43
2012

Despite a slew of positive studies and years of government and NGO promotion, farmer enthusiasm for micro-irrigation technologies has been lukewarm in most parts of India. In recent years, however, Gujarat and Andhra Pradesh are witnessing rapid expansion in the area under these technologies. Operating through special purpose vehicles - Gujarat Green Revolution Company (GGRC) and Andhra Pradesh Micro Irrigation Project (APMIP) - both these states seem to have found farmer-friendly ways of delivering micro-irrigation subsidies. Based on a 2009 IRMA-IWMI internship report, this Highlight unpacks and compares the two innovative models and draws lessons for implementing agencies wanting to replicate their success.

IWMI-TATA
Water Policy Program

Water Policy Research

# HIGHLIGHT

## Micro-irrigation Subsidies in Gujarat and Andhra Pradesh Implications for Market Dynamics and Growth

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# Micro-irrigation Subsidies in Gujarat and Andhra Pradesh Implications for Market Dynamics and Growth[1]

**Research highlight based on Kumar and Pullabhotla (2009)[2]**

Micro-irrigation (MI) methods such as drip and sprinkler systems have been found to have significant water saving and crop productivity benefits. Studies have claimed water saving of 40 – 80 percent and productivity gains up to 100 percent (Sivanappan 1994; Palanisami et al. 2011). Estimates of the potential area that can be brought under these Water Saving Technologies (WSTs) vary from 5.84 million ha (Kumar et al. 2008 p. 29) to 69 million ha (Ministry of Agriculture 2004 p. 115). In spite of their proven benefits, policy makers and researchers have continued to bemoan the tepid growth in the actual spread of MI in India (Ministry of Agriculture 2004, 2010; Narayanamoorthy 2004; Kumar and Palanisami, 2010), prompting the Ministry of Agriculture in Delhi to launch the `National Mission on Micro Irrigation' (NMMI) in 2010, revising and reformulating the Centrally Sponsored Scheme (CSS) on Micro-Irrigation which was introduced four years earlier.

The government's key policy instrument for MI promotion continues to be subsidizing farmers' capital costs of drip and sprinkler systems. The operational guidelines for NMMI stress that `the success of the scheme will depend on an effective delivery mechanism' (Ministry of Agriculture 2010) . However, this particular aspect of the MI story in India has received scant attention among policy researchers. Overall, in the period 2005/06 and 2010/11, the central government disbursed nearly Rs 2750 crore[3] in MI subsidies according to media reports (Seetharaman 2011). But, except for an evaluation by the Ministry of Agriculture itself (NABCONS 2009)[4], there has not been any research on the current subsidy delivery mechanisms and their impact on market dynamics and stakeholders.

This Highlight provides a preliminary examination of the MI subsidies in two states – Gujarat and Andhra Pradesh - that have received attention for their innovative delivery mechanisms *(ibid)*. We take an organizational approach, unpacking the underlying institutional structures and mechanisms of subsidy delivery in the two states and examining the incentive structure along the principal-agent chain originating from the funding source and culminating at the final beneficiary – the farmer.

## Micro-irrigation subsidies and spread

The real thrust on promoting MI adoption largely started with the recommendations of the Micro Irrigation Task Force in 2004. Their report sought to increase the emphasis on MI technology and recommended a broader framework, viewing MI technologies as a part of the overall water management strategy. It also recommended more financial resources for subsidies, with state governments taking up 10 percent of the cost, while the central funds would account for 40 percent and advised greater flexibility for states to determine their appropriate implementation structure and institutional mechanisms for subsidy disbursement (Ministry of Agriculture 2004) Based on these recommendations, in 2006, the Central Sponsored Scheme (CSS) on MI was launched.

