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Diagnostic and Socio-economic Analysis of Bhimsagar Irrigation Scheme

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ABSTRACT

Faulty operation and poor upkeep of irrigation infrastructures have caused low irrigation efficiency in many major and medium schemes globally. Low performance is mainly caused due to poor physical conditions and low maintenance. This study was done to carry out the diagnostic and socio-economic analysis of the Bhimsagar irrigation scheme. In the diagnostic analysis, operational problems in the entire canal network of the Bhimsagar irrigation project were assessed by conducting several field surveys and by holding farmers meeting. Agriculture development schemes in any area cause changes in the economic condition of farmers. Therefore, socio-economic analysis was done on a total of 600 families engaged in agriculture and covering 3118 persons/farmers in the scheme's entire command area. Results revealed that water delivery and distribution system is not satisfactory. Head reach farmers utilized more water than the middle and tail end section without considering the actual crop water demand. Overall, irrigation efficiency was 27 %, emphasizing that current operational and maintenance policies should be changed to improve systems performance. Agriculture is the primary income source of people, and their living standard is inadequate. New technology adoption is rare due to poor education and knowledge on recent developments in agriculture technologies.

Key words : *Diagnostic analysis, Socio-economic analysis, Conveyance efficiency, Minor, Crop water use efficiency, Water quality and irrigation scheme.*

Introduction

Water is the most critical input into agriculture in nearly all its aspects, having a determining effect on the yield.Though India is blessed with abundant freshwater resources but injudicious use of this precious natural resource has forced policymakers to be concerned about its conservation for future generations. As water is a renewable entity, but its indiscriminate use has led to disastrous impacts on the environment. The world will not achieve food security without significant increases in water use effi-

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ciency (F.A.O., 2006), especially in the context of irrigation. Large and medium irrigation projects have changed the country's fate by making agriculture sustainable and increasing crop yield in canal command. Many irrigation projects worldwide are not performing up to their potential due to low operation, inadequate repair and maintenance activities, and fewer people's concern about the government's property. The socio-economic study is carried out to know up to what extent the development activity has brought changes in the population's general prosperity, education, and living standards.

Diagnostic Analysis (DA) defined by (Podmore, 1983) as an ordered method/structured investigation of examining an irrigation system to identify its values and constraints. This may assist in enhanced crop water productivity by resolving the problems occurring in the canal command system. Large and medium irrigation schemes should be diagnosed throughout their life to identify constraints and remedial measures to optimise their irrigation potential. Successful irrigation scheme is the one which can deliver the required quantity of water over the entire region of interest without a loss (Zerihun *et al.,* 1997). Rajput *et al.,* 2017a evaluated water delivery performance of left main canal of Bhimsagar irrigation project in Rajasthan state. He reported that all indicators showed less availability of water at tail reaches primarily due to improper operation and management of canal distribution system.

Researcher Isidoro *et al.* (2004) stated that water management diagnosis at the irrigation district level is required for the rational modernization of the irrigation schemes and the subsequent increase in the efficiency of the water allocation and application. Zwart and Bastiaansen (2004) reported that the ranges of crop water productivity (C.W.P.) of wheat, rice, cotton and maize exceed in all cases those noted by F.A.O. earlier. On-farm reservoir (O.F.R.) can minimize water losses by storing excess water applied during irrigation system. Hesse and Baade (2008) reported sediment-laden river water is used for irrigation in the Palpa valley in southern Peru's coastal desert. Adoption of better measures in the upstream region of the river could improve the water quality. David and Luciano (2008) used SIMIS (The F.A.O. Scheme Irrigation Management Information System) is a decision support system that integrates tools and performance indicators to facilitate the planning and management of irrigation scheme. Mishra (2009) conducted a diagnostic analysis of Rajsamand reservoir and showed that low irrigation efficiency was due to lack of awareness among the farmers about adequate crop water requirements, improper irrigation schedules and damaged canals, outlets and gates.

Chauhan (1994) concluded that age, education, annual income, socio-economic status, farm power and land holdings were significantly positively associated with the farmers' knowledge. Chandra (1995) found that all categories of the farmers with high socio-economic status bear more knowledge, whereas those with low socio-economic status bear inadequate knowledge about the innovations. Machiwal (2001) conducted 45 sampled farmers' socio-economic status on the head, middle and tail reach of Right Main Canal of Jakham Irrigation Project. He concluded that agriculture is the main occupation of the farmers who were the most tribal, their literacy per cent, and family assets were meagre. Therefore, the farmers were not aware of new technologies of farming. This is evident because the head and middle reach farmers did not have even electrical supply, and the machines and types of equipment were only 4.94 per cent of the total farm assets. Canal projects evaluation utilizing comparative and maintenance indicators is also essential along with diagnostic assessment for further improvement of irrigation systems performance (Rajput *et al.,* 2017b, 2018c). This evaluation is followed by modernization of water distribution system. But this needs to supported by development of optimum irrigation schedules to achieve water distribution equity. First step in redeveloping an irrigation scheme is to identify the constraints which are restricting the optimal performance of the system and also to evaluate the impacts scheme has brought to the beneficiary's livelihood and living standards. Therefore, present investigation focusing on assessment of performance of irrigation scheme using diagnostic and socio-economic factors to identify practical limitations and impacts on the command area beneficiaries. Such studies are must to frame policies for better utilization of water resources in canal command system.

