CHAPTER-II
REVIEW OF LITERATURE

Through the researcher has gone through the number of articles, books and report, the review of all is neither possible nor expected to. The review of some of the selected reports and books pertaining to irrigation projects & irrigation development is reviewed.

Gadgil, D.R. (1948)\(^1\) his work on "Economic Effects of Irrigation" pertaining to the Godavari and Pravara Canal throws light on many direct and indirect benefits of irrigation. He has also analyzed the beneficial impact of irrigation in relation to dry areas (un-command) which are deprived of irrigation facility.

He has concluded that the provision of irrigation facility to the farmers coming under the command areas of Godavari and Pravara Canals has enabled them to have superior cropping pattern, higher per acre productivity and increase in gross farm income. In addition, indirect benefits have accrued to the people who are involved in processing and transporting of the increased agricultural production of the command area.

The volume of trade has also increased on account of increased agricultural production. Irrigated agriculture being labour intensive has increased the demand for hired labour, which in turn helped to raise wage rate and to improve economic conditions of laborers’.

Thus, he has concludes that the construction and maintenance of a project have far reaching effects on the economic life of the agricultural community living within its region and also to some extent on the neighboring community of the region.
Maharashtra State Irrigation Commission Report (1962)\(^2\) is considered as a pioneering work in the assessment of water resources of Maharashtra. The commission was headed by Shri. S. G. Barve. He had strongly felt that the water resources of the state both surface and underground should be fully exploited within the shortest possible period i.e. up to the year 1980.

The commission had dressed the total water resources and concluded that both type water resources taken together can cover about 30 percent of the cultivated area. The commission further recommended that wherever possible, the flow irrigation should be combined with the irrigation, and which areas are not within the command of irrigation projects, underground water resources should be exploited in good manner.

Diwakar Jha (1967)\(^3\) his studies are on assessment of benefits of the irrigation facilities provided by different projects. With the help of primary data, he has concluded that irrigation is beneficial to farmers by various ways such as: irrigation leads to intensive use of land, land shifts from food grain to commercial cash crops, increasing of cropping intensity, motivate for the use of modern and traditional inputs to increase of per acre gross productive and income.

Maharashtra Government Project Report (1969)\(^4\) on development of groundwater resources, land and form mechanization in Maharashtra is prepared by the govt. of Maharashtra on the request of an agricultural credit mission of the World Bank. The mission visited the Maharashtra state in June 1969. In his visit, the mission explored the possibilities for providing form credit for suitable projects in Maharashtra so, as to increase agricultural production. The team took interest in the progress made by the state in agriculture and explored the scope for further development of minor irrigation through wells co-operative lift
irrigation and land development in the command areas of major and medium irrigation projects.

The members of with the concern officials, co-operative agencies and academic institutions working in the concern fields, on the request of the said commission in state government prepared detailed project reports with the help of technical officers in the department of agriculture, the land development bank and the co-operative banks on the following five schemes:

1) Tube well irrigation for the Purna-Tapi alluvial area.
2) Constructions and revitalization of well and energisation of wells for irrigation.
3) Lift irrigation schemes through co-operatives.
4) Land development in the river valley project areas on a phased basis.
5) Mechanization of forms on the areas covered by co-operative sugar factories, the use of tractors and other implements for cultivation as also for transportation of sugarcane.

Finally all reports are consolidated in the form of one report. In the report, the planners noted that the fact that well irrigation has an important role to play in the state, as about 74 percent of its area is not likely to receive the benefit of canal irrigation in the foreseeable future.

Massive programme of drilling 1000 tube wells, contribution of bore wells, installation of 8650 new open wells, renovation of 19350 old open wells, contribution of 1000 new bore wells, installation of 3630 electric motors and organization of 128 lift irrigation schemes were recommended in the report. This package programme was to prepare so, as to be completed in the succeeding five years. The areas selected for the different projects are spread all over the state and cover 100 talukas in 22 districts of the state out of the total of 237 talukas in rural Maharashtra.
Singh S.P. and Singh B. (1972)\(^5\) have attempted to study the impact of tube-well irrigation on cropping pattern and productivity in Bichpuri Block in U.P. in 1970-71. He observed that average cropping intensity is higher on owned tube-well farms (180\%) as compared to hired tube-well irrigated farms (168\%) and well irrigated farms (158\%). The production of high yielding varieties of wheat was high at 34 quintals per ha on owned tube-well irrigation farms as against 27 and 25 quintals per ha respectively on hired tube-well irrigated and well irrigated farms.

Meti T.K. (1972)\(^6\) has attempted to make an ex-post assessment of the benefits of irrigation of Tungabhadra project. His study is mainly based on "before and after" approach in which he tried to assess the benefits of irrigation by comparing the differences in production, income, savings, investment, asset formation, consumption pattern, social attitudes and values etc., in the area prior to the construction of the canal and in the year of investigation.

He has concluded that there are positive changes in production, consumption, income, savings and investment, asset formation pattern, social attitudes, etc.

A report of the fact finding committee (1973)\(^7\) for survey of scarcity areas of Maharashtra is submitted to the state government in the year 1973.

The committee was asked to identify those areas of the Maharashtra state in which conditions of scarcity have appeared in the report of the committees in the past.

The committee has made depth survey of irrigation, forestation, agriculture, animal husbandry, dry, drinking water and rural credit in the state, then the committee has identified 83 talukas as drought prone in the state.
According to the committee the drought prone area is approximately a little area \( \frac{1}{4} \)th of the total area of the state, while the population living in the drought prone areas is more than 20 percent of the population of the state.

The committee has given stress on groundwater development and adopting of artificial measures of groundwater recharging.

The committee opined that a certain minimum amount is set aside every year for the development of the drought prone areas, particularly for building up of the irrigation assets.

Bhatia J.P. and Tiwari R.N. (1974)\(^8\) have study based on cost-benefit analysis. They have studied five electric tubewell irrigated farms and four non-irrigated farms in Bisambi Block of Bodami District of Uttar Pradesh for financial analysis. They found that the investment made in tubewell irrigation (Rs. 8800) during the year 1969-70, can be recovered within a year. They also found that benefit-cost ratio for tubewell irrigation was 2.78 at optimum level.

Sen L. K. (1976)\(^9\) has attempted to conduct the role of irrigation in agricultural development. According to his research more than three fourth of our net sown areas are without irrigation facilities. Past of the country which normally receive heavy rainfall and where the farmers do not considered irrigation.

He has focused a quick glance at irrigation statistics. It shows that in 1951-52 only 18 percent of our total cropped area was irrigated. The percentage went up very slightly, to about 22 percent and 25 percent in 1960-70 and 1973-74 respectively. The irrigation commission (1972) has estimated total potential for irrigation in the country is about 81 million hectares’ which is roughly 50 percent of the total cropped area in the country. Out of this potential, 45.5 million hectares can be covered by
major & medium irrigation and remaining 36 million hectors by minor irrigation projects.

Meti T. K. (1977)\textsuperscript{10} has attempted to make ex-post assessment of the benefits of irrigation of Tungabhadra projects in Karnataka. His study was mainly based on ‘before and after’ approach. He has tried to assess the benefits of irrigation by comparing the difference in production, income, saving, investment, asset formation, consumption pattern, social attitudes and values etc. In prior to the construction of the canal and in the year of investigation, the analysis also takes into consideration of the controlled area and relates the changes in the project area. He concludes that there are positive changes in production income, saving and investment, asset formation, consumption pattern and social attitude.

Pandey M. P. (1978)\textsuperscript{11} an author of book entitled, the impact of irrigation on rural development- A case study. The book is devoted to judge the impact of irrigation on rural development. It was study of socio-economic development of the irrigated area under public irrigation systems. The command area under the public dams is selected for the study for Bihar viz.

1) Lower kill valley project, completed in 1959.
2) Badud irrigation project, completed in 1966.
3) Chandan irrigation project, completed in 1963.

