A REVIEW OF SELECT LITERATURE
CHAPTER - II

A REVIEW OF SELECT LITERATURE

Review of available literature on a particular problem or study helps to identify the research gaps and focus on various aspects of problems. Several researchers and academicians have studied various issues and tend to provide meaningful solutions that help to formulate general policy. The vital role of irrigation in the economic development of the countries has attracted not only individual researcher, scholar and government but also the international organizations like Asian Development Bank, World Bank (International Bank for Reconstruction and Development) etc. Such studies focus their attention on the operation and management of the irrigation works, and examine their impact on the socio-economic conditions of the people and other related variables of agricultural transformation in India and abroad. Some of these studies deal with regional level impacts and some other have been conducted at macro level. The databases of these studies have been both primary and secondary. Since there are numerous studies in this field, we shall try to give here a brief review of literature pertaining to the objectives of present research work. The review will be related to the contributions of irrigation on agricultural production, productivity, cropping pattern, input uses, income, savings, expenditure and employment, and also on agricultural structure.

In the beginning of the Independence of India, Gadgil (1948) undertook a study to evaluate the economic effects of irrigation with regard to Godavari and Pravara canals. It was cross-sectional study, covering two villages from the Godavari and Pravara canals, and two non-irrigated villages from adjacent region, is first of its kind in evolving a systematic plan to inquire into direct and indirect benefits of irrigation. The study found that provision of irrigation facility to the farmers enabled them to have a superior cropping pattern, higher productivity and hence larger gross farm income and employment potential. In addition, indirect benefits were accrued to the people who were involved in processing and transporting of the enhanced agricultural production.
command area. The irrigated agriculture had also increased the demand for hired labour, which in turn raised their wage rates and whereby enabled them to improve their economic status. Thus, the study concluded that the irrigation projects had resulted far-reaching effects on the economic life of the community in the region.

Just after the inception of Indian Planning, Epstein (1962) conducted a study during 1954-1956 in Wangala and Dalena in Mandya district of Karnataka. She did a comparative study of an impact of canal on Wangala irrigated village and Dalena dry village and concluded that canal irrigation to Wangala, brought one new dominant new opportunity: the growing of commercial crops such as sugar cane and paddy. As a result of this, productivity of land had been considerably increased. As a consequence, the market price of land went up by 3.3 times. Canal irrigation minimized instability in production and also lessened the risks of farmers, caused by erratic and meager rainfall. In the wet village, agriculture dominated the economic profession but the dry village, in contrast, developed into a kind of servicing center for adjacent wet villages and hence its economy was diversified. To Dalena farmers, irrigation presented no such an outstanding opportunity.

Patil (1966) studied the input costs and returns of major irrigated crops in Mandya district of Mysore State (now Karnataka). In the study, the cost of production of sugarcane was compared to the cost of production of paddy and irrigated ragi. It was three times the cost of production of paddy and four times the cost of production of irrigated ragi. The Sugarcane grower earned a net income of Rs. 6,600/- per hectare which was 20 times the net income from paddy and 15 times the net income from irrigated ragi. It was 8 times more than the net income derived from production of paddy and irrigated ragi.

Savale (1966) studied the role of irrigation and cropping pattern in agricultural development in Nasik district of Maharashtra. The study was based on data collected in the Farm Management scheme of the Planning Commission, Government of India. The benefits of dry and irrigated farms indicated that the net returns from 10 and 20 acres irrigated farms were Rs.4, 853/- and Rs.10, 363/- respectively. While the same size dry farm net returns were only Rs. 535/-
and Rs.1,159/- respectively. Net returns per rupee of capital invested in different size of irrigated farms paid back 150 per cent to 200 per cent as compared the dry farms. Further, the study observed that the irrigated farms had employed almost five and half times more human labour and two and half times more bullock labour as compared to dry farm.

Biradar (1975) found that major portion of the command area of the Ghataprabha project received water for four months either in Kharif or rabi season. Smaller part of the command area of the project received the water for 8-12 months. Based on factors like soil characteristics, climatic conditions, water requirements of crops etc., the following cropping patterns were suggested for the command area, hybrid jowar, hybrid maize, ground nut and pulses in shallow to medium deep and loamy soil; Hybrid jowar, hybrid maize, chilli and wheat on clay loam to clay in texture and cotton on clay soils. Thus, sugar cane, cotton and wheat were not suggested for the command as such.

Kumar (1977) studied the economic impact on cropping pattern, cropping intensity, labour and inputs utilization in Hirakud canal in Sambalapur district of Orissa, on the basis of comparison between the irrigation system of villages with and without field channels. He used Cob-Douglas production function. The study revealed that the field channels had considerably reduced the problems faced by the farmers and had led to an overall increase of 13 per cent in the irrigated area and nine per cent increase in the cropping intensity. Field channels reduced over-flooding and loss of nutrients due to flood irrigation. This had resulted in the adoption of high yielding varieties of paddy in 72 per cent area in villages with field channels as compared to only 54 per cent in villages without field channels in rabi season.