Materials and Methods

Bhimsagar Project

The Bhimsagar project is a medium irrigation scheme in Rajasthan state. The dam is situated on the river Ujjar, a tributary of Kalisindh near the vil-

lage Mau-Borda of tehsil Khanpur in Jhalawar. The catchment area of the project is mostly hilly, and the economy is predominantly agriculture-based. The topography of the site to be commanded is almost plain. The land area having slope 0-1 per cent is 55.1 per cent, and land area having slope 1-3 per cent is 44.9 per cent. Gross command area (G.C.A.) of the Bhimsagar irrigation project is 10512 ha, and Culturable command area (C.C.A.) is 9986 ha. Irrigated command area (I.C.A.) of Bhimsagar irrigation project is 8903 ha. Study area location map and Index map of Bhimsagar irrigation project are shown in Figure 1 and 2, respectively.

Canal System and Minor

The distribution system consists of two main canals; the Right Main Canal (R.M.C.) and the Left Main Canal (L.M.C.). The R.M.C. covers the length of 16.36 km to irrigate C.C.A. of 2708 ha, while the L.M.C. covers 29.26 km to irrigate C.C.A. of 7278 ha. The distribution system comprises of 19 minors involving total length of 55.27 km. Out of these five minors, off-take from R.M.C. and rest fourteen minors from the L.M.C. The details of the canal system are given in Table 1.

Monthly average value of climatic parameters is shown in Table 1. It shows large variation of climatic parameters in different months. Principal data of canal system of Bhimsagar irrigation system are shown in Table 2.

Cropping Pattern

The main occupation of peoples of the area is agriculture. The cultivation depends entirely on monsoon rainfall. The soil in the command area is generally black cotton and is suitable for the cultivation of all crops. The crops grown at present are mostly maize, jowar, soybean in *Kharif* and wheat, mustard, coriander and garlic in *Rabi* season and are confined to irrigated areas. The land is fertile and suitable for cultivation of almost all types of crops. Soybean is the principal crop in *Kharif* season whereas wheat is the major crop in *Rabi* season.

