CHAPTER I
INTRODUCTION
INTRODUCTION

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INTRODUCTION

1.1. Introduction

The present study aims at exploration of agriculture in our life. Agriculture is a large activity in India as well as Maharashtra. The term ‘Agriculture’ is originated from the word ‘Ager’ meaning there by a cultivation.¹ But now a day, the concept of cultivation or taking grains from farm, is changed and it becomes larger concept. We get food, clothes and house from trees and animals. Now, we are doing side business in agriculture along with taking grains such as livestock, fishery, apiculture, to keep silkworm, flowering, horticulture, etc. In short, which agriculture is done with the help of man, water, instruments, and various equipment’s to take grains and benefits called modern agriculture. In the world majority of the peoples are engaged in agriculture. It is an activity on which we are living or survive. More than 50% people are directly or indirectly depend on agricultural activity in the world.

In underdeveloped country, the large percentage of population derives their livelihood from agriculture. The agricultural development plays a significant role in stabilizing and initiating the overall process of economic growth. The increase in levels of agricultural production could be achieved through the process of extensive and intensive cultivation. There is a wide scope for increasing the level of agricultural production with the help of to improvement in productivity in agriculture. Various inputs like water, fertilizer, pesticides improved seeds are use as properly it becomes increases in productivity of agriculture. Of these inputs, water becomes obviously the most important one; because the use of fertilizers, improved seeds etc. are depend on adequate and timely supply of water input. Irrigation ensures a secure harvest, act as insurance against inadequate and inconsistent monsoon. It increases the Net Area cultivated and more importantly, the Gross Cropped Area by enhancing the intensity of crops through double or multiple cropping. Since the marginal productivity of irrigated land is higher than that of non-irrigated land. It is more profitable to cultivate an irrigated rather than non-irrigated area of land.
Due to this positive correlation it exists between provision of irrigation and increased agricultural production, extensive development of irrigation, in fact, an essential and necessary precondition for an accelerated agricultural development. The irrigation has many benefits such as changing in cropping patterns, absorption of modern inputs i.e. High Yield Variety seeds, chemical fertilizers, pesticides, etc. It raises gross income and promotes consumption and investment expenditure of farmers. The irrigation assists the growth of output processing and input servicing industries. It activates trade and transport, encourages rural electrification programmes and enables primary sector to achieve self-sufficient in food grains and raw materials. Indirectly the irrigation increases social status, such as education level, knowledge, changes in the attitude of the farmers etc. It also, helps to give push to the growth of tertiary sector.

1.2 Irrigation in India

Since independence, during the 50 years, the central Government had spent about Rs. 2, 31,400 crores on major, medium and minor irrigation project works. As a result, the irrigation potential of the country has increased from 22.6 million hectares in the pre plan period (i.e. 1950-51) to 95.12 million hectares at the end of 2001-02 with this, India has the largest irrigated area among all the countries in the world. This has greatly contributed to the increase in food grains production of the country from 50.82 million tons in 1950-51 to 203 million tons in 2001-02.

1.2.1. Irrigation potential and actual utilization in India

Table 1.1 Irrigation potential created and utilized upto the end of 1999-2000 (Million Hectares)

<table>
<thead>
<tr>
<th>Source</th>
<th>Potential created</th>
<th>Potential utilized</th>
<th>Present utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major and medium irrigation</td>
<td>35.3</td>
<td>30.5</td>
<td>88</td>
</tr>
<tr>
<td>Minor irrigation</td>
<td>59.4</td>
<td>54.2</td>
<td>90</td>
</tr>
<tr>
<td>Total irrigation</td>
<td>94.7</td>
<td>84.7</td>
<td>89</td>
</tr>
</tbody>
</table>

Source: Economic Survey, 2001-02, planning commission Govt. of India.
The irrigation potential created over the years from major and minor projects has not been fully utilized. For instance, at the end of the Seventh Plan (1989-90), the irrigation potential created and the actual irrigation utilized were 77 million hectares and 69 million hectares respectively i.e. the gap of 8 million hectares. By 1999-00, this gap between potential and actual irrigation has widened still further. As against the irrigation potential of 95 million hectares created, the actual utilization was only 85 million hectares, with the gap of 10 million hectares. The non-utilization of the created irrigation potential occurred mainly due to delay in the construction of field channels and drains and in land leveling/shaping. Lack of involvement of farmers is also an important constraint in achieving full utilization of the created potential.\(^3\)

In view of narrowing the gap between the potential created through the major and medium irrigation projects and its ground level utilization, the Government has started the Command Area Development (CAD) programme. The basic objective of Command Area Development programme is to maximize productivity in the irrigation command areas through an integrated approach covering farm land development works including construction of farm channels and field drains, land shaping, wherever necessary and the introduction of rotational supply of water to ensure equitable and assured distribution to individual farm holdings. CAD programme has not been particularly successful even though the Eighth Plan expected greater participation of the farmers (through their cooperatives) in the various activities of CAD programme.