Since then, the two models followed in Gujarat and Andhra Pradesh – the GGRC and the APMIP model respectively, have been seen as the most successful in terms of `capacity and quality' of implementation (NABARD Consultancy Services Pvt. Ltd, 2009). APMIP was established as a Special Purpose Vehicle (SPV) housed in the Directorate of Horticulture prior to the CSS in 2003 itself. GGRC was a later entrant. In contrast to

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[1]This IWMI-Tata Highlight is based on research carried out under the IWMI-Tata Program (ITP). It is not externally peer-reviewed and the views expressed are of the authors alone and not of ITP or its funding partners – IWMI, Colombo and Sir Ratan Tata Trust (SRTT), Mumbai. The authors gratefully acknowledge the cooperation extended by officials from GGRC, APMIP, various micro-irrigation firms, dealers and farmers. The report benefitted from feedback and guidance provided by Tushaar Shah, Sunderrajan Krishnan and Rajnarayan Indu.

[2]This report is available on request from p.reghu@cgiar.org

[3]One crore = 10 million

[4]We supplement some of our own findings in this study with observations from this evaluation.

APMIP, GGRC was set up as a SPV in the form of a public compay promoted by Gujarat State Fertilizers and Chemicals Ltd, Gujarat Narmada Valley Fertilizers Company Ltd and the Gujarat Agro Industries Corporation Ltd.

The two states also differ in other pre-conditions, particularly their respective levels of MI development prior to these SPVs. Andhra Pradesh was one of the early adopters of MI, and in 2002 had about 12 percent of the 5 lakh[5] ha under drip irrigation in India. Gujarat, at the same time, only had about 2.5 percent of the share (Ministry of Agriculture 2004). Since this period, both states have seen an increase in factors that are likely to be positively associated with MI adoption. For instance, area irrigated by groundwater has gone up, particularly in Gujarat. Both states have also seen an expansion in area under crops suitable for drip irrigation such as horticulture and cotton (Table 1).

A number of other factors at the macro-level such as pricing and quality of electricity supply for agriculture use, water availability etc influence the spread of MI. At the farmer level – financial assets and access to credit, cost and availability of labor, access to water, awareness etc., can mediate the decision to adopt MI systems. These factors which can be state, district or even farmer specific make it difficult to isolate the impact of subsidies alone on drip and sprinkler adoption. However, both Andhra Pradesh and Gujarat are seeing more and more agricultural area being brought under these technologies. Since the inception of their respective subsidy implementation agencies, both states have also seen an increase in the pace of expansion, with the area added per annum going up each year (Figure 1).

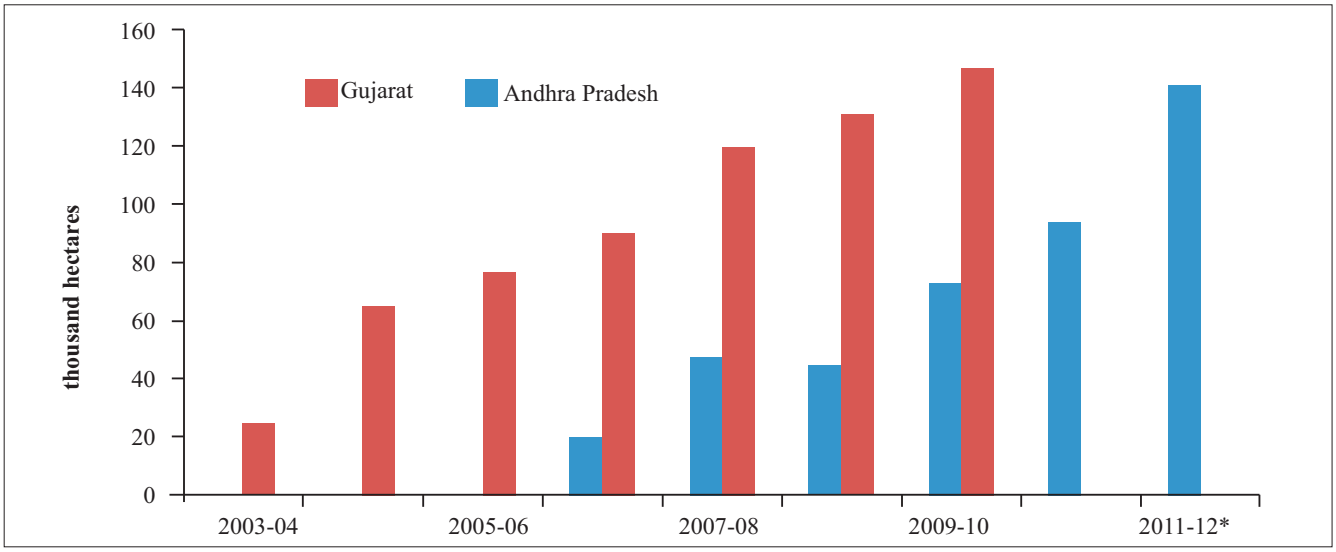
Even if all this growth cannot be attributed to the subsidy implementation alone, the significance of GGRC and