Pandy (1979) observed that irrigation projects provide socio-economic benefits in the Kiual-Badua-Chandan command area of South Monghyar and South Bhagalpur districts in Bihar State. The study found that economic benefits accrue in the form of cropping pattern and enhanced use of HYV seeds and chemical fertilizers which cause increase in per acre yield and income. This in turn generates more employment opportunities in irrigated villages than in the unirrigated villages.
Adriano (1981) tried to study the impact of development of new irrigation project in the region of Iloilo in Philippines on labour use and income distribution. His study was based on the income and labour use measurements made in the region before and after irrigation. The study observed that almost all the farmers who received water from the new irrigation system in the region, grew at least one crop of rice in the dry season, whereas farmers in rainfed areas grew some diversified crops and left most of their land fallow in the dry season. The total labour used in growing one hectare of rice on irrigated farms was about the same as that used on rainfed farms, but hired labour found substantially greater employment and income on irrigated farms. However, hired labour's relative share of total income from rice production was slightly less on irrigated farms than on rainfed farms. The study found that those who profit from public irrigation and pay relatively little for their benefits were landowners, sellers of current farm inputs, and sellers of general goods and services to the rural sector. However, the researcher observed that irrigation cannot be expected to increase the production or the absolute share of the income of the direct participants in production, and at the same time distribute the benefits equitably. And therefore, irrigation infrastructure in itself does not typically constitute a very efficient re-distributive instrument.

Asnawi and Shand (1981) studied the impact of improving irrigation system on rice production in West Sumatra of Indonesia. They used Cobb-Douglas production functions to quantify the response of rice production to irrigation. He calculated relative contributions of different factors to West Sumatra’s rice production between 1969 and 1978. His study indicated that irrigation improvement was found to be relatively more important in increasing rice production than the other factors, like agricultural intensification, fertilizer use and pesticide use. The study concluded that the benefits are real, substantial and profitable.

George and Raju (1981) examined the impact of irrigation on total economic activity, with special reference to labour absorption in the command area of Nagarjun Sagar Left bank canal in Andhra Pradesh. The study was conducted during the year 1978-79. The selected families included cultivators,
land less agricultural labourers, rural artisans in services and an allied agricultural activities. Irrigation was found to have led to more absorption of labour in on-farm activities, particularly in crop production.

Patel (1981) analysed the impact of irrigation on employment at the farm level in the command areas of 24 different medium irrigation projects in Saurashtra and Gujarat regions of Gujarat State. Each study region was consists of 12 project command areas. The study found that irrigation created to about 32 per cent of additional man-days of work in the command areas of both the regions. The regression analysis of the study indicated that one hectare of rainfed farm converted into an irrigated farm would generate about 48 and 52 man-days of work in the Saurashtra and Gujarat regions respectively. Thus, on the basis of these results, he estimated total additional employment to 21,86,960 man-days for the Saurashtra and 71,55,772 man-days for the Gujarat region.

Selvarajan and Subramanian (1981) employed the profit maximization model of linear programming technique to study the economic impacts of optimization resource (water) augmentation on cropping pattern, cropping intensity, human & bullock labour utilization and farm income in Prambikulam Aliyar Project (PAP) in Coimbatore district of Tamil Nadu state. The results of the study indicated that water augmentation had favored in increasing the acreage under cotton, sugar cane and maize. The cropping intensity was increased from 169.23 per cent to 194.85 per cent in the optimal plan. With regard to bullock labour and human labour the study revealed that days of employment was increased by 13.08 per cent and 21.87 per cent in the project years and in the non-project years 9.68 per cent and 21.87 per cent respectively. Resource use optimization suggested an increase in the optimal plan gross income by 25.97 per cent, net income by 33.11 per cent, family labour income by 76.91 per cent and farm business income by 45.13 per cent in the existing plan. The study pointed out that there existed ample scope for increasing farm incomes and employment through resource use optimization and water augmentation.

Goldman and Squire (1982) studied impact of Muda irrigation project in the Malaysia. Study revealed that as a result of the water supply in the command area 50,000 farm-families switched from single to double cropping paddy and
also increased in the paddy yields. The result of these structural changes was a leap in production from 3,84,721 tonnes in 1969 to 7,95,830 tonnes in 1974. It was about 50 per cent of Malaysia's production. Consequently, net farm income of families was changed, and hence, it comprised changes in the asset ownership, allocation and productivity.

Patel and Patel (1984) examined the direct economic impact of irrigation on cropping pattern and input uses in agriculture under the Dantiwada Command area in the Gujarath State, on the basis of comparison between irrigated and rainfed farming. The study period was 1979-80. The study revealed that per hectare net income in the irrigated farms was found to be higher by Rs. 896 over that in the rainfed farm. On the other hand, the employment of human labour in the irrigated farms was found to be higher by 34 man-days per hectare or 61 per cent over the one used in the rainfed farm. However, the additional benefits or income generated by irrigation was higher for the medium and large farmers than that for the marginal and small farmers.