**1.2.2 Command Area Development Programme**

The Union Government had started a Command Area Development Programme (CADP) in 1974-75, to bridge the gap between the created potential and utilizable potential which is now being continued. In the beginning of this programme 60 major and medium irrigation projects with a culturable command area of 15 million hectares were included under this programme. There were 236 projects covered under this programme with a culturable command area of 22.72 million hectares spread over 28 states and 2 union territories As on March 31, 2001.
1.2.3 Water Requirement in 2050

According to the planning commission of India and National Commission for Integrated Water Resources Development, the water requirement for irrigation alone would be 1191 billion cubic meters and a total of 1681 million cubic meters including that for other purposes by 2050.4

1.3 Indian Agriculture

In our country agriculture is the backbone of Indian economy. In India farming is a main business. Today, in India 65% people are depending upon agriculture.5 After independence, Indian govt. has provided much attention on agriculture through five year plans to develop it in a systematic way. After the succession of ‘The Green Revolution’, India became independent country for food. This time we come across that there are many changes in agriculture and production. Many changes and problems have been occurred in agriculture.

Today, Indian population is rapidly increasing and we are getting anxious about available food stock is it sufficient or insufficient? And if it is insufficient then what, agriculture and food production are main problems, along with it there are various problems such as education, health, social, and industrial etc. Metro-cities are widening monstrously, so there is a big problem of non-employment, a problem of a slum dweller in city. Many village youth is running towards city for getting job. They have good talent, hard work, honesty but not jobs. So they became useless, un-employment.

Agriculture is most accepted occupation in the rural area. It is a mean of living. Now, agriculture is not only remained for food production but also for business. Now arable land turns under irrigation. Farmers are not using traditional seeds but they are using hybrid seeds, insect sides, chemical etc. Farmers are selling their food production not only in district but out of state and country. They are implementing modern methods in agriculture. Farmers are taking interest in flowering farming on the basis of money. Taking this in account Indian govt. gives attention in agriculture and its problems, and then there will be development in the field of agriculture. Agriculture plays a vital role in human life.
Indian economy is 7th ranked agro-based economy of the world. Indian farming is depended upon monsoon which is uncertain, sometimes it come either earlier or late. Sometime this comes after long gap. All these factors effect on crops and finally agricultural production. If we provide regular and fix water supply for agriculture it will defiantly increase in production. In India With the help of Dam, Canal, well, tube well and other facilities 490 lakh hectare area under irrigation. Whatever is available land for agriculture, 35% land come under irrigation. India is the first country in the world which is irrigates most of area.

In British period, Indian economy and farming was totally neglected. After independence, population increased very rapidly and there were severe problems of food. Govt. had provided more attention on farming with the help of five year plan and planned for systematic development. The green revolution succeeded and India becomes independent country for food grains. Due to the green revolution, food and other production increased in large after independent, we get many changes & problems in relation with farming.

Today Indian population 1.27 billion the need of water is also increased because of increased population. but the intensity of rain and supply of water is remained same. Nowadays, water is becoming rare so it should be need to provide attention on water management. Today in India nearly 3 thousand 50 lac hectare area is good for cultivation and 1410 lac hectare area is under crops. For this land, if we provide water regularly there we will do production of food to needed and increased population. Instead of agriculture and agro-products, we have many other problems, such as education, health, electricity, etc. in urban area slum areas, unemployment increased in large scale comparing to villages. Rural peoples are very hard worker but they don’t have jobs/work, so they are becoming unemployed which is a social problem. If in India, agro-related facilities will be provided then production will be increase. Agriculture is main occupation in rural areas. Nowadays, agriculture is not limited only for food but also business and it turned from monsoon dependent to irrigate. Farmers are using modern seeds instead of traditional and selling production out of district, state and international market.
Food stuff farming turned into horticulture and gives many benefits to the farmers. If Govt. is also providing attention towards the development and problems of farming, definitely production will increase. Thus farming plays vital role in making human being happy and satisfied. Farming is one of the important occupations in human development.

1.4 Irrigation in Maharashtra

In Maharashtra, the net area irrigated in 2001-01 was 29.59 lakh hectares, out of which the area irrigated under wells was 14 lakh hectares. The gross irrigated area was 36.47 lakh hectares. The proportion of gross irrigated area to gross cropped area was 17.8 per cent.\textsuperscript{10} In 2010-11, the proportion of gross irrigated area to gross cropped area increased only by 0.4 percent.\textsuperscript{11} The total geographical area of the state is 308 lakh hectares and cultivable area is 226 lakh hectares out of this 41 per cent of the area is drought prone and 7 per cent area is flood prone. The rainfall is highly variable in Maharashtra ranging from 400 to 6000 mm. It occurs in a four months period from June to September with the number of rainy days varying between 40 to 100 days. The estimated average annual availability of water resources consists of 164 km\textsuperscript{3} of subsurface resources. The 5 major river basins, only 58 percent of this average annual availability is found in the four major river basins (Krishna, Godavari, Tapi and Narmada) from east of the Western Ghats. These four river basins comprise 92 percent of the cultivable land and 75 percent of the people living in the rural settlements, fast growing towns and industrial area. An estimated 49 percent of the area of these river basins containing 43 percent of the population is already considered deficit or highly deficit in regard to water availability and these river deficit areas are expected to increase steadily as both the population increase and the economic growth takes place.\textsuperscript{12}

