population of crossbreed cows Artificial insemination programme has been implementing from last three decades. State has been exporting milk to the neighbor’s state but even the availability of milk in national level and compare to other state in Maharashtra state milk production less than other. This opinion has been expressed in their article.\textsuperscript{16}

According to Nitin Markandey “animal husbandry has been doing from ancient time in India and there is highest livestock population of the world. In India, nearby 580 million total livestock population of the world. In India wasteland has been using as permanent pasture land, in India.” India have first rank milch animals and highest in population of cows, buffalos and goats in the world. For the dairy development in the state co-operative movement has been working but their development in the state co-operative movement has been working but their progress work is declining day by day. In the Maharashtra state Mahananda dairy working as a state milk federation. As well as in the state there are 33 dairies union, 13\textsuperscript{th} co-operative chilling centres, 7 milk powder plants and 78 districts and tahsil milk co-operative union in the Maharashtra state.

According to writer adulteration in milk by the co-operative has been increasing day by day and this problem has been not solved yet. As well as according to writer there has been greatest need of firm decision for the dairy development in the state and the greatest need in the implementation in government policies, as well as it is must to extend the artificial insemination centres, veterinary facilities, fodder development,
and also to create the opportunities for the exporting milkmaid menu on
the Global level. If the all programmes has been efficiently implemented
dairy progress will be confirmed in the state these optimistic view
expressed by the writer in these articles.

According to Dr. Verghese Kurien, “In India mostly farmers has
been small farmer, they have limited agriculture plots and also they used
the agricultural waste as feed for animal.” According to them livestock
animals in India can’t used the green carpet as same to New Zeeland,
Europe and North America because in India these types of carpet hasn’t
available in the country. As a result, our dairy animals typically produce no
more than three or four liters of milk a day.

According to writer as per the FAO publication food outlook 1997
India along with the United States was the largest producer of milk in the
world at the end of 1997. Out of total production 70.8 million tones
combined with a growth rate much higher than that of the us leads us to
expect to overtake the United State and go on to produce 74 million tones
in 1998.

According to them the India dairy was not blessed with a great many
natural advantages. As well as India is milk drinking nation but milk
availability per person per day is very less. The farmer’s problems were
complicated by the fact that milk would not keep beyond three hours in our
climate the problem has been noted in Indian dairy development.

According to Dr. V. Kurien it is must to increase the benefit from
dairy business it is must to establish primary milk producer co-operatives
societies and in 1965 Amul has been created. Amul had acquired a name
for itself as the best run and most modern dairy co-operatives in the country. Then they made sure that the co-operative offered artificial insemination facilities, fodder for cattle veterinary services and etc.

In 1965 Prime Minister of India Lal Bahadur Shastri, visited Kheda district and decided that the Amul example should be replicated all over the country. These lead to the setting up of the national dairy development board with the mission of replicating the Amul experience. What came to be called the Anand Pattern of dairy co-operative all over India? The programme to achieve that replicating on operation flood began with a plan to build four metropolitan dairies. One for each of India’s biggest cities and to promote dairy co-operative in 17 premising areas termed milk sheds in 10 states. The European community played a helpful role in ensuring that the Anand pattern replication succeeded by donating milk powder and butter oil to India these programme implemented in three phase. Today there are 10.1 million farmers who are members of 77000 village dairy co-operatives societies each of which is affiliated to one of 170 district and regional milk Producer co-operative unions which in turn are of a state co-operative marketing federation. There are 22 of these federation which offer dairy and other products in the market successfully competing among themselves and with dairy firms owned by individuals investors and multinationals.19

The industry as a whole today produces enough milk and milk products to ensure that the country imports virtually no dairy products.

According to Kurien total production of milk 20 million tones and in 1970 our milk production now exceeds average 70 million tones. This
means that even if the price of milk is calculated at just Rs. 10,000/- per tones an additional Rs. 50,000 crore more flows back into the rule economy each year.

After all over the study Dr. V. Kurien said that Indias dairy industry is indeed a study in contrasts the world largest milk producer where milk begins in trickles of a few liters poured by millions of dairy farmers twice a day, trickles that join into streams, flow into rivers and ultimate's become a flood of milk that meet the need of our consumers while bringing prosperity and better life to those whose lives depend on dairying.

A Banerjee expressed their view in the Articles Dairying systems in India; they said that, in India dairying is recognized for social and economic development. The nations milk supply comes from million of small producers dispersed throughout the rural areas. Milk production in India is dominated by small and marginal landholding farmers and by landless labourer who in aggregate, own about 70 percent national milch animal herd. As well as they said that dairying as a subsidiary source of income is a real most of economically weaker groups in the society.20

According to Benerjee, about the dairy development in India, they said that operation flood programme has been successfully implemented in India. They say that India was commercially importing around 55000 tones of milk powder annually to meet the urban milk demand. Currently, many developing countries either commercially import dairy products on a large scale or rely on donations to meet the gap between demand and supply of milk products. Together, developing country imports account for over 70 percent of total world trade in milk product as well as they says that the
major challenge for the dairy sector in any developing nation is to increase milk production in order to meet the increasing demand resulting from the almost inevitable expansion of population and presumably, growth of income to meet this challenge, policies must become more market oriented. The adoption of appropriate technologies for production, procurement, processing and marketing after the unique environmental, social economic, political and cultural environment of the individual country has been considered is an important aspect of dairy development.

According to Banerjee operation flood may be considered the central event of twentieth century dairying in India. An analysis of the lesions learned through the implementation of the programme should be useful for those involved in formulation dairy development policies and programmes for the developing nations of Asia and Africa.

The network of co-operative institutions created through the operation flood programme now comprises 70000 dairy co-operative societies in 170 milk sheds encompassing 8.4 million milk producer families. Average milk procurement by these co-operative has now reached some 12.3 million kg per day of which 8.2 million liters are marketed as liquid milk while the remainder is converted into products such as milk butter, cheese, ghee and a wide range of traditional milk product. Milk processing capacity of 6.5 million liters per day and milk powder production capacity of 726 tones per day have been established through the programme.

One of the most challenging aspects of dairy development in a tropical or subtropical country is the movement of milk over long distances. In flood operation this has been made possible through the operation of
about 140 insulted rail tankers each with a capacity of 40000 liters, supplemented by another 25 rail tankers of 21000 liters capacity. Approximately 1000 other insulted road milk tankers operate throughout the country as well. The milk production had been 20 million and 22 million tones during the 1960 and has steadily increase to around 59 million tones and annual growth rate of about 7.8 percent per caputa availability of milk which had declined consistently during the two decades between 1951 and 1970, dropping to 107 gm. Per day at the start of operation flood is now 187 gm. Per day.²¹

In the success of operation flood a number of programme and policies have played in a role in this success and the unique co-operative infrastructure with which NDDB works marks the adoption of technologies and the dissemination of knowledge relatively easy and it has enabled operation flood to facilities the application of modern technologies to enhance milk production, all these way all these way all view about the dairy development in India has been expressed by the A. Banerjee in this review Dr. Arhun Nanaware, and Dr. J. P. Jagtap and N. J. Patil have been studied dairy farming and economic condition of farmers in Drough prone area. This study reveals that there is high positive correlation between percentage of number of milch animals and net earnings of farmers in village Kavhe. The dairy farming is found to be more effective than the other variables considering per year net earnings of farmers. It is found that increase of one milch animal causes, for an increase of 73.81 thousand rupees per year of farmers practicing dairy farming. Therefore it is to be stated that the dairy farming is the best way to improve economic
condition of farmers in drought prone area public awareness about dairy farming as a sideline of suicide of farmers due to poor economic condition.  

Dr. Motilal Madan has been studied the impact of climate on animal production and health are to be considered not in solution but in association with economic, social, health and environmental perspectives. The critical issues of climate impacting animal health and production, both long term and short term, should not only be seen in alternations which the climate change brings about in the psychological functions of the animal systems but also in terms of animals capacity to adjust to the production process ability by adjusting its body system functioning to this climate change.

Under the climate stress there can be a decrease in the efficient of nutrient utilization dry matter intake decrease in animals subjected to heal stress. This depression in dry matter intake can be either short term of long term depending on the length and duration of heat stress decreases 10 to 20 percent are common in summer hot days. There is normally a decrease in milk production for cows under heat stress. These decreases can be either transitory or longer term depending on the length and severity of heat stress. These decreases in milk production can range from 10 to 25 percent. Heat stress has also been reported to decrease reproductive performance in dairy cows as well as it is observed that temperature stress changed the circulating level of several hormones, the most critical of than being those connected with and reproduction and metabolism and they in turn effecting the feed intake, reproductive cycle the length and intensity of
the expression of heat conception rate growth and size of ovarian follicles
risk of early embryonic deaths, fetal growth and calf size, the efficiency of
most production processes and the ability of withstand the challenge from
disease due to reduced disease resistant mechanism.23

As well as writer says that temperature and humidity with water
 longing are most favorable for parasitic (Ecto & endo) and disease vectors.
Helminthes infection connected with climate in South East Asia course 25
percent reduction in growth rate reduction in goats. Helminthes are
estimated to cause 12 percent reduction in production globally. It is
estimated that collectively disease cause 24 percent reduction in livestock
production due to reduce growth rate fertility loss, morbidity and
decreased work rate even subclinical disease can lower productivity by 20
percent. These way writers have studied impact of climate on livestock
production and health.