On the basis of purposive random sampling six villages, three irrigated and three unirrigated were selected from each of the three command areas. The author noted the facts that the irrigation facilities are having over all positive change in the group pattern i.e. change for more productive and remunerative cultivation use of chemical fertilizers & use of high yielding varieties.
It is indicates that the irrigation is not enough to effect the overall development of the farmers. Though, the yield rates in irrigated villages are higher than the unirrigated villages.

The author further observed that the people of the irrigated village could find employment for more man days in a year rather than the people in the unirrigated villages. Therefore, naturally, the standard of living of the people in the irrigated villages is comparatively better than the irrigated villages.

Ultimately, he recommended that there is need the best administered and assured irrigation system to improve the socio-economic conditions of rural people.

Sisodia J. S. (1978)\(^{12}\) in his study on economic evaluation of Chambal Irrigation Project (M.P.) observed that assured irrigation would increase area under high yielding varieties with consequent increase in production and income of the farmers.

Patil R. G., Suryawansi S. Q. and Kapse P. M. (1978)\(^{13}\) have attempted to conduct a socio-economic survey in the command area of Girna irrigation project in Jalgaon District of Maharashtra state. They conclude that the project has provided socio-economic benefits to the farmers of the command area. Economic benefits received in the form of modern cropping pattern, increased use of inputs have helped to increase per hectar productivity and the income of beneficiaries. They also conclude that the irrigation facility is being required to improve the standard of living of beneficiaries.

Valera (1979)\(^{14}\) in his study he found that farmers producing rice crop waste 60 per cent of water through surface drainage and showed that better water management would result in considerable savings of water. Similarly, Sumayao (1979)\(^{15}\) also observed that optimum
allocation of the available water increased efficiency of the irrigation system and resulted saving of water to the extent of 60 per cent.

Mishra and Vivekanand (1979)\(^{16}\) their study on the impact of canal irrigation in the command area of Tungabhadra projects of Bellary district (Karnataka). They observed that the canal irrigation has induced the use of modern inputs and practices in farming. The productivity and net income per acre are higher in irrigated areas than the dry areas. In the command area they found that the assets, consumption expenditure and debt positions of sample households show that large farm households are better than the others.

Alexander K. C. (1979), \(^{17}\) has conducted a study at Attabira and Rengati Block under Hirakud command area and concluded that economic development and social change are closely associated irrigation facility. His study revealed that introduction of canal irrigation led to intensification of agriculture through larger use of labour. Also he found out that there is a six fold increase in production of paddy crop due to irrigation facility.

Patel P. G. and other (1980)\(^{18}\) have attempted to conduct a study in Ghod project area of Maharashtra with reference to socio-economic conditions of the farmers in the command area.

He has used cluster sampling method. In Karjat taluka 2 clusters, in Shriganda taluka 5 clusters, Shirur taluka, 3 clusters were selected.

He has compared the yield rates at two points of time i.e. 1969-70, 1975-76, before the onset of irrigation and after. The result indicated that past irrigation was better off over pre-irrigation in all aspects. The consumption of cereals pulses etc. food grain, protective items like milk, oil, vegetables, spices, meat, fish, egg, fruit beverage per family, per adult unit was observed to have improved in the irrigated area.
Bhargava B. S. (1980)\textsuperscript{19} the author of the book of Minor Irrigation Development Administration. The author compiled the data of Karnataka state minor irrigation projects for the 20 years from 1956-57 to 1975-76. He gave detailed organizational structure of the minor irrigation administration and also the procedure and steps of initiation, formation, implementation and completion of the minor irrigation projects in Karnataka state. The author found that the minor irrigation projects are more beneficial than the major and medium irrigation projects.

The Author suggested that there is a need to improvement in organizational structure to harness the maximum benefits from minor irrigation projects. Also he has suggested that there is need of effective co-ordination among the concern sections.

Kumar et al. (1981)\textsuperscript{20} they observed that the introduction of intensive surface irrigation in the command area, ground water level has been raised. They have suggested optimal cropping pattern for conjunctive use of ground and surface water. Their study indicated that by further pumping out of about 600 million cubic metre of water, more area could be brought under irrigation and cropping pattern could be changed for the benefit of the farmers.

Patel A. S. (1981)\textsuperscript{21} has analyzed the impact of irrigation on employment at farm level in the command areas of 24 medium irrigation projects in different parts of Gujarat during the period 1976-77 to 1979-80.

The analysis was based on the data collected from 100 farm households from each project area under study. Spatially 40 talukas out of the total of 184 talukas in the state were covered in bench mark study. Finally, in 2400 farm households were studied for the purpose.
His study revealed that one hectare of a rain fed farm converted into an irrigated farm would generate about 50 man days of work in Gujarat. To concluded that the impact on employment at the farm level was very much.

**Sinha and Bhatia (1982)**\(^{22}\) in their work on economic appraisal of irrigation project have attempted to reviews alternative approaches to pre-sanction appraisal of irrigation projects. They have recommended use of social benefit cost analysis (SBCA) for testing economic feasibility of irrigation project. The methodology of SBCA has been illustrated with the help of Auranga Reservoir major irrigation project, Dist. Chhotanagpur, Bihar. They have also developed computer programme for SBCA. Their study also includes sensitivity analysis for reducing risk and uncertainty in the process of investment decision in irrigation projects. Benefit-cost ratio of Auranga Reservoir irrigation project is found equal to 3.0 which is greater than the norms given by Central Water Commission with present methodology, After removing methodological deficiencies in the present methodology, they have worked out benefit cost ratio of Auranga Project by considering time value of money and they found discounted benefit cost ratio is equal to 2.99 and Internal Rate of Return (IRR) is 21.5 per cent. Increase in construction period of the project badly affects on benefit cost ratio and internal rate of return.

**Alexander A. C. (1982)**\(^{23}\) has attempted to study irrigation impact on agricultural development and social transformation in Ganganagar district of Rajasthan. Primary data collected was from 900 respondents from various Tehsils, of which 600 respondents were from irrigated area and remaining 300 respondents were from uncommand area. He found that irrigation has provided intensification of agricultural activities through larger use of inputs led to increase in per acre production, productivity and gross income.
K. Palanisami (1984) has studied canal water allocation and distribution procedure in Major Irrigation Project in Tamil Nadu. The analysis has a relevance to the conditions existing in many irrigation systems in South and South-east Asia. He has focused on the water allocation and distribution procedure & availability of water and its impact on cropping pattern, input use and crop yield. He observed that there is poor water distribution performance in the area of this project. The water charges are very low from the inception of the project. He has also observed that there is lack of coordination among various related departments.

Satpathy T. (1984) has studied the development of minor irrigation in Orissa comparison with other states. In this study he observed that states like Punjab, Haryana, Rajasthan, Tamil Nadu & Gujarat have made very rapid growth than Orissa.

In terms of percentage of ultimate irrigation potential created by 1977, 78, the performance of Orissa is the lowest, the Punjab being the highest with 84 percent.

Thus it is be concluded that the progress in respect of minor irrigation development in Orissa has been much below the expectation which in its wake has significantly contributed to the sluggish growth of irrigated average in this state.

Jha U. M. (1984) has tried to attempts the various aspects of irrigation management. He has discussed the rate of irrigation particularly minor irrigation in economic development of an agrarian economy of Bihar.

He has observed that the minor irrigation schemes would be more beneficial such as in the contiguous patches of cultivated land available in undulation area and rocky terrain and are generally small. There are yet
other areas where minor, medium and major schemes have to pay a complementary role to perform.

Sindhu et al. (1984)\textsuperscript{27} have made on economics appraisal of various sources of irrigation in Punjab during the year 1982-83.

In this study indicated the positive relationship between the degree of water supply flexibility and reliability and the use of fertilizer, irrigation and other variable inputs. Owing to the higher use inputs which was the result of increase in the degree of water supply flexibility and reliability the yield and economics returns were also higher at source of irrigation. The performance of the farmers having diesel plus electric alternative was much better in all respects compared with all other categories. Indications are available that operated of higher production frontier as a result of assured irrigation constructing diesel & electric sources.