Alshi and Galgalikar (1984) examined the impact of irrigation on input utilization, output-cost ratios and productivity of wheat. The study was conducted during the year 1980-81 in Nagpur district of Maharashtra State. The study was based on the comparison between the dry and irrigated wheat farms. Per hectare input utilization of human labour, fertilizer and seed was higher on irrigated wheat farms. The higher level of input use resulted in 13.14 quintals per hectare yields on the irrigated farms as against 5.58 quintals in the dry wheat farms. The output-cost ratio was also higher for irrigated wheat than that for dry wheat. And also production function analysis indicated that the production response of the capital (fertilizer, irrigation) was higher in irrigated wheat, indicating a higher marginal product of these factors on the irrigated wheat farms.

Charan (1984) analysed the impact of irrigation on cropping pattern and income of sample farmers of Narmada Command area in Vadodara of Gujrat State. The study revealed that gross returns in different size-groups were 2-3 times more on irrigated farms than the non-irrigated farms and also total man-days of employment was more in irrigated farms than the non-irrigated farms.
Dak and Sharma (1984) found that with the growth of irrigation potential over the years with the change in the levels of irrigation, there were corresponding changes in the cropping, agricultural technology, productivity, and incomes, health, and education, transport, and communication and institutional development in Haryana.

Ghosh (1984) analysed the impact of irrigation on the income and employment in a village of Damodar Valley Canal Command area in the state of West Bengal. The study covered a period of 8 years from 1967-68 to 1975-76. He found that the proportion of area under HYV programme in the Kharif went up from 7.16 per cent in 1967-68 to 50.80 per cent in 1975-76. Consequently, the per farm income increased by 163 per cent and the labour employment went up by 135 per cent during the same period. Further, he recommended that in order to increase the labour intensity and agricultural productivity simultaneously, the irrigation facilities should be fostered.

Joshi et al., (1984) examined the magnitude and socio-economic consequences of soil salinity and water logging due to the canal irrigation in 11 selected irrigation projects of India. They used secondary sources of data for the study. They observed that canal seapage and mismanagement of water system had adversely affected the crop growth and hence, decreased the productivity and production of rice in all selected irrigation projects. This had resulted in the changes in the cropping pattern and low profits.

Mhadhvsamy (1984) observed the effect of irrigation on profitability of crops and farm business income in Kakatiya Canal Command area of Andhra Pradesh State. He compared the results of the study between the project area and non-project area. The results of the study indicated that the net profit per hectare was far more in the 'project area' as against in the 'non-project area'. The average total farm business income increase in the per hectare of operated area was Rs.2,087 in project area as against Rs.850 in the non-project area. As a result of this, the per hectare total farm business income in the project area was found to be higher by Rs.1,237.
Ray (1984) observed that in the absence of irrigation both types of irrigated and non-irrigated farms grew crops like pulses and mustered in the Rabi season. With the introduction of irrigation facilities, more profitable crops like high yielding paddy, potato and wheat gradually replaced these crops. As a result of this, net returns per acre significantly improved from the existing plan.

Satpathy (1984) studied the impact of public irrigation on farm economy of Cuttack Sadar I Block in Orissa. For this he adopted "with and without" principle. He used the tool of farm management procedure for assessment of Cost A, Cost B and Cost C and also Cobb-Douglas production function had fitted to examine the input-output relationship between independent variables such as human labour, manure, fertilizer and irrigation charges and dependent variable output per hectare. The study was undertaken in the year 1980-81. The study results revealed that on the whole input costs were higher than that in unirrigated farms. The three measures of farm profit, such as farm business income, return to family labour and management and net income for irrigated farms were higher than that in unirrigated farms. Though curve linear regression approach adopted to examine the input-output relationship, regression coefficients for human labour, manure, fertilizer and irrigation charges were indicated significant impact of irrigation the value of gross return per hectare. Further, the study indicated that a hectare of irrigated farm increased by the employment opportunities by 40.34 per cent as compared to the unirrigated farm.

Dhawan (1984) in his study sought to determine the magnitude of increase in farm income due to canal irrigation and to assess how this increase varied with the farm size. The analysis was based on data collected on two canal commands of Gima and Ghod in Maharashtra. He found that introduction of irrigation had no doubt, increased farm income, but had also increased the absolute income differential in the farm sector in the two commands. The larger farmers on account of superior access to all inputs, irrigation, credit, extension services, education, communication etc. had gained more income benefits per unit of irrigation water, as compared to small farmers. He observed that the income benefits from a crop hectare of irrigated area were found to be positively associated with the farm size. In Ghod sample, the marginal farmers with
average farm holding of 1.25 hectare, realized half as much benefits, as do the big farmers with average farm holding of over 11.50 hectare. Further, he observed that additional per capita income due to canal irrigation too found to rise sharply with the farm size in both the command areas.