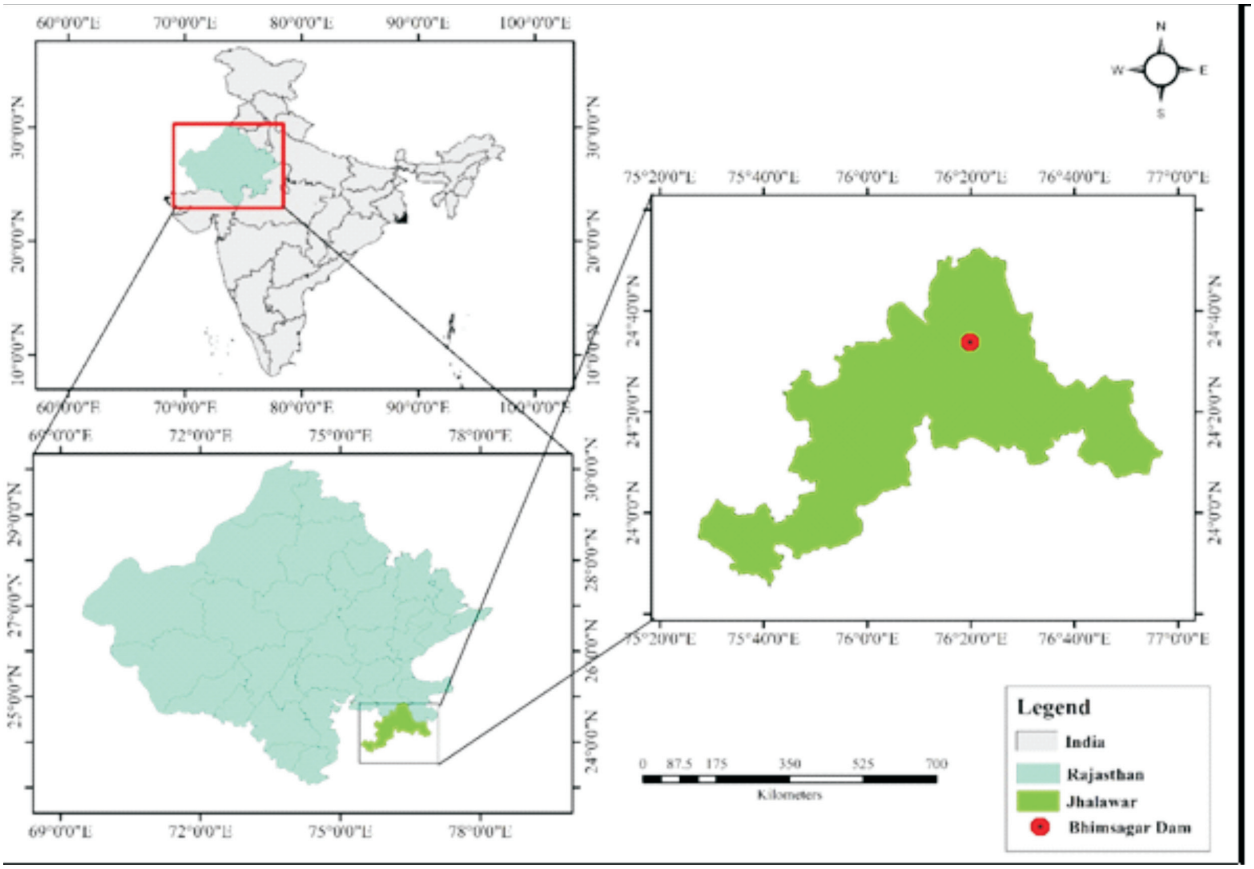

Fig. 1. Location map of Bhimsagar Dam, Jhalawar, Rajasthan

Table 1. Monthly average values of meteorological parameters in the study area (2001-2012)

Month	Temperature °C		Humidity %	Wind Velocity (km/Day)	Bright Sunshine, (hrs.)	Solar Radiation (MJ/m²/day)
	Max.	Min.				
Jan	22.8	6.4	64	84	7.6	14.7
Feb	26.0	9.8	57	81	8.7	18.0
Mar	33.5	14.6	41	91	9.5	21.6
Apr	39.0	21.4	28	97	9.9	24.1
May	42.2	27.1	29	122	10.0	25.0
Jun	39.3	28.1	47	134	8.4	22.7
Jul	34.3	26.3	72	98	5.2	17.8
Aug	31.7	25.2	78	76	4.7	16.5
Sep	32.8	23.8	70	63	8.0	20.0
Oct	34.6	17.9	54	56	9.3	19.4
Nov	30.2	12.2	58	59	8.2	15.7
Dec	25.4	8.3	60	121	7.3	13.7

Yield and Labour Requirement

Based on the last five-year (2008-09 to 2013-14) records obtainedfrom the Agriculture department and information obtained from the agricultural department, the command area's average yield is given in Table 3.

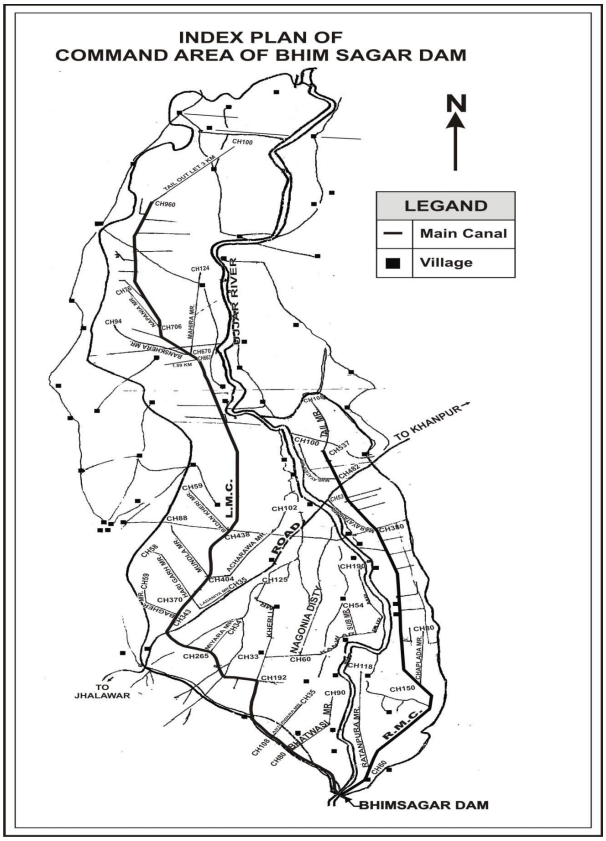

Fig. 2. Index Plan of Bhimsagar Irrigation Project

Diagnostic and Socio-economic analysis

Three minors each on Left main canal and Right main canal were selected to evaluate the system's physical condition. The criteria were considered are as: the location of minor concerning headworks, the physical condition of canal lining, the status of canal outlets, and the presence of vegetation in the canal water distribution system. Ratnapura, Chaplada and Maraita II minors were chosen on the right main canal while Kherli, Bagher and Badankhedi onthe left main canal. The diagnosis assessment was done by carrying out canal survey manually during different seasons. General information on canal water distribution system was also collected by interviewing with the farmers and irrigation department personnel. A survey was undertaken during to get information about farmers socio-economic status. Information such as educational background, average yield of different crops, land holding status, animal population, types of houses etc., were collected interacting directly with the farmers.