**Table 1 Trends in factors promoting micro-irrigation in Gujarat and Andhra Pradesh in 2000s**

| Factor | Andhra Pradesh | | Gujarat | |
|---|---|---|---|---|
| | (Year) Value | (Year) Value | (Year) Value | (Year) Value |
| Net irrigated area – groundwater ('000 ha)[1] | (TE.2001-02) 1927 | (TE.2009-10) 2298 | (TE.2001-02) 2492 | (TE.2009-10) 3340 |
| Net irrigated area – surface water ('000 ha)[1] | (TE.2001-02) 2264 | (TE.2009-10) 2096 | (TE.2001-02) 423 | (TE.2009-10) 885 |
| Area under fruits and vegetables('000 ha)[2] | (2001-02) 798.3 | (2010-11) 1297.3 | (2001-02) 381.5 | (2010-11) 865.8 |
| Area under cotton ('000 ha)[1] | (2001-02) 1108 | (2010-11) 1740 | (2001-02) 1615 | (2010-11) 2633 |

Sources: 1 – Indiastat, 2012; 2 – National Horticulture Board, 2011
Note: TE – Triennium ending

**Figure 1 Area added under drip and sprinkler irrigation**




Source: GGRC (2012a), Reddy and Satyanarayana (nd.)
Note: *Up to 10 November 2012

[5]One lakh = 0.1 million

APMIP in spurring this growth cannot be discounted. Both these organizations had the backing of their respective chief ministers, and they continue to receive much attention from the state governments.

### Unpacking the subsidy system

While the overall objective of MI subsidies is to promote adoption of these technologies by farmers, there a number of conditions that the subsidy system has to fulfill in order to ensure optimal outcomes. MI adoption cannot be at the cost of adversely affecting farmers' interests. Ensuring quality standards of drip and sprinkler systems, educating farmers about efficient application of this technology along with required agronomic inputs and appropriate market support for the output are needed to ensure long term viability of farms adopting water saving technology. MI manufacturers and dealers form another significant group of stakeholders. With the private sector being solely responsible for the supply of MI systems (with the exception of some NGO led efforts for low cost drip systems), the subsidy system needs to be conducive towards their activities. Finally, as with any publicly funded scheme, accountability and monitoring the use of funds spent is also an important requirement. Both GGRC and APMIP have been successful in addressing many of these concerns.

In both these cases there are four main actors/ agents in the subsidy chain: funding authorities, implementing agency, MI firms and farmer beneficiaries. In addition, other players include banks and other credit agencies, third party monitoring and evaluating agencies, agriculture extension personnel, and MI dealers and marketing agents (who in some cases represent multiple MI firms). The process of subsidy disbursement remains largely the same across various categories of farmers (with minor differences between self-financing farmers and those availing bank loans). Figure 2 and Figure 3 provide an overview of this process under GGRC and APMIP respectively, starting with the farmer's purchase decision[6].

A key contrasting feature of this process between the two states is that under the GGRC system the farmer directly approaches the MI firm of his choice, usually through a dealer, whereas in the APMIP system, the farmer's point of contact is the local APMIP officer who has jurisdiction in the area. The farmer indicates his choice of the company at the time of submitting his application and a number of additional approvals are needed before the company receives the farmer's demand and proceeds to prepare the cost estimate. This feature of APMIP adds another layer of delay and unnecessary scrutiny in the subsidy disbursement process[7].

