Har Khet Ko Pani?
Madhya Pradesh's Irrigation Reform as a Model

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The Pradhan Mantri Krishi Sinchayee Yojana programme should concentrate on two low-hanging fruits. First, it should quickly put to use 20–40 million ha of unutilised irrigation potential created in major, medium and minor irrigation projects. Second, it should provide better quality power rations to farmers during the time of peak irrigation demand. Madhya Pradesh has done precisely this and multiplied the state's irrigated area quickly, at small incremental cost, delivering double-digit agricultural growth.

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1 Introduction

Massive irrigation initiatives have always been the favourite of leaders for political grandstanding. However, we need to remember public irrigation in India has proved a bottomless pit. According to a Reserve Bank of India (RBI) study, during 1991–2007, the country invested well over Rs 2 lakh crore (at 2007 prices) in irrigation and flood control (Balakrishnan et al 2008). Yet, thanks to "deficiencies in planning, implementation and management," the area served by government canals actually decreased by 3.8 million hectares (mha) during that period. RBI researchers viewed this, correctly, as, "a question of governance." Without tackling this "governance deficit," public investment in irrigation is simply throwing good money after bad.

The growing gap between irrigation potential created and utilised is symptomatic of the governance deficit. According to the Ministry of Water Resources (MoWR), the utilisation of potential created was 100% until 1980 but fell to 58% by 2007.[1] The more we invested in canal irrigation, the less irrigation we got. The reality is likely much worse because the land use survey (LUS) data by the Ministry of Agriculture shows the area irrigated by surface schemes to be below 17 mha throughout the 2000–13 period[2] compared to MoWR's claim of 42.7 mha and created potential of 56.4 mha (Ministry of Agriculture, Tables 11A.8, 11A.9 and 11D.1).

The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) with a commitment to invest Rs 50,000 crore over five years in universalising irrigation access (*Har Khet Ko Pani*, or water for every field) is a new attempt to deal with the problems in irrigation. PMKSY can progress towards har khet ko pani by focusing on two low-hanging fruits: first, quickly utilise 20–40 mha of already created canal irrigation potential that is awaiting utilisation; and second, improve the productivity of tube well irrigation by providing farmers quality power supply, for a fixed daily ration, during peak irrigation season. Madhya Pradesh (MP) has in recent years demonstrated how to do this with great success.

2 Accelerated Irrigation Expansion in MP

Post 2000, the United Progressive Alliance (UPA) and Bharatiya Janata Party (BJP) chief ministers have pursued sharply different irrigation strategies. UPA governments in Maharashtra and Andhra Pradesh (AP) have used massive irrigation investments to create rent-seeking opportunities and left the anarchy on rural electricity network totally untouched. Soon after he became Chief Minister in 2004, Y S Rajasekhara Reddy announced free power to farmers until 2017 and launched Jala Yagman, a massive scheme to provide irrigation to over 1.2 crore acres at a cost of Rs 1.86 lakh crore.[3] Between 2003–04 and 2011–12, the state

Figure 1: Index of Canal Irrigated Area (2000–01=100)

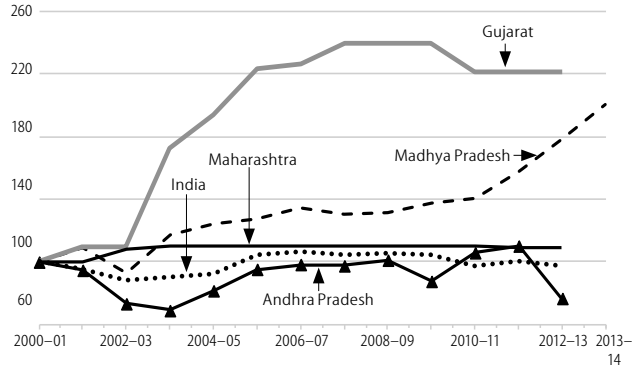


Figure 2: Index of Net Area Irrigated from All Sources (2000–01=100)