Results and Discussion

Ratanpura Minor

This minor off takes from head of R.M.C. at CH 60 and the length of minor is 3.6 km which is completely lined and having designed discharge capacity of 0.206 Cubic meter per second (Cumec) against measured discharge of 0.156 Cubic meter per second (Cumec). The check gate was damaged resulting into uncontrolled flow in the minor. Seepage and overtopping were the two major problems in the

Table 2. Basic details of the canal system of Bhimsagar

S. No.	Particulars	R.M.C.	L.M.C.
1.	C.C.A.	2708 ha	7278 ha
2.	Length of Main Canal	16.36 Km	29.26 Km
3.	Length of Minors	3.85 Km	41.96 Km
4.	Discharge	1.95 Cumec 127.14 Cusec	5.24 Cumec 107.47 Cusec
5.	Bed Width	1.8 m	3.60 m
6.	F.S.D.	1.00	1.37 m
7.	Side Slope	1:1	1:1
8.	Velocity	0.835 m/sec	0.849 m/sec
9.	Free Board	0.46 m.	0.46 m.
10.	Bed Slope	1 in 3333	1 in 400 to 1 in 3333

Table 3. Average yield of different crops in the command area

S.No	Crop	Yield (q/ha)
1	Wheat	50.00
2	Mustard	18.00
3	Garlic	70.00
4	Coriander	11.00

middle reach of command because of cracks in the lining. Here, tail end farmers of the minor are getting sufficient quantity of water. Tail end section of the minor is damaged which results in wastage of considerable quantity of water. However, it has sufficient capacity to satisfy crop demand throughout the crop season. There are 9 outlets on the minor to command C.C.A. of 286.20ha

Chaplada Minor

This minor off takes from middle of R.M.C. at CH 150 and the length of minor is 2.44 km which is completely lined and having design discharge capacity of 0.177 Cumec against it measured discharge was found 0.106 Cumec. The control structures and gateswere completely damaged resulting into uncontrolled supply in the minor. Seepage and overtopping were the two major problems in the command because of cracks in the lining and canal breaches. Many pipe outlets in the minor are damaged and obstruction in the minor is provided by farmers to draw more irrigation water. Tail end farmers of the minor get less in sufficient quantity of water for irrigation. There are 6 outlets on the minor to command C.C.A. of 246.45 ha.

Maraita II Minor

This minor is situated on tail end of R.M.C. and off takes at CH 482 and the length of minor is 3.05 km which having cement concrete slab lining. The cross-section of lining is trapezoidal and having design discharge capacity of 0.132 Cumec against it measured discharge was found 0.068 Cumec. There is a major problem of water shortage in this minor due to being situated at the tail end and seepage through canal breaches. Water covers whole length of this minor but time consume for irrigation activity is more due to less discharge. Bed of this minor is fully damaged. The minor is weed infested at many places which create obstruction in water supply. Tail enders were getting water from others sources such as wells, tube wells, etc. There are 7 outlets on the minor to command C.C.A. of 196.35ha.

Khelri Minor

This minor off takes at CH 33 from Nagoniya distributary that which off takes from L.M.C. at CH 192 and the length of minor is 3.81 km which is completely lined and having design discharge capacity of 0.392 Cumec, which is same as measured discharge. The sluice gate was working at Nagoniya distributary resulting into water is control at distributary naka point. Check gate is working at minor naka point. There is controlled supply of water in this minor. Seepage and overtopping were not major problems in the command due to controlled wa-

Table 4. Physio-chemical properties of soil in command area

S. No.	Village	EC (dS/m)	pH
1	Ratanpura, RMC	0.559	6.9
2	Chaplada, RMC	0.568	7.3
3	Marayata, RMC	0.556	7.2
4	Kherli, LMC	0.527	7.1
5	Bager, LMC	0.584	7.3
6	Badan Kheri, LMC	0.534	7.0

ter supply in the distributaries and its minors. Tail end farmers of the minor get sufficient quantity of water for irrigation. The rectangular cross-section area of the minor is varied and continuously reducing from starting point to tail end point which results in smooth supply of water. However, it has sufficient capacity to satisfy crop demand throughout the crop season. There are 9 outlets on the minor to command C.C.A. of 474.69 ha.

