CHAPTER II

PROGRESS IN IRRIGATION DEVELOPMENT AND UTILISATION
OF CREATED POTENTIAL

Irrigation, an artificial mean of meeting the soil moisture deficiency for growing crops, is known to the farmers of Indian subcontinent for a long period of time. But the planned development of irrigation resources dates to British period. During British period, while the riceland reeled under colonial exploitation and vagaries of weather simultaneously; Punjab, Doab land of Western Uttar Pradesh, Narmada valley in Gujarat and Godavari delta experienced a spurt in wheat, rice, sugarcane and cotton production from 1840s to 1920s because of canal irrigation development. However, Britishers were never interested in tapping water resources of the country and thereby providing a technological breakthrough to increase the production of stagnant agricultural economy of the country and protecting it from the vagaries of weather. Concerted efforts for providing irrigation development began only after the independence of the country.

At the time of independence created irrigation potential in India (including major, medium and minor projects) was 22.6 million hectares. During the First Five
Year Plan irrigation potential increased at the rate of 0.7 million hectares per annum. Similarly, Fifth and Sixth Five Year Plan periods witnessed an annual growth rate of irrigation potential by 1.6 and 2.2 million hectares respectively. Target of the Seventh Five Year Plan was 2.5 million hectares per annum. The 'ultimate irrigation potential' of the country is estimated to be 113.5 million hectares and is expected to be achieved by 2010 A.D. On the other hand, cultivable land of the country is estimated to be 180 million hectares of which about 155 million hectares was under plough in 1980-81. Comparison between 'ultimate irrigation potential' and cultivable land reveals that even if the irrigation resource of the country is developed and utilised fully, it would not be sufficient to irrigate the cultivable land even during one crop season. Moreover, there is a great deal of spatial variation in distribution of water resources and diversion of water from moisture surplus regions to moisture deficient regions needs a plenty of resource investment and advance technology. The present situation demands for efficient and optimal utilisation of existing irrigation potential through an efficient water management and equitable distribution; and further harnessing the water resources for the moisture deficient areas, thereby providing protection against the vagaries of inadequate and erratic rainfall.
Under Utilisation of Irrigation Potential

Under utilisation of created irrigation potential has been a cause of concern since the beginning of the plan period in India. The gap between created irrigation potential and its utilisation is more pronounced in the command areas of major and medium irrigation projects as compared to that of minor projects. At the end of First Five Year Plan only about 60 per cent of the created potential of major and medium projects was utilised. This gap narrowed down till the end of Third and Fourth Plan as about 80 and 82 per cent of created potential was utilised respectively. But even this gap is wide enough to indicate the gross underutilisation of invested public resources.

Keeping this in view Fifth Plan changed the strategy towards irrigation development. It emphasised on completion of old lingering projects expeditiously rather than taking up a large number of new projects, except where it is necessary; increase in the level of utilisation of already created potential and reduce inter state imbalance in respect of irrigation development. Main features of the strategy towards irrigation development in the Fifth Plan was adoption of an integrated approach towards the development of command areas. This approach has been discussed in details in later part of the chapter. But, it
is evident that even this approach has not been able to plug the gap between created irrigation potential and its utilisation. It is evident from the fact that by the end of 1988-89 only about 85 percent of created potential was utilised in the command areas of major and medium projects.

By the end of year 1988-89 total created irrigation potential (including all major, medium and minor projects) was sufficient to irrigate 76.36 million hectares. But, only 68.43 million hectares was utilised which accounted for about 90 percent of the created potential. In case of minor irrigation projects utilisation level of irrigation potential is 93 percent. It gives the impression that minor irrigation projects are comparatively more efficient. But it can not be ascertained as prior to 1983-84 utilisation and creation of irrigation potential in minor irrigation projects was taken as same.

Some scholars have maintained that under utilisation of created irrigation potential is fictitious and a result of intensive use of water near the head of the project. This is specially true for irrigation works located in low and medium rainfall region of the country, namely, southern and western parts of India. The farmers utilise the bulk of the reservoir water for growing paddy,
sugarcane and other water intensive crops, especially in the upper and middle reaches of a canal system. This has resulted in a drastic curtailment in total irrigated area - mainly at the expense of the farmers in the tail reaches - apparently showing underutilisation of created irrigation potential that is conventionally expressed in terms of irrigable land. Although this observation sounds well and implicates the farms of upper and middle reaches of the command areas for over utilisation of created irrigation potential. By implication it means that the task of the irrigation projects does not end with the completion of the network but also they have to ensure equitable distribution of water in the command areas. This calls for an extensive soil and land survey of the the command area and suggesting a cropping pattern keeping in view the availability of water and condition of soil and other environmental characteristics. Enforcement of suitable cropping pattern along with on-farm development and availability of the infrastructure, agricultural inputs and credits could realise not only the equitable distribution of water in the command areas but also help in full utilisation of irrigation potential. This has been the major objective in adopting an integrated approach towards irrigation development in the Fifth Five Year Plan and termed as "Command Area Development".
Command Area Development:

The adoption of an integrated approach towards irrigation development for full utilisation of irrigation potential began with initiation of a central sector scheme in the Fourth Five Year Plan. This scheme proposed to finance certain amenities in some project command areas such as market complexes, shops and link roads. The scheme was to be implemented provided the state Governments improve the project administration, conduct soil surveys, do land levelling and landshaping, determine proper irrigation practices, provide for drainage requirements, suggest suitable cropping pattern and effect the consolidation of holdings, provide agricultural inputs, agricultural extension and farmer education, credit, infrastructure and make arrangements for conducting research. Besides, the cooperative sector was supposed to provide loans to the needy farmers. The Fourth Five Year Plan made a provision of Rs. 15 crores for this purpose. However, this scheme could not be implemented in the absence of adequate financial resources, proper studies of requirements of projects and soil survey informations.

A comprehensive view of the situation was taken during the fifth Five Year Plan. It was realised that these problems in water management of major and medium irrigation
projects can be overcome and optimum agricultural productivity from the irrigated land can be achieved only through a successful implementation of "Command Area Development" programme.

The Fifth Five Year Plan maintained that Command Area Development requires enforcing two fold efforts - (i) lining of field channels and water courses, and levelling and shaping the land, (ii) fixing and enforcing suitable cropping pattern; ensuring supply of agricultural inputs and credit; providing communication facilities, agricultural extension, training and demonstration and agricultural output processing facilities. A general programme of Command Area Development as adopted by the plan and its main elements are as under:

(i) Adopting area development approach.

(ii) Apart from outlays on infrastructural facilities, it should also provide credit and loan for land levelling, shaping the field channels and drainage facilities.

(iii) Speedy acquisition of land to construct distributaries and minors.

(iv) Ensuring equity in water distribution below the outlet level through the implementation of Warabandi system.
(v) Evolving suitable cropping pattern and ensuring its implementation.

National Commission on Agriculture has also taken the cognisance of underutilisation of created irrigation potential and has recommended integrated area approach in the command areas of the projects to overcome it. To fulfill the tasks of integrated area development of command areas it had proposed the constitution of "Command Area Development Authority" (CADA), which would be responsible for implementation of Command Area Development programme and would establish coordination and cooperation among various departments placed at its disposal.

CAD Programme of IGC Command Area

Indira Gandhi Canal Command Area was one of the very few command areas of the country where central sector scheme was introduced during the Fourth Five Year Plan to ensure full utilisation of the created irrigation potential. But this plan miserably failed in the absence of financial resources. Thereafter, it was one of those command areas of the country where CAD programme was introduced and implemented immediately after it was conceived. This programme was introduced in the command area of Indira Gandhi Canal in July 1974. Apart from the reasons of introduction of this programme discussed in the earlier part
of the chapter, there are some specific features which make it necessary to adopt integrated area development approach in Indira Gandhi Canal Command Area. These specific reasons are as under:

(i) Most of the command area of the canal is newly settled and still being colonised. Hence, the new settlements require to be connected with roads, communication, civic amenities such as drinking water, electricity, education and health services. Apart from this, new settlers require easy access to market, agricultural inputs, agricultural credit and loan, agricultural extension, training and demonstration facilities and agricultural outputs processing facilities.

(ii) Command areas of the canal are uneven and infested with sand dunes rising to the height of 60 metre. It is impossible to irrigate the land and utilise the irrigation potential unless it is levelled and shaped. Moreover, texture of the soils is sandy and sandy loam and percolation rate of water is very high. This results into overuse of water and heavy conveyance losses in the absence of lined watercourses. Hence, on-farm development is a precondition for the efficient utilisation of irrigation resources in the canal command area.
(iii) Soils, particularly in the command area of Stage II, are underlain by lime concretions or hard pan of calcareous and clay material. Depth of this hard pan varies from one metre to ten metre below the surface. Growing water intensive crops with intensive irrigation in the command area may lead to water-logging and soil salinity. Some areas of stage I of the command area already have developed salinity sand waterlogging. Hence, determination and enforcement of a suitable cropping pattern is compulsory in this region.

(iv) Wind erosion is very severe in the command area of the project, particularly during the months of May and June. This poses very serious threat to cultivation in the Kharif season. The erosion in one area and its deposition in the cultivated land contaminates the soils. Wind deposition also leads to silting and chocking of the canal and water courses. Measures required to check the hazards of wind erosion are large scale afforestation, particularly raising shelter belt, and canalside and radside plantation, not only in the command area but also in the adjoining areas of the command area.

(v) Traditional economy of the canal command area, particularly that of Stage II has been pastoral. Hence, pastures also should be developed with the help of
irrigation so that its benefit can also reach the local population. Furthermore, pasture development would also help in stabilisation of shifting sand dunes and arresting wind erosion.

The objectives of optimum agricultural productivity, equitable distribution of the fruits of economic development and full utilisation of irrigation potential of the project cannot be realised unless the problems posed by aforementioned specific characteristics of the command area are taken care of.

Tasks of the CAD Programme

Command Area Development Programme has taken up following tasks in the command area.

(i) On-farm development which includes soil survey and planning, water course lining, land shaping and land reclamation.

(ii) Afforestation which includes block plantation on culturable wasteland, fuelwood plantation and canal and roadside plantation.

(iii) Development of pasture and grazing land and sand dune stabilisation.

(iv) Construction of district and village roads

(v) Construction of waterworks for drinking water supply.
(vi) Monitoring ground watertable
(vii) Agriculture extension and training.

Implementation of the CAD Programme:

Command Area Development Programme was in progress in Stage I of Indira Gandhi Canal Command Area and it was not introduced in Stage II till 1988. Although some preliminary work had been undertaken in Stage II too. Stage I was divided into two phases for the implementation of this programme.

Schemes of the Stage I:

Phase I - Phase I of the programme covered 2.44 lakh hectares culturable command area of the canal in Stage I. It proposed to include entire command areas of Rawatsar, Naurangdesher, direct outlets from main canal from Lakhuwali to 74 Km and Suratgarh and a part of Anupgarh systems. Work on this phase commenced in July 1974 and was completed in June 1983 after a delay of three years. This project could not be successfully implemented in case of one of the most important tasks i.e. water course lining. In 1980-81 only about one fourth of the appraised target of water course lining was completed. After the completion of the project in 1983 about 23.3 percent of the culturable command area of Phase I did not have lined watercourses. However, progress in respect of other
Above (2.1) Lined Water Course in the Command area of Sheopura Distributary. Below (2.2) Terraced Lined Water Course in the lower command area of Lunkaransar-Bikaner Lift Canal.
components of the programme was satisfactory.

Phase II: Phase II of CAD programme in Stage I covers an area of 2.46 lakh hectares spread over about 1650 chaks. The programme in this phase includes entire culturable command area of direct outlets from main canal up to Lakhuwali, North Ghaggar Canal, direct outlets from main canal from 74 to 189 Km., Pugal systems and a part of Anupgarh system. Work on this project began in January 1980 and was supposed to have been completed in December 1988 after much delay. Progress in this phase regarding afforestation, construction of roads and drinking water supply was stated to be satisfactory by the end of 1986-87. However, progress of work related to on-farm development, specifically water course lining was not in conformity with the appraisal target of the project. Only about 50 percent of appraisal target of water course lining was completed at the end of year 1986-87.

Schemes of Stage II:

Development of infrastructure, providing assistance for settlement and provision of ration are prerequisite to initiate the process of development in Stage II command area of Indira Gandhi Canal. Hence, some preliminary programmes such as development of settlements,
construction of roads and afforestation have been taken up in this region. Some other schemes such as adaptive trials, soil survey and assistance to new settlers under World Food Programme are also being carried out before a full-fledged CADP is launched. Low rate of settlement in this part of the command area is primarily due to the non-availability and high prices of food stuffs. A programme was introduced for two years in the beginning with the help of World Food Programme to provide free food to new settlers. In addition to this, another scheme is to provide an interest free loan worth Rs.2000 per family of new settlers repayable in four instalments after a period of two years. Command Area Development programme is expected to cover about 2 lakh hectares of culturable command area by the end of Seventh Five Year Plan.

Water Distribution System below the Outlet Level

Indira Gandhi Canal Command Area has one of the most scientific water distribution system below the level of outlet. This water distribution system is called as Warabandi or Rotational Water supply which has been in operation in north west India including Rajasthan for over one century. Principle of the function of this system has been equitable, dependable and adequate supply of water in the entire command area of the outlet. The essential
elements of Warabandi are specification of the day and time when a farmer will receive water and the duration of water supply determined on the basis of the size of the land holding in the outlet command area. Thus, weekly supply of water on specified days between fixed time interval is the essence of Warabandi. \[13\] A refined Warabandi system which corrects the imbalance of wateruse efficiency between top enders and tail enders and compensates the tail enders for conveyance loss of water was introduced in the canal command area soon after the introduction of irrigation. Rajasthan Irrigation and Drainage Act 1954 empowers the executive engineer to enforce Warabandi for equitable water distribution in the Chaks. Participation of the farmers in the maintenance and management of watercourses has been ensured through formation of chak committees and election of chak representatives.

Strategy for Irrigation Development

Indira Gandhi canal project is a gigantic human effort to transform the economy of one of the most backward regions of India. Command area of this irrigation project is characterised by scanty and erratic rainfall which has been the most limiting factor for agricultural development in this region. Frequent occurrence of droughts and dry spells during the south west monsoon season result in
frequent failure of crops. Indira Gandhi canal project envisages for providing protective irrigation in the region. Protective irrigation is primarily aimed at guarding against the adverse effects of scanty and erratic rainfall on crop output. Furthermore, the strategy of irrigation development is different for two stages of the project because of differences in environmental and socio-economic conditions.

Stage I:

Stage I constitutes the upper command area of the canal and includes the area irrigated by branches, distributaries and direct outlets from the main canal up to the length of 189 km. Irrigation was introduced in the upper parts of the command area of Stage I in 1961. Strategy for irrigation development in this stage is to provide for intensive irrigation with an irrigation intensity of 110 per cent. Water allowance in this stage is 5.23 cusecs which is comparatively higher than that of Stage II. Intensive irrigation has been visualised in Stage I because of relatively flat land and loam and sandy loam textures of soils except the lower command areas. Besides, cultivators in this region have an experience of sedentary cultivation. Culturable command area of this stage is about 5.3 lakh hectares including 0.5 lakh hectares under lift canal. Potential of irrigation of Stage I is 5.84 lakh hectares.
Stage II:

Strategy towards irrigation development in Stage II has been widely debated. Hence the plan of irrigation development in the command area of Stage II has been revised eight times. Central point of debate regarding strategy of irrigation development in this region has been to provide for irrigational facilities to larger area, development of pastures and restoration of ecological balance. The revised irrigation plan in 1985 has proposed for extensive rather than intensive irrigation. Under the revised proposition culturable command area of this stage has been increased to 10.12 lakh hectares which includes 7 lakh hectares under flow and 3.12 lakh hectares under lift canals. Right bank branches of the canal are flow channels while the left bank branches are lift channels. Stage II has potential to irrigate about 8.10 lakh hectares of land with a reduced irrigation intensity of 80 per cent. Consequently the water allowance is also reduced to 3.5 cusecs. It is also proposed to irrigate an area of 3.66 lakhs hectares in this stage for pasture development which will in turn contribute to the development of animal husbandry which is mainstay of the local population. Irrigation was introduced in the command area of Stage II in mid eighties. At present a very small proportion of the command area in upper reaches
IGC COMMAND AREA (STAGE 1)
IRRIGATION SYSTEMS

BOUNDARIES
- International
- Interstate
- Interdistrict
- Command Area

INDEX
1. Direct Outlets up to Lakhwali
2. Rawatsar
3. Naurangdesar
4. Direct Channels & Outlets between Lakhwali & 74 Km.
5. Suratgarh
6. Anupgarh
7. Direct Outlets between 74 & 189 Km.
8. Pugal
9. Lunkaransar-Bikaner Lift Canal
is irrigated. Distribution systems in a large part of the command area have not been completed till now.

Total culturable command area of the canal is estimated to be about 15.40 lakh hectares, though the canal has a potential to irrigate about 13.94 lakh hectares of land per year with an average irrigation intensity of 90 percent.

Progress of Irrigation in IGC Command Area

Irrigation was introduced in the IGC Command Area in 1961 and Naurangdeshar and Rawatsar branches which take off from the head of the main canal were the first irrigation systems to irrigate the land. The area irrigated by the canal increased progressively as irrigation potential was created further down in the command. Beneficiary of irrigation till mid eighties was Stage I of the canal where full irrigation potential was created. In 1982-83 Indira Gandhi Canal was responsible for about 35 per cent of gross irrigated area in Ganganagar and 100 per cent gross irrigated area in Bikarner district. Fig. 2.2 shows the progress made in terms of gross irrigated area in Stage I of the command. It is evident that gross irrigated area reached the mark of 5.21 lakh hectares in 1986-87. Gross irrigated area has increased progressively except for few years when it had
Fig. 2.2

IGC COMMAND AREA (STAGE 1)
Gross Irrigated Area

Area in Lakhs Hectares


Years
stagnated or declined. This is a consequence of drought conditions in the catchment area of water source or breach in the canal lining etc. Effect of drought in the catchment area was evident in 1987-88 when because of fall in water level of Hareke barrage canal discharge fell considerably particularly during the rabi season and gross irrigated area declined to 3.61 lakhs hectares. In the command area of Stage II only about 7000 hectares area was irrigated in 1987-88.

Creation of Irrigation Potential

There has been a steady progress in the creation of irrigation potential in Stage I and till 1986-87 irrigation potential of 5.67 lakh hectares was created. It is evident from table 2.1 that bulk of the shortfall of the target irrigation potential lies in the lower command area of Stage I, i.e. below 74 km. of the main canal. In the upper command area about 92 per cent of the target of potential creation was achieved.

Utilisation of Created Irrigation Potential

Underutilisation of created irrigation potential, particularly that of major and medium projects, has been a cause of concern all over the country. Utilisation is generally computed as a ratio between gross area irrigated
Fig. 23

IGC COMMAND AREA (STAGE1)
UTILISATION OF IRRIGATION POTENTIAL
1986-87

PERCENT UTILISATION
- 120% & above
- 90-120
- 60-90
- 30-60
- below 30

20 0 20 40 60 KM
by the project and the created irrigation potential in terms of percentage. Hence, spatial dimension of the project is considered as a unit and not much attention is paid to spatial variations in utilisation of the irrigation potential and the factors which cause spatial variations in irrigation utilisation.

It is evident from table 2.1 that there is a gap between creation and utilisation of irrigation potential in Indira Gandhi Canal Command Area. Although, it is not as large as estimated for all major and medium irrigation projects of the country. At the time of the introduction of CAD programme, in 1974-75, about 84 per cent of created irrigation potential was utilised which, however, dropped down to 63 per cent in 1976-77. Decline in the utilisation level of created potential during this period is attributed to two factors. One that disturbances caused in water application because of watercourse lining in the upper command area and secondly, that in the lower reaches of the canal, utilisation did not keep pace with the created potential because of higher percolation rate of water and the absence of land levelling and shaping. Utilisation level has increased steadily after 1976-77 and reached 92 per cent in 1986-87. But, there is a great deal of spatial variation in utilisation level of created irrigation
<table>
<thead>
<tr>
<th>Year</th>
<th>Upto 74 km.</th>
<th></th>
<th>74 km. to 189 km.</th>
<th></th>
<th>Stage I</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Created</td>
<td>Utilised</td>
<td>Percent Utilisation</td>
<td>Created</td>
<td>Utilised</td>
<td>Percent Utilisation</td>
</tr>
<tr>
<td>1974-75</td>
<td>2.90</td>
<td>2.57</td>
<td>89</td>
<td>-</td>
<td>0.01</td>
<td>N.A.</td>
</tr>
<tr>
<td>1975-76</td>
<td>3.11</td>
<td>2.85</td>
<td>92</td>
<td>0.55</td>
<td>0.04</td>
<td>7</td>
</tr>
<tr>
<td>1976-77</td>
<td>3.55</td>
<td>2.74</td>
<td>77</td>
<td>0.86</td>
<td>0.05</td>
<td>6</td>
</tr>
<tr>
<td>1977-78</td>
<td>3.48</td>
<td>2.88</td>
<td>83</td>
<td>1.11</td>
<td>0.06</td>
<td>5</td>
</tr>
<tr>
<td>1978-79</td>
<td>3.62</td>
<td>3.11</td>
<td>86</td>
<td>1.28</td>
<td>0.10</td>
<td>8</td>
</tr>
<tr>
<td>1979-80</td>
<td>3.72</td>
<td>3.30</td>
<td>89</td>
<td>1.39</td>
<td>0.17</td>
<td>12</td>
</tr>
<tr>
<td>1980-81</td>
<td>3.73</td>
<td>3.41</td>
<td>91</td>
<td>1.47</td>
<td>0.19</td>
<td>13</td>
</tr>
<tr>
<td>1981-82</td>
<td>3.76</td>
<td>3.75</td>
<td>100</td>
<td>1.56</td>
<td>0.27</td>
<td>17</td>
</tr>
<tr>
<td>1982-83</td>
<td>3.96</td>
<td>3.93</td>
<td>99</td>
<td>1.57</td>
<td>0.37</td>
<td>24</td>
</tr>
<tr>
<td>1983-84</td>
<td>4.04</td>
<td>3.98</td>
<td>100</td>
<td>1.60</td>
<td>0.39</td>
<td>24</td>
</tr>
<tr>
<td>1984-85</td>
<td>4.05</td>
<td>3.78</td>
<td>93</td>
<td>1.60</td>
<td>0.38</td>
<td>24</td>
</tr>
<tr>
<td>1985-86</td>
<td>4.05</td>
<td>4.17</td>
<td>103</td>
<td>1.61</td>
<td>0.46</td>
<td>29</td>
</tr>
<tr>
<td>1986-87</td>
<td>4.06</td>
<td>4.63</td>
<td>114</td>
<td>1.61</td>
<td>0.60</td>
<td>37</td>
</tr>
</tbody>
</table>

Source: Status Report, Oct. 1987
Indira Gandhi Canal Project Commissioner, Area Development, IGCP, Bikaner.
potential and it declines as moving south ward in the command area.

In the upper command area of State I, which includes the command area of direct outlets, channels and branches taking off between the head and 74 km. of main canal, 89 per cent of irrigation potential was utilised at the time of launching of CAD programme. Decline in utilisation level in 1976-77 was because of disturbance created by construction of lined watercourses. The mark of 100 per cent utilisation was achieved in 1981-82 and it further rose to 114 per cent in 1986-87. Table 2.2 and fig. 2.3 further show that there is areal differentiation in utilisation level of irrigation potential even within the upper reaches of the command area. It is evident that command areas of direct outlets from the main canal upto Lakhuwali and Anupgarh branch have lowest level of irrigation utilisation in the upper command area of Stage I, but even it is about 100 per cent. Infact, rest of the upper command is overutilising the created irrigation potential. Utilisation level in the command area of North 15 Ghaggar Canal was 152 per cent in 1986-87. In the command areas of Naurangdeshar and Rawatsar branches utilisation level of irrigation potential was about 150 and 125 per cent respectively which is more than the envisaged utilisation level of the project.
TABLE 2.2

INDIRA GANDHI CANAL COMMAND AREA, STAGE-I

Utilisation Level of Irrigation Potential

1986-87

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Canal System</th>
<th>(In Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Direct Outlets from main canal upto Lakhuwali</td>
<td>98</td>
</tr>
<tr>
<td>2.</td>
<td>Rawatsar Branch</td>
<td>125</td>
</tr>
<tr>
<td>3.</td>
<td>Naurangdeshar Branch</td>
<td>148</td>
</tr>
<tr>
<td>4.</td>
<td>North Ghaggar Canal</td>
<td>152</td>
</tr>
<tr>
<td>5.</td>
<td>Suratgarh Branch</td>
<td>109</td>
</tr>
<tr>
<td>6.</td>
<td>Direct outlets and channels from Lakhuwali to 74 km.</td>
<td>107</td>
</tr>
<tr>
<td>7.</td>
<td>Anupgarh Branch</td>
<td>101</td>
</tr>
<tr>
<td>8.</td>
<td>Direct outlets from main canal from 74 km. to 189 km.</td>
<td>45</td>
</tr>
<tr>
<td>9.</td>
<td>Pugal Branch</td>
<td>19</td>
</tr>
<tr>
<td>10.</td>
<td>Lunkaransar-Bikaner Lift Canal</td>
<td>28</td>
</tr>
</tbody>
</table>

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  Total Stage-I                                                   92

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Utilisation of irrigation potential and difference in the level of utilisation is primarily influenced by (i) the availability of water or distance from the head of main canal, (ii) relief and soil characteristics, and (iii) implementation CAD programme, particularly water course lining. Influence of the third factor on the utilisation level of irrigation potential is evident from table 2.3. It shows that difference of irrigation potential utilisation between the command areas of fully lined watercourses and unlined or partially lined courses in upper command of Stage I was of 47 per cent in 1980-81. In the command areas of lined watercourses irrigation utilisation level was 22 per cent more than the envisaged potential while in that of unlined or partially lined watercourses it was short of potential by 25 per cent. Infact, water course lining has helped in overutilisation of irrigation potential in the command areas of the branches taking off from the head of main canal (Naurangdeshar and Rawatsar branches) and direct outlets and channels between Lakhuwali and the 74 km. of the main canal. While on the other hand utilisation level of potential was only 84 per cent in the command area of direct outlets from the main canal between its head and the 74 km. in the absence of lined watercourses. The role of relief and soil
### TABLE 2.3
**INDIRA GANDHI CANAL COMMAND AREA, STAGE-I UPTO 74 KM. OF MAIN CANAL.**

**Utilisation Level of Irrigation Potential**

**1980-81**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Canal System</th>
<th>Fully Lined</th>
<th>Unlined or partially lined</th>
<th>Total</th>
<th>(In Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Direct Outlets from main canal upto Lakhwali</td>
<td>-</td>
<td>84</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Rawatsar Branch</td>
<td>131</td>
<td>92</td>
<td>104</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Naurangleshar Branch</td>
<td>137</td>
<td>124</td>
<td>129</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>North Ghaggar Canal</td>
<td>-</td>
<td>142</td>
<td>142</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Suratgarh Branch</td>
<td>104</td>
<td>80</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Direct outlets and channels from Lakhwali to 74 km.</td>
<td>124</td>
<td>92</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Anupgarh Branch</td>
<td>106</td>
<td>58</td>
<td>61</td>
<td></td>
</tr>
</tbody>
</table>

---

Total Upto 74 km of Main Canal: 122 75 82
characteristics in determining the level of irrigation utilisation is evident from the fact that created irrigation potential was over utilised in the command areas of Naurangdesher branch and North Ghaggar Canal even in the absence of lined watercourses. Command areas of these systems is relatively flat land and its soils texture is generally loam and loamy sand. Hence, it requires relatively less effort in levelling and water application rate is also comparatively higher. Apart from this, it was a well populated region even before the arrival of the Indira Gandhi canal and farmers had the experience of sedentary cultivation.

Utilisation level of irrigation potential is very low in the lower reaches of Stage I i.e. the command area of direct outlets and branches taking off from 74th to 189th km. length of main canal. Only about 7 per cent of the created irrigation potential in this region was utilised in 1975-76 which increased to 37 percent in 1986-87. Lag in the utilisation level of created potential in this region is a direct reflection of slackness in the implementation of CAD programme. As discussed earlier there has been a shortfall in the on-farm development work of CAD in Phase II of Stage I. Beside this, time lag in introduction of irrigation is also responsible for spatial variation in the utilisation of irrigation potential.
In the command area of Stage II irrigation potential of 0.76 lakh hectares was created by the end of year 1986-87 of which about 0.40 lakh hectares was reported to be utilised. It would be premature to discuss and analyse the performance of the Stage II of the irrigation project in terms of utilisation of created irrigation potential. However, it is crystal clear that performance of this stage of project would much depend not only on the success of the CAD programme implementation but also on the performance of engineering department to ensure the supply of allocated volume of water to this region.

Intensity of Irrigation

As mentioned earlier the envisaged intensity of irrigation in the command area of Stage I is 110 per cent. Preference has been given to rabi crops for providing irrigation because soil moisture deficit in the region is relatively more during this season. The stipulated ratio of water consumption between kharif and rabi seasons is 47.63.

As evident from Table 2.4 irrigation intensity in the command area of Stage I has increased steadily since the introduction of irrigation in 1961-62 and reached the mark of 96.5 per cent in 1986-87. It gives the impression that irrigation intensity of this stage was quite less than
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Direct outlets from main canal up to Lakhwali</td>
<td></td>
<td>36.7</td>
<td>78.2</td>
<td>98.5</td>
<td>99.7</td>
<td>108.1</td>
<td>52.4</td>
</tr>
<tr>
<td>2</td>
<td>Rawatsar Branch</td>
<td></td>
<td>28.8</td>
<td>65.5</td>
<td>71.7</td>
<td>123.5</td>
<td>137.6</td>
<td>61.2</td>
</tr>
<tr>
<td>3</td>
<td>Naurangdeshar Branch</td>
<td>5.1</td>
<td>49.5</td>
<td>85.0</td>
<td>114.4</td>
<td>150.4</td>
<td>162.8</td>
<td>73.0</td>
</tr>
<tr>
<td>4</td>
<td>North Ghaggar Canal</td>
<td></td>
<td></td>
<td>136.6</td>
<td>154.7</td>
<td>164.2</td>
<td>167.0</td>
<td>81.3</td>
</tr>
<tr>
<td>5</td>
<td>Suratgarh Branch</td>
<td></td>
<td>11.9</td>
<td>53.1</td>
<td>73.1</td>
<td>98.9</td>
<td>120.2</td>
<td>50.3</td>
</tr>
<tr>
<td>6</td>
<td>Direct outlets and channels from Lakhwali to 74 km.</td>
<td></td>
<td>28.9</td>
<td>70.4</td>
<td>92.2</td>
<td>116.4</td>
<td>117.3</td>
<td>55.1</td>
</tr>
<tr>
<td>7</td>
<td>Anupgarh Branch</td>
<td></td>
<td></td>
<td>24.2</td>
<td>48.7</td>
<td>77.5</td>
<td>110.7</td>
<td>47.6</td>
</tr>
<tr>
<td>8</td>
<td>Total Upto 74 km.</td>
<td>0.4</td>
<td>12.8</td>
<td>48.1</td>
<td>72.0</td>
<td>98.6</td>
<td>121.6</td>
<td>53.1</td>
</tr>
<tr>
<td>9</td>
<td>Direct outlets from main canal from 74 km. to 189 km.</td>
<td></td>
<td></td>
<td></td>
<td>19.6</td>
<td>49.5</td>
<td>21.2</td>
<td>28.3</td>
</tr>
<tr>
<td>10</td>
<td>Pugal Branch</td>
<td></td>
<td></td>
<td></td>
<td>7.2</td>
<td>21.1</td>
<td>10.5</td>
<td>10.6</td>
</tr>
<tr>
<td></td>
<td>Lunkaransar-Bikaner Lift Canal</td>
<td></td>
<td></td>
<td></td>
<td>15.5</td>
<td>29.9</td>
<td>12.9</td>
<td>17.0</td>
</tr>
<tr>
<td>b.</td>
<td>Total 74 km. to 189 km.</td>
<td></td>
<td></td>
<td></td>
<td>15.4</td>
<td>36.7</td>
<td>16.1</td>
<td>20.6</td>
</tr>
<tr>
<td></td>
<td>Grand Total (Stage-I)</td>
<td>0.3</td>
<td>9.0</td>
<td>33.9</td>
<td>50.8</td>
<td>74.0</td>
<td>96.5</td>
<td>42.2</td>
</tr>
</tbody>
</table>
IGC COMMAND AREA (STAGE 1)
INTENSITY OF IRRIGATION
1986-87

Percent
- 150 & Above
- 125-150
- 100-125
- Below 100
the postulated in the project. But it is a fictitious impression for there is a great deal of spatial imbalance in this respect. In the upper reaches of the canal, irrigation intensity has risen very fast and crossed the stipulated level to reach the mark of 121.6 per cent in 1986-87, while in the lower command area of Stage I i.e. below 74 km. of the main canal, irrigation intensity was very low (36.7 per cent) in 1986-87.

There is a great deal of spatial variation in the level of irrigation intensity in the upper reaches of Stage I too. Command areas of all the branches and outlets upto 74 km. of the main canal have achieved the stipulated level of irrigation intensity. Direct outlets from the main canal upto Lakhuwali and Anupgarh branch have comparatively low intensity of 108 and 111 per cent respectively. On the other hand it is very high in the command areas of North Ghaggar Canal, Naunagadesar and Rawatsar branches. Distance from the head of the main canal, implementation of on-farm development works of CAD and soil and relief characteristics have caused the difference in the level of irrigation intensity over the space within the upper reaches of the command area. Irrigation intensity is very low in the lower reaches of Stage I. It is comparatively higher (50 percent) in the
command area of direct outlets from the main canal. Laxity in the implementation of CAD programme is the prime cause for this dismal performance. Successful implementation of CAD programme, particularly on-farm development work is a precondition to achieve the stipulated level of irrigation intensity in this region because of undulating relief and predominance of sandy soils.

Watercourse lining helps greatly in increasing irrigation intensity which is evident from table 2.5. In the upper reaches of Stage I irrigation intensity for the lined watercourses was 134 per cent in 1980-81. While it was about 50 per cent less for unlined or partially lined water courses (83 per cent). Naurangdeshar branch has highest intensity among the lined water courses. Comparatively very high irrigation intensity in the unlined command areas of North Ghaggar canal and Naurangdeshar branch is due to flat land and loamy soils which have higher soilmoisture retention capacity.

The preceding discussion on utilisation of irrigation resources in the command area indicates that gap between utilisation and creation of irrigation potential can be plugged only through successful implementation of CAD programme. Exceeding level of utilisation and intensity of irrigation in the upper parts of the command area of Stage
TABLE 2.5

INDIRA GANDHI CANAL COMMAND AREA, STAGE-I

Irrigation Intensity for Lined and Unlined Water courses

(Upto 74 km of Main Canal)

1980-81

(In Percent)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Canal System</th>
<th>Fully Lined (%)</th>
<th>Unlined or partially lined (%)</th>
<th>Total (%)</th>
<th>Percentage of lined command area in CCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Direct Outlets from main canal upto Lakhuwali</td>
<td>-</td>
<td>92</td>
<td>92</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>Rawatsar Branch</td>
<td>144</td>
<td>101</td>
<td>115</td>
<td>31.89</td>
</tr>
<tr>
<td>3.</td>
<td>Naurangdeshar Branch</td>
<td>150</td>
<td>136</td>
<td>142</td>
<td>42.48</td>
</tr>
<tr>
<td>4.</td>
<td>North Ghaggar Canal</td>
<td>-</td>
<td>156</td>
<td>156</td>
<td>-</td>
</tr>
<tr>
<td>5.</td>
<td>Suratgarh Branch</td>
<td>114</td>
<td>88</td>
<td>90</td>
<td>6.45</td>
</tr>
<tr>
<td>6.</td>
<td>Direct outlets and channels from Lakhuwali to 74 km.</td>
<td>136</td>
<td>102</td>
<td>110</td>
<td>22.97</td>
</tr>
<tr>
<td>7.</td>
<td>Anupgarh Branch</td>
<td>117</td>
<td>63</td>
<td>68</td>
<td>7.96</td>
</tr>
</tbody>
</table>

Total: 134 83 90 13.03

Source: Indira Gandhi Canal, Command Area Development, Bikaner.
I also underline the fact that not only the application of water per unit of cultivated land is higher than that envisaged in the project but also more area than proposed in the project is being irrigated in this region. This is contrary to the principle of protective irrigation and has the implication of reduction in the water allowance and irrigated area in the lower reaches of the command area. Moreover, the intensive irrigation in the region runs the risk of losing fertile land to waterlogging and soil salinity.
REFERENCES


11. Ibid, Annexure IV.

12. Ibid. pp. 3-4.


15. North Ghaggar Canal does not draw water from Indira Gandhi canal. however, it is a part of CAD programme of IGC. CAD programme was introduced in its command area in Phase II, in 1980.