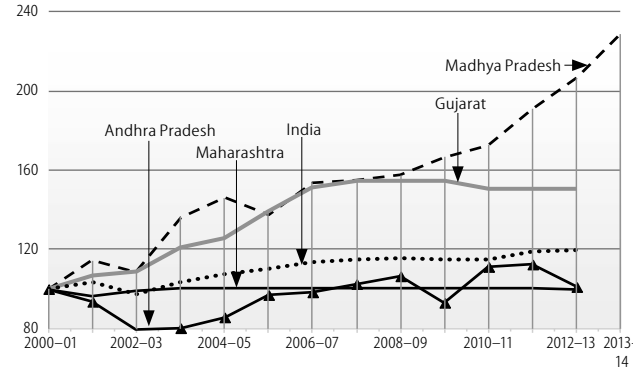


Figure 3: Cropped Area in February 2008–09

Figure 4: Cropped Area in February 2013–14

government invested Rs 74,200 crore on this programme (Government of Andhra Pradesh, Chart 5.4). However, a 2012 Comptroller and Auditor General audit concluded that its benefits are illusory. In Maharashtra, similarly, the Congress–Nationalist Congress Party government got mired in an irrigation scam in drought-prone Vidarbha region that cost the exchequer over Rs 70,000 crore but resulted in hardly any increase in irrigated area leading to accusations that half the funds spent were swindled by politicians. In both the states, farm power supply remained free but with progressive deterioration in quality and availability. Between 2000–01 and 2012–13, when massive irrigation investments were made in AP and Maharashtra, their index of area irrigated by government projects, as well as by all sources, was flat or declining (Figures 1 and 2). The major beneficiaries of these investments arguably were politicians and contractors.

In contrast, irrigation scene in BJP-ruled Gujarat and Madhya Pradesh has been different as evident in Figures 1 and 2. Vaidyanathan (2007) had shown that all agricultural growth in India during 1970–2000 could be attributed to irrigation-induced productivity growth. As if on cue, Narendra Modi and Shivraj Singh Chouhan as chief ministers pursued agricultural growth through irrigation development as a political strategy for capturing agrarian vote-banks rather than rent-seeking. Since 2000, these states rapidly expanded areas under canal irrigation and improved farm-power supply.[4] Neither Modi nor Chouhan nor their colleagues got accused of irrigation scams. As Gujarat's chief minister, Modi was the original architect of this strategy that delivered to Gujarat's agricultural growth rate of 9% per year during 2000–08 (Shah et al 2009). Modi did this inter alia by: (a) expediting the construction of the Sardar Sarovar project; (b) implementing a highly successful programme of supporting local communities for water harvesting and groundwater recharge; (c) improving quality of farm power ration through the Jyotigram scheme of feeder separation; (d) issuing over 5 lakh new electricity connections to Scheduled Castes/Scheduled Tribes and small farmers. Modi's agrarian success in Gujarat was unparalleled. But Chouhan, who took over as chief minister after Modi in Gujarat has outdone even Modi in accelerating irrigation benefits. Chouhan's most notable success has been in quickly improving power supply for rabi irrigation and rapidly expanding the utilisation of created canal irrigation potential from major, medium and minor schemes.

Figures 1 and 2, with irrigation index numbers—by government canals and all sources—in the four states using LUS data clearly show a strong upward trend in Gujarat and Maharashtra during the new millennium while these are flat in Maharashtra and AP. Figures 3 and 4 are remote sensing maps of cropped areas of MP in February 2009 and February 2014.[5] These maps have not been validated for accuracy. However, they point to an unmistakable expansion of irrigated areas (reflected in peak crop signatures) in MP by some 1.6 mha, from 7.36 mha in February 2009 to 9.26 mha in February 2014. The actual increase is likely to be more than twice this figure at some 3.6 mha. One of the 10 crop signature series examined showed a low peak in

Figure 5: Area Reported To Be Irrigated by Public Canals in Different River Basins of Madhya Pradesh (2011–12 to 2013–14)