Bagher Minor

This minor off takes from middle of L.M.C. at CH 343 and the length of minor is 1.80 km which is completely lined and having discharge capacity of 0.158 Cumec and measured discharge was found 0.127 Cumec. The control structure frame is fine, but gate not exists from many years resulting into uncontrolled supply in the minor. Seepage and overtopping is not much effective problem, but damaged C: C slab lining and weed infested minor creates problem in water supply up to tail ends and lost of water during conveyance. Many pipe outlets in the minor are damaged, so farmers has broken the outlet naka point and provided obstruction in the minor to draw more irrigation water. Tail end farmers of the minor get sufficient quantity of water for irrigation. There are 6 outlets on the minor to command C.C.A. of 219.04 ha.

Badan Kheri Minor

This minor is situated on tail end of L.M.C. and off takes at CH 438 and the length of minor is 1.8 km which having cement concrete slab lining. The cross-section of lining is rectangular at initial and after approx CH 7.7 the cross-section of lining is trapezoidal and having design discharge capacity of 0.177 Cumec against it measured discharge was found

0.07 Cumec. There is a major problem of water shortage in this minor due to being situated at the tail end and seepage through canal breaches. Water covers whole length of this minor but time consume for irrigation activity is more due to less discharge. Maximum part of lining of this minor is damaged. The minor is weed infested at many places which create obstruction in water supply. Tail enders were getting water from others sources such as wells, tube wells, etc. There are 6 outlets on the minor to command C.C.A. of 221.86 ha.

Analysis of Water Quality and Soil Properties

Water samples were obtained from canal as well as wells and hand pumps located in the upper, middle and tail reach of command for water quality analysis. E.C. and pH of main canal water wasobtained as 0.654 dS/m and 7.3, respectively whereas EC of groundwater in selected villages ranged from lowest 0.58 (Chaplada village) to highest 0.69 dS/m (Badankhedi village) and for other villages it varied between lowest and highest values. Value of groundwater pH ranged from lower value of 6.5 (Chaplada village) to higher value of 7.2 (Ratanpura village). Canal water pH was 7.3. For other choosen villages, pH varied between lower and higher value with no certain trend corresponding to location of village with respect to location in canal network. Soil pH and electrical conductivity in the selected villages was also assessed. Table 4 shows the soil pH and EC in the command area.

Conveyance Efficiency

Conveyance efficiency of selected minors and L.M.C. and R.M.C. are shown in Fig 3 and 4. The inflows and outflowswere used to calculate conveyance efficiency using equation 1.

$$Ec = \{1-(\text{inflow}-\text{outflow})/\text{inflow}\} \times 100 \quad .. \quad (1)$$

Where, E_c = water conveyance efficiency, per cent

Water Use Efficiency

The water utilization by the crop is generally described in terms of water use efficiency (kg/ha-cm). Water use efficiencies in the command for wheat, mustard, garlic and coriander crops were found as

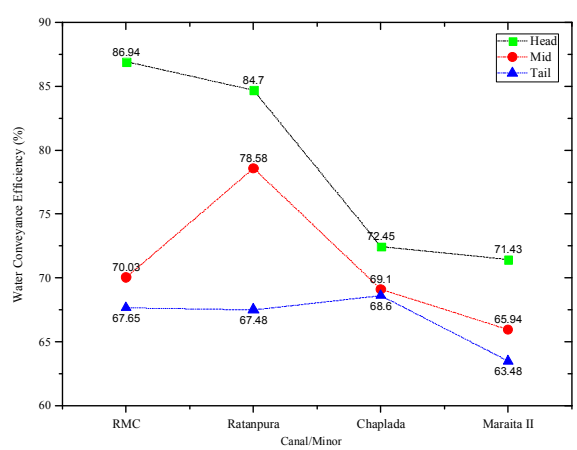

Fig. 3. Water conveyance efficiency of RMC and selected minors on RMC

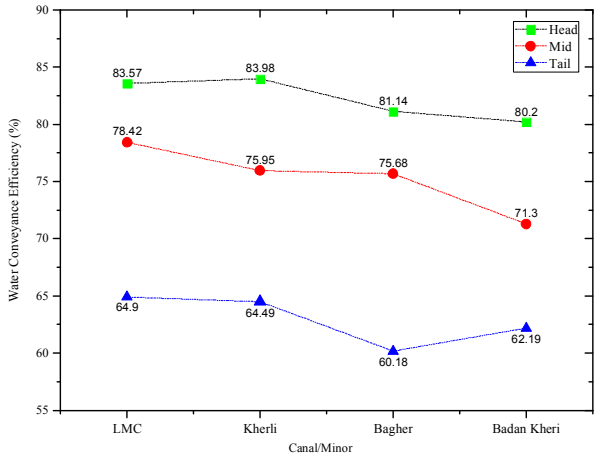

Fig. 4. Water conveyance efficiency of LMC and selected minors on LMC

159.49, 43.62, 103.55 and 31.52 kg/ ha-cm, respectively and given in Table 5. It is irrelevant to compare different crops in terms of water use efficiency as each crop has specific crop water requirement and yield potential under a given climatic condition in a particular year. Wheat crop was found most efficient in terms of water use efficiency followed by garlic, mustard and sugarcane, respectively.