Dr. Sachin Kakde and Vishwas Toradmal explain “their views in their
book Animal Husbandry breeding, Nutrition and Management about the
Dairy industry, and the necessary thing such as types of milch animal, How
to select types of fodder, veterinary services all important issue related
with dairy farming discuss in their books.”24

Dr. Anikumar Kulkarni express “their opinion in their book dairy
industry according to him success of any business depend on the skillful
management they said that every manger of Dairy farm want to be
concentrate on the technical thing for better production of milk as well as
they try to gives the information about selection of milch animals, their
breeding, feed and fodder management in their books.” 25

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Dr. S. S. Burkule expresses “their view about the dairy business in their book Ideal dairy business. In that they guide in this book they gives the information to the milk producer to concentrate about the crossbreeding of milch animal, diet of milch animal, how to keep continuity in milk production as well as they informed the milk producer about the dangerous disease.”  

G. H. Schmidt & L. D. Vleck has been expressing their view about those on the mammary gland, physiology of milk secretion, simple genetics, basic principles of dairy cattle nutrition and fundamental of reproduction and care and management of cows in their book Principles of Dairy Science.  

Shivajirao Thombre and Vasantrao Khauspe to express an opinion on fodder crops according to him unavailability fodder is the major problem in dairy business. They says that there are 70 percent portion are dry and green fodder in the diet of milch animal to increase milk production it is must to give nutritional diet to the animal, as well as they suggest how to reduce expenditure on the feed and fodder by using new technology and new fodder crops cultivation etc.  

As well as Henrik Sen, (1998) studied issues is how to protect the interests of the poor dairy farmers and yet keep pace of increasing the milk production de Jone 1996, Gosforth 2001, Ranjan 1999 Owen 2005 has studied poor livestock keeper whose livelihoods depend upon livestock and the challenges these resources poor families face in rearing livestock. Rangnekar 1993, Patel 1993, Bravo Bauman 2000, Rao 2001, Ramkumar and Rao 2001 studied how to the surplus labour in these families can best
be utilized in rearing dairy cattle thereby generating productive employment in the rural areas. In this way many researchers has been research on dairy farming and dairy related issues.

In the following review of literature, priority has been given to mention recent works as compared to older references, which are available in the books and research publications mentioned in the review.

The Physico-chemical characters of dairy waste water from different tanks of effluent treatment plant were investigated by Khojare et al. (2005), Mishra and Joshi (2005), Sarkar et al. (2005) and Patel et al. (2006). Physico-chemical and regression analysis of dairy waste water collected from Aurangabad, Maharashtra was done by Parween et al. (2009). The characterization of milk house waste water was done by Singh et al. (2005), while, main pollutants present in the dairy effluent was investigated by Gaikar et al. (2010). Dairy effluent was investigated for its physico-chemical characters by Dhanam, (2009) and Kolhe et al. (2009). Effluent from equalization tank and from other treating tanks of dairy plant was investigated by Sharma, (2008). Simulation of pollution level (BOD and COD) of dairy plant effluent was studied by Sethi et al. (1981). Effluent characteristics of dairy were investigated by Kothapalli and Vangalapati, (2010).

Many studies have been made in abroad to investigate the physicochemical characteristics of dairy waste water. Carawan et al. (1977), Carawan et al. (1979) and Thammasat and Laortanakul (2003) have investigated the waste water characteristics of milk processing unit. The main pollutants in the waste water from dairy processing plant were
studied by Baick et. al. (1992), Silva et. al. (1999), Gough et. al. (2000),
Longhurst et. al. (2000) and Singleton et. al. (2001), while Henz, (1997)
studied the waste water as a resource for production of biogas or carbon
for gentrification.

Cullinson (1982) identified carbohydrate, fats, proteins, minerals,
vitamins and water as a nutrient in waste water.

The characteristics of dairy effluent were studied by Monroy et. al.
(1995) and Medhat and Usama (2004). High levels of suspended solids,
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turbid nature of dairy waste water because of high organic materials was
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dairy was studied by Carawan et. al. (1977). Dairy effluent on 1st, 3rd, 5th
and 7th day was investigated by Adeoye et. al. (2009). Analysis of inflowing
and out flowing waste water from the plant and comparison with legal
limits was investigated by Mantovi and Piccinini (2002). Total coliform
present in dairy waste water was studied by Monroy et. al. (1995) and
Mantovi Piccinini (2002).

Utilization of waste water of milk processing unit was studied by
many workers in India. Some of the important works have been referred.
Effect of dairy effluent and its utilization in seed germination and in
seedling growth have been investigated by workers like Pandit et. al (1996)
in Pennesetum typhoides Barm and Sorghum bicolor L, Pandit et. al. (1997)

Suppression of seedling growth by effluent diluted more than 10% was studied by Singh *et al.* (2002) in *Triticum aestivum* L., Tomer *et al.* (2002) in sunflower, Trivedi and Goel. (1984) and Singh *et al.* (1985) in rice. Dhanam, (2009) had investigated that the higher concentration of effluent is toxic to the plant growth and only after treatment and dilution of dairy effluent; it can be utilized for irrigation purpose.

Utilization of dairy waste water for the production of valuable by products was studied by Daverey *et al.* (2009). The studies have also been made on utility of waste water in crops irrigation by several workers viz. Aziz *et al.* (1999), Javid *et al.* (2006), Singh *et al.* (2006) and Nath *et al.* (2007). Utilization of effluent in eco plantation of Eucalyptus, Teak and Jatropha was done by Sharma, (2008).

Several investigations have also been done in abroad regarding the utilization of waste water of milk processing unit. Dairy waste water solids from a milk processing unit was analyzed to determine variability in composition and feeding diet containing 5% of dairy waste water studied for swine and sheep as an alternative means of disposal was studied by Belyea *et al.* (1990). Production of glycerine and bio diesel from dairy waste water was investigated by Depatii *et al.* (2009). Utilization of dairy waste water in nitrogen removal of Bermuda grass-rye and corn-sorghum system was studied by Woodard *et al.* (2000). Study was also made by Bylund, (1995) to use waste water lactose as a fodder or a coarse feed for
cattle. Thangraj and Kulandaivelu, (1994) have investigated the Biological hydrogen photo production using dairy waste water.

Use of dairy industry sludge as fertilizer for grass land in North West Spain was studied by Lopez et. al. (2002). Chemical and Biological properties of an Agro forestry soil treated with dairy plant waste were investigated by Omil et. al. (2002). Dairy waste water provides nutrients for crop growth and recycling of nutrients was observed by Macoon et. al. (2002).

Many investigations have been done in India regarding the treatment of waste water produced from milk processing unit. Anaerobic process of treatment and photo catalytic oxidation was suggested by Fang and Herbert, (1990)A, Omil, (2003) and Banu et. al. (2008). Chemical and biological treatment method for waste water was studied by Narr and Elkamah (1996), while, an aerobic method of treatment was investigated by Mohseni and Bazari, (2004). Yang and Liangjie, (2000) studied the use of anaerobic and aerobic post treatment waste water of milk processing unit. Sparling et. al. (2001) had also investigated the treatment method of dairy factory effluent.

Many works have been done by the workers on effect of dairy waste water in seed germination and seedling growth, however none of the record was found related with Net primary production of vegetables in dairy waste water.

1.16 Chapter Scheme:

The entire work has been completed in seven chapters. First Chapter Introduction deals with the introduction history of dairy farming, significance of study subject, milk production in the world, milk production in the selected countries, dairy farming in Indian Economy operation flood programme. Objective of the study, database and methodology, sampling method, review of literature and chapter scheme of the present research work detail in discussed.

Second chapter physical profile of Osmanabad District in this topic location of study region, physiography, Climate, drainage system, soil and forest, Land Utilization in Osmanabad District, cropping pattern in the district, population characteristic, irrigation facilities and their sources in the district, as well as markets centers, electricity facilities, transport and communication facilities has been studied in detail.

Third chapter devoted to Animal Husbandry in Osmanabad District, total livestock population in India and Maharashtra and their growth and milch animal density in Osmanabad District. In this chapter mainly study has been concentrate on total bovines and their distribution and on tahsilwise milch animal, their growth and drop, in the district and on spatial and temporal variation in the percentage of milch animal. Animal health and veterinary facilities in the district has been studied in the third chapter.
In this **Fourth chapter** Feed and Fodder Resources and their Requirement, feeding system, and types of feed and fodder. Such as forage cereals forage grasses, tree fodder, livestock and landuse, feed and fodder requirement for milk production in India and Feed fodder development programme. Tahsilwise percentages of permanent pasture land to total geographical area of tahsil.