Adinarayana (1984) has studied the impact of irrigation in the formation of capital assets, cropping pattern, employment, farm productivity and income, in Kakatiya Canal of Siriramsagar project in Andhra Pradesh. For this, he studied the position on farms 'without' irrigation facility and compares the same with the position observed on farms 'with' irrigation facility. The study found the impact of irrigation on asset formation was significant; the increase nearly being three times on fixed assets, while it was only marginal on working assets of the irrigated farms compared to unirrigated farms. There was an increase in employment of human labour by more than 100 per cent, farm productivity of the irrigated farms by more than 200 per cent.

Tak (1986) examined the impact of canal irrigation on cropping pattern, income and use of modern inputs in Purna irrigation project of Marathwada division of Maharashatra State. The study indicated that there was a significant positive impact of shift in the area of the crops like cotton, wheat, sugar cane and *rabi* jowar. The rate of increase in the area and yield were faster in post-project period as compared pre-project period. There was no distinct difference in cropping pattern of the beneficiaries and non-beneficiaries. However, cropping intensity of the beneficiaries was substantially higher over non-beneficiaries. The use of human and bullock labour utilization was more by 130 per cent and 91 per cent and similarly use of farm yard manure, fertilizer like NPK and plant protection measures were more by 125 per cent, 500 per cent and 195 per cent, respectively in case of beneficiaries over non-beneficiaries. Net income of per farm per annum gained by the beneficiaries was Rs.14,735.66 as against Rs.2,714.11 in case of non-beneficiaries. The input-output ratio was higher in case of beneficiaries. Thus, irrigation facilities in Marathwada region had significantly increased in the income of the cultivators by increasing the production and productivity of the crops grown.
Using the method of ‘with’ and ‘without’ approach, Rao (1987) made an attempt to assess the impact of canal irrigation system on land utilization pattern, income and employment opportunities of farm families in the command area of Malaprabha river in Karnataka. Both investment and returns were found to be much higher on the irrigated farms than on unirrigated farms, and also in regard to resource productivity and infrastructural gains. He concluded that irrigation had played the role in transforming once dry villages to prosperity. And he further observed that optimum utilization of canal irrigation would further help in achieving self-sufficiency and overall rural development.

Patwardhan (1987) has studied the impact of irrigation on paddy cultivators in command area of Itiadorh Irrigation Project of the Vidarbha region in the Maharashtra State. Main objective of the study was to assessment of the impact of irrigation on cropping pattern, production, productivity and socio-economic conditions of the three categories of paddy cultivators under the command of the Itiadorh irrigation project. A comparison of benefits from non-irrigated and irrigated fields revealed that the rate of yield of paddy cultivators increased from 2.5 quintals to 10 quintals respectively. The percentage of hired labour in case of small farmers was much lower than that of the medium and large cultivators. The study also revealed that net income of the three types of cultivators suggested that large number of 85per cent of the cultivators were subjected to meager per capita income per year in the range of Rs.200 and Rs.600, there by enabling existence below the poverty line. Due to assured water supply at required intervals enabled the more and more cultivators switched over to the high yielding paddy variety.

Vaidyanathan (1987) studied the impact of irrigation for 12 states. He estimated the average value of production of 12 major crops on irrigated and unirrigated areas for the states for the period 1974-75 to 1978-79. The all India average farm harvest price in 1970-73 was taken as the basis for valuation. He observed that the average value of productivity per hectare of irrigated crop area worked out to Rs. 1,849, which was about 2.8 times that of per hectare of unirrigated crop area.
Naidu (1987) examined the impact of irrigation on farm productivity, income and employment under Tungabhadra project. He employed ‘with’ and ‘without’ approach in his study. The study was based on the comparison of irrigated farms with unirrigated farms for the year 1979-80. He concluded that irrigation increased the cropping intensity from 100.44 percentage to 134.88 per cent and the average land value per acre in area has increased from Rs.3117.29 to Rs.7141.99 with canal irrigation. In addition, the average productivity per acre of many crops was significantly higher in the canal-irrigated area. Further, study revealed that the average cost of cultivation per acre of crop production was worked out to Rs.1550 in irrigated area and it had been also favorable effect on employment.

Dhawan (1988) examined the impact of irrigation on productivity of land, cropping pattern, and on the basis of national level. He observed that land productivity on irrigated lands was average 22 quintals per crop hectare in 1983-84 where as it was less than 9 quintals per crop hectare on unirrigated lands. Further, study indicated that productivity differential 5 years later was estimated 13.3 quintals during 1983-84. This was because of a firm upward tendency in the overall irrigated yield during the 14-year period from 1970-71 to 1983-84. This indicated that the production and productivity in agriculture had increased considerably by extending irrigation facilities.