This is not the case under the GGRC model. In many instances, the MI dealer or firm has an incentive to take up the responsibility of much of the administrative procedures such as collecting the relevant documents, facilitating access to bank documentation (in case the farmer wants to avail of credit), submitting the application to the implementation authorities etc., in order to quicken the pace of the firms' own business completion cycle. The GGRC's code of conduct for MI suppliers in fact explicitly encourages the suppliers to motivate the farmer for timely submission of application under MI Scheme' and `educate the farmer for availing loan procedures of Bank under MI scheme' (GGRC 2012b). This design therefore shifts some of the transactional costs of availing the subsidy from farmers to MI suppliers. There are also efficiency gains for the implementing agency as the private sector would be encouraged to devote some of its own resources to promote and educate the farmers about the subsidy scheme and its guidelines, in addition to the public extension efforts. This `firm first' approach of GGRC admittedly leaves open the possibility of connivance between MI supplier and farmer to possibly gain undue advantage either through duplicated applications or inflated cost-estimates. But the `implementation agency first' APMIP approach does not completely eliminate this problem either, but adds to the length of the process. Both these models, however, allow for various checks to scrutinize such misappropriation of subsidy through their design of the payment process and via third party verification procedures.

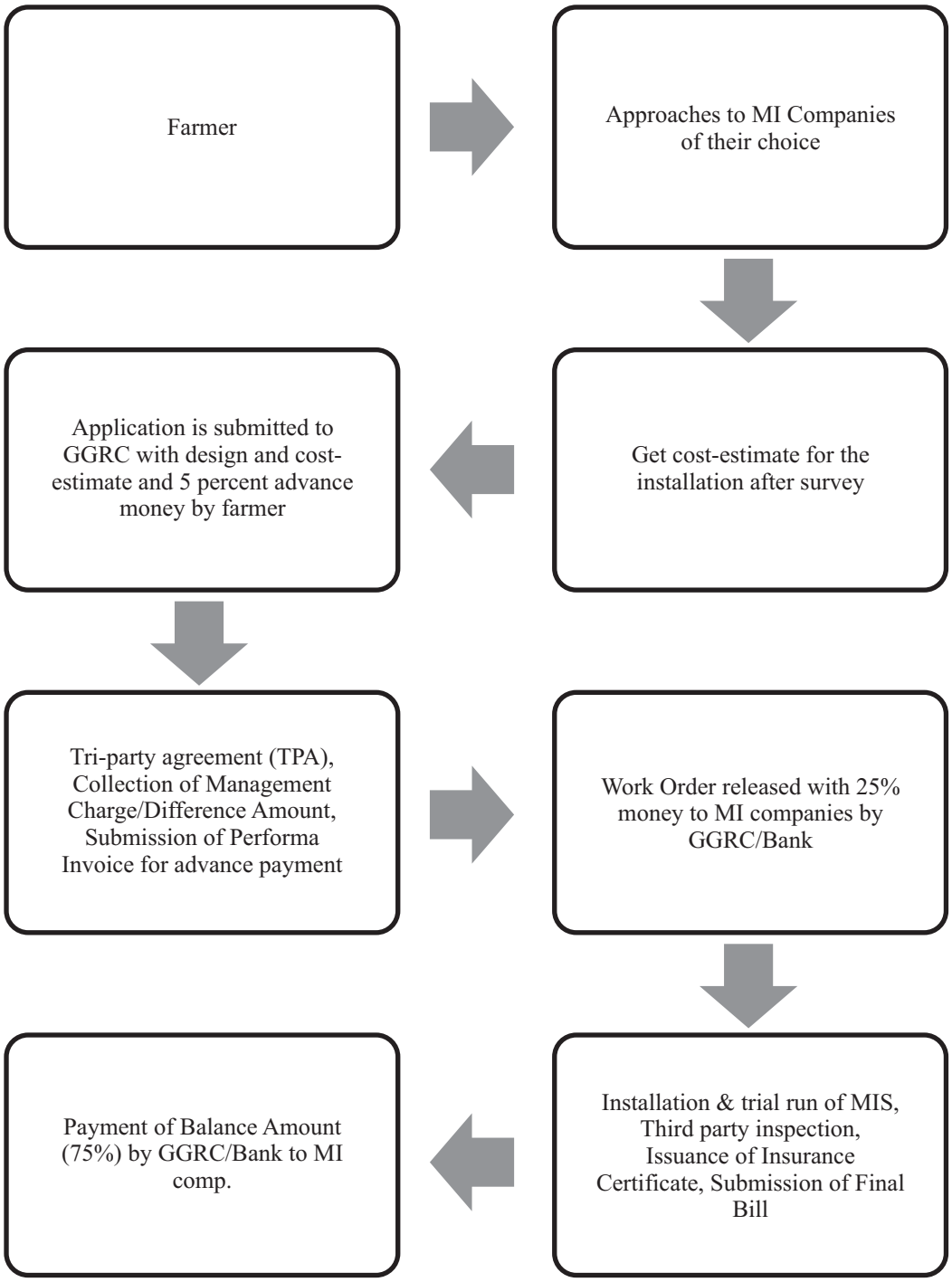
Both APMIP and GGRC follow similar procedures for collecting the farmer's share of the cost of the MI system and incorporate provisions to safeguard his/her interests. The farmer pays his share to the implementing agency, rather than directly to the MI firm. The agency, either GGRC or APMIP, releases only some portion of the amount to the supplier prior to the delivery and installation of the system, as a mobilization fund. Only after the system has been installed, a trial run undertaken and verified by a third party monitoring agency, and with the farmer acknowledging the system performance, is the complete amount (farmer's contribution along with the subsidy component) released to the supplier. This process