In this **Fifth chapter** Collection and Distribution of Milk total milk Collection in India. Total PMPCS in India, division wise milk collection and chilling center, PMPCS, Milk union in the Maharashtra State. As well as Tahsil wise total PMPCS in Osmanabad District and Tahsil wise total milk collection in Osmanabad District has been studied in the fifth Chapter.

In this **Sixth chapter** Case Study present condition of dairy farming has been studied by collecting data through survey and tries to gives the detail of selected PMPCS and their selected registered member and individual member role in dairy farming. As well as Government Milk scheme in Osmanabad District and Osmanabad District milk producer co-operative union and their functioning review has been taken in sixth chapter.

In this **Seventh chapter conclusions**, problem, and recommendations has been to arrange on research work.
References:


CHAPTER-II
PHYSICAL AND NON-PHYSICAL DETERMINANTS OF THE REGION

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CHAPTER-II

PHYSICAL AND NON-PHYSICAL DETERMINANTS OF THE REGION

2.1 Introduction:

In the first chapter introduction, place of agriculture in Indian economy, agricultural development in India, choice of the study area, aims and objectives, database and methodology, review of literature and chapter scheme all these points are discussed.

Physical and non-physical factors influence overall economic development and that factors contributing to agricultural growth must also be sought in the same perspective. However, one cannot ignore the impact of the vast multiplicity of interrelated physical and non-physical factors on agriculture, notwithstanding the fact all of them are not equally significant in influencing the regional variation and temporal development of agricultural phenomena in an area. In this sense one must analyses the distribution patterns of decisive factors in order to understand the distinctive regional characteristics of the dependents so that the regional division of an area may be tailored to the purpose of a particular study.

The varying physical conditions are indeed responsible for variations in regional patterns of agricultural phenomena, however, the different degree of combinations in institutional, biotechnological, operational, demographic, cultural and infrastructural factors influencing agricultural patterns must be considered useful. This is because the combination of these circumstances furnish the basic material needed for explaining the modifications brought about in agricultural activities which otherwise are
the primary creation of natural forces. Therefore, their discussion is unavoidable to comprehend the varying levels of agricultural development from place to place at a point of time.  

Part A

Physical Determinants of the Region

2.2 Introduction:

This part is mainly related with the location and boundaries, historical background, physiography, geology, natural vegetation, drainage, climate soil of the study region.

2.3 Location and Boundaries:

Osmanabad is the Southernmost district in the Aurangabad division of Maharashtra state situated between 17°35’ North to 18°40’ North latitudes and 75°16’ East to 76°40’ East longitudes. It has an area of 7512.4 sq.kms. This area has rural area (96.79%), whereas the 241.4 sq.kms. area is urban area (3.21%). District rank 24th in Maharashtra in respect of total geographical area. East-west maximum extent is about 282 kms and North-South extent is about 204 kms.

Solapur district lies in the South-West, Ahemadnagar to the North-West. It is rounded on the North by Beed and East and North-East by Latur, and South by Bidar and Gulbarga districts of Karnataka state (Map.2.1)

The district is divided into two revenue divisions for administrative purpose. Bhum, Paranda, Kalamb and Washi are included in Bhum Sub-division whereas Tuljapur, Omerga, Lohara and Osmanabad are included in
Osmanabad Sub-division. Lohara and Washi are new formed tahsils in June 1999. These tahsils are not considered for present study due to non-availability of data.

2.4 History of Osmanabad District:

Tuljapur town of this district enshrines the temple of Goddess 'Bhavani', the popular deity of Maharashtra. The cult of Goddess is very ancient one and finds mention even in 'Vedas' where she is called 'Aditi'. The earliest inscriptional evidence regarding its antiquity cannot go beyond 1098 A.D. The Goddess was the principal deity of Chhatrapati Shivaji, the other Chhatrapatis and Peshwas who donated quite generously to the temple. The village 'Thair' in the district is also an ancient place and was known as 'Tagara'.

In 1853, the district was temporarily rerized by Nizam to the British Government. It was reverted to Hyderabad State in 1860. Its headquarters formerly used to be at Naldurg and the district was known as Naldurg district till 1904. The district of Naldurg was abolished and the new district of Osmanabad was formed with headquarters at Osmanabad. In 1905, two tahsils with headquarters at Washi and Naldurg were abolished. Washi was merged in Kalamb and Naldurg in Tuljapur. Headquarter of Ausa tahsil was shifted to Latur and the tahsil was named as Latur tahsil. Among the districts of Marathwada, Osmanabad had the biggest area under the Nizams own estate called Sarf-e-Khas. The Sarf-e-Khas was merged with the Government area under the Sarf-e-Khas (Merger) Regulation in the year 1949. All the Jagir areas were also abolished and taken over under district
Govt. administration in the same year. Consequent upon the integration of Sarf-e-Khas and Jagir areas, the boundaries of all the tahsils were reconstituted in the year 1950. Two new tahsils with headquarters at Ausa and Omerga and new Peta with headquarters at Bhum were created. In the same year (1950), eleven enclave villages from Solapur were transferred to Solapur district. With the reorganization of the State in 1956, the district came to be included in Mumbai State. Three tahsils of Ahmedpur, Nilanga and Udgir were transferred from the adjoining district of Bidar to Osmanabad district. On the same date, 8 villages of Barshi tahsil of Solapur district were added to the Osmanabad tahsil. Osmanabad, Tuljapur, Paranda, Kalamb and Bhum tahsils remained in Osmanabad district. Latur district was formed on August 1982 and Ahmedpur, Latur, Nilanga, Ausa and Udgir tahsils were included in Latur district.  

2.5 Physiography:

Physiography is one of the important parameters of physical environment and its impact on patterns and density of agriculture is immense. The study of the influence of environment upon the nature and distribution of crops and livestock is of prime importance in agricultural geography. Nature with its physical characteristics provided a host of possibilities for agriculture in different areas. Cropping system in the region is generally dependent upon physical factors and socio-economic conditions respectively. Whereas in case of the hilly tract, the latter is more dominant this has greatly caused diversification of the crops.
A greater part of the district situates on the triangular Balaghat Plateau generally over 610 meters above sea level, sloping towards the South and east forming the water divide between the Godavari and Bhima valleys. The district is covered with small hills and offshoots of the Balaghat parts of Bhum, Kalamb, Osmanabad and Tuljapur tahsils are situated on Balaghat plateau and the rest on the table lands. The highest point the district a little over 792 meters is situated on this divide, just North west of Kanheri about 6 km South west of Washi. North of Terkhed a spur extends castwards and makes a right angular turn to the South around Babhalgaon and again continues the easterly trend and runs with a summit level of about 700 meters passing South of Moha (Map No.2.2).

The District can be divided into three important regions geographically.

1. The Western bulge comprising Paranda tahsils and the western part of Bhum tahsil in the Sina drainage basin.

2. The South western region comprising the Southern and western part of Tuljapur tahsil in the Bhima drainage area.

3. The Balaghat plateau made of residual interfluves and the valleys of streams dissecting the plateau.

A) Western Region:

The western bulge consisting of the Paranda tahsil and the western part of Bhum belongs to the Sina Basin. In marked contrast to the plateau relief of the first region. The sharp relief with innumerable small streams with rugged interfluves between them is the characteristic of the region. These valleys have fertile soils and abundant ground water supplies both
accounting for the dominance of rabbi cultivation. The crossing of this area by innumerable streams has enabled the execution of several minor irrigation works, but has to some extent hindered the development of good roads which is reflected in the fact that Paranda has the lowest percentage of development.

B) South Western Region:

The South western region comprising the Southern and western part of Tuljapur tahsil comes under the jurisdiction of Bhima basin. This part is drained by the tributaries of the Bhima system. This part is fertile and covered by deep regur soil.

Agricultural activities are mainly concentrated in the river basin and plateau region. Balaghat range region of Bhum, Kalamb, Washi, Osmanabad and Tuljapur Tahsils is not suitable for agricultural activities.

C) Balaghat Plateaus:

This plateau region rises rather steeply from the plains to the west and dips gently towards the east. The main trunk road from Beed to Tuljapur and Naldurg is laid along the top of this divide behind the scarp. The principal agricultural villages are all situated away from this divide in the valleys of streams either to the east or west and everywhere there are Kutcha approach roads linking these villages to the main road.