Socio Economic Status

Development of agriculture in area brings about changes in the economy of farmers, followed by changes in economic and social attitude of the people. These changes are reflected in level of education, pattern of agricultural production and the occupational distribution etc. In the area with the commencement of irrigation, there have been slight changes in socio-economic status of the farmers of this particular command area though the process of transformation has been comparatively slow. Due to illiteracy and lack of knowledge, the farmers were slow to adapt to the appropriate procedure regarding crop production and other agronomic practices recommended to them by agriculture department.

This section deals with the socio-economic status of the sample farmers in the command area. Results presented in this section are outcome of interviews conducted with the sample farmers and the analysis of the questionnaire. Family composition, occupational pattern, ownership of livestock, farm assets distribution, cost of cultivation and cost of returns are the major components of theanalysis.In the command area there were 600 families surveyed, which covers approximate 7.5 per cent of total households. The survey covered 3118 persons, which is approximate 7 per cent of total population in command area and 12 per cent of total cultivator and agriculture labors.

Family Composition of the Sample Farmers

The information of each family member was collected through survey questionary such as number of family members, migration, age, sex, education level and occupation of family members etc. Average family size in the command area is 5.19 members per family. The analysis of size of family, different age group, sex and education level and occupation pattern of sample farmers was summarized in Table 6 and shown in Figures 5, 6 and 7, respectively.

There does not exists migration problem in the command area, only approximate 1 per cent people have been migrate from their native place for employment in nearby town and cities such as Khanpur tehsil, Jhalawar and Kota. Approximate 8 per cent people were found linked with different type of organisations. The sex ratio is (784) than that of the Rajasthan state average of (928) and national average of (940) as per the 2011 census. Literacy per cent of sample farmers is found 85.54 per cent as per survey. The 33.74 per cent population is engaged in agricultural as well as farm labours.

Table 6. Details of male and female surveyed in command area

S. No.	Sex	No. of Persons	Percent
1	Male	1748	56.06
2	Female	1370	43.94

Table 5. Water use efficiency of principal crops in Bhimsagar canal command

S.No.	Crop	Crop Yield (kg/ha)	Water Utilized by Crop (cm)	CWUE(kg/ha-cm)
1	Wheat	5000	31.35	159.49
2	Mustard	1800	41.26	43.62
3	Garlic	7000	67.60	103.55
4	Coriander	1100	34.90	31.52

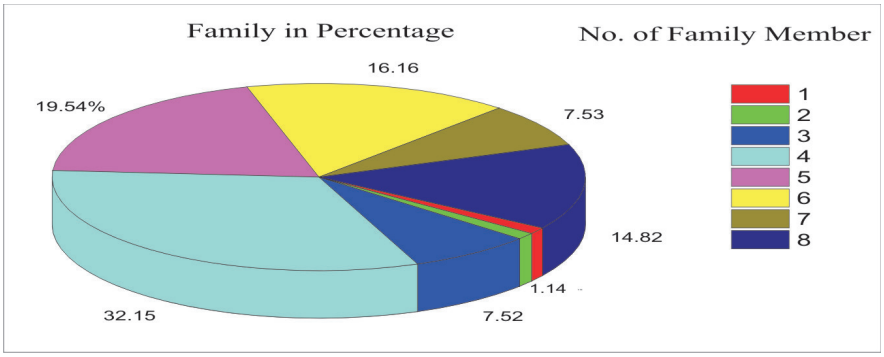

Fig. 5. Summarized size of sample family

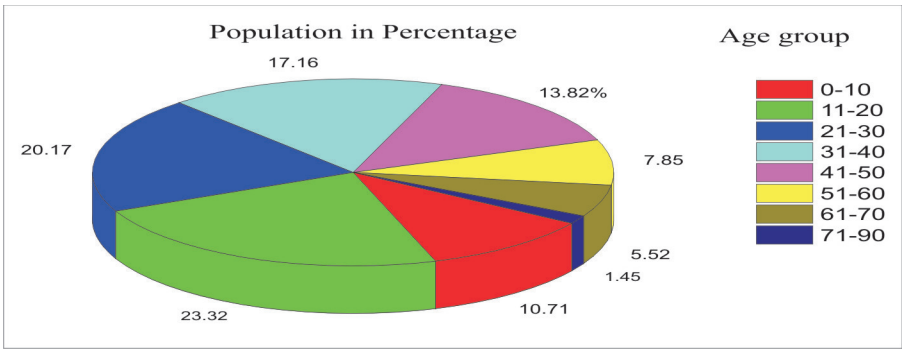

Fig. 6. Details of different age group

Buildings

As per survey only 11 families live in partial pukka house or pukka house and rest are living in kaccha house before irrigation project. But at present 239 families lives in kaccha house, 75 families' lives in kaccha-pukka house and 286 families' lives in pukka house. The present status of residential building of surveyed family is shown in Table 7.