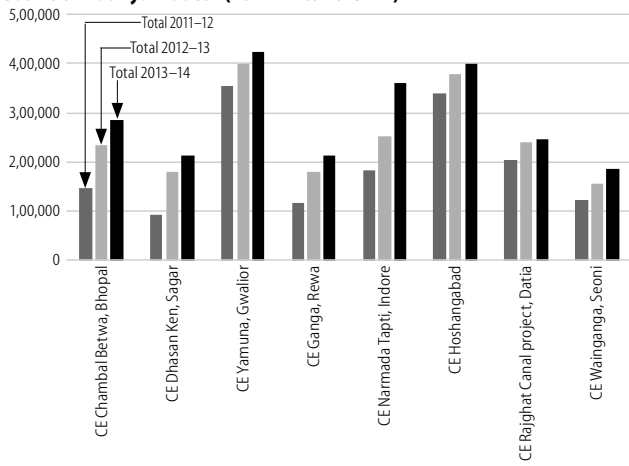
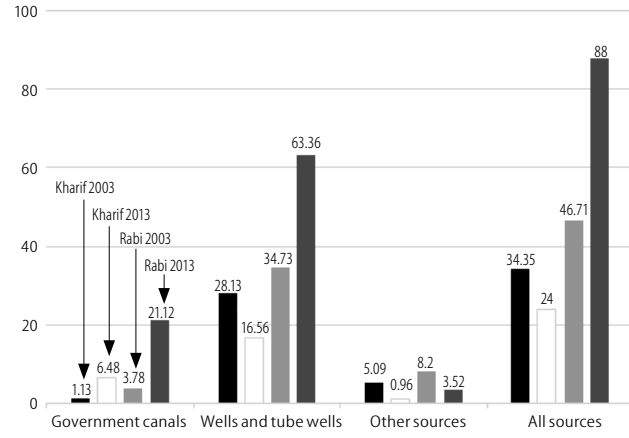


Figure 6: Increase in % of Cultivated Area under Irrigation by Different Sources in Madhya Pradesh: Comparing NSSO Round 59 (2002–03) with NSSO Round 70 (2012–13)



February 2009, indicating low-yielding rain-fed fodder crop on some 2 mha.[6] All of these turned into much greener irrigated area in February 2014 while that particular crop signature disappeared altogether in February 2014.

A remote sensing map (not shown here but can be accessed from the authors) which shows the spatial distribution of the difference in NDVI (or winter cropped area) suggests that there is an increase in irrigated winter cropping all over the state but there is much more in groundwater-irrigated western districts (Ujjain, Rajgarh, Dewas, Dhar, Burhanpur, Shehore, Barwani) and less so in eastern and north-eastern parts (Rewa, Satna, Sidhi, Shahdol, Sagar, Damoh and other districts) which have much of the state's canal command areas.

3 Power Supply to Agriculture

The Government of MP's agricultural growth strategy initially focused on expanding irrigation to the wheat crop by improving quality of power supply to farmers during the 110-day wheat irrigation season. But MP was critically short of power and he inherited a rural power network that was in disarray. Chief Minister Chouhan began attracting investments in power generation and soon thereafter, he also followed Modi's Jyotigram scheme of rural feeder separation to provide 24×7 power supply to rural households and quality power ration to farmers. Both these would, however, take several years to fructify. In the meanwhile, total anarchy ensued in rural power network during winter when rampant hooking on low tension lines by frustrated farmers led to low voltage, frequent blackouts and transformer burnouts.

The government imposed a modicum of order on this anarchy by issuing temporary winter-season power connections. Irrigation demand for power during winter was so high that farmers were willing to pay Rs 2.70–Rs 3.00 per unit of reliable power. The government contracted advance power purchase for the winter months, created a sense of plenty, and began liberally issuing winter-season irrigation connections. For a 5 hp winter connection, for example, the DISCOMs charged a flat rate of Rs 13,850 of which the farmer paid Rs 8,430 (an estimated Rs 2.72 per kilowatt hour (kWh)) in advance and the government paid the DISCOM a subsidy of Rs 5,420. During 2010–13, 3.12 million winter season connections were issued resulting in a 40% increase in power consumption in rabi irrigation[7] and expanding wheat cultivation by some 1.8–2 mha per year (Shah et al 2012). While seasonal power connections to farmers delivered a large part of increased irrigation in the state, even more significant in qualitative terms were management reforms that MP irrigation department introduced in government canal projects.