2.6 Geology:

No systematic geological work has been carried out in the Osmanabad district. The information available on the geology of the region is meager. The underlying rock formation is termed as ‘Deccan Trap’ is
found in all tahsils of the district and it is ‘Pleistocene Recent’. A large part
of the region is occupied by rocks to the Deccan trap formation,
represented by almost horizontal lava flows of basaltic composition,
through to have been emplaced from fissures towards the close of the
Mesozoic era on the lower Tertiary area.

The trap gives rise to either brown to red or to black cotton soil
(Regur). Such belt of soil is noticed in Kalamb, Tuljapur, Omerga and some
parts of other tahsils.

2.7 Drainage:

Surface and underground water are the major sources of drainage. It
is the result of a combination of numerous factors including climate
particularly precipitation, insulation, humidity, cloudiness, wind force and
direction, structure and type of rocks, vegetation, soil and human
utilization, human obstruction to natural water flow such as roads,
railways, dams and reservoirs also change its nature. However, drainage is
one of the most important components of physical environment which
affects agriculture directly and indirectly. Ground water influent becomes
the base flow that maintains the flow of streams in fair weather. When we
speak of surface water is by far the most important means for providing
substantial irrigation which stabilizes and improves agro-economic life in an
area that has otherwise plenty of land potential. Because of the improved
agricultural techniques and landuse planning without combating the
problem with the help of shallow and deep water tables is bound to be
absorptive.
Rivers of the Osmanabad district are from North-West to South-East and from North to South (Map 2.3). The drainage of the area is of the ordinary dendratic pattern because rivers and streams have developed a branch like system. Most of the rivers are seasonal except Manjara which flows from the Northern border area of Kalamb, Washi and Bhum Tahsils.

1. **Bori**:

   The Bori River rising of Dharur, flows in a South easterly direction East of the ridge from Tuljapur to Naldurg. After cutting through the gap at Naldurg it flows in a general South-Westerly and Southerly direction to join the Bhima River.

2. **Harni**:

   The Harni River is an important tributary of the Bori, flows West of Tuljapur to Naldurg ridge with a course of about 25 kms within the district to join the Bori about 10 kms North of Akkalkot.

3. **Sina**:

   The Sina river, a major tributary of the Bhima River, runs along the Western boundary, but receives many tributaries draining the Bhum and Paranda tahsils. These are beginning from the North the Kheri, the Nalli, the Dudhana with its tributary the Ulupa and the Chandani. All these are more or less parallel streams flowing in Southerly or South westerly direction and having their sources on the western scarp faces of Kunthalgiri, Osmanabad, Tuljapur and Naldurg watershed.

4. **Banganga**:

   Banganga is tributary of the Sina River. It is an important river in the district. It flows Bhum and Paranda tahsils and joins the Sina River.
5. **Manjara**:

It Manjara river rises near Gaurwadi in Beed district. It flows in a South easterly direction towards Osmanabad district. It forms the district boundary for the greater part of its easterly course, barring a few deviations of the boundary some to the North and some to the South of the river; it is useful to the Kalamb and Washi tahsils of the Osmanabad district.

6. **Terna**:

The Terna River over 150 kms, in length from the source to its confluence with the Manjara has the longest course of all the rivers lying entirely within the district. The Terna project consists of an earthen dam on the river.

7. **Benithora**:

The Benithora River is a tributary of the Bhima rises on the slopes of Deobet hill and flows in a South westerly direction passing by Jevali, Yenegur and Murum. At about four kilometers South of Murum, it turns eastwards and receives a number of tributaries like Gunjoti nala and Omerga nala. It then turns Southwards and passes outside the district.

2.8 **Climate**:

In a large measure climate determines where man may live and thrive what crops he may raise? What pests and diseases he must combat. What type of home he may appropriately build? What sort of clothing he may wear? The potential crop producing capacity of a given area is dependent mainly on the existing climatic and soil conditions. Since, climatic factors exert mainly a regional influence on plant life, the
differences in the behaviour on a crop or a group of crops over extensive area as in a given state or a group of states may be considered as due primarily to differences in climatic rather than soil condition\textsuperscript{7}. The climate dictates the range of crops which a country can economically produce. This in turn sets the range of commodities which that country must import if it wishes its people to live a full life in the modern sense\textsuperscript{8}. The success and failure of the cropping season is determined by the intensity of the climatic factors. The primary determinants of crop growth are temperature, water supply and light\textsuperscript{9}.

The year may be divided into four seasons. The cold season from December to February hot season from March to May, South west monsoon from June to September and the post monsoon from October to November are the part of the climate.

A) Temperature:

The conditions of temperature have been for less erratic from year to year than rainfall conditions in each agricultural region. However, great annual ranges may be highly significant in different zones giving rise two or more cropping seasons. For this season, especially in Osmanabad district, a different crops are raised in different seasons without suitable temperature conditions, germination of seeds and growth of plants are retarded. Temperature regulates all the chemical and physical processes begin with rise of temperature until they reach a maximum at a temperature called the optimum. Further with rise in temperature above the optimum level the metabolic activity is showed down until it ceases\textsuperscript{10}.
Each crop plant needs a certain number of effective heat units for germination, growth stalking, maturity and ripening. This is called the thermal constant and varies from crop to crop. The above temperature is minimum, effective in furthering the growth of a plant towards maturity and ripening. The crucial air temperature is 6°C at and above which plants grow. It is also known as the crucial limit. Ideal temperature conditions for crop production are between 18.3°C and 23.90C.

For the agricultural geographer, two of the best indicators of regional differences in temperature currently available or derived are a) length of the growing season and b) accumulated temperature above the maximum for plant growth.

There is only one meteorological observatory at Osmanabad, the details which follows is mainly based on the records of the observatories of the Osmanabad town. The cold weather commences towards the end of November when temperatures begin to decrease rapidly. December is generally the coldest month with the mean daily maximum temperature at about 29.5°C and the mean daily minimum at about 15°C.

On some occasions, the minimum temperature drops down to about 4°C or 5°C. The period from about the middle of February to the beginning of the South-west monsoon season is one of continuous rise in temperature. May is generally the hottest month with the mean daily maximum temperature at about 40°C and the mean daily minimum at about 25°C. The heat during summer is intense and maximum temperature sometimes goes up to about 45°C. Afternoon thunder showers which occur on some days bring welcome relief through only temporarily. With the
onset of the South-west monsoon in the district early in June there is appreciable drop in temperature with the withdrawal of the monsoon early in October there is a slight increase in day temperature. Nights, however, progressively become colder.

B) Rainfall:

Rainfall is the dominant single weather element influencing the intensity and location of farming system and the farmer's choice of enterprises. It also becomes a climatic hazard to farming when it is characterized with scantiness, concentration intensity variability and unreliability.

It is all the more important in the minimal region where average or normal rainfall is generally necessary for successful crop production. In such area, the system of crop production must be corrected more or less to the moisture factor. About more than 84% of the annual rainfall in the region is received during the South west monsoon season, the rainiest month being July gets the heaviest rainfall in North-east, while the retreating monsoon rainfall in September becomes more important in the east on an average there are 51 rainy days.

The South-west monsoon is the pivot round which almost the entire from life and economy swings. Rainfall has control and for this season is a seasonal rhythm of conditions influencing the patterns of landuse. The record of the rainfall in the Osmanabad district is available for the period ranging from 1986 to 2006. The details of the mean annual rainfall and coefficient of rainfall variability from 1986 to 2006 are given in the table 2.1.
Yearly variation in the rainfall is large in the district. It decreases from South-east to North-east and increase from North to South.

Table 2.1 indicates that below 600mm, there is mean annual rainfall recorded in Paranda tahsil, whereas 600 mm to 800 mm mean annual rainfall was recorded in Osmanabad, Kalamb, Omerga and Bhum tahsils from 1986 to 2006. Above 800mm mean annual rainfall was observed in Tuljapur during the period of investigation (Map No. 2.4).

Table No. 2.1

Mean Annual Rainfall and Co-efficient of Rainfall Variability in Osmanabad District for the Period beginning from 1986 to 2006

<table>
<thead>
<tr>
<th>Name of Tahsil</th>
<th>Mean Annual Rainfall in mm</th>
<th>Co-efficient of rainfall variability in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osmanabad</td>
<td>768</td>
<td>26.98</td>
</tr>
<tr>
<td>Tuljapur</td>
<td>815</td>
<td>30.92</td>
</tr>
<tr>
<td>Paranda</td>
<td>597</td>
<td>39.58</td>
</tr>
<tr>
<td>Bhum</td>
<td>705</td>
<td>33.85</td>
</tr>
<tr>
<td>Kalamb</td>
<td>690</td>
<td>34.47</td>
</tr>
<tr>
<td>Omerga</td>
<td>721</td>
<td>29.58</td>
</tr>
</tbody>
</table>

Source: Computed by the Researcher.
The co-efficient of rainfall variability is calculated by the following formula:

\[ \text{Co-efficient of rainfall variability} = \frac{S}{X} \times 100 \]

Where, \( S \) = The Standard Deviation
\( X \) = The arithmetic mean of rainfall during the 25 years.