Migration Details

No seasonal and long duration migration was found for employment. Very few people has going as labour in nearby villages or towns and other places which ranges between 20 km to 80 km.

Land Use

Before irrigation project, value of irrigated land was Rs. 7000/bigha and unirrigated land was Rs. 4500/bigha, because during that time most of area is unirrigated. After irrigation project, there was drastically changes in land value due to increase in irrigation facility and production, because of almost all areas irrigated through canals network. At present, the value of land goes up Rs. 2,50,000 per bigha.

Table 7. Residential status of farmers in command

S. No.	Type of House	No. of households	Per cent
1	Kaccha	239	39.83
2	Pukka	75	12.5
3	Kaccha Pukka	286	47.67

Age and Social Participation of the Farmers

The analysis states that most of the farmers belonged to young age group i.e. (below 30 years) which was followed by middle age group (i.e., 31 to 49 years) and old age group (above 50 years) farmers. In the age group of young, middle and old farmers there were 54.20, 30.98 and 14.82 per cent farmers respectively. Farmers involved in any social organisation as Panchayat were considered under social participation. Only 8 per cent farmers were found in active participation in social organisation in the study area. It means that most of the farmers have not interest in socialactivities.

Distribution of Farm Assets of Sample Farmers

The distribution of farm assets are presented in the Table 8. Almost all the farmers in the command area

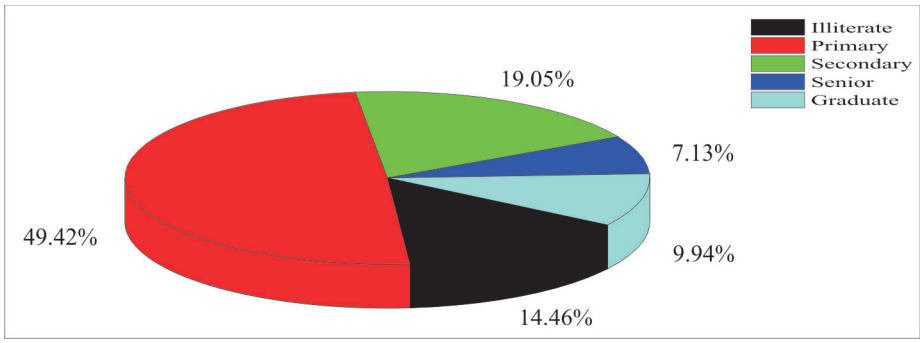

Fig. 7. Details of education level of sample farmers

were hiring machines for field preparation and cultivation practices. The economic level of the farmers in the command is poor. Some farmers in the command area were without lands and they work as a farm labour on the other farmers' land. It is observed that major portion of farm assets are Spade, Gaiti, indigenousplough, sprayer and tractor contributing 23.50 per cent, 21.99 per cent, 8.83 per cent, 7.61 per cent and 7.61 per cent, respectively.

Distribution of Non-Farm Assets of the Sample Farmers

On the analysis of obtained data from selected farmers in command area, number of non-farm assets per family and their per cent individually are given in Table 9. Most of the farmers do not have any non-farm assets in the command area. It means almost all the farmers come under very low economic status.

Ownership of Live Stock of the Sample Farmers

The pattern of ownership of livestock in the selected farmers is presented in Table 10. The average number of cows in the command area was 1.45 per family. The average buffaloes were estimated 1.29 per family in the command area.

Occupational Pattern of the Sample Farmers

Figure 8 clearly depicts that most of the farmers practice farming as a major source of living in their own farm. Most of the adult women performed farming practices along with domestic work. Only 2.09 per cent of total family members were on service in government and private organizations in nearly cities as Khanpur, Jhalawar and Kota etc.