4 Canal Reforms

During Chouhan's first decade, the MP government spent a total of Rs 36,689 crore on irrigation, far less than AP and Maharashtra had done. Yet, MP tripled irrigated area in canal commands (from all sources) from 0.808 mha in 2006 to 2.5 mha in 2012–13. One might suspect that the large increase in canal irrigation resulted from new projects commissioned on the Narmada. However, as Figure 5 shows, canal irrigated area increased in all of MP's river basins rather than just Narmada. Figures from the MP irrigation department would be expected to show a rapid increase; but even LUS figures show the rapidly increasing trend in canal irrigation (Figure 1). Figure 6 compares the irrigation data for MP compiled by the 59th round of the National Sample Survey for 2002–03 and round 70 for 2012–13. These too show a near doubling of rabi irrigated area from all sources and a near sixfold increase in canal irrigation for the farmers sampled.

In 2003, government canals in MP irrigated around 0.65 mha. Under the chief minister's prodding, irrigation inched up. In 2008 assembly elections, Chouhan reaped rich electoral dividends from farmers for his irrigation policies. So in 2010, after sacking a corrupt irrigation secretary, the chief minister brought a dynamic, upright and pushy officer Radheshyam Julaniya to run the irrigation department, with the promise of a stable tenure and total support in stamping out political interference in running canals. This move delivered. The area irrigated by government canals jumped from less than 1.0 mha in 2010 to 1.56 mha in 2011, to 2.02 mha in 2012, and 2.33 mha in 2013.

How did MP achieve such miraculous expansion in canal irrigated area? We undertook an open-ended field investigation to understand key elements of

MP's irrigation management reform campaign. We visited several major, medium and minor systems, interviewed farmers and their leaders, met irrigation staff from principal secretary and superintending engineers down to *chawkidars*. The top political and administrative leadership implemented reforms by making performance-linked demands (PLD) on the bureaucracy and offered performance-linked supports (PLS) so that the department could rise to the challenge. The PLD–PLS strategy involved six components:

(1) Restoring Canal Management Protocol: Four rules of effective canal system operation—rationalised irrigation schedules, tail-to-head irrigation, *osarabandi* (operating canals by strict rotation) and operating canals at full-supply level (FSL)—have eroded in all Indian systems. MP restored their primacy and insisted on full enforcement of all these principles. Obsolete irrigation schedules were revised; water allowances were adjusted to reflect new cropping patterns; areas served by lift irrigation from surface and groundwater in command areas began to get counted as canal irrigated areas. Irrigating "tail-end first" removed the head–tail inequity endemic to canal irrigation; FSL canal operation meant that water reached tail-ends and could be distributed in an orderly manner; enforcing osarabandi ensured that distributaries could be operated at FSL during their rotations. The most difficult of all in the early years was enforcing the tail-end first rule because it challenged the long-entrenched power relations. In some projects, tail-end farmers were asked to complete land preparation a week or so in advance so that water could be released in advance when head-end farmers were not ready. Restoring the primacy of tail-end first required a massive thrust first; but once it got accepted, things began to fall in place; farmers adjusted planting schedules; water demand in head began lagging that in the tail. Earlier, when canals ran non-stop at low-supply, it was a winner-take all game for head-end farmers who had no pressure to time planting or save water. Now, osarabandi delivers full-supply for specific predetermined time slots that drives farmers to manage water better. Over time, there is greater appreciation among farmers for the discipline of tail-end first irrigation and osarabandi since with greater discharge of water, the fields are irrigated faster saving the farmer time and labour.

(2) Last Mile Investments: To enforce the three core rules requires that systems are well-maintained and in good repair. A World Bank loan and internal resources were found to prioritise and quickly complete last-mile projects with high potential. Lining big earthen canals on old systems helped reach water to tail-ends quickly. Small investments in rehabilitating over 4,000 minor irrigation schemes doubled the area served by them in just two years from 3,67,000 hectares to 7,60,000 hectares.

(3) Reducing Deferred Maintenance: Canals can be operated at FSL only if they are regularly maintained and will not breach. In most states, after salaries are paid, irrigation departments are left with no resources for management, operation and maintenance (MO&M). In MP, the department was provided resources to undertake proper MO&M. Two months ahead of every irrigation season, the department would be mobilised to desilt and clean all main canals while water user associations (WUAs) cleaned sub-minors and field channels. Even then, in older systems, risks of canal breach remained. Engineers were enjoined to run FSL and, if they occurred, fix the breaches within a stringent time limit; in doing so, they were backed by the department bosses.