It is known from table 2.1 that the variability of rainfall in the Osmanabad District ranges between 26.98% to 39.58% in Osmanabad tahsil and Paranda tahsil respectively. In Osmanabad and Omerga tahsils, rainfall variability is below 30%. About 30% to 35% rainfall variability was noticed in Kalamb, Tuljapur and Bhum tahsils while above 35% rainfall variability was experienced in Paranda (39.58%) tahsil during the period of investigation.

2.9 Soils:

The changeable climate and rough soils are the natural endowment of an area. Infact, it is agriculture that modifies soils, excepting certain virgin soils which can retain their original characteristics. Primarily, soils constitute the physical base for any agricultural enterprise. Farming is the main business so as good soil is a part of the farmers' stock in trade. Good soils are good to the extent that man makes judicious use of them. Our standard of living which predominantly depends on agriculture is often determined by a combination of the physical, chemical and biological characteristics of the soils and the crops and livestock's raised on them. Thus, soils endowed with a proper combination of texture, structure, salts
and humus yield good results. Great civilization have almost invariability flourished no good soils the alluvium in particular.

Soils provide essential material on which agriculture is based and therefore, comprehensive survey of the geography of agriculture should a fairly through treatment of soils. Even at the beginning of his work on political geography. Ratzel made a statement of great significance and insight (Every nation is a bit of soil and humanity)\textsuperscript{15}. These are the source of practically the entire stock of man's food clothing and we ever increasing list of other needs so much so, that man gets nearly all of his food from the soils less than 1\% of what he eats being fish\textsuperscript{16}. Of the long list of nature's gifts to man, productive soils and water are the most basic to human life\textsuperscript{17}. The top or upper layer of soils has an average thickness of between 15 and 20 cm. depending upon local conditions.

In Osmanabad district, there is an influence of Topography on soil variation. It is covered by the geological formation of Deccan trap. The development of soils is therefore, mainly influenced by the topographical situation soils along the river banks are deep and clay. Most of the region is covered with black cotton soils or ‘Regur’ drained from the Deccan trap volcanic rock. However, the soils vary greatly in texture and depth. Soils along the river banks and nalas are deep and vary fertile and capable of retaining moisture. The soils however, coarse, shallow and relatively poor along the hill slopes and at the foot of the hills\textsuperscript{18}.

Major portion of the region is covered by medium black soils. The deep black soils are found along the banks of Manjara, Terna, Bori and Benitora. Soils have light grey brown to grey brown colour on the surface,
clayey texture and blacky structure. They are moderately high in soil reaction with the total soluble salt continents varying between 0.26% and 0.94% calcium carbonate is high but shows wide variation from 5.20% to 19.60% organic matter varies from 0.5% to 1.58%.

Out of the total soil medium black soils covers about 6 lakh 19 thousand hectares land (84.21%), deep black 29 thousand hectares (3.95%) and coarse and shallow soil covers 87 thousand hectares (11.84%) land in Osmanabad district.

All these soils are highly clayey with clay content varying from 45.80% to 69.5%. The high rechargeable capacity of the soils indicates the inherent high status of soil fertility.

We found four types of soils of the district:

i) Shallow soil
ii) Medium soil
iii) Medium deep soil
iv) Deep soil

1. **Shallow Soils**:

The North West part is under the shallow soils. Some small patches also occur in the western and North-western part of the district. Particularly this type of soil is occurred in Paranda, Bhum and Washi tahsils. These soils are light brown to dark grey brown colour, loamy to clay loam in texture with granular to sub granular blocky in structure with 1% to 3% slope. However, some patches of medium soils are also seen as a result of deposition. High sheet erosion is observed resulting in exposure of rocks and disintegrated murum at places. Soils are tending towards alkaline in
reaction. The PH varies 7.97 to 8.7. The total soluble salts are less than 0.34% calcium carbonate varies from 2.6% to 9.7% which is fair to moderate. The exchangeable calcium varies from 8 to 24 M.e.% , the higher proportion not being desirable. Exchangeable Na+K is less than 3.5 M.e.%.

Total nitrogen contents of the soils are fairly low, round about 0.05%. The organic matter is low to moderately low ranging between 0.38% and 0.93%. The available phosphate is from moderate to moderately high varying from 17.85 to 38.46 Mgm%. The available potash is also fair to moderate varying from 14.91 to 26.80Mgm%. Thus it will be seen that the soils are deficient in nitrogen and organic matter. Contents will give better yields on the application of the same with provisions of adequate water supply (Map No. 2.5).

2. Medium Black Soil:

The areas of Bhum, Washi, South-west Kalamb, Osmanabad, Tuljapur, Lohara and Omerga and eastern part of Paranda tahsils are covered by medium black soils. The soils are clay loam to clayey in texture with sub angular blocky in structure with dark brown to dark grey brown in colour.

The soils are alkaline in reaction with Ph 8.08 to 8.53. The total soluble salts are less than 0.4%. The calcium carbonate varies from 2.4% to 9.7% which is fair to moderate. The organic matter contents are slow to fair varying from 0.77% to 1.53%. The exchangeable calcium varies from 24.5 to 56.0 m.e. %. The exchangeable magnesium varies from 8.0 to 24.0 m.e. % which is not a desirable feature when the magnesium contents are on the high side.
The exchangeable sodium and potassium together vary from 1.5 to 4.0 m.e.%. The total nitrogen is round about 0.056% which is also low. The available phosphate is fair to moderate ranging between 17.85 and 38.45 Mgm%. The available potash varies from 14.92 to 26.30 Mgm.%. Thus it will be seen that the soils are deficient in nitrogen and organic matter contents and need the application of the same for better yields.

3. **Medium Deep Black Soil**:

These types of soils are scattered and found in the North West and Northern areas and also eastern parts of North central zone in the district. The soils are clay loam to clayey in texture, granular to sub granular blocky in structure and the lower zones of the profile show angular blocky to massive structure also. The soil colour varies from dark grey brown to very dark brown. The soils are alkaline in reaction, the PH ranging between 8.38% and 8.89%. The calcium carbonate is fair to moderate ranging between 4.1% and 9.2%. The organic matter contents are fair to moderate ranging round about 1.5%. The exchangeable calcium varies 31.5 M.e.% to 55.00 m.e.% The exchangeable magnesium varies from 7.0 to 20.00 m.e.% which is not desirable when % in higher proportion. The exchangeable Na/K varies from 1.5% to 11.5 M.e.% which is also high and will require careful management if the soils are to be irrigated. The total nitrogen content varies from 0.045% to 0.057 % which is low. The available phosphate is from fair to moderate 8.89 to 12.34 Mgm%.

4. **Deep Black Soil**:

Deep black soil covers 3.95% area of the Osmanabad district. The deep black soils are found along the banks of Manjara, Terna, Benithora,
Bori, Harni and Sina and their tributaries. Soils have light grey brown to grey brown colour on the surface, clayey texture and blocky structure. They are moderately high in soil reaction with the total soluble salt contents varying between 0.26% and 0.94%. Calcium carbonate is high but shows wide variation from 5.20% to 19.60%, organic matter varies from 0.5% to 1.58%. These soils are highly clayey with clay content varying from 45.80% to 69.5%. The high rechargeable capacity of the soils indicates the inherent high status of soil fertility.

Exchangeable calcium varies from 32 and 57 m.e.% and exchangeable magnesium between 5 and 34 m.e.% plant nutrients status of these soils are moderately good with nitrogen varying from 0.03% to 0.06% available, Phosphate 10.92 to 15.14 Mgm% and available potash 14.35 to 27.02 high fertilizers will be useful in increasing the crop production in the region. Deep black soil is rich in plant nutrients supporting Kharip and Rabbi Crops like cotton, jowar, bajara, wheat, groundnut and pulses.

The soil erosion is mainly found in Bhum, Paranda and some parts of Osmanabad district.19

2.10 Natural Vegetation:

Vegetation is some part of the natural covering of the land surface of the earth. Even so called deserts have their vegetation, through it may be scanty and inconspicuous. The fertility of soil and rainfall distribution is depending upon natural vegetation. It also checks the soil erosion to the greater extent. It also keeps the environmental balance. Forest also provides wood for making form implements.
The natural vegetation of region depends upon the distribution of climatic elements over the region, edaphic or soil conditions, topography of the region, biotic factors, extent of human interference, drainage condition. Osmanabad district has been scattered type of trees. The forests are somewhat dense in Tuljapur Tahsil. There is very little trees cover over Balaghat plateau region. They occupy too little a portion of the total area in this district which has definitely resulted in soil erosion to a great extent.
Part B

Non-Physical Determinants of the Region

2.11 Introduction:

This part deals with the analysis of irrigation, demographic characteristics, animal resources, agricultural implements, use of high yield varieties, chemical fertilizers, pesticides, agricultural credit and finance, marketing and electricity and transport or communication.