1.4.1 Irrigation Potential in Maharashtra

According to Barve commission report, in 1962, the first Maharashtra Irrigation Commission popularly had known as estimated surface irrigation potential of 52.61 lakh hectares and 9 lakh hectares as ground water potential.
The ultimate potential in state as per evaluation by the World Bank in the year 1979 was estimated at 61.93 lakh hectares. In 1984, the state government had appointed a fact finding committee on regional imbalances in Maharashtra under the chairmanship of Late V. M. Dandekar to identify backlog portion pertained to irrigation in three regions of the state.\textsuperscript{13} The committee had found that the major backlog portion pertained to irrigation and accordingly estimated that Rs. 1386 crores would be required to remove the backlog. It was estimated that three-fourth of ultimate irrigation potential is likely to be realized through surface water resources.

Out of the total cultivated area of 200 lakh hectares in the state about 84 lakh hectares (42 percent) can be brought under irrigation from all resources. Different studies have revealed that It is estimated that about three fourth of ultimate potential i.e. 63.05 lakh hectares would be through surface water resources. Second Maharashtra Irrigation Commission (Chitale Commission) report submitted in 1999 estimated that 126 lakh hectares (55.75 percent) area can be brought under irrigation. Potential created through major and medium irrigation projects is 60 lakh hectares and utilization is around 37 lakh hectares.

**Table 1.2 Actual water use in Maharashtra 2010-11(M.cum.)**

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Water use</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design storage of competed projects</td>
<td>33385</td>
<td></td>
</tr>
<tr>
<td>Actual live storage as on 15\textsuperscript{th} Oct.2010</td>
<td>27309</td>
<td></td>
</tr>
<tr>
<td>Evaporation</td>
<td>5383</td>
<td>20.16</td>
</tr>
<tr>
<td>Non-irrigation</td>
<td>5876</td>
<td>22.00</td>
</tr>
<tr>
<td>Irrigation</td>
<td>15447</td>
<td>57.84</td>
</tr>
<tr>
<td>Total</td>
<td>26706</td>
<td>100</td>
</tr>
<tr>
<td>Break-up of non-irrigation water use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinking</td>
<td>3260</td>
<td>56</td>
</tr>
<tr>
<td>Industrial</td>
<td>656</td>
<td>11</td>
</tr>
<tr>
<td>Other uses</td>
<td>1990</td>
<td>33</td>
</tr>
<tr>
<td>Total non-irrigation</td>
<td>5876</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: WRD, GOM, 'Irrigation Status Reports', 2005-06 to 2010-11.
Actual water use in the year 2010-11 is presented in Table 1.2. Out of total reported water use, 57.84 percent water has been used for irrigation and 22 percent for non-irrigation; evaporation being 20.16 percent. Water use as reported in Irrigation status Report is silent about water use in local sector projects. Significant percentage of other uses in non-irrigation could be a matter of serious concern. So water for irrigation is being increasingly diverted for non-irrigation purposes and hence, significantly less volume of water would be actually available for irrigation.\(^{14}\)

### 1.4.2 Growth in irrigated Area

The growth in relation to percentage of Net irrigated area to Net Sown area and also gross irrigated area to gross sown area is in table 1.3. It shows that in Maharashtra, the proportion of net irrigated area to net sown area has increased from 6.00 percent in 1960-61 to 18.2 percent in 2010-11 and the proportion of gross irrigated area to gross sown area has increased from 6.48 percent in 1960-61 to 18.27 percent in 2010-11 showing a significant growth in irrigated area in the state Maharashtra.\(^ {15}\)

### Table 1.3 percentage of irrigated area to Net Sown Area in Maharashtra State

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Percentage of net irrigated area to net sown area</td>
<td>6.00</td>
<td>7.62</td>
<td>10.19</td>
<td>14.39</td>
<td>17.8</td>
<td>18.2</td>
</tr>
<tr>
<td>2</td>
<td>Percentage of gross irrigated area to gross sown area</td>
<td>6.48</td>
<td>8.38</td>
<td>12.30</td>
<td>15.18</td>
<td>17.39</td>
<td>18.27</td>
</tr>
</tbody>
</table>

Source: Economic survey of Maharashtra, 2002-03 & 2010-11)
1.4.3 Irrigation Projects

The Government of Maharashtra had set a target to cover 73 lakh hectares of land with irrigation projects but until now it has realized a potential of only 36 lakh hectare after spending Rs. 25,000 crores on 1940 major, medium and minor irrigation projects.\(^{16}\)

It is still working on 1,160 such projects involving an instrument of Rs. 27,000 crores and may take more than ten years to complete the same. The irrigation potential in the state by the end of June 2000, through all the types of irrigation projects taken together was 46.876 lakh hectares.\(^{17}\) the share of major, medium and minor (both state and local sectors) irrigation projects in total irrigation potential was 47.2, 12.80 and 40 percent, respectively.