[6]This information pertains to the period 2008-09. Some of the steps involved might have undergone a change in the intervening period, though all attempts to update and verify this information from secondary sources have been undertaken.

[7]The NMMI guidelines recommend the GGRC model where the farmer approaches the firm of his choice. Information on whether the APMIP has changed its existing system in accordance with these guidelines was not available.

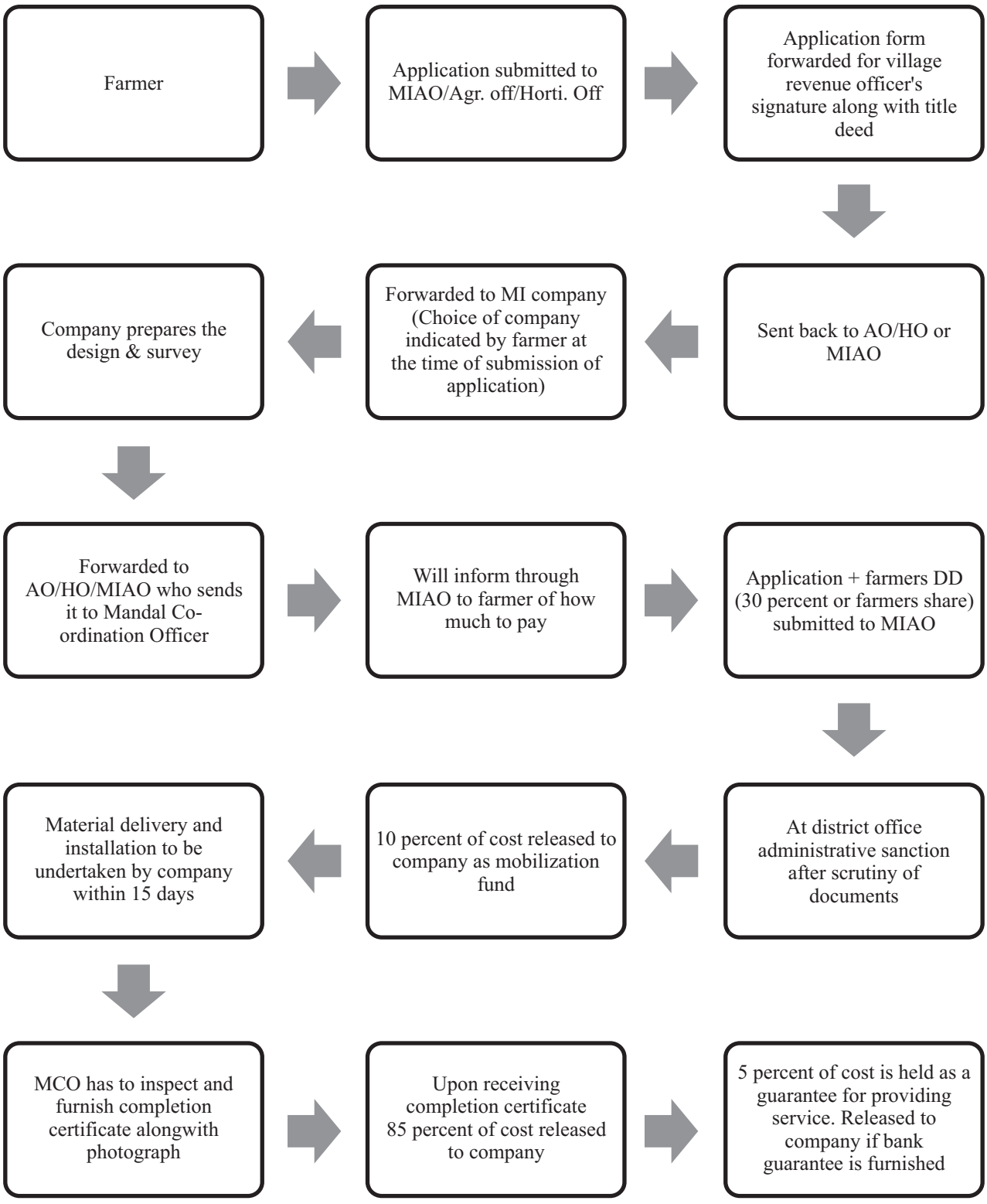
serves both objectives – ensuring satisfactory service to the farmer and verifying that the subsidy amount is properly used. Additionally, in cases where the farmer avails of credit from a bank or some other source, the same process can be used to minimize the costs of adverse selection and moral hazard through provision of information that is potentially useful for the lender. Similar benefits are accrued to insurance agencies providing coverage – the GGRC model does in fact couple insurance coverage provision to the farmer with this process. In these respects, the GGRC model, and to some extent the APMIP model, incorporate useful design elements that align incentives for suppliers (of MI technology as well as credit and insurance suppliers) in a manner that is advantageous to farmers. Other major differences across the GGRC and APMIP models are summarized in Table 2.