(4) Constant Monitoring: The hallmark of new management was relentless monitoring. Potential created was taken as the target for irrigation. Regular weekly video-conferences taken by the secretary to the irrigation department and newly introduced information and communications technology systems created pressure for performance. The long abandoned practice of engineers overseeing irrigation operations in the field got revived with the secretary and chief engineer themselves frequently heading out in the field. Irrigating tail-end areas became an obsession and from the secretary down, the key variable monitored was whether tail-end fields were watered. In a masterful innovation, the engineer-in-chief would randomly call any of the 4,000 odd mobile numbers of tail end farmers to enquire if water reached her/his field.

(5) Animating the Irrigation Bureaucracy: Unstinted support of the chief minister empowered the irrigation bureaucracy to establish order and rule of law in canal commands. Local political interference was firmly crushed, when needed with direct intervention from the chief minister. This had magical effect on the department's morale which was further enhanced by a new system that recognised and felicitated high performing staff. The chief minister's backing also made coordination with agriculture, forest, revenue departments and district collectors easier, quicker and result-oriented. Time-consuming peripheral issues were decluttered. An invigorated irrigation bureaucracy was focused on the core task of delivering water to as many farmers as possible especially in the tail-ends.

(6) Vitalising Farmer Organisations: Under a new law made in 1999, some 2,000 WUAs were formed but mostly lay defunct. WUAs had little role when poorly managed main system failed to deliver water to many parts of the command for years. Now that the MO&M of the main system improved, water began reaching the tail-ends and defunct WUAs sprung to life. By involving them in pre-rabi desilting of minors and sub-minors, the department enhanced its outreach and WUAs became critical partners in irrigation scheduling, maintenance below outlets and orderly water distribution.

5 Sustaining Gains: Unfreeze, Change, Refreeze

Management Guru Kurt Lewin argued 75 years ago that changing a system succeeds only if change sustains after its driving impulse peters out. In his popular

model, managing change involves three stages: unfreezing, changing and refreezing. Unfreezing involves making a compelling case for changing the current order and preparing the stakeholders for embarking on a change programme. This is followed by actually implementing the change programme, overcoming the uncertainties, anxieties and fears about the new reality, and preparing stakeholders to embrace new behaviours, processes and ways of thinking.

The MP irrigation department has completed these two steps in its irrigation reforms; but it needs to reinforce and solidify the new order by refreezing through supporting policies, mechanisms, structures and norms. It is very likely that irrigation gains will gradually fizzle out if, for example, the present secretary is replaced by someone less zealous or Shivraj Chouhan makes way for another politician. So far, chief minister and secretary (irrigation) have been the sole source of PLD and PLS that have driven change; refreezing requires that farmers become the providers of PLD and PLS. This can happen only by building a strong relationship of mutuality between the irrigation department and farmers through aggressive recovery of the irrigation service fee (ISF). In this sense, MP's irrigation reforms are incomplete. While the area irrigated has increased fourfold, ISF recovered has increased only 60%, from Rs 10.5 crore in 2005–06 to Rs 16.45 crore in 2013–14. The irrigation department staff in other states are loathe to recover ISF because they do not offer reliable service. The MP irrigation department offers reliable irrigation; and therefore, is best placed to vigorously recover a rationalised ISF.

Like MP's irrigation department, its DISCOMs also undertook change management but their dealings with farmers are more likely to be sustained at a new and higher plane because they have completed the refreezing process. Until 2008, the anarchy on MP's rural electricity feeders was as bad as in its canal commands. Power theft by farmers was rampant. Unable to offer reliable service, DISCOMs were reluctant to recover tariffs and stop theft. Once order was established and DISCOMs had reliable power to offer, they began selling seasonal connections to farmers at a fairly high price of Rs 2.70 per kWh that was collected in advance. And because farmers paid a high price, the DISCOMs were under pressure to offer matching service. A vicious cycle was replaced by a virtuous one; farmers morphed from being beneficiaries to customers. The same process needs to be replicated in irrigation commands.