2.12 Irrigation Facilities:

Irrigation is the term to overcome lack of deficiencies in rainfall for growing crops\textsuperscript{21}. For successful and well developed agriculture it requires supply or water at regular interval and in required quantity. This could be done by artificial supply of water to the agricultural land for growing crops and it is known as 'Irrigation'\textsuperscript{22}.

Irrigation is a pre-requisite for the adoption of new technology in agriculture and for the rapid growth of agricultural sector. It is also helps to the farmers to take two or more crops from the same field within a year and it increase the productivity of the land by transforming the agriculture. The impact of irrigation is all pervading as it leads to changes in cropping pattern, increases yield rates and labour utilization; and in the ultimate analysis brings prosperity for socio-economic change that sets motion the productive forces in the agricultural sector\textsuperscript{23}.

The study region is as not having permanent drainage pattern even though it is possible to raise irrigated area by minor irrigation projects.
(a) Major Irrigation Projects:

An irrigation project which covers more than 10,000 hectares as the cultivated command area is called Major irrigation Project. There are four Major irrigation Projects in the study region. They are lower Terana, Manjara, Turori and Rui. All Projects are completed.

i. Manjara Project:

It is constructed on river Manjara near Dhanegaon in Beed district Rs. 3311.41 lakh amount was spent for the construction and development of canals. It was completed in 1984. It is 36 meter high from the river bed. The total length of the canal is about 168 Kms. The maximum storage capacity of this project is 250.50 million cubic meters. Total irrigation potentials are 17713 hectares. This project provides irrigational water to Beed, Latur and Osmanabad district. Manjara project is beneficial for an area of 627 hectares of Osmanabad district.

ii) Lower Terna Project:

It is constructed on river Terana near Makani of Lohara tahsil. It was completed in 1989 Rs. 16521 lakh was the total expenditure of this project. It is 26 meter high from the river bed. The total length of the canal is 192.5 Km. the maximum storage capacity of this project is about 160.46 million lakh sq. meters. About 20263 hectares irrigation potentials are created by this project. This project provides water about 16614 hectares land of Latur district and 3649 hectares areas of Osmanabad district. This project comes under the jurisdiction of Godavari valley project.
iii) Turori Project:

It is constructed on Turori River near Ashta village of Omerga tahsil. It was completed 1985 and about Rs. 309 lakh was spent on its completion. The height of the dam is 17.5 meter whereas the length of the canal is 21 km. The storage capacity of the dam is 7.66 million cubic meters. About 1074 hectares of land is benefited by this project.

iv) Rui Project:

This project is constructed on Rui River near Ruibhar village of Osmanabad tahsil. It was completed in 1994 and about Rs. 910.361 lakh was spend on its work. The height of the dam is 11.75 meters while about 29 kilometer canal is constructed from this dam. About 1650 hectares of land is benefited by this project.

(B) Medium Irrigation Projects:

Medium Irrigation Projects are those with culturable command areas between 2000 to 10,000 hectares.

Table No. 2.2

Statement Showing Completed Medium Projects in Osmanabad District

<table>
<thead>
<tr>
<th>Name of the Project</th>
<th>Year of completion</th>
<th>Project Expenditure in Rs. Lakh</th>
<th>Height of Project in meters</th>
<th>Length of canal in Km.</th>
<th>Max. storage capacity in Million M$^3$</th>
<th>Gross area commanded in hectare</th>
<th>Irrigation area in hectares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khasapur Ta. Paranda</td>
<td>1954</td>
<td>56.15</td>
<td>13.77</td>
<td>30.90</td>
<td>9.8</td>
<td>3616</td>
<td>3575</td>
</tr>
<tr>
<td>Chandani Pimpalwadi Ta. Paranda</td>
<td>1966</td>
<td>212.50</td>
<td>20.70</td>
<td>23.50</td>
<td>23.79</td>
<td>2091</td>
<td>2891</td>
</tr>
<tr>
<td>Hirani Naldurg Ta. Tuljapur</td>
<td>1966</td>
<td>76</td>
<td>16.65</td>
<td>37.50</td>
<td>12.58</td>
<td>1672</td>
<td>1543</td>
</tr>
<tr>
<td>Kurnoor Ramtirth Ta. Tuljapur</td>
<td>1967</td>
<td>100.83</td>
<td>23</td>
<td>9.50</td>
<td>35.26</td>
<td>7248</td>
<td>5463</td>
</tr>
<tr>
<td>Terna VIII. Thair Ta. Osmanabad</td>
<td>1970</td>
<td>80.30</td>
<td>15.00</td>
<td>38.00</td>
<td>2202</td>
<td>3350</td>
<td>2177</td>
</tr>
<tr>
<td>Khandala Ramtirth Ta. Tuljapur</td>
<td>1972</td>
<td>54.40</td>
<td>13.00</td>
<td>5.60</td>
<td>6.26</td>
<td>1384</td>
<td>1384</td>
</tr>
</tbody>
</table>
Out of the total medium irrigation project nearly 50% projects are found in Tuljapur and Paranda tahsils as on 30 June 2006. All these projects are completed through five year plans. Nearly Rs. 173 crores 42 lakh amount was spent on the sixteen medium irrigation projects.

About 38887 hectares land comes under irrigation due to the 16 medium projects. Sometimes these projects are having very little water in summer season due to the lack of storage from monsoon water. Even then these projects have changed the production of industrial crops to a greater extent.

(C) Minor Irrigation Schemes:

An irrigation project which covers less than 2000 hectares as the cultivated command area\(^{25}\) there are 62 minor irrigation projects in Osmanabad district. During the rainy season when water collects and forms a pond, it is usually called a tank. Maharashtra Government has completed 29 minor irrigation tanks and 33 minor projects are completed by the Zilla
Parishad in the study area. Table No. 2.3 gives the idea about the tahsil wise distribution of minor irrigation projects.

**Table No. 2.3**  
Tahsilwise Distribution of Minor Irrigation Schemes in the Osmanabad District  
(As on 30\textsuperscript{th} June 2005).

<table>
<thead>
<tr>
<th>Name of the Tahsil</th>
<th>Number of Minor Irrigation Schemes</th>
<th>Irrigation Potential Created in hectar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osmanabad</td>
<td>24(38.71)</td>
<td>6413(33.72)</td>
</tr>
<tr>
<td>Kalamb</td>
<td>12(19.35)</td>
<td>3046(16.01)</td>
</tr>
<tr>
<td>Tuljapur</td>
<td>12(19.35)</td>
<td>3824(20.11)</td>
</tr>
<tr>
<td>Omerga</td>
<td>07(11.29)</td>
<td>2056(10.81)</td>
</tr>
<tr>
<td>Bhum</td>
<td>05(08.06)</td>
<td>1861(09.78)</td>
</tr>
<tr>
<td>Paranda</td>
<td>02(03.22)</td>
<td>1820(09.57)</td>
</tr>
</tbody>
</table>

*Source: Irrigation Department Osmanabad*  
(Figures in the Brackets indicate percentage)

Table No. 2.3 indicates that out of the total minor schemes nearly 38.71% schemes are found in Osmanabad tahsil. The shares of Kalamb, Tuljapur, Omerga, Bhum and Paranda were 19.35%, 19.35%, 11.29%, 8.06% and 3.22% respectively as on 30\textsuperscript{th} June 2005.

The highest irrigation potentials are created in Osmanabad (33.72%) tahsil by the minor schemes whereas only 9.57% potential are created in Paranda tahsil. Minor irrigation schemes have created 19020 hectares potentials but there is no guarantee of that potentials in every year due variability of rainfall.
Well Irrigation:

As the cost of construction of well is low they are suited to poor and marginal farmers. There is great demand for irrigation wells due to the paucity of other irrigation facilities. Maharashtra state Government has given priority for the construction of new wells as well as repairs for old wells. Irrigation wells are increased through five year plans in the study region. There were 26,175 irrigation wells in 1996-97; it increased up to 36,698 in 2005-06.

Out of the total wells nearly 33,563 wells were in use, and 3,135 wells were not in use. Out of the total wells about 7,306 wells were located in Omerga tahsil. Paranda tahsil in 6,176, 5,450 in Bhum tahsil, 4,719 in Kalamb tahsil, 7,356 in Osmanabad and 5,691 in Tuljapur tahsil during in 2005-06.

2.13 Population:

The social, cultural and economic development of region is depended upon the growth and density of population. The ratio of man land, Sex and density are the elements of population which effects on it. It is the people which are the key of social progress, social wealth, develop science and technology through their hard work.

Man is both creature and molders of his environment. Man being a powerful geographical factor on the earth surface not only determines the economic pattern of resource utilization but is himself a very dynamic and important resource for the society. He plays a crucial role in the entire progress of production and he is also the beneficiary of the resource
utilization and economic development man gets nearly all his food from the soil, less than 1% of what he eats being fish\textsuperscript{27}.