1.4.4 Regional variation

There was found variations in irrigation development amongst the regions of the state. Western Maharashtra region occupied largest share (50 percent) in gross irrigated area of the state (Chitale, 1999). In spite of highest rainfall in the konkan region, irrigated area is lowest amongst the four regions of the state. In Konkan region, slope and percolating lateritic soil reduce water storing capacity. Irrigated area in Marathwada and Vidarbha regions was 9.03 and 8.00 lakh hectares respectively during 2000-01. Highest growth in irrigated area was found in Marathwada region.\(^{18}\) The reason behind the highest irrigated area of Western Marathwada was diversion of rivers from Sahyadri to east of it in Western Maharashtra.

1.5 The Problem

The Maharashtra state is having great scope for increasing irrigation for agriculture. The area under irrigation may be increased by increasing availability of irrigation water as well as by developing irrigation technology. After the introduction of Green Revolution, there were vast changes in the cropping pattern of the state agriculture. Besides this, the high yielding varieties of different crops are introduced. Use of fertilizers and pesticides has been also increased efficiently. In view of this, it is necessary to examine all these changes in the agriculture of Maharashtra state over a period of time in general and irrigation development in particular.
The growth and development of irrigation has not been smooth over entire state and there exists disparities in growth and development of irrigation between different regions of Maharashtra. Irrigated area under different crops in different regions is also varying over a period of time. However, a very few studies were undertaken to assess the problem regarding Agricultural and economic changes in command area of Kukadi canal irrigation project in Western Maharashtra.

In western Maharashtra Pune, Ahmednagar, and Solapur district comes under rain shadow area and known as drought prone zone. Kukadi canal irrigation project plays a vital role in agricultural development in this region. So changes occur in agricultural production, cropping patterns, and harvesting etc. and its effect on economic development in Junner Tahsil of Pune, Parner, Shrigonda, Karjat Tahsils of Ahmednagar and Karmala Tahsil of Solapur districts. So, it is essential to study this problem in depth and hence the research topic, is undertaken for the study with some particular objectives.

1.6 Statement of Problem:

‘A Geographical study of Agricultural and Economic changes in Command Area of Kukadi canal Irrigation Project in Western Maharashtra.’

1.7 Concepts and definitions:

Agriculture: The word agriculture comes from the Latin word ‘Agricultura’ the main word ‘Ager’ means Field and ‘cultura’ means culture or cultivate.\(^{19}\)

Watsons (1976), he define the word Agriculture in ‘Longman modern English Dictionary’, “Agriculture is the business or art where a lot of land come under cultivation to increase production.”\(^{20}\)

Canal: Canals are used for the conveyance and delivery of portable water for human consumption and agricultural irrigation. There are four types of canals that are Discharge, irrigation, electricity generation, and water transportation ways.\(^{21}\)
Irrigation: Irrigation means to provide water for sustainable crop production in agriculture with the help of artificial sources without rain water. For ex. Dam, Well, Canal, Tube well, etc. in artificial irrigation, canal irrigation plays vital role.

Command Area: it means an area irrigated or capable of being irrigated either by gravitational flow or by lift irrigation or by any other method from a Government source and includes every such area whether it is called Command Area or by any other name under any law for the time being in force

Culturable Command Area: It is the area which can be physically irrigated from a scheme and is fit for cultivation.

Gross Irrigated Area: The total irrigated area under various corps during a year, counting the area irrigated under more one crop during the same year as many times as the number of crops grown and irrigated.

Gross Irrigation Potential: The total area proposed to be irrigated under different crops during a year by a scheme. The area proposed to be irrigated under more than one crop during the same year is counted as many times as the number of crops grown and irrigated.

Minor Irrigation Project: A scheme having Culturable Command Area up to 2,000 hectares individually is classified as minor irrigation project.

Medium Irrigation project: A project having Culturable Command Area up to 2,000 hectares and up to 10,000 hectares individually is a medium project.

Major Irrigation Project: A project having Culturable Command Area more than 10,000 hectares is known as major irrigation project.
1.8. Aims and Objectives

The study was undertaken with the specific objectives, which are decided in relation with the development of agriculture in kukadi command area before and after canal irrigation. These are as follows-

i. To study the agricultural development In Kukadi canal command area of Western Maharashtra.

ii. To study of kukadi canal irrigation project.

iii. To study of the farmers in kukadi canal command area.

iv. To study the impact of canal irrigation on cropping patterns.

v. To study the role of agriculture in economic development.

1.9. Hypothesis

The researcher has primary knowledge and experience about the research problem with the help of previous knowledge and experience the researcher has drawn some conclusions to reach at possible answers and put forward hypothesis. Those got proper direction to research scholar.

i. Crop productivity increases due to irrigation.

ii. Due to irrigation facilities the view of farmers would be changed towards traditional farming.

iii. Cropping patterns change due to irrigation.

iv. There is close relation between Agriculture and economic Development.