Sisodia J. S. (1984)\textsuperscript{28} has attempted to study the impact of Chambal Command Area Development project on various issues like cropping pattern intensity, yield level of principal crops, structure of inputs and also he has considered the benefit - cost ratio of the project.

In this study he had concluded that the intensity of cropping and irrigated area in the projects area is increased after land development. This study also showed the increase in production per rupee of investment cost. The increase in gross value of the production was about 3.17 per rupee of investment.

Suryawanshi S. Q. and Kapse P. M. (1985)\textsuperscript{29} have attempted to find out the impact of Ghod irrigation project on female employment in agricultural sector in Pune and Ahmedanagar districts of the Maharashtra state.
It was found that after the introduction of irrigation facilities in period 1968-69, the cropping pattern was changed and shifted in favor of cash and labour intensive crops. In the period 1975-76 cash crops such as a groundnut and sugar cane were introduced, which gave more employment both to the male and female workers. In general due to irrigation crops labours employment increased more than two fold (double).

This trend was higher in case of female than the male labour. It was also found that per farm total male female labour utilization increased from period 1968-69 to 1975-76. The utilization of male labour on per farm basis was increased from 90 days to 169 days i.e. 88 per cent whereas in case of females, it increased from 70 days to 178 days, i.e. more than two and half fold. In case family female labour self farm employment was also almost twice in period 1975-76.

It is concluded that there is increased in the opportunity of employment of the female due to irrigation facility.

Dhande et al. (1986)\textsuperscript{30} have conducted a socio-economic survey in Khadkwasla command area in Maharashtra. They have completed ‘attitude’ survey of 100 farmers by proportionate basis.

He has found that the intensity of cropping is not increased. Therefore, there was need to increase the cropping intensity by adopting multiple cropping.

It was found that per hectors yield of irrigated crops was higher than that of per hector yield of un-irrigated crops in study area.

Deshpande R.S. and S. Iyyampillai (1986)\textsuperscript{31} have attempted to find out the impact of irrigation on cropping pattern in the command area of Krishna Raja Sagar (KRS). They have used "with and without” approach. They have analyzed of cropping pattern from the different conditions, such as cropping pattern in the command talukas of KRS project, cropping pattern in wet and dry villages, cropping pattern of sampled
households from wet and dry villages and cropping pattern across different size of land holdings. Then, it was concluded that the cropping pattern has converted into commercial crops. They also observed that irrigation gave boost to adoption of new technology not only in the both wet & dry villages.

Daines S.R. and Pawar J. R. (1987) have study of Mula and Bhima command area. They have noted that employment has generated more per crop per ha of irrigated crops as compared to rain fed crops. They found that annual employment of adult male labor increased in double & more than three times increased in adult female. Also there was increased in demand of hired labor due to the availability of irrigation water.

Joshi Amardeep Singh (1987) has examined the development of water resources in India with special reference to Punjab. The study has brought out that there are significant inefficiencies in the allocation of water resources between regions, crops and overtime. The returns to fixed resources could be increased by one to two times more than existing situation when surface water is optimally used. But when the surface water is supplemented with ground water the returns to fixed farm resources could increase by two to eight times.

The study has clearly brought out the misallocation of water by farmers in all the canal zones of the study area. Canal water is the cheapest, followed by electric motors, diesel engines and state tubewells. Finally he concluded that the present status of modernisation of agriculture in Punjab could not have been achieved in the absence of canal water and supplementary supply of groundwater.

Vasudeva Rao (1987) has attempted to study role of irrigation in agricultural development and consequently rural development. He has analyzed the impact of irrigation on agricultural development both micro & macro level study. This study was conducted in two villages under the
command area of Malaprabha Irrigation Project in Dharwar district of Karnataka. Both these two villages had similarities in all respects except irrigation facility. For micro-level analysis, he selected a sample of size 209 cultivators from irrigated area and 98 cultivators from dry villages and for macro-level analysis, Nargund taluka (irrigated area) was compared with neighbouring dry Ron taluka.

He found that the rate of return on investment was higher in irrigated village as compared to dry village. The household annual income and consumption expenditure was also higher in irrigated village. More households was above poverty line in irrigated village than in dry village. Commercial and cash crops are taken in irrigated area. His study concludes that the irrigation has a paramount importance in transforming poor villages to prosperity.

**Gujar Ram Kumar (1987)** has attempted to study on the impact of irrigation on land use pattern, intensity of cropping, cropping pattern and modernization of agriculture in the Indira Gandhi Cannal command area. This study was based on the time series data for the period 1971-72 to 1980-81. In this study he found that there was continuous increase in double cropped area because of the introduction of irrigation facility. He observed in the context of farmers that more and more farmers have motivated to pluses, cash crops and folder crops. There was 24.35 percent increase in index of cropping intensity during the study period. He revealed that positive impact of irrigation on agriculture development. Finally he observed that there is shift from traditional farming to scientific farming coupled with mechanization and farm management.

**Daines S.R. (1989)** has attempts to find the impact of irrigation on income, employment and health in Maharashtra through the evaluation of three projects, Mula Major Project (Dist. Ahmednagar),
Chulband Medium Project (Dist. Bhandara) and Sidhanath Minor Project (Dist. Sangli).

He revealed that the economic rate of returns (ERR) for Mula, Chulband and Sidhanath projects are 19.5 per cent, 9.77 per cent and 15.9 per cent respectively. He observed that significant portion of the crop diversification benefit has come from wells inside the Mula and sidhanath commands and also on wells outside the command which lie in the area where groundwater recharge from the systems directly affects groundwater supplies. He found that employment opportunities are more in inside the command area than outside. In case of health impact his study revealed that there is significant reduction by almost half in the number of ill days associated with irrigation in the Mula project, with a lesser but still noticeable effect in Sidhanath.

Dhawan B.D. (1988)\(^{37}\) has attempted to assess irrigation impact on farm economy in high rainfall area of Kal Irrigation Project, district Raigadh, M.S. In this study he assessed irrigation impact on various aspects. As far as labour employment is concerned, his study revealed that the canal irrigation lead to an additional on-farm job opportunity for about 300 man-days per ha in a year.

Bilas Ram (1988)\(^{38}\) the book, Rural Water Resources Utilization and planning, is a unique study in the field of rural water resources and its kind.

The book is published in 1988. The author has given the geographical approach to study water supply is considered in its totality in the context of regional framework i.e. rural areas of the Varanasi district. The study is based on field investigation and laboratory testing and the results were mapped out with proper methods.
The most of the part of this book is devoted for the demand & supply side of water. Finally, the author concludes that the water being scare and limited must be used scientifically and economically.

**Dhawan B.D. (1988)** has studied impact of irrigation on productivity, and equity with reference to Indian Farm is based on secondary sources of data. His study reveals that the total output expansion in crop output per irrigated hectare is nearly 19 quintals in food grain. Gain in output stability is observed in nine out of eleven states, though the extent of gain varies from State to State. His study revealed that on-farm benefits from a unit of irrigated area need not rise with the size of farm holding. Small farmers can gain as much benefits per hectare from irrigation as do large farmers.

**Mishra S. V. (1988)** has published his research work on Irrigation Development and Economic Growth takes the account of water resources of Bihar and their development in the five year plans. He has emphasized the need of augmentation of rate of growth of irrigation at least up to 10 percent per annum, he concludes that the existing annual rate of growth will take a long time to harvest total utilizable water resources of the state. The author further stresses the need of bringing down the huge gap between irrigation potential created and irrigation potential utilized.

**Gumaste M. G. (1988)** submitted his Ph.D. thesis on Management of water resources in Marathwada region- An operational research study in 1988 to the Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. According to him, there is a negative tradeoff between income generation from agriculture and employment generation through agriculture. The research work finally concludes that, the emphasis should be given on increasing the water use efficiency by
adopting sprinkler and drip irrigation systems. So, that there would be increase in income generation from agriculture.

**Sharma J. C. and Crutinh (1988)** have assessed the growth of irrigation and its impact on land use and crop productivity in Karnataka during the period from 1961-62 to 1976-77. The study indicated that the bulk of the created irrigation potential has been used by farmers for raising a few intensity irrigated crops and has not led to multiple in any significant measures shift in favor of high productivity irrigated crops like paddy, maze, wheat, and sugarcane are common in all irrigated tracts in the state. Low yield crops such as Jowar, Pulses, and oilseeds have cost heavily.

Productivity of paddy, wheat, maze and sugarcane has gone to up due to increased irrigation facilities.

**Kallur M.S. (1988)** has studied the impact of irrigation facilities provided by the Left Bank Canal of Tungabhadra Project (Karnataka) on different size-groups of farmers. The data was collected from 240 respondents (120 from the project command area and 120 from the controlled area i.e. un-command area). He found that irrigation has brought several changes in cropping pattern of command areas. Commercial crops or high value crops occupy a larger area of the total cultivated area.

He has concluded that Irrigation has enhanced per acre gross amount of income of farmers by enabling them to grow commercial or high value crops. Sugarcane and cotton are taken generally in command area of the projects. Per acre production and gross productivity have increased due to irrigation and use of modern inputs. The double and multiple cropping have increased. Irrigation has also led to improvement in infrastructural facilities and standard of living of the people in the command areas.
Betal H.R. (1988)\textsuperscript{44} study for Medinipur district of West Bengal showed that irrigation is highly related to net sown area and multiple cropping. Multiple cropping will result in diversification of agriculture due to sufficient irrigation. He stated that farmers are using chemical fertilizers and HYV seeds. His study also revealed that there is positive relationship between irrigation and food production.

Pawar C.T. (1989)\textsuperscript{45} has attempted to study irrigation and its impact on agricultural land use in Upper Krishna Basin of Maharashtra with emphasis on geographical analysis. He made an attempt to highlight physical and demographic setting of the region in his study. He assessed the effect of irrigation on land use, cropping pattern, input use, crop productivity, cropping intensity and crop diversification. For macro-level analysis, he used secondary data, collected from government and private organizations and for micro-level analysis he used his own collected data. The Upper Krishna basin is divided into three physiographic units which have governed the development and methods of irrigation. Eastern plateau is suitable for well irrigation. Canal irrigation is feasible only in the plains of the major river valleys, whereas lift irrigation suits to south central and southern hilly parts of the region. He observed that the spatial variation in the environmental and demographic setting have led to the regional imbalances in the development of irrigation facility. He found that lift irrigation is predominant particularly on river banks of central and southern parts of the region, sharing about 45.62 per cent of total irrigated area. This is followed by dominance of well irrigation (37.40 \%) in the east, canal irrigation in the north-central and local source of irrigation in north-west. He observed that use of mechanical and biochemical inputs has increased in irrigated tracts.
He found positive influence of irrigation on land use pattern. He observed slight decrease in area under forest. The fallow land and other uncultivated lands have recorded decrease whereas net area sown has increased due to irrigation facility. Regarding cropping pattern, he observed that jowar and bajra crops dominant prevail zone, in eastern dry part, rice and in western heavy rainfall zone. among the irrigated crops are fodder cultivation In the central sugarcane is a single dominant crop sharing about one half of the total irrigated area of the region. Other irrigated crops are rice, wheat, and gram.

In view of the overall changes there is shift from food grains to sugarcane and from inferior cereals to superior one. He also observed significant increase in intensity of cropping in the central river valley area where adequate irrigation facility is available. The levels of crop productivity and overall development of agriculture reflect similar trend. The analysis of the differential levels of agricultural development clearly indicates level of agricultural development in relatively high irrigated area. In general, the levels of development are related to the degree of development of irrigation.

Renuka C. (1990) has studied rural development through irrigation a study in Kadam irrigation project in Andhra Pradesh.

The sampling design of the study was multi-stage random sampling method. Canal was the first stage unit selection of villages was the second stage of unit and respondent was the third or last stage of unit.

The study covered the randomly selected localized & non-localized villages of Kadam project.

The study has revealed that 68 percent of total land in the study area was cultivated. The land utilization, cropping intensity and cropping pattern in wet irrigated, dry and un-irrigated land off differ from village to village and form size. His study also revealed that gross farm income

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from all the selected crops was increasing as the level of irrigation increase.

**Varghese and Solanki (1990)**\(^{47}\) have assessed the impact of irrigation on economic variables such as income, consumption, saving and investment by using the primary data collected from 60 farm households having farms irrigated through Bhakra canal in Ganganagar district of Rajasthan.

It was found that the income of households having irrigated farms was 2.6 times higher over households having un-irrigated farms. The consumption expenditure was also found to be higher by 1.61 times in case of irrigated farms. The saving was 15.7 times more times and the new investment for the Year (1983-84) was four more in case of irrigated farms. It is concluded that there is positive impact of irrigation on irrigated farm.

**Acharya et al. (1990)**\(^{48}\) have studied the in cropping pattern and land use pattern and yields in the command area of Guda irrigation project located in Bundi district of Rajasthan. This study was based mainly on the primary data collected from 150 farmers coming under the two minors of the left and right bank canals of Guda project. Some secondary data was also collected from the officers of the Irrigation Department. They found that cultivated area has increased by 20.6 per cent and the cropping intensity has increased from 70 per cent to 151 per cent during the period of 26 years (1956-59 to 1984-85). The cropping pattern was found to be shifted in favor of wheat, sugarcane and maize, which has replaced barley, gram and jowar.

**Mishra K.M. (1990)**\(^{49}\) attempted to study how irrigation water can be utilized more effectively. He used both primary and secondary data for analysis. A survey was undertaken in four different regions which was irrigated districts of the Orissa state.
He found that water rates are quite low in Orissa as compared to the cost incurred. He suggested that a marginal cost pricing policy be adopted for initial years and thereafter average cost pricing policy should be adopted in fixing water rates.

He also observed that the cropping pattern has increased due to expansion of irrigation facilities. The cropping intensity is increased from 121 per cent to 145 per cent during the period 1970 to 1984.

*Sharma, Bhati and Shekhawat (1990)*\(^5\) have attempted to study cropping pattern, cropping intensity, cost-benefit analysis and income-land relation of irrigated and unirrigated farms. In this study primary data was collected from the households of irrigated and unirrigated villages of Shriganganagar district of Rajasthan. It was found that the overall cropping intensity an irrigated zone was 126 per cent as against 98 per cent in unirrigated zone.

It was found that traditional crops like jowar, bajra and gram covered bulk of the cropped area in unirrigated zone, whereas in irrigated zone commercial crops like cotton, mustard, and cereal crop like wheat occupied remarkable part of cropped area. This study also indicated that irrigation leads to mechanization, modernization and replacement of human labour.

Further, it was found that the rate of change of income due to unit change in cropped area was more than four times in irrigated zone as compared to unirrigated zone.

*Asturkar D.W. and Satputt T. M. (1992)*\(^5\) have conducted socio-economic surveys in the command area of upper Penganga project and Purna project. They studied different socio-economic factors of beneficiaries of command areas of these two projects. In Upper Penganga Command Area they found that average employment days per working male female and children showed that male labor got more employment
(233 days) followed by female (220 days) and children (63 days) per year. In Purna Command area they found that average employment days in case of male labors is 223 days, followed by female (209 days) and children (55 days) per year.

Ashturkar B. W. and Satpute T. G. (1992) have conducted socio-economic survey in the command area of upper Penganga irrigation project and Purna irrigation project in district of Nanded and Parbhani of Maharashtra state. In Purna irrigation project, total sample of 988 were selected for the study. The sample was drawn from 32 villages of the command area of Purna irrigation project out of which a sample of 828 cultivators and 160 landless labours were selected randomly for this study. The selection of cultivators in different size groups of holdings.

They studied different socio-economic factors of beneficiaries of command areas of these two irrigation projects. In upper Penganga command area they found that average employment days per working male females and children showed that male laboures get more employment (233 day) followed by female (226 days) and children (163 days) per year.

In Purna command area, they found that average employment days in case of male labours were 223 days followed by female 209 days and children 55, days per year. It was found that in case of cropping pattern, cash crops were the main group of crops occupied 43.40 percent of the gross cropped area. The cereals and pulses had the share to the extents of 40.12 percent and 1.17 percent in the gross cropped area, whereas 15.09 percent of the gross cropped area was allotted to the oilseed crops.

Raghuwanshi C. S. et al. (1991) have studied the socio-economic impact of irrigation management on employment and farm income. This study was based on primary data collection from 57 farmers of 9 villages in Merut district of Uttar Pradesh. The study was found that
the level of education of farmers influences due to adoption of irrigation management technology and income. It was also found that income level goes hand in hand with farmer technical knowledge. A farmer with more knowledge of irrigation management technology is more likely to use optimum does of water and takes interest in scientific management. The study also reveals that the employment on irrigated farm was much higher than on un-irrigated farms.

Dhawan B.D. (1993)\textsuperscript{54} has used time series data in his study on recent changes in Indian irrigated agriculture. He found that the cropping intensity has increased due to expansion of irrigation facility as compared to unirrigated condition.

His multiple regression analysis exercise reveals definite evidence of the close relation between irrigation development and the rise in intensity of cropping at all India level. The overall yield level of the irrigated segment has risen at the rate of about 2 per cent per annum in case of Punjab, Haryana, Gujarat and MP and it exceeds 3 per cent in AP.

This study also indicated that irrigation reduces yield instability. Ultimately, there is positive relationship between irrigation and food grains production.

Sharma S.D. (1993)\textsuperscript{55} has attempted to study the socio-economic impact of major irrigation projects in India. He used secondary data, compiled through the reports of various evaluation studies of irrigation projects in India, covering different regions of the country. He tried to assess the impact of major irrigation projects on cropping pattern, productivity of crops, employment generation, household income, consumption and asset formation, etc. He found that high value crops have taken (viz. sugarcane, tobacco, etc.), in irrigated area which cannot
be raised at all under the rain fed condition. Cropping pattern found changing with superior crops (viz. cotton, wheat, gram etc.) replakening inferior crops. Regarding production, it was found that land is used more intensively and that average yields of all crops are substantially higher. Household income of the beneficiaries was about 43 per cent to 150 per cent higher as compared to those of the non-beneficiaries.

It is observed that the irrigation leads to improvement in level and spread of education, better infrastructural facilities and changes life style of the beneficiaries.

Nandini Chatterjee (1995) has attempted to ascertain the impact of irrigation on land use, cropping intensity and cropping pattern by both micro & macro level in West Bengal. The beneficial impact of irrigation is best visualized with respect to winter and summer season crops of wheat and rice. The irrigation system in West Bengal has positive impacts on cropping intensity and crop yields and it has acted as a catalyst in the introduction and spread of HYV seeds and fertilizers. It is conclude that rice and wheat is most beneficial crop in irrigated area in West Bengal.

Government of India (1996) evaluation study for CAD program for Chambal project revealed that the cropping pattern in Kharif season has shifted towards paddy and soyabean and in Rabi season towards wheat and mustard.

It was also observed that the yield level has increased manifold in command area & net farm incomes have also increased. In the economic analysis of the project they found that benefits cost ratio was found to be positive.

Government of India (1996) evaluation study of Barna irrigation project Madhy Pradesh, it was observed that the yield per hectors of principle crop in command area, especially wheat and gram in rabi season has raised substantially over past decade (1982-92). The
increase in production of rabi crops was due to availability of irrigation facility and better inputs supply. Also there is increase in production of oilseed and pulses.

Sangle S. T. (1996) has studied economic impact of irrigation in Jayakwadi Command Area, using the multistage stratified random sampling, village and farm families as the first, second and third stages respectively. In all 500 farm families were selected of which 350 belonged to command area and 150 were from un-command area. But due to non response, ultimate sample size was turned out to be 458 farm families of which 326 belonged to be command area and 132 were from un-command area. This study was based on both primary and secondary data. The primary data were collected for assessing an impact of irrigation on household economy. A socio-economic survey was conducted in command and un-command area of Jayakwadi irrigation project during the year 1994-95. The study indicated that the cropping pattern in command area was in favor of commercial crops and high water consuming crops as compared to un-command area. Further his study indicated that the degree of diversification was more in command area in compared to un-command area.

Irrigation has enhanced the average per hectare productivity of almost all crops in command area and it was higher than that of un-command area.

It was observed that per family average annual income from different sources was significantly higher in command area (Rs. 34.780) than that in the un-command area (Rs. 27.430).

Further, it was observed that un-command area employment opportunities were available to 91.67 percent landless labours in rabi seasons to followed by Kharip (87.50 percent) and summer (27.50%) as
against 63.30 percent, 73.33 percent and 6.67 percent respectively in un-command area.

Thus, the employment opportunities to landless labour were significantly more in command area than that in un-command area.

**Water and Land Management Institute (WALMI) (1996)** conducted post project socio-economic survey in the command areas of Dhom and Kanher irrigation project, Dist. Satara (M.S.). A sample size of 394 and 556 were taken from Dhom and Kanher irrigation projects respectively by stratified random sampling. In their study, they found significant and positive changes in case of income level, consumption pattern, cropping pattern, socio-psychological factors, diversification in occupations, additional employment generation, educational facilities, etc.

The Dhom and Kanher irrigation projects have emerged as a boosting factor in the rapid economic development of the beneficiaries through irrigated agriculture with sizeable net rate of returns. Farmers from command area of the both projects are growing commercial crops and crop like sugarcane which consumes more water. The cropping intensities under Dhom and Kaner irrigation projects are found 123.74 per cent and 132.30 per cent respectively.

In the study, it is observed that the yield levels of most of the crops are about 50 per cent lower than the potential yield levels due to lakhk of farm mechanization and adequate use of various inputs. There is scope for improving productivity by using proper irrigation methods and conjunctive use of canal and well irrigation.

**Government of India (1996)** found that the discounted benefit cost ratio for the project turned out to 2.84. It is also observed that an average nearly 30-35 per cent and 35-40 per cent of total cropped area in a year was occupied by paddy and wheat crops respectively. Other crops
which include mainly maize, barley and gram occupied approximately 20-25 per cent of the gross cropped area.

The irrigated yield was considerably higher for all crops in comparison with unirrigated yield. Average crop yield for paddy was recorded as 27.5 q/ha and 15.7 q/ha from irrigated and unirrigated areas respectively. Wheat productivity was found on an average as 27.5q/ha and 18.8 q/ha respectively

**Government of India (1996)** evaluation study of Dharoj Project, it is found that in the cropping pattern bajra, custard and maize are more popular kharif. In rabi farmers prefer mustard followed by wheat and custard. Crop yield per hectare are higher in command area as compared with uncommand area. Benefit cost ratio at 10 per cent interest rate is 2.2 and economic rate of return of the project is worked out as 16.32 per cent, which appears to be financially viable.

**Government of India (1996)** evaluation study of Chambal valley irrigation project, Rajasthan revealed that the cropping pattern in Kharif has been shifted towards paddy and soyabean and in rabi toward wheat and mustard. The cropping intensity in the command area has increased to 119.86 per cent. The study also revealed that the yield levels of all the principal crops have increased manifold in command area. Net farm income has also increased.

In the economic analysis of the project they found that benefit cost ratio at 10 per cent interest rate is 4.1 and internal rate of return is 24.48 per cent indicating that benefits from the project are very impressive.

**Government of India (1996)** Barna Irrigation Project is located in the heart of the Madhya Pradesh. It is one of five projects of Narmada Valley taken up in first phase of development in M.P. and has got a very compact and good command.
In the evaluation study of Barna Project, it is observed that there is no kharif irrigation. Farmers are preferring rainfed soyabean crop. In the recent years, area under soyabean has gone up considerably and the area under jowar has shrunk. The yield per hectare of principal crops in the command area, especially rainfed soyabean in kharif and wheat and gram in Rabi, has increased substantially over the past decade (1982-92).

**Government of India (1996)** have study on Giri Project (Himachal Pradesh) is primarily a hydro-electric scheme. Water released in the tail race channel after power generation is utilised for irrigation. The project area lies in Sirmaun district. In the evaluation study of Giri Medium irrigation Project, it is observed that the cropping intensity is increased from 163.6 percent to 177.4 percent by CAD activities. In Kharif season, predominant crops are paddy (54.7%), and maize (18.7%) and that of in Rabi are wheat (67.6%) and burseem (8.8%).

This study revealed that yield of main crop like; paddy, wheat and sugarcane are more than that of State level average.

**Government of India (1996)** study on The Kosi Project was originally planned as food protection multipurpose irrigation scheme but later on converted into irrigation project for providing extensive benefits to the area protected for food. Their time series analysis shows that cropping intensity has increased from 136.2 per cent to 141.5 per cent during 1976-77 to 1985-86 and then up to 149.45 per cent in 1991-92 in the Kosi Project.

The cropping pattern has shown a change with the area under paddy, oil seeds and jute going up and the area under wheat, maize, pulses and sugarcane shrinking. There has been marked increase in productivity of pulses, wheat and oil seeds but with a marginal fall in case of cereals. The improvement is mainly due to increased interest and effort by farmers after the land is reclaimed from flood ravage. The Kosi project
has been more helpful and productive as a flood protection scheme than as an irrigation scheme.

Reddy V. R. (2003)\textsuperscript{67} has published his article on Irrigation: Development and Reforms in Economic and Political Weekly. In his article he examines the allocation and utilization of funds in the irrigation sector. Although Andhra Pradesh has pioneered large-scale institutional reforms in irrigation management, such as legislation to create water user associations, it is necessary to strengthen and sustain the policy initiatives, including plakhing a greater focus on demand-side management.

As per the Economic Survey of Andhra Pradesh (2001-02) the total (major, medium, minor and others) area under irrigation never crossed 45.39 lakh ha (1998-99) during the last 45 years. Though, it is shown in the plan documents that 61.90 lakh ha of area was actually brought under major, medium and minor irrigation (achievement) by the end of March 2000.

In recent years the average share of plan irrigation expenditure in the total plan expenditure is about 30 per cent, while the non-plan share is below 10 per cent in all the years. This indicates that more emphasis is placed on new projects rather than maintaining the old systems. A secular increasing trend is observed in the irrigation expenditure during the past five years even in constant prices. There is a spurt in the expenditure during 1998-99 in major and medium as well as minor irrigation.

A significant share of the irrigation expenditure goes towards major projects (about 80 per cent) followed by medium and minor irrigation schemes.

Hussain Intizar & Hanjra M. A. (2004)\textsuperscript{68} have made to attempts the study on irrigation and poverty alleviation. The purpose of study is to clarify the linkages between irrigation and poverty by offering an
objective review of recent research on the subject. The key questions addressed herein are: (1) what is the role of irrigation development and management in poverty alleviation? (2) What are the linkages and pathways through which irrigation contributes to poverty alleviation? (3) What is the magnitude of anti-poverty impacts of irrigation? And (4) what are key determinants of anti-poverty impacts of irrigation? Their review focuses on topical empirical research studies in Asia.

Further, they identify three main pathways through which irrigation impacts poverty. These are: Micro-pathway: through increasing returns to physical, human, and social capital of the poor households (productivity and distribution pathway); Meso-pathway: through integrating the poor into factor-product and knowledge/information markets (market participation pathway); and Macro-pathway: through improving national growth rates and creating second-generation positive externalities (growth pathway).

The extensive review suggests that there are strong linkages between irrigation and poverty. These linkages are both direct and indirect. Direct linkages operate via localized and household-level effects, and indirect linkages operate via aggregate or sub national and national level impacts. Irrigation benefits the poor through higher production, higher yields, lower risk of crop failure, and higher and year-round farm and nonfarm employment. Increased production makes food available and affordable for the poor.

The indirect linkages operate via regional, national, and economy-wide effects. Irrigation investments act as production and supply shifters, and have a strong positive effect on growth, benefiting the poor in the long run.

Recent advances in irrigation technologies, such as micro-irrigation systems, have strong anti-poverty potential. Ongoing studies in Asian
countries document strong evidence that irrigation helps to alleviate both permanent and temporary poverty.

The antipoverty impacts of irrigation can be intensified by creating conditions or enabling environments that could achieve functional inclusion of the poor. These include: (1) equitable access to land; (2) integrated water resource management; (3) access to and adequacy of good quality surface and groundwater; (4) modern production technology, (5) shift to high-value market-oriented production; and (6) opportunities for the sale of farm outputs at low transaction costs.

_S. N. Lele, & R. K. Patil (2006)_ has studied on Equality, Access and Allocation, Discrimination in an irrigation project. He has focused on some point that Iniquitous distribution, participatory irrigation management: a new phase, etc. According to their research, rising population and over exploitation of groundwater for irrigation has aggravated conflict among farmers located at the upper Godavari project of Maharashtra. The formation of water users association did alleviate the conflict to some degree, but there continues to be disagreement between the governments’ water department and the WUAs on the terms of allocation and other measures. The upper Godavari irrigation project in Nasik district, Maharashtra, is a multi-stage, multi canal systems.

They suggested some solution as the problem of short fall in water supplied for irrigation and the conflicts arising out of the situation are going to be a constant feature in the future. The government and the users will have to work out a long-term solution to effect sustainable service.

In the sense of conclusions it is noted that the water plays an important role in farm income and crop productivity.

_Narayanmoorthy A. (2007)_ has published his article in Economic and Political Economy on ‘Turnaround in Financial Recovery in Maharashtra’s Irrigation sector. In his article he focused on financial
recovery in some selected states of India and specially mentioned Maharashtra state.

His paper has been organized into four sections. Section I, presents an overview about the studies available on the issue of financial recovery in the irrigation sector. Section II, analyses the financial performance of the irrigation sector for the country as a whole and for selected states. The turnaround in the financial performance of Maharashtra’s irrigation sector and the factors that are responsible for the same are discussed in section III.

The study based on specific objectives, they were, (i) To study the water rates, working expenditure as well as financial recovery of Maharashtra irrigation sector vis-à-vis other states since the mid-1970, and (ii) To find out the policy factors & responsible for achieving a better financial recovery rate in the irrigation sector.

According to him, the financial performance of the irrigation sector has been deteriorating over the years because of rising operation and maintenance expenditure as well as low and revised water rates. The financial rate of recovery was close to 100 percent in 1975-76, but declined sharply to 7.90 percent in 2002-03.

Further he stated that the state agency is not able to carry out the O & M as well as other rehabilitation works needed to improve the quality of water supply to the farmer. Various committees, commissions, policy makers and researches have suggested different policy measures at different time points for improving the financial performance of the sector at least over the last two decades, but not much improvement has taken place, in terms of recovery rate at the all India level. However it has been reported that Maharashtra’s irrigation sector has made a tremendous turnaround in the financial recovery rate since 1999-2000.
Thawale Prashant et al. (2007)\textsuperscript{71} have published his online Article on ‘Agro-economic Evaluation of Water Resource Project – A Modeling Approach’ in Springer Science & Business Media B.V. They have focused on various issues as Agricultural returns in the existing scenario, water requirement for crops, Economic considerations, Land use pattern, Existing crop use pattern, Fertilizer requirements and costs, etc.

The paper describes an approach to estimate the agricultural benefits/economics due to irrigation projects. The environmental and ecological economics due to construction of dam needs to be integrated with economics of construction of dam to project the feasibility of the dam. As the execution of irrigation project takes several years and the prices of agricultural inputs and outputs fluctuate during the period, this approach needs to be reviewed from time to time. The data obtained during the study clearly shows the importance of considering the use of mathematical modeling approach during the decision making for deciding the exact cropping pattern for particular land use.

Talati Jayesh, Dhaval Pandya (2007)\textsuperscript{72} have published his article on ‘Issues in Canal Infrastructure Development and Canal Irrigation Management’ in Economic and Political Weekly.

They attempts to understand the dynamics of canal irrigation management at the village service area in the absence of proper infrastructure development and institutional arrangements.

The Gujarat government is experimenting with different approaches to develop canal infrastructure and manage canal irrigation below tertiary (minor) canal in the Sardar Sarovar Project. Though the project is based on the principle of participatory irrigation management, hardly any water users’ associations have taken over canal management below the level of the minor canal. The Sardar Sarovar Project (SSP) of
Gujarat is the world’s largest irrigation system. The system consists of a 66,000 km long canal network including the main canal, branch canals, distributaries, minors, sub-minors and field channels. The entire canal command of the project is divided into four administrative phases.

They recommended that there is a strong need to organize a mass awareness campaign at various levels. Conducting periodic and regular training programmes for officials of implementing agencies, WUA committee members and beneficiary farmers is essential to strengthen their interpersonal relationship.

Gaur A. et al. (2008)\textsuperscript{73} has published his article on Water Scarcity Effects on Equitable Water Distribution and Land Use in a Major Irrigation Project—Case Study in India in Journal of Irrigation and Drainage Engineering © ASCE.

He stated that the many river basins, upstream development and inter annual variations in rainfall can cause both episodic and chronic shortages in water supplies downstream. He presents an integrated approach to assess how cropping patterns and the spatial equity of canal flow changed with water supply shocks in the left canal command area 3,592 km\textsuperscript{2} of Nagarjuna Sagar. He combined 3 years 2000–2003 of canal release data with census statistics and high temporal resolution 8–10 days moderate resolution imaging spectrometer MODIS 500-m resolution satellite imagery.

The results suggest that head reach areas receiving high supply rates during a normal year experienced the highest risks of fluctuations in water supply and cropped area during a water short year compared to downstream areas, which had chronically low water supply, and better adaptive responses by farmers.

The findings suggested that equitable allocations could be achieved by improving the water distribution efficiency of the canal network
during normal years and by crop diversification and introduction of alternative water sources during water shortage years. The findings primarily suggested improving the water distribution efficiency of the irrigation network during normal years and conjunctive water use and crop diversification during water shortage years.

*Aghav Vilash (2009)* has published his article on ‘A study of regional imbalance development and demand of separate Vidarbha state’ in international research journal.

He concludes that the Vidarbha is a backward area from the establishment of united Maharashtra. The economy of Vidarbha is depending on agriculture. The irrigation backlog is impact of economy on the lifestyle of people. 65 percent irrigation backlog is remained in compare with the irrigation backlog of Maharashtra. In financial year 2000-01 Rs. 400 crore has been permitted for the backlog of irrigation but it did not yet.

It is concluded that Vidarbha could not be developed due to the backlog of irrigation and other backlogs and it is not completed after the various remedies.

*Kurulkar R. P. (2009)* has made an attempt to study the problem of regional disparities in Maharashtra state with special reference to the fact finding committee report (1984) and the indicators and backlog committee report (1997). He stated that the problem of regional disparities exists at the international, national as well as the state levels. Between 1984 and 1994, the data show that, the regional disparities, instead of reducing, have actually increased.

*Koppa G. G. & Mishra D. (2010)* they completed his research paper with broad objective of the study as use to a new approach to help investigating the sustainability of irrigation cooperatives with special
reference to small holding and ability and willingness of the farmers/non farmers to pay the water fees determined by Irrigation Cooperatives.

The specific objectives of the study were:

1. Identify and analyze the critical factors for financial success/failure of canal irrigation co-operatives in the context of agro climatic conditions.

2. Elicit the conscious steps taken by the supporting agency and farmers for ensuring the financial strength of these Irrigation Cooperatives.

3. Develop recommendations for enhancing financial viability of the Irrigation Cooperatives while simultaneously taking adequate care of Maintenance & Repair of canals.

4. To identify and analyze the scope for charging multiple use of water including domestic, livestock and industrial purpose by making non farming users as members of the irrigation cooperative in the context of irrigation scheme and agro climatic conditions using scenario testing model.

He concludes that there are number of cooperatives which are functioning well with enough income generated and are going to be self-sufficient. He found that there is lot of variation on the proportion of expenses on maintenance and repair (M&R), the government must fix some portion specifically for M & R of canals (excluding operators’ salary).

K. Palanisami et al. (2011)\textsuperscript{77} have studied on spread and Economics of micro irrigation in India: Evidence from nine states.

All the states were covered for an analysis of the potential MI area and actual spread. For the farm level analysis on the costs and returns among the different farm groups, nine states were covered, viz. Andhra Pradesh, Gujarat, Karnataka, Kerala, Maharashtra, Orissa, Punjab,
Rajasthan and Tamil Nadu. Both primary and secondary data are used. Secondary data was collected covering the state level MI sources, cropping pattern, existing area under MI & government subsidies. Primary data had collected from a 150 farmer sample from each selected state using a semi-structured questionnaire covering the source of irrigation, farm size, irrigated area, area under MI, crops grain, subsidy availed, crop income and expenditure under crops with and without MI. The sample was post stratified into marginal, small and large farmers.

In his article he noticed that there is a scarcity of water in India therefore he suggested options for reducing water demand. First, the supply side management practices include watershed development and water resource development through major, medium and minor irrigation projects. The second is through the demand management practices which include improved water management practices.

It is also concluded that the rate of adoption of MI technology is still very low compared to the potential. Only a few states like Andhra Pradesh, Maharashtra and Tamil Nadu have expanded the area under MI. The poor adoption can be attributed to number of factors such as high cost, complexity of the technology and other socio-economic issues such as lakhk of access to credit facilities, fragmented landholding, localized crop pattern, etc.

Kumar et al. (2012) have published his article on ‘Socio Economic Status of Farmers and their Awareness on Irrigation under Sri Ram Sagar Project Command Area in Andhra Pradesh, India, in International Journal of Bio-resource and Stress Management.

They had selected Sri Ram Sagar Project (SRSP) for the study. The project is constructed across the Godavari River in Andhra Pradesh with storage capacity of 90 TMC for command areas of 6.824 lakh ha covering the districts of Adilabad through Saraswthi canal, Nizamabad through
Laxmi canal and Karimnagar, Warangal, Khammam and Nalgonda through Kakatiya canal. The study was taken up under 2R minor of D51 distributory by selecting three villages one each from head, middle and tail reach. From each village 10 farmers were selected, whose fields were under canal command area by random sampling method.

The randomly selected farmers of 2R minor, D51 distributory, Kakatiya canal, SRSP were interviewed in a face to face situation with a pre-tested questionnaire to collect the data that allow analyses for addressing the pre-determined objectives.

From this study it has been observed that 68% farmers were above 40 years and 71% were educated. The average land holding size was 2.05 ha with low agricultural implements. The study conclusively indicates that involvement of farmers in planning and management is essential for successful performance of on farm water management. The farmers continued following their own irrigation schedule what they desired.

Majority of the farmers were of the opinion that poor operation and maintains of the irrigation system was the major reason for low water use efficiency and tail end farmers expressed that head reach farmers were using more water than required.

**Ghosh Souvik et al. (2012)** have analyzed of irrigation, agriculture, livelihood and poverty linkages in the districts of Odisha. Different indexes were constructed for the assessment of district-wise scenario of irrigation, agriculture, livelihood and poverty like, Irrigation Potential Development Index (IPDI), Groundwater Development Index (GWDI), Irrigation Potential Utilization Index (IPUI), Irrigation Coverage Index (ICI), Composite Irrigation Index (CII), Agricultural Development Index (ADI), Poverty Ratio Index (PRI), and Level of Living Index (LLI).
It has been recognized that irrigation resources plays a major role in poverty alleviation by ensuring agricultural development, expanding livelihood opportunities and employment both on and off the farm. Development of irrigated agriculture has been a major engine for economic growth and poverty reduction.

Ajay Dandekar, Shahaji Naravade (2013) has published his research on “The case of Maharashtra’s Disappearing Water” in Economic & Political weekly.

They have stress on drought position of Maharashtra despite the Maharashtra is the largest dam in the country. But unwillingness of planning and political will, there is no increase in irrigation. According to their research that every passing decade the geographic spread of drought prone area has kept increasing. They also focused on the gross irrigated area, according to the research article; gross irrigated area to the gross cropped area in Maharashtra in the year 2011-12 was 17.9% this was far below the national average of 45% purposely. They also focused on major projects the biggest irrigation project in Marathwada was launched in 1965 and envisaged construction of a reservoir on the Godavari River at Jaikwadi near Paithan. This project was planned with the assumption that 215 thousand million cubic feet (TMC) of water would flow into the reservoir at the Jaikwadi dam site. It was also assumed that about 115 TMC of water would be reserved for the upstream area to store. Thus 100 TMC of water would be available for the command area spread over Aurangabad, Jalna, Beed, Nanded, Parbhani districts. This violated the first assumption of planning as more water was stored upstream than the original planned design of Jaikwadi. One can cite the example Nandura Madhmeshwar in curtailing Jaikwadi. As a result today the Jaikwadi reservoir has been reduced to being simply dead storage.
They also focused on some important points as politics of Dams. The government of India spent close to Rs. 1, 30, 000 crore from 1991 to 2007 on major and medium irrigation projects with the sole objective of achieving a significant increase in the net area under canal irrigation in the country.

Over a decadal your period after expanding capital on such a massive scale there was virtually no increase in the net area irrigated by canals. They are lakhk of maintenance of irrigation infrastructure, absence of and lakhk of political will to put the canal network in place, siltation and water logging and a water intensive crop region.

Purandare Pradeep (2013)81 has published his article in Economic and Political weekly on “Water Governance and Droughts in Marathwada”, he stated that The drought of 2012 in Marathwada region was mainly the result of lakhk of good water governance and poor operation of watershed development and irrigation projects

He defined minor irrigation projects having cultivable command area (CCA) of up to 250 ha are termed as minor irrigation (local sector) in Maharashtra. The Zilla Parishad (ZP) looks after projects up to 100 CCA project having CCA from 101 to 250 ha come under the jurisdiction of the water conservation department. All government reports only talk about the potential created under this sector but is silent about the potential utilized. Those projects can best be described as “build and forget” projects.

He also focused on state sector irrigation projects, according to him bad planning and design, sub-standard construction, poor physical status of canals and distribution network, bandobast or jugad in the name of operation and management (O & M), poor recovery of water tariff, inequitable distribution and inefficient use of water are some of the well known characteristics of the irrigation sector in Maharashtra state.
Gitte M. R. (2013) have published his article on ‘Development and Management of water resources in Maharashtra in International Journal of Humanities and Social Science Invention. According to his, irrigation is the basic input for the development of agriculture from rain fed to the commercial one.

He stated that the progress made by the Maharashtra state in respect of creation of irrigation potential and its utilization is very dismal. The actual utilization of the available potential is less than 50 percent, leaving a huge gap between creation and utilization of the irrigation potential.

He finds out some causes of tardy irrigation development & under utilization of irrigation potential & Causes of inadequate development of irrigation facilities are delay in administrative approvals and re-approvals from government of India, delay in land acquisition from forest department and farmers and also delay in farmers’ rehabilitation, delay in executive and completion of irrigation projects, cost escalation due to inflation and rising prices, and inadequate allocation of funds, non-construction or defects in construction or canals and distribution system, non-maintenance or ill-maintained distribution system, lakhk of education, extension and training to farmers.

He concludes that it is essential to manage and suggest strategies for improving the performance of irrigation sector and also to solve water related disputes in the state.

Gawande G. B., Tikande R. P. (2014) have attempts to find out the irrigation potential created and utilization through irrigation projects & financial constraints in India

He revealed that the creation of irrigation potential in the country and expansion of installed capacity of various irrigation projects have been important policy objectives of India’s development planning but
there is a gap between irrigation potential created & Utilization also large number of irrigation related projected were facing financial constraints and the investment already made in these projects was treated as ‘Sanken investment.

Padgalwar S. L., Barde A. B. (2014)\(^84\) have attempts the role of irrigation in agricultural development.

In his research paper he concludes that irrigation has a direct impact on agriculture. Irrigation yield turns into desired result when it is adequately available and timely supplied along with other modern inputs of production.

It is also conclude that improved irrigation access will increase crop yield and production, and in turn, results in increased farm income, increased farm and off-farm employment opportunities, increased cropping intensity and crop diversification opportunities and the feasibility of year round crop production activities.

Munde B. M. (2015)\(^85\) has attempts to focus on burning issue of water in Maharashtra state by using secondary sources.

He has concluded that irrigation is approximately constant even through government of Maharashtra spent thousands of crore for irrigation development. He also concluded that government doesn’t have efficient mechanism to get latest information of irrigation sector.

He has found the causes of low irrigation ration in Maharashtra like: delay in completion of the projects, absence of long term plan and prioritization of projects, cost escalation & financial mismanagements etc.

Dhawale K.N. (2015)\(^86\) has attempts study of availability & allocation of water in India. He has used secondary data. The information was collected from National Commission for integrated water resources
development. At the same time data was taken from various newspapers, Magazines, Journals, etc.

He has studied the water allocation priority. First priority was given to drinking water, second to irrigation.

He revealed that the availability of water resources is declining in India in all the river basins compare to increasing population. As per as the water requirements are concerned, there is a continuous increase in water requirements for different purposes.

Pharande S. S. (2015) has study on minor irrigation in Maharashtra state. He has tried to find out the direct & indirect benefit of minor irrigation in the command area during the year 2004-2014 by using the both primary as well as secondary sources.

He revealed that cropping pattern has been replaced by cash crops instead of food growing crops. Farmers are growing cash crops like, sugarcane, turmeric, wheat, soyabeans & vegetables, etc. instead of Jowar, Bajara, Beans.

He has concluded that irrigation has brought about technological changes in agriculture. Farmers are using HYVS, Chemicals & fertilizer etc.

He has concluded that due to minor irrigation projects there has been improvement in socio-economic status of farmers.

To sum up, a number of scholars and researchers have analyzed irrigation impact by considering various aspects of irrigation. Most of the studies relating to irrigation impact are related to change in land use and cropping pattern, input use and crop productivity. These studies revealed that irrigation leads to better land use pattern by way of extensive and intensive farming. Results of these studies show that proportion of net area sown and proportion of double cropped area has increased due to assured irrigation facility and thereby enhances cropping intensity.
Most of these studies have revealed that the yield levels of different crops are better in command area as compared to uncommand area. However, these yield levels are significantly low as compared to potential yield levels to be possible in the respective command areas. Irrigated tracks are using more proportionate commercial crops, standard of living. A few other studies reveal labor is required for irrigated crops and landless laborers’ from command area are getting opportunities almost throughout year, which increase their level of Farmers from In area under income and that more therefore, employment nutshell, the results of various studies done by different scholars on similar aspects show more or less similar results with some degree of variations. All these studies reveal favorable impact of irrigation on rural life.
References