Conclusion

The diagnostic analysis was conducted to study the operational problems in entire canal network of R.M.C. and L.M.C. of the Bhimsagar irrigation project. There does not exist proper water distribution system. The farmers at head reaches divert

Table 8. Distribution of farm assets of sample farmers

S. No.	Particulars	Number	No./Family	Per cent
1	Tractor	206	0.34	7.61
2	Seed drill	181	0.3	6.69
3	Indigenous plough	239	0.4	8.83
4	Sprayer	206	0.34	7.61
5	Soil Pulveriser	25	0.04	0.92
6	Diesel Engine	136	0.23	5.03
7	Electric Motor	51	0.09	1.88
8	Well	62	0.1	2.29
9	Borewell	60	0.1	2.22
10	Pump	60	0.1	2.22
11	Thresher	181	0.3	6.69
12	Gaiti	595	0.99	21.99
13	Spade	636	1.06	23.50
14	Kudali	88	0.15	3.25

Table 9. Distribution of non-farm assets of the sampled farmer

S. No.	Particulars	Number	No./Family	Per cent
1	Chairs	1282	2.14	22.84
3	Fan	1010	1.68	18.00
4	Television	448	0.75	7.98
5	Radio	520	0.87	9.27
6	Cooler	351	0.59	6.25
7	Tap Recorder	520	0.87	9.27
8	Cycle	140	0.23	2.49
9	Motor cycle	379	0.63	6.75
10	Mobile	520	0.87	9.27
11	Almirah	107	0.18	1.91
12	Electric iron	335	0.56	5.97

Table 10. Ownership of livestocks of the sample farmers

S. No.	Particulars	Number	No./Family	Per cent
1	Cow	871	1.45	52.88
2	Buffallo	776	1.29	47.12

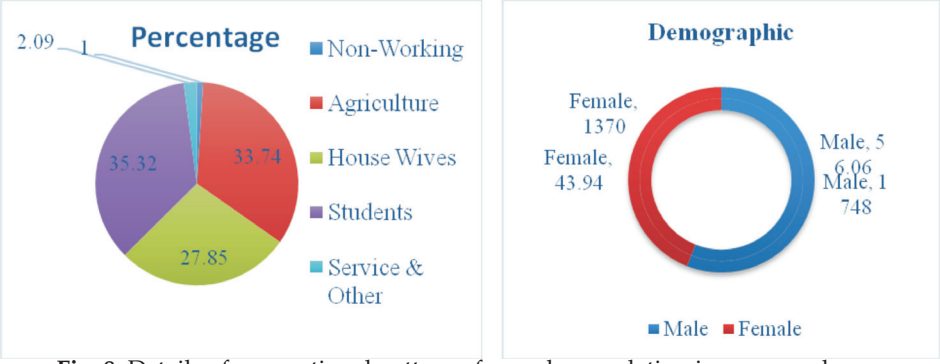

Fig. 8. Details of occupational pattern of sample population in command area

more water than actual crop need by putting obstructions in canals and do not allow water flow to tail reach areas. Farmers at the tail end of the network are not getting sufficient water for irrigation. Therefore, they irrigate their fields from wells or keep theirfields uncultivated during the *Rabi* season. The water logging problem is observed in the low lying area during irrigation season on account of seepage from the at a canals. The canal lining was observed damaged at a number of locations in the entire canal network. The majority of pipe outlets and gates were found tempered and numbers of them are oversized outlets. As per farmers of command approximately 27% of total command of the project is getting a limited supply of irrigation water in the tail reaches from past few years. The silting in canal is taking place due to the entry of run-off water in the canal at many places. The conveyance efficiency of L.M.C. and R.M.C. is found as 74.87 per cent and 75.63 per cent. Similarly, the conveyance efficiency is found as 74.8 per cent, 72.33 per cent, 71.23 per cent and 76.92 per cent, 70.05 per cent, 66.95 per cent for Ratanpura, Chaplada, MaraitaII and Khelri, Bagher and Badan Kheri minor, respectively. The average value of water use efficiency for command area was observed as 159.49 kg/ha-cm, 43.62 kg/ha-cm, 103.55 kg/ha-cm and 31.52 kg/ha-cm for wheat, mustard, garlic and coriander, respectively.

The socio-economic survey was conducted on total of 600 families engaged in agriculture and covering 3118 persons/farmers from R.M.C. and L.M.C. command area. It was observed that agriculture is main occupation of people and their living standard is poor. They are not aware of new technologies on account of poor education. The average household

livestock ownership is 2.75 per family in the command area. The productivity of the area is good due to black cotton soil and availability of irrigation water in the command. The cost of cultivation of wheat, mustard, garlic and coriander crops was estimated as Rs.38839, Rs.28715, Rs.88357, and Rs.29580, respectively and net benefits of Rs.51161, Rs.26885, Rs.156643, and Rs.43320 for these crops can be achieved per ha basis in the study area. The findings of present investigation may help in understanding the status of water distribution system and farmer's socio-economics conditions. This could assist in developing efficient water management plans which suit the existing cropping pattern requirement to elevate the socio-economic status of farmers.

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