1.10. Importance of the problem

If we have taken in to account the importance and need of research statement, then the scope of farming is considered for study. In the human cultural development, agriculture has very vital part; some developed country had been giving scientific status to farming. It is the need to increase provisions, due to increasing population, industrialism, shortage of food and raw material etc. to increase provisions, irrigation plays important role.
1.10.1 Need of the study

In Western Maharashtra Ahmednagar, eastern part of Pune, and Solapur districts come under Rain shadow region. A very short part of it comes in under impression of Bhima, Ghod and Kukadi Rivers. These rivers help in the development of agricultural production. Before the kukadi canal irrigation project, this area comes under drought prone area. But, nowadays the picture is changed due to canal irrigation. It makes an impression upon the crop production and cropping patterns, use of seeds, and many others.

1.10.2 Importance of study

Pune, Ahmednagar and Solapur are leading Districts in western Maharashtra by many ways. Particularly in co-operation Shrigonda Tahsil of Ahmednagar district. In 1950, first Sugar Factory is started at Pravaranagar in Ahmednagar. Considering Maharashtra state Ahmednagar district produces more than half sugar production of total production, and Shrigonda Tahsil is leading in it. Shrigonda is leading Tahsil in lemon production and food grains, fruits and vegetables, milk productions etc.

From last 10-15 years, with the help of canal irrigation Agricultural production is increased in this region. Agricultural practices are also changed due to irrigation facilities. So it is important to study the agricultural and economic changes in kukadi command area.

The study would focus on allocation of irrigation water to different crops, change in cropping patterns, allocation of inputs and technology etc. the study of temporal and spatial changes in canal irrigation growth over a period of time in kukadi command area will help in understanding structural development of irrigation in western Maharashtra. It will be helpful to formulate schemes pertaining to the specific region.

Results will identify specific crops in the different regions for which modern water saving technologies can be used and overuse of water can be reduced. It will be helpful to find out specific crops where water diversion is possible. The findings of the study will be useful for preparing policies regarding construction of watersheds, installation of drip and sprinkler irrigation systems, construction of canals and tanks and harvesting of water as per need of the particular region.
It will be useful for allocating water between irrigation and non-irrigation purpose with respect to their needs and also in allocating water between rural and urban areas.

1.11 Study area—Geographical aspects

Irrigation and agricultural practices depend on geographical and climatic conditions, such as soil types, temperature, rainfall, humidity etc. these factors vary from place to place. It is necessary to study the geographical and agro-economic features of the area. With this objectives in view, some important features of the area selected for the present study are briefly discussed.

1.11.1 Location

Maharashtra is the third largest state of the Indian Union. It is also the second largest state by population, next to Uttar Pradesh. Maharashtra is located between 15.4°-22.1° N latitude and 72.6°-80.9° E. longitude and it forms a major part of peninsular India with sea coast length of 720 km. on western side. The state divided into 6 division’s viz. Mumbai, Pune, Nasik, Aurangabad, Nagpur and Amravati for revenue purpose.

Geographically, historically and according to political sentiments, Maharashtra has five main regions i.e. Vidarbha, Marathwada, Khandesh and North Maharashtra, Western Maharashtra or Desh, and Konkan.

Pune district located at the western region in Maharashtra. It is Thane district to the north west, Raigad district to the west, Satara district to the south, Solapur district to the southeast and Ahmednagar district to the north and north east. Pune district lies in the Western Ghats or Sahyadri mountain range and it extends on the Deccan plateau on the east.

Pune stands on the leeward side of the Western Ghats. Pune is at an altitude of 559m. Pune district is located between 17.5° to 19.2° North and 73.2° to 75.1° East. Administratively the district is divided into 15 Tahsils. Junner is one of them which, comes under Kukadi left bank canal irrigation.
**Junner Tahsil:** Junner is first Tahsil from the north side of Pune district. It is Akole Tahsil to the north, Parner Tahsil to the east, Thane district to the west, Ambegaon Tahsil to the south and Shirur Tahsil to the south west. Junner Tahsil lies in 19°12'35" North latitude to 73°57'32"East longitudes. There are four main Dams of Kukadi Project as Yedgaon, Pimpalgaon joge, Manikdoh, and Wadaj in this Tahsil. Total population is 24,741 and total geographical area is 13,8452 hectares. About 27115 hectare area comes under Kukadi command area.
Ahmednagar is the largest district of Maharashtra state with, geographical area of 17418 sq. km. which is 5.66% of area of Maharashtra state. Out of total areas 391.5 sq. km. is urban area and remaining 16,656.5 sq. km. is rural area. Ahmednagar is centrally located in western Maharashtra. In Ahmednagar district there were 14 Tahsils.

