

Affordable Micro-Irrigation for the Poor

Affordable Micro Irrigation Technologies (AMIT) for the Poor was a four year action research project supported by UK Department for International Development's (DFID) Knowledge and Research Programme (KaR).

Purpose of the research

To understand the impact of AMITs on the livelihoods of resource-poor farmers and the use of a market-driven approach in the dissemination of these technologies.

Study areas

INDIA: East - Jarkhand, West Bengal.
West - Maharastra, Himachal Pradesh & Gujarat

ZIMBABWE: Masvingo Province



Close-up of lateral & micro-tubes

Research Questions

To evaluate the irrigation technologies and the market mechanisms used to bring them within reach of poor and marginal farmers, the project was guided by four key research questions:

- Q1. Do AMITs offer sustainable technical and financial benefits to users when compared with conventional irrigation practices?
- Q2. Whose livelihoods can be enhanced by purchasing AMIT, in what way, and by how much?
- Q3. What are the constraints and opportunities of a market-oriented approach to support the sustainable adoption of AMIT by the poor?
- Q4. How transferable are the technologies and the approach to other areas?



Drum kit in Zimbabwe

Q1. Do AMITs offer sustainable technical and financial benefits to the users?

AMIT Technology

The AMIT concept aims to make drip and sprinkler technologies 'affordable' by marketing off-the-shelf kits that irrigate very small plots. A "Bucket kit" may sell for US\$5 and irrigates 15 to 20m². A "Drum kit irrigates 120 m² and costs around US\$25. A fixed micro sprinkler system for 250 m² may cost US\$18, excluding the cost of a pump, and a portable sprinkler system for 4000m² may cost US\$100 including a small electric pump.

The prices appear low because of the small scale however on a per hectare basis the systems may be no cheaper than conventional designs.

The bucket and drum systems rely on gravity head and avoid the costs of installing and operating a pump. However, the sprinkler systems and larger, so-called "customised" drip systems do require a pumped supply.

The goal is that poor farmers should be able to exploit the technical benefits that these technologies can offer, namely: higher water application efficiencies, improved crop yield and quality, reduced labour requirements and more productive use of a limited water supply; in order to generate livelihood benefits (in terms of increased food security and potentially raised incomes).

The technologies support production of vegetable and horticultural crops. They are not targeted at the irrigation of basic cereals - the main consumers of water from much larger irrigation schemes.



The Bucket Kit



The Drum Kit

The Research Findings

Benefits are only realised where users receive sustained technical and **agronomic** training and support. Access to produce markets and some form of **credit** provision are also vital, particularly for the poorest.

Bucket kits offer some improved family nutrition and food security during the **dry season** but households could irrigate a similar, very small plot through **careful**, manual watering. Larger customised systems irrigating a high-value **crop** offer the greatest financial impact on livelihoods. The income generated **may** contribute as much as 60% of the total household income, provided a **market** for the produce is accessible.

Low head kits, where a container is filled manually, do not offer significant **saving** in labour inputs, but larger, pump pressurised systems do, such as the **systems** found in Western India.

AMIT kits do increase water productivity – 'more crop per drop' – when **compared** with current irrigation methods. However, overall water use may remain constant or actually increase, either because farmers expand the area under irrigation, or, as in the case of Zimbabwe, manual irrigation using buckets to carry water to small basins results in under irrigation and low yields. In this instance AMIT increased the depth of water applied and raised yields.

The customised systems appear to differ little from existing hardware but the great benefit is in the focus they have brought to rationalising design standards and therefore reducing costs, for small systems.

The degree of sustainability of technical and financial benefits will depend on the availability of spares, of technical and agronomic support from the supply chain, continuing availability of the minimum water requirements, the presence of a viable market for AMIT produce, the ability to access that market, and (not least) the effectiveness and efficiency of the supply chain.



Pegged lateral & wetted plants

Q2. Whose livelihoods can be enhanced by purchasing AMIT, in what way, and by how much?



Filling up the Bucket

The kind of people whose livelihoods may be enhanced (in terms of greater food security and/or increased incomes) are those who have access to:

- Credit
- Quality inputs
- Markets - supplying inputs and for the sale of produce
- Technical assistance/extension services
- Adequate, albeit limited and accessible, water supply
- Their own, secure plot of land
- Little fear of theft of equipment

Impacts on Livelihoods

For those people described above possible impacts on livelihoods are:

- Drum and bucket kits – food security and nutritional value, particular for the family.
- Customised and larger kits require a change to the livelihood strategies and farming systems (dependent on market potential for produce and availability of technical and agronomic support).
- Larger systems + high value product = most major visible impact on livelihoods through potential cash income eg. West India (can therefore provide a substitute for migratory labour).
- Potential to increase cash income, if market for agricultural products exists (mainly for larger irrigation systems).
- Market approach – can create jobs throughout supply chain.
- There are gendered impacts of AMIT kits on traditional labour patterns which require careful consideration. The bucket kits tend to involve women and children more. The drum kits require filling by men.