**Figure 2 Subsidy process under GGRC**




Source: Kumar and Pullabhotla (2009)

**Figure 3 Subsidy process under APMIP**




Source: Adapted from Horticulture Department (n.d.)
Note – Abbrevations used: MIAO – Micro-irrigation Area Officer; AO/HO – Agriculture/Horticulture officer; MCO – Micro-irrigation coordinators

**Table 2 Comparison between GGRC and APMIP models of subsidy delivery**

| Parameters | GGRC-model | APMIP-model | Remarks |
|---|---|---|---|
| Funding Source | Government of Gujarat | NABARD assistance | No delays in release of subsidy in either case;<br>Full support from respective state governments |
| Subsidy Model | Per acre, per farmer | Per family | Farmer try to bypass the limits imposed by APMIP-model by fudging land records |
| Autonomy | Semi- autonomous corporation supported by GSFC | Works under the Horticulture department of GoAP | Decision making on operational issues faster in GGRC;<br>APMIP suffers some administrative delays |
| Organizational Structure | Centralized; single-window operations | Decentralized; district offices carry out key functions | APMIP model facilitates easier handling of large volume of applications and smoothens monitoring and field inspection |
| Subsidy: Regulated or Unregulated | Unregulated; no quotas for drips / sprinklers or for MI companies | Yearly quotas for drips and sprinklers fixed; MI companies allotted geographical domains | APMIP quota systems cripples competition and distorts the MI market |
| Administration and Processing | Streamlined; uniform procedures | Variation between districts; ambiguous chain of command | Administrative overlaps and non-uniformity of processes creates bottlenecks |
| Transparency | Online tracking of application status | Toll-free number for enquiries about application status | Process of fixing quotas in APMIP and information about funds disbursement under GGRC lacks transparency |
| Marketing Strategies | Farmer networks; perceived quality of service | Dealer networks; perceived quality of service | Unit costs of MI systems standardized; price differentiation not possible |
| Quality of Service | Emphasized but variable; despite the threat of de-registration due to poor farmer awareness | Emphasized but variable; despite the threat of de-registration due to poor farmer awareness | GGRC monitoring and field inspection out-sourced to third party, often inadequate or not stringent |