Among them Parner Tahsil, Shrigonda and Karjat Tahsil come under command area of Kukadi left bank canal.
Parner Tahsil: is located at west part of Ahmednagar, on 18.32° to 19.19° North latitude and 74.15° to 76.24° East longitude the area occupied by 1,930.28 sq. km. and total population is 248,347.25. Parner Tahsil is bounded by Sangamner Tahsil in North West, Rahuri in north, Ahmednagar in east, Shrigonda in south east, Junner Tahsil and Shirur Tahsil (Pune district) in south west and south. In this tahsil 14,740 hectares area irrigated through kukadi left bank canal.

Shrigonda Tahsil: Shrigonda is located at the southern part of Ahmednagar. Shrigonda Tahsil situated on 18°-27'-18'' North to 18°-51'-54” North latitudes and 74°-23'-24’ East to 74°-52’ East longitudes. At north boundary it is bounded by Parner tahsil in North West, Ahmednagar Tahsil in the northern, Shirur tahsil in West, and Dound tahsil in south west (Pune district) and Karjat tahsil in east.

This tahsil is situated partly in the upper Saraswati basin and partly in Bhima, Ghod and Kukadi river basin. The area occupied by 1605.61 sq. km. with 286,608 population. In this 30,616 hectare area comes under kukadi left bank canal irrigation.

Karjat Tahsil: Karjat Tahsil is situated in the south east part of Ahmednagar district. It is located 75 km. from its district city of Ahmednagar. The absolute location of the tahsil is from 19°09’ north to 19°46’65” North latitude and 75°25’25’” to 75°50’8” East longitude, with the total geographical area of 1,503.61 Sq. km. Karjat taluka is bounded by Ashti tahsil (Beed District) in North and, Jamkhed Tahsil in North east, Dound Tahsil in South West, Karmala tahsil in South. In this 29,990 hectare area is benefited through kukadi canal.

Karmala Tahsil: Karmala tahsil is located in North West part of Solapur district at 18°25’12”N to 18°42’ North Latitude and 75°12’0” E to 75°20’00” East longitude. It has an average elevation of 562 metres. The Karmala tahsil is bounded by Karjat Taluka in North West and Jamkhed Tahsil in North of Ahmednagar district, Indapur Tahsil in West of Pune district, Madha Tahsil in south, Paranda Tahsil in east and Jamkhed Tahsil in North East. At the 2001 India census, Karmala had a population of 21,933.

It occupies 1609.70 sq. km. area. In Karmala 24,562 hectare area comes under kukadi canal irrigation.
1.11.2 Physical structure

The physiography of these five tahsils has been understood with the help of generalized information about relief, drainage, soil, climate, natural vegetation and ground water. The features of the study area are dominated by hilly and plain region, low rugged, highly dissected topography. There are various land forms founds in kukadi command area. These different types of land forms in the region constitute its physical set-up. The physical structure of study areas are the following divisions.

1. Western hilly regions: The Junner Tahsil lies in the western Ghat or Sahyadri mountain range and it extends on the Deccan plateau on the east. Junner stands on the leeward side of the Western Ghat. Lenadri, Shivaneri are the highest peaks in Junner tahsil. At the northern part of Shrigonda, ranges of Harishchandragad and Balaghat spread from North West to south east direction among these hilly ranges Hanga Ghod, Saraswati tributary rivers basins are developed in main basin of Bhima river. Average height of these regions is 600 meter from mean sea level. The slope decreases from north to south direction.

2. Central plateau region: Parner Tahsil and parts of Shrigonda, Karjat and Karmala are included in this region.

3. Plain regions: Eastern part of Junner Tahsil, Southern part of Parner, Shrigonda, Karjat and Karmala tahsils included in this region. This region covers basins of the Ghod Bhima and Sina Rivers.

1.11.3 Soil Patterns

Soil plays a key role in cultivation and production of crops in study region. It nourishes and supports growth of plants. The growth of crops depends upon soil structure, colour, thickness and texture. Water and air are essential in soil for plant growth. The development of soil in any region depends mainly upon parent material, climate, living organism, land utilization and Physiography. The soils in the Kukadi command area can generally be classified into groups various like Deep black and shallow black. The Maths, Kasthi, Ajnuj, Pedgaon, Sangavi dumala, Visapur in Shrigonda tahsil has comparatively deep black soils.
This soil mainly found along Bhima and its tributaries. The colour of this soil varies from brown to dark black. This soil is well drained, clayey and I appears dark brown to grayish in colour owing to excessive predominance of humus content. This soil varies in depth from 5 to 20 feet. The crop cultivation is supplemented by irrigation sugarcane, vegetables, wheat, fodder crops are grown in this soil.
Near the Ghod and Bhima rivers wide tracts of deep rich lands are found. Further up in the hilly areas to the east of Junner and north of Shrigonda North of Karjat and west of Karmala tahsils red soil derived by residual weathering of the basalt in a tropical humid climate, deeper on the slopes than on the levels is found. The dang or hill county is a land of Bajara and Jowar are important crops.