(A) Growth of Population:

It is considered that the growth of population in any region is the index of its economic social and cultural development and many other characters. Hence the growth of population is one of the main factors that directly affects on development of agriculture land. Mortality and fertility separately it is now appropriate to consider their interactive contribution to overall population growth through natural increase\textsuperscript{28}. There are many factors which are responsible for increasing the natural growth of population. The demographic factors and social factors influence the growth rate of population. The present pattern of population growth is simply the latest phase of census of growth trend in the past. The trends of population growth are basic to the changes in the overall geographic personality of any area\textsuperscript{29}. The following formula is used to calculate the growth rate of population.

\[
r = \frac{P_n - P_o}{P_o} \times 100
\]

Where:

\[ r \] = Denotes growth rate of population

\[ P_n \] = Denotes current year population

\[ P_o \] = Denotes base year population.
Table No. 2.4
Growth of Population in Osmanabad District

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Decade</th>
<th>Growth Rate in %</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>General</td>
<td>Rural</td>
<td>Urban</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1941-51</td>
<td>9.85</td>
<td>04.99</td>
<td>58.33</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1951-61</td>
<td>20.23</td>
<td>24.24</td>
<td>8.00</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1961-71</td>
<td>28.28</td>
<td>26.68</td>
<td>43.48</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1971-81</td>
<td>10.75</td>
<td>8.30</td>
<td>31.31</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1981-91</td>
<td>23.88</td>
<td>20.22</td>
<td>49.23</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1991-2001</td>
<td>16.50</td>
<td>15.83</td>
<td>20.21</td>
<td></td>
</tr>
</tbody>
</table>

Source: Computed by the Researcher.

Table No. 2.4 reveals, that the trends of general, rural and urban population growth rate vary from the one another during the span of sixty years. General population growth rate increased from 9.85 to 28.28 from 1941-51 to 1961-71 and again it decreased to 10.75 in the decade of 1981-1991. It was increased to 23.88 in the decade of 1981-91 and deceased in the last decade 1991-2001 by 16.50%

The highest increase in rural population growth 26.68% was observed during 1961-71 decade while the lowest increase in rural population was noticed during 1941-51 decade 04.99%. The highest growth rate 58.33% of urban population of Osmanabad district was experienced in 1941-51. Whereas, the lowest growth rate was noticed in 1951-61 (8.00).

(B) Density of Population:

Density of population is the pressure of population on agricultural land. Density of population is very high there would be pressure on land
and land area is not sufficiently productive over population will result. Tahsilwise density of population is shown in table no. 2.5 and graph no. 2.1 there is variation in density from tahsil to tahsil.

Table No. 2.5

Tahsilwise Density of Population in Osmanabad district

(Density pe Sq.Km.)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Tahsil</th>
<th>1991</th>
<th>2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Paranda</td>
<td>133</td>
<td>149</td>
</tr>
<tr>
<td>2</td>
<td>Bhum</td>
<td>153</td>
<td>154</td>
</tr>
<tr>
<td>3</td>
<td>Washi</td>
<td>--</td>
<td>147</td>
</tr>
<tr>
<td>4</td>
<td>Kalamb</td>
<td>169</td>
<td>207</td>
</tr>
<tr>
<td>5</td>
<td>Osmanabad</td>
<td>229</td>
<td>277</td>
</tr>
<tr>
<td>6</td>
<td>Tuljapur</td>
<td>140</td>
<td>163</td>
</tr>
<tr>
<td>7</td>
<td>Lohara</td>
<td>--</td>
<td>204</td>
</tr>
<tr>
<td>8</td>
<td>Omerga</td>
<td>193</td>
<td>247</td>
</tr>
<tr>
<td><strong>Total District</strong></td>
<td></td>
<td><strong>170</strong></td>
<td><strong>198</strong></td>
</tr>
</tbody>
</table>

*Source: Computed by the Researcher.*

Graph No. 2.1: Tahsilwise Density of Osmanabad District (1991 - 2001)
During 1991 below 150 persons per sq. Km was found in Paranda and Tuljapur tahsils, while 150 to 170 person per Sq.Km was noticed in Kalamb, Bhum and Omerga. Above 170 densities per Sq.Km was experienced in Osmanabad and Omerga tahsil.

While below 150 density per Sq.Km was found in Paranda and Washi Tahsils in 2001. Above 150 to 200 densities per Sq.Km was noticed in Bhum and Tuljapur tahsils, above 200 densities per Sq.Km was experienced in Kalamb, Osmanabad, Lohara and Omerga tahsils. Population pressure on land is increased in every tahsil during the period under study.

(C) Literacy of Population:

Literate is able ‘both to read and write a letter’ literacy is necessity for all those who wish to practice the agricultural occupation on modern lines. Literacy is essential for the agricultural development on progressive lines. Literacy which brings about a change in agriculture.
Table No. 2.6
Tahsilwise Change in Literacy Percentage in Osmanabad District

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Tahsil</th>
<th>1991 Percentage of literacy</th>
<th>2001 percentage of literacy</th>
<th>Volume of Change in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Paranda</td>
<td>47.22</td>
<td>64.27</td>
<td>17.05</td>
</tr>
<tr>
<td>2</td>
<td>Bhum</td>
<td>54.57</td>
<td>66.46</td>
<td>11.89</td>
</tr>
<tr>
<td>3</td>
<td>Washi</td>
<td>--</td>
<td>68.10</td>
<td>--</td>
</tr>
<tr>
<td>4</td>
<td>Kalamb</td>
<td>58.00</td>
<td>70.81</td>
<td>12.81</td>
</tr>
<tr>
<td>5</td>
<td>Osmanabad</td>
<td>59.80</td>
<td>72.45</td>
<td>12.65</td>
</tr>
<tr>
<td>6</td>
<td>Tuljapur</td>
<td>50.03</td>
<td>67.82</td>
<td>17.79</td>
</tr>
<tr>
<td>7</td>
<td>Lohara</td>
<td>--</td>
<td>68.20</td>
<td>--</td>
</tr>
<tr>
<td>8</td>
<td>Omerga</td>
<td>52.53</td>
<td>68.19</td>
<td>15.66</td>
</tr>
<tr>
<td><strong>Total District</strong></td>
<td><strong>54.27</strong></td>
<td><strong>69.02</strong></td>
<td></td>
<td><strong>14.75</strong></td>
</tr>
</tbody>
</table>


Table No. 2.6 indicated in the highest (59.80%) literacy was observed in Osmanabad and the lowest (47.22%) literacy was found in Paranda in 1996. Below 65% literacy was found in Paranda (64.27%) while 65-70% literacy was recorded in Bhum, Washi, Tuljapur, Lohara and Omerga tahsils in 2001. Above 70% literacy was experienced in Osmanabad and Kalamb tahsils in 2001. About 14.75% positive change in literacy was took place in the entire study region. About 11.89% to 17.79% positive change was experienced in Paranda, Kalamb, Omerga, Osmanabad and Tuljapur tahsils during the period of investigation.
2.14 Agricultural Implements:

'Relief and endemic climatic conditions largely control the use of agricultural implements and machinery in an area. In addition, the quantum of irrigation available, the size of holdings the degree of intensiveness in farming the substance or commercial character of agriculture and the present way of life further determine the use of farm implements'.

Osmanabad district have been using form tools since time immemorial in a traditional way. The major farm using tools implements are wood ploughs, iron ploughs, electric pumps, oil engines and tractors.

Table No. 2.7

<table>
<thead>
<tr>
<th>Tahsil</th>
<th>Wooden Ploughs</th>
<th>Iron Ploughs</th>
<th>Bullock Carts</th>
<th>Sugar cane crasher</th>
<th>Electric Pumps</th>
<th>Oil engines</th>
<th>Tractors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paranda</td>
<td>0.0</td>
<td>18.55</td>
<td>3.06</td>
<td>0.15</td>
<td>6.86</td>
<td>0.47</td>
<td>0.35</td>
</tr>
<tr>
<td>Bhum</td>
<td>0.34</td>
<td>2.24</td>
<td>3.72</td>
<td>0.12</td>
<td>3.26</td>
<td>0.59</td>
<td>0.13</td>
</tr>
<tr>
<td>Kalamb</td>
<td>0.97</td>
<td>4.23</td>
<td>6.37</td>
<td>0.03</td>
<td>5.75</td>
<td>0.15</td>
<td>0.12</td>
</tr>
<tr>
<td>Osmanabad</td>
<td>1.61</td>
<td>2.02</td>
<td>4.80</td>
<td>0.36</td>
<td>3.97</td>
<td>1.76</td>
<td>0.14</td>
</tr>
<tr>
<td>Tuljapur</td>
<td>1.26</td>
<td>1.79</td>
<td>2.22</td>
<td>0.10</td>
<td>3.18</td>
<td>0.24</td>
<td>0.03</td>
</tr>
<tr>
<td>Omerga</td>
<td>Nil</td>
<td>7.59</td>
<td>3.73</td>
<td>0.12</td>
<td>4.82</td>
<td>0.34</td>
<td>0.18</td>
</tr>
<tr>
<td>Total Dist</td>
<td>0.72</td>
<td>3.55</td>
<td>3.79</td>
<td>0.15</td>
<td>4.47</td>
<td>0.55</td>
<td>0.14</td>
</tr>
</tbody>
</table>

Source: Computed by the Researcher. (Figure in the brackets indicates percentages)

Wooden plough is not used in Omerga and Paranda tahsils whereas its density in remaining tahsils varies from 0.34 % to 1.61 % per 100 hectares. The lowest iron plough density per 100 hectares was found Tuljapur (1.79 %) while the highest iron plough density recorded in Pranda (18.55 %) in 2005-06. The Proportion of electric pumps per 100 hectare
ranges from 3.26 % to 6.86% oil engines per 100 hectare range from 0.15 % to 1.76 %. The lowest tractor density was experienced in Tuljapur whereas the highest density per 100 hectares was found in Paranda in 2005-06.