### Implications for supply side agents

Gujarat and Andhra Pradesh, as well as other states, have witnessed an increase in the number of micro-irrigation manufacturers over the past decade. These include domestic industries as well as international firms which have started operations in India. Reports in the popular press place the number of firms to be around 200 in 2011 (Seetharaman 2011), a sign that there has certainly been some growth in demand. The cost of most MI systems range from Rs. 0.7 lakh to Rs. 1.3 lakh per ha depending on the crop and type of system (Palanisami et al. 2011). This constitutes a sizable investment for most farmers, and the potential market for MI adoption would be much smaller in the absence of subsidy support. Inasmuch as expanding the market size is concerned, MI firms do seem to have much to benefit from the subsidies.

The subsidy process however, does impose additional costs and constraints on MI suppliers. A major source of potential market distortion is the policy of recommended unit prices. The central government norms identify an `indicative' list of components and price of the unit based on spacing, field size and category of state[8]. The rationale for these indicative costs is to ensure that at the time of drawing up of the design estimates for a farmer's field, MI

[8]The state categories are based on extent of market development. Category A states are those with more than 20000 ha under drip irrigation. Other states are category B, except the north-eastern states, Jammu & Kashmir and some mountainous regions which are classified as category C. The cost is determined to be 15 percent higher in `B' states and 25 percent higher in `C' states, compared to `A' states.

manufactures do not overcharge the farmer or the public exchequer. The actual cost of an MI system can vary widely from these norms, and the subsidy the farmer would need to bear this additional cost over the indicated norms (GGRC has provisions to allow higher indicative costs under some conditions). In practice, fixing the unit prices restricts product differentiation on the basis of prices. It reduces the incentive for firms to design low cost alternatives, and also restricts the non-subsidy market.

These indicative prices are to be revised according to any changes in costs of raw material or manufacturing. But firms report that there is usually some lag in updating the prices after manufacturing costs increase. In the event of steep spikes (for instance, due to rise in petrochemical prices which raises the cost of the primary raw material for pipes), the manufacturing firms may need to absorb this rise in prices, at least until the cost norms are revised leading to an increase in working capital requirements. In addition, delay in release of final payments to the suppliers also adds to the working capital burden. The prescribed time for release of payments varies between 40 – 45 days for both GGRC and APMIP. Manufacturers, however complain that these reimbursements can sometimes take as long as a few months (in extreme cases, almost 12 months). According to press statements, Jain Irrigation, the largest MI firm in India, in 2011 had on its accounts receivables of Rs.1700 crore of which Rs. 1300 crore was pending subsidy reimbursements (Seetharaman 2011).

These delays in price revision and payments can put severe strain on the working capital burden of the firms; and end up favoring the big players that can afford to bear the cost of delays. They can also cascade down to the supply chain to dealers and service agents who fail to receive their commissions in time. Ultimately, quality of service and support to farmers could suffer in cases where the firm does not have adequate working capital to maintain its distribution and service network, leading to failure to comply with the after-sales service requirements.

MI firms also encounter additional transaction costs as a result of the subsidy regime. Some of these are justifiable from the point of view of protecting farmers from risks. The current subsidy system lays down requirements for after sales and agronomic services to be provided by the MI supplier to the farmer. These provisions are required for ensuring that the farmer gets optimal benefits, and help the overall growth of MI by minimizing the risk of dis-adoption due problems resulting from improper use or maintenance. In addition, these costs of `good' service quality are likely to payoff for the firm in market returns by helping them tap into the farmer's social networks and promoting beneficial word-of-mouth publicity for the brand. In our field interactions with farmers in Gujarat and Andhra Pradesh, the firm's reputation on these parameters did turn out to be one of the major factors influencing farmer's preference for particular MI brands.

Both GGRC and APMIP models can result in such cost escalations for suppliers. Manufacturers interviewed were however of the opinion that the costs due to delayed payments were more prevalent in Andhra Pradesh, while the speed of transactions under GGRC was significantly better. Part of the reason could be that APMIP, whose organizational structure is bottom heavy, has more activities concentrated around the district-level administration. While this might reduce the work-load in terms of application processing that needs to be done at the state-level, it also introduces delays in the payments which need to be routed from state to district administration before being disbursed to the MI firms. Another possibly market-distorting feature, specific to APMIP is that it has district specific quotas assigned for companies, and not all companies operate in all districts, the reasoning being that this would ensure equitable spread of MI in all areas of the state. This regimentation however results in hindering farmers' choices, cripples competition and results in suboptimal allocation of supply and demand in the state.