Soils on the plateau regions are considerably depending upon the terrain and slope conditions. They are well suited from the production of a number of Rabi crops. However, on the terraces, the soil is too inferior and the hill slopes are stony. Fairly productive black soils are seen only in low grounds. In western southern parts of region separating fertile along the bank of Ghod and Bhima basin area, therefore develop only narrow strips. Topography is plan, soils grayish black moderately alkaline pH 7.4-8.4, lowest layer is Murum strata fair in NPK content. It is well drained and good for irrigation. Laterite coarse shallow soil is found in north in Junner Tahsil. Coarse shallow high hill soil, which is laterite, found in west part in study region. This soil is well drained and calcareous in nature. Jowar and Bajra crops are well grown in this soil.

1.11.4 River System

The drainage system of Kukadi command area belongs to Kukadi, Bhima and Ghod are the major rivers.

**Kukadi River**: The western region of the Junner taluka is adjacent to the Western Ghats. There is Kukadi River system is the Major rivers in Junner Tahsil. Kukadi is a river of Western Maharashtra, India, a tributary of the Ghod River. Several temples lie on its banks including the Vigneshwara temple, Ozar and Malganga Devi temple (Parner Tahsil). The Yedgaon dam the river, creating an artificial lake.

During the months when it is visible, the riverbed is considered to be a wonder of nature, characterized by rock erosion from water movement and gorges that are gouged with large potholes near Nighoj village in Parner Tahsil. Folk tales abound about the river. The river valley is characterized by grape vineyards. The Kukadi originating in the Western Ghats is an easterly flowing tributary of the Ghod. The source of the river lies in Western Ghats near Naneghat.
The river passes to the north of Junner and is situated outside Nighoj, near a road to Shirur. The Kukadi rivers tributaries include the Dimbhe, Manikdoh, Pimpalgaon Joge, Wadaj, and Yedgaon.
The river rises in the Western Ghats high rainfall zone where the rainfall is greater than 4,000 millimeters. In Junner tahsil there are four Major Dams of Kukadi project i.e. Yedgaon dam (kukadi), Pimpalgaon Joge (Pushpavati), Manikdoh (Meena), and Wadaj (Ar). 

**Bhima River:** the Bhima river origin at ‘Bhima Shankar’ in Pune district. The west and south part of Shrigonda, South west part of Karjat Tahsil come in the basin of the river Bhima, which also fix the west and south boundaries. The river originates in Pune district and enters Ahmednagar near village Sangavi Dumala in Shrigonda tahsil and flows in a south east direction. The banks of the rivers are generally low and the bed is generally sandy crossed a few places by rocky barriers. The chief tributaries of Bhima River are Ghod and Sina. The Ghod also flows in a south east direction for about 80 km. within the region.

**Ghod River:** The Ghod River, main left bank tributary of Bhima, rises on the slopes of the Sahyadri in Junner tahsil of Pune district. It flows in a south easterly direction for over 80 km. from part of the south western boundary of Pune. Near the cantonment township of Shirpur, it receives on its bank, Kukadi River and further down its volume is increased by the waters of Hanga and Patal River the streams which, drain into the river waters, of Parner and Shrigonda tahsils on the right bank. The banks of the stream are low and its bed is generally rocky. In dry month the stream is easily fordable but during rains cannot be crossed without boats. The Ghod falls in to the Bhima near the village Sangavi Dumala in Shrigonda tahsil. It is two canals, the left bank canal irrigate 17,000 hectares and right bank canal 7,000 hectares. The left bank canal benefits the Parner and Shrigonda tahsils.

**Sina River:** The Sina river has two chief sources, one near Jamgaon about 20 km. west of the town of Ahmednagar and the other near Jeur about 16 km. to its north east. The city of Ahmednagar built on the right bank of the river. For a distance of about 55km. roughly, the river forms boundary between Ahmednagar on the one hand and Beed district on the other. On the right, it receives the waters of Mahekri, and ultimately joins the Bhima on the Karnataka state border. The banks of the Sina are low and its bed sandy.
After heavy rains, its flow is somewhat rapid, during summer; the river becomes practically dry. The construction of Sina Medium project is completed in the year 1985, in Karjat tahsil, the command area of 8445 hectares under the Sina medium project. Bhose Khind Tunnel increases the ultimate potential of 8445ha.\(^\text{35}\) now it is possible to irrigate the full command area which, lies in drought prone area of Karjat Tahsil and Beed district also.