Kallur (1988) evaluated major impacts of irrigation on different categories of farmers in relation to cropping pattern, cropping intensity, input uses, production and productivity in command area of Left Bank canal of Tungabhadra project in Karnataka. His study was based on ex-post analysis. The study revealed that in the project area, growth of new commercial crops like paddy, hybrid cotton, sugar cane etc. had taken place. Consequently, the cropping intensity was 199 percentage in the command area; in contrast it was 116 percentage in controlled area. Uses of modern inputs were more in command area than in controlled area. The average per acre income of kharif and Rabi was Rs. 3547.29 and Rs. 6070.35 as against Rs. 305/- and Rs. 844 in the controlled area respectively.
Gorter (1989) made an extensive research study on the agrarian changes due to development of Canal irrigation in Kesala region in Valsad district of South Gujarat. For the purpose, it studied the agrarian conditions in the region over period from 19th century to 1980s when the canal irrigation was introduced in the region. The study indicated a strong trend towards capitalist farming. This trend was, however, mainly limited to the large landholders. In the early 1960s, agriculture was already commercialized and especially Patidars and Anavils, the farmers of elite class in the region used wage labour on a permanent basis. These castes had been the peasant vanguard in the process of commercialization during the 19th and early 20th century. The construction of a large-scale canal irrigation system in south Gujarat had offered these farmers the means to transform from commercial farmers into full-fledged rural capitalist entrepreneurs. These elite class farmers started investing their high profits in machinery, the permanent use of wage labour and extra land. As a result of this, the small and marginal were to withdraw from agriculture all together, and rent or sell their land to larger farmers. Further, the study also revealed that cropping pattern was completely changed and cotton had disappeared. While the area under jowar was no more than a shadow. These 'dry' crops had been substituted with irrigated crops. The area under paddy became tripled, vegetables gained importance and sugar cane became very popular. Consequently, the area under sugar cane was increased from 5 acres to 90 acres between 1963-64 and 1982-83.

Patel and Patel (1989) studied the impact of irrigation on income and employment under the three medium sized irrigation project in Gujarat State. The study was compared with 'Before irrigation' baseline information. A random sample of 50 irrigated farmers was selected from each project area. In 1985-86, the net income obtained by the sample farmers was significantly higher than for the unirrigated farms. At constant prices, net income per hectare showed an increase in 1985-86 over the baseline year by 140 per cent in Panama, 362 per cent. Watrak and 54 per cent in Fatewadi. The net incremental income per hectare of net-cropped area as a result of irrigation in 1985-86 was estimated as Rs.678 in Watrak, Rs.2046 in Panama and Rs.3674 in Fatewadi. The net incremental employment in man-days per hectare was 65, 61 and 115 days.
respectively in three project areas. The study revealed that irrigation played an important role in raising the level of income and employment at farm level in project areas.

Reddy (1990) has studied the socio-economic impact of Ghataprabha project in Karnataka. He was made a comparison between post-irrigation data with pre-irrigation bench mark data. The study revealed that the crop patterns and input structure in the irrigated farms were distinctly different from the bench mark study. Further, the cropping intensity was increased by four per cent when compared with bench mark study. Consequently, the value of output per irrigated acre has increased by six times and net output per irrigated acre was increased more than five times over that in the unirrigated acre. The use of yield enhancing inputs like fertilizers and pesticides had gone up.

Kaul and Sekhon (1991) examined flexibility and reliability of irrigation and their effects on yield in Punjab. A comparison was made between different farm categories, each operating under different sources of irrigation. The findings of the study revealed that yields were higher on the farms having alternative source of irrigation compared to farms having single source of irrigation. In the case of wheat farms, having alternative source of irrigation obtained 50 per cent higher yield than the canal irrigated farms.

Shukla and Gurjar (1991) analysed the impact of water on cropping pattern, input uses, and crop yield and ‘Time’ and ‘Use’ relation of irrigation yield in Indira Gandhi canal command area of Rajasthan. The results of the study revealed that availability of water and the cropping pattern was inter related. In the area where supply of water was constant and adequate cash crops were prominent over others and cropping intensity was also greater. In the command area, they found that more cash crops like Gur, Cotton, Sugarcane, Chilies, Spices and Vegetables were grown in the areas near Head portions whereas the percentage of cash crops declined southwards in the middle and tail end portions, where more of the food-grains were found. Further, the study revealed that the yield of wheat, gram and mustard per hectare was the highest in the head portion, where adequate amount of irrigation water was available. In
comparison to this the yield of all three crops was much less in the tail end portion because of uncertain and irregular supply of water.