Recently some of the larger firms have been trying to launch their own initiatives to overcome this problem. Jain Irrigation has considered the establishment of its own nonbanking financial corporation to provide credit to farmer-consumers. Others are experimenting with cash-and-carry models to tap into demand from farmers who may not qualify for subsidy or have immediate requirement for the system and do not wish to wait for the subsidy process (Seetharaman 2011).

## Conclusions

The subsidy models in Gujarat and Andhra Pradesh under the GGRC and APMIP respectively provide useful templates for drawing lessons for subsidy implementation. Both these models emphasize safeguarding farmers' interests and have in place various oversight measures to this end. Some of these aspects, particularly the design features that provide incentives for the suppliers to share the transaction costs of farmers, are noteworthy.

Implementing agencies in other states could follow a `best-of-both-worlds' system based on the GGRC and

APMIP cases. It is preferable that the implementing agency should have a high degree of autonomy on the lines of GGRC, and not hindered by administrative delays associated with government departments at least in terms of operational and managerial decisions. An optimal structure would be the one that combines the best of GGRC and APMIP - one that is decentralised with a clear line of authority and administrative procedures across the state. Functions related to scrutiny of applications, verification of design and cost estimates, and preliminary hearing of complaints should be carried out at district or regional offices. Funds flow, payment to companies, registration and scrutiny of companies, planning and co-ordination can be centralised functions.

Also, as long as the policy of fixed prices Qis in place, states need to secure own funding sources other than the centre, in order to respond quickly to changes in prices. If this is taken in the form of loan or assistance from NABARD, as in the case of APMIP, this might result in the IA putting in place stricter measures for financial accountability to fulfil the conditions required for availing the loan or assistance. This might also ensure that there are regular external audits of the functioning of the IA.

The pattern of subsidy assistance could vary across districts in a state based on land-holding size, cropping and rainfall patterns. The state implementing agency should have the flexibility to modify the subsidy norms to suit regional variations. It should also have the flexibility to experiment with innovative delivery schemes such as MI systems being paired with priority electricity connection provision, albeit, at a higher tariff; use of drips and sprinklers in conjunction with surface water sources and lift irrigation etc, as GGRC and APMIP have been doing.

These lessons are applicable not just to the subsidy for micro-irrigation, but could find application in other instances of agricultural technology promotion. The costs of oversight, both financially and in terms of time, will, however, rise as the volume of beneficiaries increases. With more number of adoptees of the technology, it is also likely that with awareness among farmers about quality and service standards would rise. The implementing agency should be geared to withdraw from individually certifying MI systems on each farm in the future, and instead help farmers access redressal mechanisms and rights as consumers to address risks of adoption.

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## About the IWMI-Tata Program and Water Policy Highlights

The IWMI-Tata Water Policy Program (ITP) was launched in 2000 as a co-equal partnership between the International Water Management Institute (IWMI), Colombo and Sir Ratan Tata Trust (SRTT), Mumbai. The program presents new perspectives and practical solutions derived from the wealth of research done in India on water resource management. Its objective is to help policy makers at the central, state and local levels address their water challenges – in areas such as sustainable groundwater management, water scarcity, and rural poverty – by translating research findings into practical policy recommendations. Through this program, IWMI collaborates with a range of partners across India to identify, analyze and document relevant water-management approaches and current practices. These practices are assessed and synthesized for maximum policy impact in the series on Water Policy Highlights and IWMI-Tata Comments.

Water Policy Highlights are pre-publication discussion papers developed primarily as the basis for discussion during ITP's Annual Partners' Meet. The research underlying these Highlights was funded with support from IWMI, Colombo and SRTT, Mumbai. However, the Highlights are not externally peer-reviewed and the views expressed are of the author/s alone and not of ITP or either of its funding partners.

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