1.11.5 Climate

The climate of Junner, Parner, Shrigonda, Karjat and Karmala tahsils is generally hot. In this region there is hot summer and general dryness during major part of year except during rainy season. Rainy season normally starts in the second week of June and is over by the end of September. October and November constitute the post monsoon or retreating Monsoon season. Winter season is from the month of December to February. The different parameters of climatic condition are as:

1.11.5.1 Temperature

In Junner taluka, Moderate temperature area mainly observes here. Summer here begins from March to July. Summer is dry and hot. The temperature ranges from 20\(^\circ\)c to 38\(^\circ\)c, though at the peak they may reach 40\(^\circ\)c. The Parner Karjat Shrigonda and Karmala Talukas enjoy a tropical monsoon climate, the hot scorching summer from March onwards yet to the rainy monsoon in early June. Seasonal variation in temperature quite large from March onwards is a period of continuous increase in day temperature, the night remaining cool. In summer season maximum temperature is 39\(^\circ\)C and winter minimum temperature is 11.7\(^\circ\)C. The annual average temperature in both tahsils is 27.5\(^\circ\)C. Withdrawal of monsoon day temperature progressively decrease, from about the middle of November both day and night temperature decrease rapidly. December is the coldest month of year with the mean daily minimum temperature is 11.7\(^\circ\)C.

1.11.5.2 Rainfall

Average rainfall in the Junner taluka in Pune district is 761.1millimetres. This is usually during the monsoon months from July-October. The rainfall is unpredictable in the tune with the Indian Monsoon. Near the western border of the region the rainfall decreases rapidly as one proceeds towards east.
But from a line roughly north-south in the central parts of the region the rainfall gradually increases towards the east. About 77 per cent of the annual rainfall in the region is received during the south-west monsoon season, September being the rainiest month. The average rainfall in Shrigonda taluka in 2011 is recorded 326mm. in Parner Tahsil it recorded as 438mm in 2011. The average rainfall in Karmala tahsil recorded as 338mm in 2011. The variation in rainfall from year to year is large.

1.11.5.3 Humidity

In Kukadi command area, as the characteristic feature of semiarid climate region dryness prevails throughout the year except in the south west monsoon season. This area comes under drought prone. During the south west monsoon average relative humidity is between 60-80 percent and then decreases rapidly in the post monsoon season. The air from February to May is dry and particularly so in the moon time and average relative humidity is around 20 percent. The temperature conditions are favorable for agriculture throughout the district but scarcity of water is well felt problem. Evapotranspiration affects prospects of crop humidity.

1.11.5.4 Wind

Generally wind is blowing from light to moderate strengthening in the south-west in monsoon season. Winds are from direction of south west in the post monsoon season. Winds from the North West and north are common in the morning while in the afternoons wind blow from direction between north and east. In the cold season winds are variable in direction. Wind between northwest and southeast being more common. In the summer season monthly to northwest winds are more common in present study area.

1.11.6 Natural resources

No natural minerals of economic importance are available in the study area. The hard and compact basalts, however, are used extensively as building material and road metal. The pinkish colored vesicular variety is amenable to cutting into blacks of desired sizes. The calcareous kankar is burnt in lime kilns and is responsible for a regular lime industry around Ahmednagar town. The commercially important species found the forests are teak, neem. Babul, sissoo, sandalwood, etc. Other important miscellaneous species are khair, hiwar, herkal, amoni, apta, bet, etc.
The growth is stunted and poor soils and lack of adequate humus. Vast stretches of grass lands are also found. The species of grass commonly found are kusal, dongari gavat, pavanya and marvel. Plants and animals in the area of Shrigonda and Karjat and Karmala tahsils, there is very rare forests which are favorable Maldhok and Dears. There are some animals such as antelope, Maldhok which are scare in quantity. Forest ecosystem is developed upon monsoon and atmospheric conditions. The life of animals developed according to the forest and monsoon such as antelope, peacock, monkey, nightingales, serpents, parrot, herons, crows, etc. there is also good availability of honey bees in December to February, because here is harvest of flowers. In the contact of water area, local and foreign migratory birds travel in winter. This is a good opportunity for tourists.

1.12 Conclusion

In the present chapter, tries to make us aware of selected area very honestly. In this tries to introduce importance of agriculture and irrigation, irrigation in India, irrigation condition in Maharashtra, irrigation potential and regional variations. Here put forward the statement of problem with aims and objectives. The physical or geographical aspects of study region has discussed with importance of the study. There are part of three districts of Western Maharashtra comes under Kukadi canal irrigation project. In these five talukas i.e. part of Junner tahsil in Pune district, Part of Parner, Shrigonda, Karjat tahsil in Ahmednagar and part of Karmala Tahsil in Solapur districts are benefited tahsils. Through Kukadi left bank canal total 96,396 hectares area of these five tahsils are irrigated. Average rainfall is 549.5 mm. the temperature ranges from 11.7°C to 40°C in study area. Deep black soil is identified in central and southern and marginal areas in Bhima and its tributaries basin. Course shallow hill soil or laterite soils are found in Western Ghats and hilly slope areas. Course shallow soil is found in eastern parts in study area. There are no found economically important natural minerals in command area. There is found some commercially important species of plant in forested areas i.e. teak, neem, sandalwood, etc. the Rehekuri Sanctuary, a world famous habitat for deer and there is a habitat for the Great Indian Bustard nearby Karjat Tahsil.
REFERENCES

27. Ibid, Pp. 210-211.
28. Ibid, P. 210
34. Ibid

37. Ibid, 274.