Family with bucket kit



Women demonstrating how she unblocks laterals by sucking

Analysis of AMITs' Impact on Livelihoods

In eastern India, where there is no familiarity with the technology, limited technical training and support, and only local markets for produce, the borderline and self-sufficient wealth categories were able to achieve some financial benefit - they increased their annual income by 5-8%. The very poorest seldom purchased the technology – it is not affordable to them. Where they obtain a kit through some form of subsidy they do see a benefit from an improved food supply.

In western India, where enabling conditions are more favourable, AMIT technology fits as part of a larger investment in horticultural production, which can contribute up to 60% of annual household income. The poor can benefit from this by pooling their resources and saving over many years to make the necessary investment costs.

Experience showed in Zimbabwe that it was households of average or above average wealth, with access to their own water source who showed greatest interest in using AMIT kits. The poorer families did not have private land or water resources to exploit.

Q3. What are the constraints and opportunities of a market-oriented approach to support the sustainable adoption of AMIT by the poor?

The Marketing Approach

The theory underlining the approach is that the more innovative farmers should be targeted first of all to adopt the AMIT kits. These early adopters of the new technology will not be the poorest but will be the wealthier farmers. IDE, the promoter of the market approach, believes that once the rural poor see how these farmers are benefiting they will also take-up the technology. If the product meets the needs of the farmers, considerable market growth should result, creating a sustainable supply channel for the product. The envisaged increased demand for the low-cost technologies, it is purported, will create employment on the supply side and result in consumer satisfaction on the demand side, in terms of technological support and agronomic results.

The marketing approach covers 5 stages:

- Identification of a need and therefore a market opportunity for a solution
- Research and development
- Field testing and technology refinement
- Commercialisation and market development
- Withdrawal of the donor funds supporting the set-up



Zimbabwean farmers preferred to peg laterals above the ground

Donor funding of the NGO meet the costs of these stages. Thus, although market oriented and using many of the tools of commercial marketing there are important non-commercial elements. These are:

- Start-up costs (product and market development) provided through external grant assistance.
- Users – or facilitating intermediaries such as NGOs – pay only for the product (they do not repay the costs of product and market development).
- Costs of local NGOs, that are an essential element of the supply chain (particularly to reach the poorest), must be met from their own funds – they are not reimbursed from the market price of the product.



Good quality crop and yield produced under AMIT

Opportunities from the Marketing Approach

- NGO intermediaries working with the very poor support the identification of this category of farmers and facilitate their adoption of AMIT. Without such mediation the very poor would probably not access the technology.
- Payment for a product by a farm household represents a stake in making it work.
- Profit-making distribution systems, based on open transactions, support distribution efficiency and enhance farmer access. By comparison, in West India the subsidy regime of the government inflates the user price and tends only to permit access to irrigation technologies by larger farmers.
- The potential exists to stimulate competition between equipment suppliers and service providers which should result in better service delivery for the farmer. However, it proved difficult to find examples of this working in practice as there were not sufficient numbers of service providers in a given location.
- The commercial marketing of AMIT can work effectively where extension services and markets exist to support the production of high value cash crops.

Constraints to Marketing Approach

- Collaborating NGOs are inclined towards using subsidies or grants to enable the poor to obtain kits. This is not sustainable and it results in insufficient attention or interest on the part of the 'beneficiary' farmer, and distorts the market.
- NGO staff may not have the time or expertise to address farmer concerns in use of the technology and lack the resources to increase their capacity to support users. Consequently, follow-up support, especially agronomic, may be weak. Where the market approach disseminates 'simple technologies' such as the treadle pump this problem may not arise. However, drip irrigation is a relatively complex technology which depends on changed agricultural practices and accessing unfamiliar markets. It requires considerable on-going training and support before small farmers can successfully adopt the technology.
- This training and support, at least in the early stages of market and supply chain creation, cannot be provided by the market and therefore represents a significant donor cost.
- There is a danger that distributors and installers might shift away from very small-scale drum and bucket kits since their profits would be higher with larger scale kits.



Man with failed AMIT crop due to inadequate information about crop water requirements with AMIT

Q4. How Transferable are the Technologies and the Approach to other regions or countries?

Enabling conditions are requirements that support the successful transfer of the AMIT kits and the marketing approach to kit dissemination in other regions or countries.