In an extensive research work, Rajan (1991) made an attempt to study the impact of irrigation and agriculture modernization on the economic and social conditions of rural women workers. He carried out his study in Kodad block of Nagarjunasagar canal irrigation scheme in Andhra Pradesh; tapped varied information on employment and other socio-economical details through detailed household survey, interviews and group discussions. The study indicated differential impact of irrigation and agriculture modernization on women as compared to men. The male labourers got highly benefited by change in the cropping pattern from dry farming to wet farming, specially paddy cultivation, by way of both increased employment and increased wages. But however, most women reported a decrease in agriculture labour employment and no upward effect in daily wages after introduction of canal irrigation. This, the researcher analyzed as follows. Due to development of intensive cultivation like paddy, there was excessive migration of male labourers from neighboring dry farming area to canal irrigated area. There was also an effect of mechanization of paddy cultivation, due to which there was decrease in the demand for women labour. The study also observed that there was little incidence of organized women's activity reaching the poorer sections. It concluded that the canal irrigation had apparently no positive impact on women's socio-economic conditions in the study area.

In the article "Socio-Economic Impacts of River Valley Projects", Sharma (1991), made an attempt to test the hypothesis that the implementation of River Valley Projects in India has led to the sustained economic growth of the areas. For the purpose of the study, he used the secondary data on socio-economic indicators as brought out by Central Water Commission, New Delhi, in the evaluation studies of the 7 major River Valley Projects. He found that, as a result of increment in agricultural production due to irrigation projects, household income of the beneficiaries had increased by 43 to 150 percent, as compared to those of the non-beneficiaries. The employment impact in absolute terms was noticed rather modest; 46 man-days to 90 man-days per hectare irrigated farms,
as compared to unirrigated areas, i.e., an increase of 43 to 200 percent. On social front, marked improvements were generally noticed in the command areas than in the control areas, as reflected in higher level and spread of education, better infrastructural facilities and public services including health, greater social mobility, communication among people, in attitude and life style of people in the two situations. It was thus concluded that the River Valley Projects in India have generally led a sustained economic growth in the project areas.

Rao (1992) studied the economic impact of canal irrigation in Nalgonda district of Andhra Pradesh state, on the basis of a comparison between command and non-command areas. The study found that canal irrigation in the command area facilitated not only to input use expansion but also input use efficiency. Consequently, the canal irrigation contributed to the growth of factor productivity by 25 per cent and agricultural output significantly by facilitating productive absorption of new technologies.

Singh (1992) examined the impact of conjunctive use of surface and ground water on irrigation water efficiency in Upper Ganga canal command area of Muzafarnagar in the Western Uttar Pradesh. Study revealed that optimal utilization of water management changed the cropping pattern. Consequently, a major change was observed in the area under sugar cane crop which was increased to 40.13 per cent from 34.90 per cent in the previous situation. Further, it indicated that the optimal cropping intensity was decreased from 161 per cent to 153.15 per cent because of increased in the area of sugar cane in the optimal plan. The optimal net returns increase by 8.24 per cent over the existing net returns. Here, improving water use efficiency would mean getting higher income from the same quantity of water.

Umrani and Birari (1992) studied the effect of irrigation and fertilizer management for agricultural production in Mula, Girna and Khadakwasla command areas of irrigation projects in Maharashtra. They observed that the adoption of proper irrigation layout had resulted in an increase in crop yield from 9 to 35 per cent and in saving water from 20 to 30 percent. The utilization one or two protective irrigation during water stress period resulted in an increase in the various crop yields from 21 to 100 percent. The supply of irrigation water at 10
days interval to summer groundnut resulted an increase in yield by 16 and 32 per cent over the yields obtained from 7 days and 14 days of interval irrigation.

Joshi (1993) analyzed the findings of different studies and reported that both positive and negative effects were realized as a consequence of canal irrigation in different agro-climatic regions of the country. The positive effects in terms of increase in crop production and labour employment dominated at aggregate level in the command areas. The negative effects in terms of soil salinity, water logging, health hazards, etc., were posing serious threat in some pockets. It is concluded that the existing passive negative effects may gradually over-ride the positive gains from investment on irrigation if the process is left unchecked.

Paul et al. (1994) examined the cropping productivity, employment, input use and output returns, and resource use efficiency with special reference to sugarcane in Sharanpur district, on the basis of comparison between irrigated and non-irrigated farms. The analysis revealed that the cropping pattern had undergone change partially. The productivity of paddy increased from 11.67 quintals in 1979 to 14.50 quintals per hectare in 1984. Similarly, productivity of wheat and sugarcane increased from 20.85 and 459.87 quintals to 23.33 and 552.56 quintals per hectare during the same period respectively. The cropping intensity in the irrigated area under study was only 136 per cent. However, in the non-irrigated area the cropping intensity was lower and also productivity was much less. Further the study indicated that sugarcane was comparatively more profitable on an average net returns was Rs.3940.90 per hectare, wheat assumed second place which earned Rs.1566.41 per hectare. On the whole, the quality of life of farmers had improved.