Bullock carts density proportion is quite better in the study region. It ranges from 2.22 % to 6.37 % in all tahsils of the study region. Sugarcane Crushers density per 100 hectare from 0.03 % to 0.36 % in the study region.

2.15 Improved Seeds:

Seed is ‘basic an crucial input for attaining sustained growth in agricultural production’ Seed is the carrier of new agricultural technology to crop production. Agricultural investment will be more profitable after the adoption of improved seeds.

Table No. 2.8
Utilization of Improved Seeds in Osmanabad District
1996-97 and 2005-06

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Use of HYV seeds in Quintals</td>
<td>Percentage of District Total</td>
<td>Use of HYV seeds in Quintals</td>
<td>Percentage of District Total</td>
</tr>
<tr>
<td>Paranda</td>
<td>1025</td>
<td>15.42</td>
<td>1150</td>
<td>13.94</td>
</tr>
<tr>
<td>Bhum</td>
<td>1000</td>
<td>15.05</td>
<td>1225</td>
<td>14.85</td>
</tr>
<tr>
<td>Kalamb</td>
<td>1150</td>
<td>17.31</td>
<td>1450</td>
<td>17.56</td>
</tr>
<tr>
<td>Osmanabad</td>
<td>950</td>
<td>14.30</td>
<td>1500</td>
<td>18.18</td>
</tr>
<tr>
<td>Tuljapur</td>
<td>1120</td>
<td>16.85</td>
<td>1325</td>
<td>16.06</td>
</tr>
<tr>
<td>Omerga</td>
<td>1400</td>
<td>21.07</td>
<td>1600</td>
<td>19.39</td>
</tr>
<tr>
<td>Total District</td>
<td>6645</td>
<td>100.00</td>
<td>8250</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Agriculture Dept., Z.P. Osmanabad.
There is not remarkable change in the study region. The highest use of variety seeds was recorded in Omerga tahsil; on the other hand the lowest use of seeds was recorded in Paranda tahsil. (2005-06).

Table 2.8 indicates that use of improved variety seeds increased from 6645 quintal to 8250 quintal in the study region. Use of improved seeds increased by 1605 quintal.

2.16 Chemical Fertilizers:
In any scheme for boosting agricultural output the use of chemical fertilizers has an important role. Table 2.9 gives the idea about utilization of chemical fertilizers in Osmanabad district.

The farmers have learned by experience the effective use of chemical fertilizers in 1996-97 about 44890 metric tones chemical fertilizers were used, whereas about 40150 M.T. Chemical fertilizers were used in the study region in 2005-06.

Table No. 2.9
Utilization of Chemical Fertilizers in Osmanabad District
1996-97 to 2000-01 and 2001-02 to 2005-06

<table>
<thead>
<tr>
<th>Tahsil</th>
<th>1996-97 to 2000-01</th>
<th></th>
<th>2001-02 to 2005-06</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Use of Chemical fertilizer in M.T.</td>
<td>Percentage to District Total</td>
<td>Use of Chemical fertilizer in M.T.</td>
<td>Percentage to District Total</td>
</tr>
<tr>
<td>Paranda</td>
<td>2185</td>
<td>4.87</td>
<td>3500</td>
<td>8.72</td>
</tr>
<tr>
<td>Bhum</td>
<td>4526</td>
<td>10.08</td>
<td>3800</td>
<td>9.46</td>
</tr>
<tr>
<td>Kalamb</td>
<td>10380</td>
<td>23.12</td>
<td>7670</td>
<td>19.10</td>
</tr>
<tr>
<td>Osmanabad</td>
<td>8869</td>
<td>19.76</td>
<td>10480</td>
<td>26.10</td>
</tr>
<tr>
<td>Tuljapur</td>
<td>8950</td>
<td>19.94</td>
<td>8100</td>
<td>20.17</td>
</tr>
<tr>
<td>Omerga</td>
<td>9980</td>
<td>22.23</td>
<td>6600</td>
<td>16.44</td>
</tr>
<tr>
<td>Total Dist</td>
<td>44890</td>
<td>100.00</td>
<td>47670</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Agriculture Dept., Z.P. Osmanabad.
2.17 Agricultural Credit and Finance:

Agricultural credit finance has remained vital issues in the adoption of modern agricultural technology.

There are 469 primary credit societies in the district (2005-06). Osmanabad and Kalamb tahsils are having more than primary credit societies. Primary credit societies were given about Rs. 1800946 loan as on 31st March 2006. Outstanding loan was 2847260 up to March 2006, but this outstanding loan balance was previous balance. It means that recovery loan is very poor in the study region. It is essential to increase the recovery amount by increasing the output of the agriculture. There are 129 banks in the study region. There are also seven co-operative banks.

2.18 Marketing:

Marketing is a process of bringing together the producer and the buyer. Marketing is one of the most potent factors greatly stimulation agricultural production of an area and a farmer always need an efficient marked where in to all his surplus produce.

There are nine agricultural marketing committees in Osmanabad district. They are located at Paranda, Bhum, Washi, Kalamb, Osmanabad, Tuljapur, Omerga and Murum.

Table 2.10 indicates that wholesale price of agricultural products has increased to a greater extent during the period of investigation.
Table No. 2.10
Statement Showing Wholesale Prices of Certain Agricultural Commodities
in Osmanabad District

<table>
<thead>
<tr>
<th>Name of the commodities</th>
<th>Average annual price in Rs.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1997</td>
</tr>
<tr>
<td>Wheat</td>
<td>669</td>
</tr>
<tr>
<td>Jowar</td>
<td>667</td>
</tr>
<tr>
<td>Bajara</td>
<td>412</td>
</tr>
<tr>
<td>Tur</td>
<td>1570</td>
</tr>
<tr>
<td>Gram</td>
<td>1001</td>
</tr>
<tr>
<td>Udid</td>
<td>1156</td>
</tr>
<tr>
<td>Mug</td>
<td>1002</td>
</tr>
<tr>
<td>Groundnut</td>
<td>1260</td>
</tr>
</tbody>
</table>


2.19 Electricity:

The cost of the single factor which can act as a constraint on economic growth is the availability of energy. The use of electricity profoundly changed the structure and role of energy supplies in modern industry and has certain important consequences on the location of industrial activity\(^{37}\).

Among the infrastructure facilities the adequate supply of electricity is most important for the economic progress of any region. Its importance in the economic and industrial development by now has been fully realized. The consumption of electricity is now being considered as a barometer of
economic and industrial development as the same cannot be fully achieved without an adequate supply of electric power.

Electrification of eight cities and 702 villages were completed as on 31st March 2006. During 2005-06 about 48609 thousand kilowatt hours electricity was used in entire study region. Out of the total consumption of electricity 11.23% was used for household purpose 2.70 % for trade, 12.67 % for industries, 3.96% public purpose and 69.44% for agriculture.

2.20 Transport and Communication Facilities:

Transport provides the essential link between agricultural producer and buyer, as well as the means of moving various material inputs and the supply of certain inputs to the products to the markets and consuming areas.

A good network of transport can promote the development of dairying and fruit and vegetable crops 38.

Total road length was 6534.04 km as on 31st March 2006. Out of the length 2139.8 km was village roads. The shares of national highway, state highway, district roads and other roads were 905, 844.50, 1307.00, 1023.31 and 280.93 Km respectively as on 31 March 2006. It means that road system is excellent in the study area and definitely it will support to the agricultural development (Map No. 2.6).

There were 289 post offices in the study region during 2005-06. About 46388 telephone connections were given to the customers up to 31st March 2006. It means that communication facilities are also sufficient for the development of small scale units.
References:


