Working of Pressurized Irrigation Network Systems (PINS) in Selected States of India

Agro-Economic Research Centre
For the states of Gujarat and Rajasthan
(Ministry of Agriculture & Farmers Welfare, GOI)
Sardar Patel University
Vallabhbh Vidyanagar, Anand, Gujarat, India
Pressurized Irrigation Network System (PINS)

- PINS is an interface between a canal [flowing under gravity] flow/tubewells and the MIS system.
- It comprises of Pipe Network with controls, Pumping Installations, Power Supply, filtration, intake well/diggy.
- It is a common and shared infrastructure [by Group of farmers] facilitating individual beneficiary for installing and operating MIS.
Concept of PINS - Network Bridge Between Canal and MIS in the Field
POWER LINE

PUMP AND FILTRATION ROOM

CANAL

PIPES

PINS

PIPES + DIGGI + PUMP & PUMP ROOM + POWER
### Levels of Pressurization

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Level of Pressurization (Command Block)</th>
<th>Capital &amp; Operational Cost</th>
<th>Power connections Per VSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VSA (300 to 500 ha)</td>
<td>Very High</td>
<td>1 connection</td>
</tr>
<tr>
<td>2</td>
<td>Chak (40 to 60 Ha)</td>
<td>High</td>
<td>5-6 connections</td>
</tr>
<tr>
<td>3</td>
<td>Sub-Chak (5-8 Ha)</td>
<td>Low</td>
<td>About 50 connections</td>
</tr>
</tbody>
</table>

- Obviously pressurization at Terminal point i.e. Sub-Chak level would be the most economical option but would also require more number of power connections.
- Evidently to take the advantage of Cost and feasibility aspects of power connections Sub-Chaks are re-oriented radially from the centre of a Chak and pressurized flow is resorted to only at the head of sub-chaks.
## COMPARISON OF FLOW Vs PINS + MIS

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Particulars</th>
<th>Flow</th>
<th>PINS+MIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Distribution</td>
<td>Gravity</td>
<td>Pressure</td>
</tr>
<tr>
<td>2</td>
<td>Water losses</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Conveyance losses</td>
<td>7 to 9 %</td>
<td>Nil</td>
</tr>
<tr>
<td></td>
<td>b. Application losses</td>
<td>25%</td>
<td>Drip- 2- 3%; Sprinkler -10 -15%</td>
</tr>
<tr>
<td>3</td>
<td>Water availability</td>
<td>Not enough for optimum irrigation and yield</td>
<td>Availability can be increased</td>
</tr>
<tr>
<td>4</td>
<td>Water productivity</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>Conjunctive use necessity</td>
<td>More</td>
<td>Less</td>
</tr>
<tr>
<td>6</td>
<td>Poor quality of water</td>
<td>Use will deteriorate soil and crop productivities</td>
<td>Reasonably poor quality of water can be used without affecting soil productivity</td>
</tr>
</tbody>
</table>

Contd…..
# FLOW Vs PINS+MIS

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Particulars</th>
<th>Flow</th>
<th>PINS+MIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Land requirement/Ha</td>
<td>170 m$^2$ required for sub minor and FC</td>
<td>24 m$^2$ required for storage (8 hrs supply)</td>
</tr>
<tr>
<td>8</td>
<td>Land topography restriction</td>
<td>restriction</td>
<td>No restriction</td>
</tr>
<tr>
<td>9</td>
<td>Maintenance of water courses</td>
<td>Recurring maintenance expenditure</td>
<td>No maintenance problems</td>
</tr>
<tr>
<td>10</td>
<td>Drainage</td>
<td>Is a must. In long run problems may arise</td>
<td>Drainage related problems minimal</td>
</tr>
<tr>
<td>11</td>
<td>Soil health</td>
<td>Prone to deteriorate</td>
<td>Health maintained. Environmental friendly</td>
</tr>
<tr>
<td>12</td>
<td>Poor irrigable soils</td>
<td>Can not be irrigated</td>
<td>Can be irrigated</td>
</tr>
<tr>
<td>13</td>
<td>Other than command areas</td>
<td>Can not be irrigated</td>
<td>Can be brought under irrigation</td>
</tr>
</tbody>
</table>

Contd…..
## FLOW Vs PINS+MIS

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Particulars</th>
<th>Flow</th>
<th>PINS+MIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Incidences of pests, Diseases, weeds</td>
<td>More</td>
<td>less</td>
</tr>
<tr>
<td>15</td>
<td>Cost of cultivation</td>
<td>More</td>
<td>About 20 % lesser than flow</td>
</tr>
<tr>
<td>16</td>
<td>Watch and Ward</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>17</td>
<td>Ground Water pollution</td>
<td>Highly prone</td>
<td>Nil</td>
</tr>
<tr>
<td>18</td>
<td>Double cropping</td>
<td>Not possible</td>
<td>Enough scope</td>
</tr>
<tr>
<td>19</td>
<td>Crop Quality</td>
<td>Normal</td>
<td>Improved</td>
</tr>
<tr>
<td>20</td>
<td>Employment generation</td>
<td>Labor/unskilled</td>
<td>Skilled manpower</td>
</tr>
<tr>
<td>21</td>
<td>Energy requirement</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Objectives of the Study

- To undertake a broad situation analysis of various PINS programs implemented in selected states of India;

- To assess the extent of adoption and performance of PINS in terms of costs, benefits and adoptability for different crops;

- To identify the major constraints in adoption, operation and maintenance of PINS;

- To analyse the institutional arrangements for operation and maintenance of PINS.
Coverage of the Study

The study was undertaken in four states (Rajasthan, Gujarat, Maharashtra and Telangana). Following Agro-Economic Research Centres were involved in the study:

- AERC Pune – Maharashtra state
- AERC, Vallabh Vidyanagar- Gujarat state
- AERC, Vallabh Vidyanagar- Rajasthan state
- AERC, Waltair/Vishakhapattnanam – Telangana state
- Coordinator- AERC, Vallabh Vidyanagar, Anand, Gujarat
Data and Methodology

- The data were collected from selected states from sample households and PINS-WUAs as per the distribution stated below:

<table>
<thead>
<tr>
<th>States</th>
<th>No. of Beneficiary Households</th>
<th>No. of Non-Beneficiary Households</th>
<th>No. of PINS-WUAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gujarat</td>
<td>200</td>
<td>100</td>
<td>27</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>200</td>
<td>100</td>
<td>26</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>250</td>
<td>105</td>
<td>75</td>
</tr>
<tr>
<td>Telengana</td>
<td>200</td>
<td>100</td>
<td>32</td>
</tr>
<tr>
<td>Grand Total</td>
<td>850</td>
<td>405</td>
<td>160</td>
</tr>
</tbody>
</table>
Data and Methodology

- In Gujarat and Telangana, all the selected PINS were tube well PINS where as in Rajasthan, all the selected PINS were canal PINS.

- In Maharashtra, three types of PINS were selected: government PINS (100% government funded), cooperatives PINS (partially funded by government and managed by group of farmers) and private PINS (owned and managed by individual farmers).

- In addition to survey method, the Focused Group Discussion and Key Informant Interviews were conducted to capture institutional dynamics in operation and maintenance in various command areas of the country.

- Simple statistical tools were used for data analysis and interpretation of results.
Major Findings from Gujarat

- **PINS in Canal Command:** GoG has put in lots of efforts to replace conventional irrigation by micro irrigation so as to improve water use efficiency and to increase area under irrigation in the state.

- The pilot project on PINS is one such effort started in 2007-08 in the command area of SSP. Accordingly, about 25 pilot projects were initiated in the state covering 1029 farmers with 1491.6 ha of CCA and estimated budget of Rs 1306.3 lakh.

- Though the GoG followed a proactive approach to increase the adoption of PINS by the water users, the efforts did not succeed due to: (i) no change in cropping pattern, (ii) no willingness to pay for MIS, (iii) no much strict rules and regulations to check the illegal use of canal water and water theft; and (iv) no revision of water rates etc.
Major Findings from Gujarat

- **PINS in Tubewell Command:** the tube well PINS have been operating in the state since a long ago as a viable method of irrigation in the state.

- The GoG introduced the policy of pressurized irrigation system in the command area of public tube wells under Gujarat Water Resources Development Corporation (GWRDC).

- As per the Government norms, Micro Irrigation System (MIS) provided in the command area of 309 tube wells covering 1452 Ha in five districts of the state i.e. Banaskantha, Mehsana, Patan, Gandhinagar and Sabarkantha.

- The GoG had decided in March 2013 to provide MIS in Government tube wells at 100% Government cost in total nine districts. Accordingly the State Government provided MIS system in 162 tube wells in 2013-14 covering 1531 Ha and 1037 farmers.

- The MIS works covering 2984 ha of 3780 farmers were in progress in 208 tube wells which was likely to be completed in 2014-15.
Major Findings from Gujarat

Findings from Field Survey:

The water saving due to judicious use of water (94.0%), increase in agricultural income (86.7%), getting water in right time (88.0%), proper distribution of water among farmers (62.7%), getting more information on how to use water judiciously (56.7%), electricity saving (54.0%) and improved maintenance of the system (26.7%) were the major benefits accrued by the beneficiary water users/farmers.

The proportion of area under more remunerative Rabi crops was also found to be higher (53.7% of GCA) in case of beneficiary farmers as compared to non-beneficiary farmers.

The results of Probit model indicated that, more area under PINS-MIS, uninterrupted power regular supply, more depth of tubewell, sufficiency of water in PINS and group membership helped in realising the benefits like increase in yield and income, water saving and energy saving by the beneficiary farmers.

The funds constraints, unavailability of required quantity of water, unavailability of proper maintenance and repairing services and electricity problems are the major ones for the PINS-WUAs.
The PINS Programme in Rajasthan is mainly concentrated in two major irrigation projects, i.e., Indira Gandhi Neher Project in Bikaner district and Narmada Irrigation Project in Jalore and Barmer districts. Thus, the main feeder source for PINS programme was canal. No other kinds of PINS such as tube well PINS or private PINS were not available in the selected areas of Rajasthan.

Under IGNP, the PINS projects were started on pilot basis in Bikaner district from 2012-13 and initially only 33000 hectare area was covered. Total culturable command area (CCA) of these projects is 3,47,566 hectares, out of which sprinkler irrigation system has already been established in 27,449 hectares under the pilot project.

The PINS projects under IGNP are being operated in bigger area around 200 to 600 ha per diggy, whereas the size of PINS project in Narmada Project at Jalore and Barmer are of smaller size of with 90 to 100 hectares per diggy.
Index Map of Narmada Valley
Index Map of Command area in Rajasthan
The benefits of adoption of PINS with sprinkler irrigation system in place of conventional irrigation method in Narmada command area in Raj.

- The CCA has increased from 1.35 lakh hectares to 2.46 lakh hectares i.e. an increase by 78 per cent.
- The number of villages benefitted for irrigation has increased from 89 to 233.
- Drinking water facility has been provided in 1541 villages and 3 towns which was not available before.
- 5.20 cusec of water is saved per 1000 acre in sprinkler Irrigation method as compared to Convention method.
- 2236 Water User Associations have been formed for promoting farmers’ participation in irrigation and water management, which did not exist earlier.
- The value of food production has been assessed to increase from Rs 534 crore to Rs 1480 crore, i.e. by Rs 946 crore (277%) during the year 2013-14.
Major Findings from Rajasthan

Findings from Field Survey:

The major motivating factors for the beneficiary farmers for adoption of PINS-MIS were to get assured amount of water for irrigation.

Among different benefits accrued by the beneficiary farmers by participating in WUA, the increase in area under irrigation (100%), increase in agricultural income (99.0%), water saving due to judicious use of water (97.5%), getting water in right time (88.0%), timely information on release of water from canal (82.5%), proper distribution of water among farmers (68.0%), getting more information on how to use water judiciously (56.7%) and electricity saving due to use of shared pump sets attached with PINS (58.0%) were the major ones.
Major Findings from Rajasthan

- Findings from Field Survey:
  - **The major problems faced** by the farmers were insufficient electricity for operation of PINS (60%), inadequate water availability (37.5%), difficulty in getting subsidy for MIS system (26%) and the problems related to operation and maintenance of the PINS-MIS system.
  - **Among the constraints faced by the WUAs**, the funds constraints, unavailability of required quantity of water, unavailability of proper maintenance and repairing services, Poor participation of WUA members and incomplete PINS work are the major ones.
Major Findings from Maharashtra

- In Maharashtra state the types of PINS projects are of three types - government PINS (100% government funded), cooperatives PINS (partially funded by government and managed by group of farmers) and private PINS (owned by individual farmers).

- There are government PINS (govt PINS) and cooperative PINS (coop PINS) in Buldhana, Kolhapur, Sangli and Yavatmal districts, while private PINS (pvt PINS) are spread across many districts, with high penetration in districts like Nashik and Ahmednagar.

- In the state, the sources of water for PINS are river, tube well, dug well, and storages by weirs, dams etc.
Major Findings from Maharashtra

- There are large no. of lift irrigation schemes in co-operative sector, in southern part of western Maharashtra (1,01,205 ha) in Krishna basin (i.e. on Krishna river and its tributaries).

- Since, the govt PINS projects were around 100% funded by the government, there was no cost for the farmers. Regarding the coop PINS farmers, average expenditure was Rs. 47,200 on PINS project, and there was no considerable variation on the expenditure on PINS across the landholding class of farmers.

- About the pvt PINS farmer, the expenditure on PINS project was Rs. 87,325 and there was not much variation across the farmers’ landholding class. These findings suggest that being a part of cooperative system could save PINS project cost by around 50%.
Major Findings from Maharashtra

Findings from Field Survey:

The main benefits of coop and govt PINS were an increase in area under irrigation by around 60%, farm income and water saving by more than 35%, and 35% saving in electricity.

For most of the crops the production was reported higher under the PINS farm than for the non PINS farm, this indicates that the PINS improves the productivity of most of the crops.

The main problems faced by the farmers were planning and installation of PINS with MIS, delay in receiving subsidy for MIS, power to run PINS and MIS, quality of components and damage of MIS in field from rodents.
Major Findings from Telangana

- It is newly constituted state where there are no government PINS projects with MIS available in the state, alternatively the projects with MIS scheme are installed connected to the irrigation source of tube-wells/bore-wells in the state.

- From 2014 onwards, the MIP scheme (NMMI) was subsumed into National Mission for Sustainable Agriculture (NMSA) as one of the component as On-Farm Water Management (OFWM).

- Out of 17.12 lakh hectares of net irrigated area irrigated with ground water, only 5.73 lakh hectares are covered under micro-irrigation, leaving a balance potential of 11.39 lakh hectares for micro-irrigation under PINS.

- In all the districts the MIP projects through MIS scheme connecting to tube-well irrigation are implemented.

- About 5,50,212 numbers of micro-irrigation systems were installed with a coverage of area of 5,50,212 hectares the total number of beneficiaries being 2,96,436.
Major Findings from Telangana

Findings from Field Survey:

- On an average the area under PINS -MIS was 1.11 hectares per hh. All the 200 sample farmers were having drip system and only for five farmers had sprinkler system. On the whole, amount spent on MIS was Rs. 8,443 per hh.

- On an average, 40 farmers participated in a TUA. The percentage change in production realised by the beneficiaries over non-beneficiaries ranged from 30 per cent in case of paddy to 100 per cent in case of Redgram.

- The output from probit model reveals that among the explanatory variables the marginal effect of operated area under PINS is positively associated with increase in agricultural yield, income, water and energy saving but negatively associated with fertilizer and pesticide use.
Major Findings from Telangana

Findings from Field Survey:

Majority of the beneficiaries expressed the problem of power supply to MIS and a few farmers reported the problem of operation and maintenance.

Nearly 33.33 per cent of water users reported that the PINS system is not functioning properly and also due to improper management of PINS system, they received inadequate water to their farm plots.
Conclusions : Gujarat

- For successful implementation of canal PINS, it is necessary to discourage more water consuming cropping pattern, by encouraging suitable cropping pattern through some incentive structure.
- It is suggested to revise the water rates which are very less and strict rules and regulations should be enforced to check the illegal use of canal water and water theft.
- One of the major factors that contributed to less adoption of canal PINS in the state was that, PINS Projects were located very close to minors or sub minors, from where farmers are able to get water in alternative ways.
- Thus, it is suggested to re-lunch this canal PINS programme with required amendments by locating these projects at far off places where farmers are struggling to get irrigation water. Though it involves little more investments in term of infrastructure expenditure, the adaptation and long-term sustainability would be surely achieved just like the success of PINS projects in Sanchore region in Rajasthan.
- The combination of UGPLs and PINS replacing Minors, Sub-Minors and FCs need to be systematically promoted to help saving land as well as water. The UGPL system with PINS should gradually focus on more adoption of MIS with appropriate financial incentives for effective management of irrigation water while taking care of farmers’ preferences for different cropping pattern. The services of NGOs and model WUAs may be taken as motivators for more adoption of water saving technologies under UGPL with PINS.
As far as Tubewell PINS are concerned, the maintenance and electricity cost for beneficiaries of tube well PINS was found to be a major part of their expenses which was reasonably high.

Services provided by some companies were unsatisfactory; frequency of their visits was insufficient. Thus there is a need to take measures to regulate the agencies supplying MIS to the farmers and adhering to standard norms on maintaining quality and providing proper and regular services for the repairing of the PINS-MIS within reasonable time limits. There is also a need to have more testing facilities for quality checking of equipments.

Farmers are unaware, uneducated about use of PINS and MIS. The training and awareness programmes should be regularly conducted to impart training to farmers on need, importance and use of MIS with PINS and also to promote fertigation and chemigation.
Conclusions : Rajasthan

- Some instances were found, where there were a large number of incomplete diggies (mainly in Gudha malani, Barmer district) since the promoting agency left the scene in between without completing the work. Thus, it is suggested to examine the performance of these promoting companies and treat them with appropriate incentives/ disincentives.

- It was observed that some promoting companies supplying the irrigation infrastructures and servicing are not functioning genuinely. Due to low quality of materials, frequent repair becoming inevitable. It is necessary to regulate quality of products and services provided by these agencies.

- There is urgent need to provide more number of servicing centres, at least one at taluka level. On the other hand, local people should be trained to cater the need of the farmers.
Conclusions: Rajasthan

- At some places, electricity infrastructures have been damaged since a long time, for which more than 500 hectares of land failed to be irrigated. In spite of repeated requests of the farmers, the electricity facilities could not be restored. Thus, it is suggested to take up the farmers’ concern in a time bound manner. On the other hand, fully automated solar systems need to be promoted in order to meet the farmers need.

- At some places, the outlets were kept open, when not in use. This resulted in choking of outlet pipes during regular storms/sand dunes in the state. Thus, it is suggested to provide outlet covers to keep it closed while not in use.

- The farmers have expressed concern over less subsidy on sprinkler as it is evident that only about 15 per cent subsidy has been realised by the farmers. It is suggested to relook at the subsidy policy of the government on MIS, particularly on sprinklers in the state.
It is realised that, if the financial assistance is made available to the lifts Schemes, they would get converted from PINS+Flow into PINS+MIS rapidly, as the trend is already set by 15 schemes in the state.

The distribution systems of lift projects will also be converted into PINS+MIS, though not envisaged at the conceptual stages. There is an advantage for lifts, that on the way from pumps to the delivery point, there can be sufficient head available to use MIS by directly hooking up to the rising/pumping main.

There is a large scope for PINS+MIS for (i)Co-operative lifts, (ii)lifts on Other Govt Projects with lift as distribution System, (iii)Govt. Lift irrigation projects themselves, (iv)individual lifts including lifts on Minor Irrigation Schemes, and in the long run of pipe distribution systems in place of flow irrigations.

The costs of the drip systems were higher under coop and pvt PINS than the govt norms. Therefore it is suggested that the cost norms for drip irrigation system may be revised so that the farmers can afford the drip irrigation system.
Conclusions: Telangana

- Though the PINS-MIS scheme is being implemented by private agencies, the subsidy is being provided by Telangana State Micro-Irrigation Project. Due to delay in release of funds from Central Government the release of subsidy to farmers is accordingly delayed. As a result the farmer could not receive the benefit in time and could not proceed further. Thus, it is requested to release the funds by Central Government in time.

- In recent years, the tanks in Telangana are being renovated through the programme of Mission Kakatiya. This renovation should be extended to all other tanks which in turn will be useful to irrigate more land in various parts of Telangana. Thus, the PINS-MIS programme be initiated through tank irrigation also.

- The implementing agencies and department officials (TS-MIP) should ensure thorough checking of MIS systems before installations and should provide timey services for any maintenance related problems.