Meinzen-... (1995) discussed the importance of timeliness as a key dimension of irrigation performance and applied to empirical data from the Sone Irrigation System of Bihar. Using indicators of timeliness in an analysis of the contribution of irrigation to rice production showed that incorporating measures of timeliness explained much more of the variability in agricultural production than do simple measures of total water applications over a season. Results of production functions show that if water deliveries cannot be matched with crop
requirements, they have a negative rather than a positive impact on yields. Water scarcity has the greatest adverse impact in production in the middle of the season, while surpluses are most damaging at the beginning and end of the season. Temporal redistribution from surplus periods to times of water scarcity therefore offers considerable scope to increase productivity without increasing water use.

The World Bank (1995) in its recent evaluation of 208 Bank supported irrigation projects between 1961-87, estimated that about 16 million farm families were primary beneficiaries from the projects. Hence, it concluded that the 365 Bank supported projects where more than half of the project costs were spent on irrigation, evaluated or not, assisted about 28 million farm families. This means that there were over 150 million beneficiaries on farms and countless other millions who benefited as labourers, as consumers of food, household water, or electric power or as construction contractors and civil servants. And it generally observed that the benefits of irrigation investments have been widely distributed.

Chaterji (1995) studied the impact of irrigation on land use and cropping pattern in West Bengal. She concluded that tangible benefits were reaped from irrigation as an extension of farmlands in the districts located in humid western plateau. The system had positive impacts on cropping intensity and crop yields, but the former being most responsive to irrigation. In case of crop yields, it had acted as a catalyst in the introduction and spread of HYV seeds and fertilizers. Crop wise, boro rice and wheat were most benefited from the irrigation in West Bengal.

The Government of Karnataka undertook a farmers' opinion survey (1996) in four selected Major and Medium Irrigation Projects in the State. The main objective of the study was to know adequacy and timeliness supply of water in the command area of projects. It found that about 35 per cent of farmers did not get irrigation water in time in all projects. The reasons found for not getting water in time were no proper water allocation and distribution (37%), head reach farmers taking more water (35%) and inadequate water supply (28%) reported that they did not get timely.

Gutam et al. (1996) examined the land irrigation, cropping intensity and the magnitude of operational constraints in water management in the Tawa
command area of Hosangabada division in Central India. The results of the study indicated that land use intensity in canal irrigated farms was 88 per cent, while other sources irrigated farms having 74 per cent. They compared the intensity of land use among small and large canal and other sources of irrigated farms. They observed large farms having low intensity of land use. Consequently, the irrigation intensity in head, middle and tail reaches of canal farms were 71, 81 and 88 percentages respectively. The cropping intensity of canal irrigated farms were higher as compared to other sources irrigated farms by 188 per cent and 159 per cent, respectively. Further, the study indicated that constraints in water management created an adoption gap for low potential utilization of irrigation water.

In their article in "ICID Journal", Asrar-Ul-Haq et al. (1997) were studied the problems faced by Irrigation systems in Pakistan, identified that salinity, water logging, over exploitation of ground water, low efficiency in delivery and use, inequitable distribution, inadequate maintenance, and insufficient cost recovery have become main problems of Pakistan’s irrigation systems. Pakistan’s irrigation systems are under tremendous pressure due to growing needs of water. Over time, there has been a substantial increase in the number of users due to rapidly growing population and consequent fragmentation of land holdings. The irrigation intensities have increased beyond design values. In Upper Indus Basin, for instance, cropping intensities have increased to over 120 per cent as against an average design intensity of 63 per cent. They observed that there is a need for review of irrigation systems in the context of design parameters and objectives. They concluded that only addressing of root cause for shortage of water supply, complemented by institutional measures implementable in local environment as would be able solve the problems of irrigation system in the country.

Hooda (1997) has studied the impact of lift irrigation on the cultivation of commercial crops in the drought prone areas of Jui Lift canal command area in South-western Haryana. The study revealed that there was a high degree of positive correlation (0.79) between the intensity of lift irrigation and changes in the cultivation of commercial crops in the study area. It showed that Jui Lift command area witnessed a high degree of change in the harvested area of commercial crops throughout the region after the introduction of lift irrigation.
Reddy (1997) analysed the socio-economic impact of different sources of irrigation in Telangana Region of Andhra Pradesh. The results of the study revealed that canal irrigation was considered as an assured source of irrigation, level of literacy ratio was larger in smaller size of family in canal irrigation than in the tank and well irrigation. And the number of persons with higher education was larger in canal irrigation. Further, it was observed that irrigation intensity was the highest in canal areas followed by well and tank irrigated areas. The overall analyses indicated that farm size and productivity were positively related in canal and tank irrigated areas. Large farmers due to higher investment in various modern inputs were getting higher returns per acre than other categories of farmers in canal and well irrigated areas.

Dhawan (1998) analyzed the on-farm benefits from canal irrigation in India. He compared the irrigated yields with unirrigated yields at national level. For the purpose, he considered the canal irrigated yield for the period 1980-81 to 1992-93, and found that the Gross benefits from canal irrigated hectare rose from Rs. 2,087 in 1980-81 to Rs.7,132 in 1992-93. This was to a rise of 242 per cent over a 13-year span. The net output benefits from canal irrigated farming stood at Rs.1,289 per hectare in 1992-93.