It is by no means necessary that farmers pay the full MO&M cost of irrigation service provision. But the ISF needs to be rationalised and vigorously collected, if only to ensure that farmers begin to make PLDs and offer PLS to the irrigation department. MP needs to launch its own version of the National Irrigation Management Fund (NIMF) in the Twelfth Five Year Plan which offered to match the ISF collected by each irrigation system on a 1:1 basis to augment MO&M resources available with irrigation managers. In addition, to strengthen WUAs, the government should offer a 50% bonus on all ISFs collected by WUAs. Unless irrigation management reform is taken to its logical end by rationalisation and vigorous recovery of the ISF, the gains of irrigation management reform will peter out as soon as the leadership changes or takes the pressure off.

Postscript

Much of the analysis presented in this paper used data up to 2013–14 which was a normal monsoon year. Since then, however, MP has experienced two back-to-back droughts. The average rainfall was 845 mm in 2014–15 and 840 mm in 2015–16, way less than 1,472 mm in 2013 and above normal-rainfall in five previous years in a row. Many parts of the state, especially Bundelkhand and other rainfed areas, were under deep distress, especially in 2015–16 where irrigation wells dried up. Rainfed soyabean crop in kharif 2014 got nearly wiped out; however, rabi wheat, which is irrigated, thrived in 2014–15. Published final figures are still not available; however, the state's water resources secretary claimed in a recent workshop at Asian Development Bank, Manila that irrigation by all sources in MP's canal commands increased to 2.69 mha in 2014–15 and 2.81 mha in 2015–16, higher than 2.53 mha irrigated in 2013–14 (Julaniya 2016). He claimed this contributed to an increase in statewide foodgrain production from 30.07 mt in 2013–14 to 34.09 mt in 2014–15 and to (expected) 37 mt in 2015–16.[8] Irrigated wheat production increased from 1.71 mt in 2013–14 to 1.78 mt in 2014–15. However, in 2015–16, wheat production is expected to suffer a decline thanks to the second drought in a row. Irrigation reforms have clearly not prepared MP agriculture for two successive drought years. However, the strategy of spreading canal water over larger areas has promoted conjunctive management of surface and groundwater. While groundwater wells in rainfed areas dried up in the second successive drought, in canal commands many still offered supplemental irrigation to the 2015 rabi wheat crop. A clear lesson is the need for demand-side management of groundwater in hard-rock areas. Had the five successive years of normal monsoon during 2009–13 been used to maximise groundwater recharge, and had effective mechanisms been put in place for judicious use of this recharge, MP could well have sailed through even two successive drought years. Effective demand management of water must be the next priority of irrigation reforms.

NOTES

1 http://mospi.nic.in/Mospi_New/upload/Infra_stat_2010/11.ch_irrigation.pdf (table 11D.1), accessed on 30 August 2015.

2 Ministry of Agriculture, Government of India (ON802), http://www.indiastat.com/table/agriculture/2/irrigationbysource19502013/449345/9484/data.aspx.

3 Government of Andhra Pradesh, 2012, Report of the Comptroller and Auditor General of India on Jal Yagnam, Hyderabad, http://gssaap-cag.nic.in/sites/all/themes/marinelli/Reports/2011-12/Jalayagnam/English/Jalayagnam_Complete_Report_2011-12.pdf, accessed on 5 August 2015.

4 http://indianexpress.com/article/india/india-others/explained-flush-with-funds-little-work-to-show/.

5 In absence of ground coordinates, these maps were produced from unsupervised classification of temporal MODIS NDVI images for a quick assessment of winter crop area. The remote sensing data (NDVI) is from MODIS (resolution—250×250 sqm). The maps were made assuming a maximum of 10 possible classes on land labelled non-forest in the Global Land Cover Map of 2000.

6 The maps were generated from unsupervised classification of NDVI time series data. The remote sensing data (NDVI) is from MODIS (resolution—250×250 sq m). The maps were

made assuming a maximum of 10 possible classes on land labelled non-forest in the Global Land Cover Map of year 2000.

7 agricoop.nic.in/kharif2014/GroupI–MP.*ppt* consulted on 16 August 2015.

8 http://www.hindustantimes.com/bhopal/mp-records-32-rise-in-food-grain-production/story-dXzaNKQnnsSXo6g1JakkPI.html.

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