Renuka and Ali. (1998) examined the impact of irrigation on production and productivity of Chillies in the canal command and well-irrigated (in non-command) areas under the Kadam Project of Adilabad district in Andhra Pradesh. They observed that the pattern of canal and well irrigation directly influenced the production and productivity among the different categories of farmers. The conclusions of study revealed that production and productivity of commercial crops like Chillies in Command and Non-command areas are not only the same, even income from the wet land crop was more than that of irrigated dry land of command area. In the non-command area, where major source of irrigation was well, productivity was found to be higher, compared to that of the command area, where canal water was not properly distributed. Hence, canal irrigation in this command area of the project had not yet replaced the importance of well irrigation in producing commercial crops, even though huge amount of investment was made in the construction of canal, distributories and field channels.
Epstein et al. (1998) re-studied the same social micro-universe in the 1970s then and still (First study was conducted during 1954-56) is a rare phenomenon. And another re-study in the 1990s was conducted in the same villages. Both of these two re-studies revealed that the opportunities which had been came within reach of Wangala’s and Dalena by 1970, are discussed under the headings: by her (a) Agricultural productivity; (b) Cane versus Jaggery; (c) Regional Growth (d) Education Facilities (d) Education and Urban Orientation. Agricultural productivity increased through extension of irrigation and also by higher per acre crop yields. Between 1955 and 1970, Wangala’s wet land area increased as much as 69 per cent, 88 per cent of this extension of irrigation benefited villagers and outsiders acquired the remaining 12 per cent of wet lands. In 1955 slightly more than half of Wangala had access to canal irrigation; by 1970 as much as 80 per cent of land were irrigated. Rising wet land prices reflected the increase in agricultural productivity of irrigated land. In Wangala wet land prices increased by about 330 per cent between 1958 and 1971 while the consumer price index for the same period amounted to about 280 per cent.

An attempt was made by Reddy (1998) to study the problems and prospects of the command area of Malaprabha irrigation project in Belgaum district of Karnataka. The main object of his study was to find out the reasons for the gap between irrigation potential created and utilization, identify the problems on-farm development, role of agricultural extension in irrigation efficiency and productivity. Further, he analyzed impact of irrigation on crop pattern, input use, productivity, output, farm-business income and income distribution among the beneficiary farmers. In his study, both longitudinal (Before-after) and cross-sectional (with-without) approaches were used to examine the impact of irrigation on above issues. In longitudinal analyses he used the bench mark data of study in this command area for 1975-76 and in later approach he undertook a field survey in 1984-85. His study revealed that farmers were eager in seeking the agricultural extension advice right from the beginning. Irrigation was playing a positive role in transforming agriculture from the traditional low yielding low value cropping system to modern high value HYVs and commercial cropping pattern. So, there was a significant increase in the yield. An irrigated acre in the period of bench mark study, yielded 126.2 per cent more output than an unirrigated acre; in
the study period, it has yielded 454.2 per cent more. This showed that irrigation had a tremendous impact on farm output.

The Government of Karnataka (1999) was set up a "High Level Committee" to suggest appropriate water management strategies for irrigation schemes of State, studied that a total indiscipline has been developed in the use of water in all the projects of State. The farmers are raising crops according to their needs, violating envisaged cropping patterns. It has therefore become difficult to distribute water equitably to all parts of command areas and there by tail-end farmers are put to losses. It also observed that additional areas other than notified areas are irrigated in many irrigation projects. Therefore irrigated areas out side notified command areas, have resulted in to large areas within notified command areas getting inadequate/no supply of water. Such suffered area is as large as 43 per cent in Tungbhadra project and 51 per cent in Malaprabha project. There has been shortage of irrigation water in most of the irrigation projects in State. The irrigation staff put to heavy pressure, especially in rabi and summer season, to find water for maturing crops which would otherwise dry up. The High Level Committee found that the unauthorized atchkats and violation of cropping patterns have become root causes for the situations. It therefore recommended for amendment of irrigation acts to empower irrigation officers to prevent unauthorized use of water, patrolling of canals with greater vigilance and various other measures, for effective distribution of irrigation water.

Vekariya and Shiyani (2001) examined differential impact of Uben irrigation project on the farmers of South Saurashtra zone in Gujarat State. Simple random sampling technique was used for selection of villages and as well as respondents in command area. They were selected 64 beneficiary and equal number of non-beneficiary respondents from 4 sample villages. The main objectives of study was the economics of various crops and to measure the extent of income inequality between beneficiaries and non-beneficiaries. He employed, in addition to tabular analysis Cobb-Douglas production function. The study revealed that a significant reduction in unit cost of production. The impact of irrigation on yields and income was positive. Further, it indicted that irrigation was reduced the income disparity of beneficiary farmers.