Livestock-damaged crop due to lack of a fence



Pipe and Laterals

A number of such enabling conditions have been identified by the research at a variety of levels. These are detailed below:

Enabling conditions for AMIT technology

Consideration has been given to transferability at three levels, namely village, project or programme, & regional:

Enabling conditions at the village level:

- **Technology must suit prevailing cropping patterns.**
- Existing agricultural practices include irrigated cropping of vegetable, horticultural or other high value crops.
- **There must be actual and perceived water scarcity.**
- In addition the water source must be adjacent to the plot unless the growers are able to invest in pumps and pipe systems to convey water from source to field. In this case AMIT becomes part of a much larger investment.
- **Field plots can be observed from the homestead or the culture is such that equipment theft from the field is uncommon.**
- Households have some, though limited, cash earning opportunities besides the sale of agricultural produce.
- **Markets for inputs and for produce exist and can be readily accessed. In much of Africa these will be nearby significant urban centres, but in Asia such markets are more widely distributed.**
- Farmers have access to good quality agricultural inputs.
- **NGO or other agency present for at least 3 years to provide technical and agronomic support to adopters of AMIT.**

Enabling conditions at the project or programme level:

- Implementing team must be multi-disciplinary with a spread of skills including irrigation technology and design, irrigation agronomy, marketing, and socio-economic skills.
- Adequate financial and human resources to plan and implement awareness raising and promotional campaigns and demonstrations.
- Strategy to be in the area for at least 5 years.



Enabling conditions at the regional level

Fenced Plot

- Plastic extrusion and moulding industries should exist.
- Drip irrigation sector should already exist amongst the commercial farming sector to heighten awareness amongst smallholders of the function of micro-drip kits and the potential benefits.
- The presence of such a sector will also help to ensure a supply of basic drip irrigation components within the region.
- The implementing team must be multi-disciplinary with a spread of skills including irrigation technology and design, irrigation agronomy, marketing, and socio-economic skills.
- Government policies should be supportive ie. they do not already offer micro-irrigation on subsidy.
- There should be some availability of credit to facilitate the involvement of the poorest.

Enabling conditions for the Market Approach to AMIT Technology Dissemination

- A functioning private sector and an NGO presence in-country.
- The price of the AMIT products must support fair margins for the supply chain.
- There should be availability of donor funds of at least US\$5 per family for a duration of 5 years to facilitate the market creation, the supply chain establishment, agronomic support, and the after-sales activities.
- There should be a free market, or least some degree of liberalisation.



Bucket kit showing plot size

AMIT, the Market Approach and Risk

- Farmers who have some wage labour opportunities as back-up support, are less risk-averse and are more willing to invest in new technologies particularly in larger, customised systems.
- In Maharashtra the technological risk is reduced because drip has already been proven to be 'appropriate'. In this region risk is more related to farmers' ability to access and to repay finance.
 - There is less of a risk associated with the technology, the risk is rather whether AMIT is an appropriate intervention for the local conditions, and how the market approach is implemented .
 - The upper economic categories are most likely to be early adopters of kits and to accept risks.
 - Reduction of risk for the poor can be achieved by ensuring the enabling conditions and support factors outlined above are in place.
 - There is a donor/funding risk and a vulnerability to agency presence and programme demands, for example, if funding to the East India programme is withdrawn at its current stage it is likely that the AMIT market in that area will collapse.

RESEARCH CONCLUSIONS

Project conclusions on the impact of AMIT on livelihoods

The lessons from this and other research are that as a technology AMIT is well proven, i.e., from a technical perspective. It has a niche in assisting rural communities cultivate crops in drought prone areas. It does, however, have drawbacks such as being site and community specific, where easy uninhibited access to water is essential. The poorest members of communities in general do not benefit from the technology due to their lack of resources particularly water, usable land and finance.

It is possible to conclude that small unit AMIT kits do not offer much incentive in terms of livelihood impact to resource-poor farmers, albeit they can provide some assistance with regard to food security through production of vegetables for the household. The larger customised and pressurised systems, more akin to conventional drip technology, do offer greater benefits and are more attractive to farmers who can make the required investment – these people are usually not in the poorest wealth categories but the technology nonetheless offers them substantial benefits.



Traditional method of carrying water to the vegetable garden in Zimbabwe

Project conclusions on use of a market-oriented approach to getting technology to the poor



Parched land during a dry season



Man selling locally grown tomatoes at the village market

The marketing approach investigated here has potential as a means to extend and market technologies like AMIT, however there are a number of issues which need to be addressed, the most important of which being:

- 1) the funding of market development and after sales service
- 2) the involvement of NGOs in extending the technology and the commensurate effect of subsidies which these organisations provide
- 3) the detrimental effect of subsidies being offered on the same technology in the same locality on a market approach, and
- 4) the role of government departments in this kind of approach to technology transfer

Low-cost drip irrigation technology cannot be treated as a **'silver bullet' technology** that can be introduced into any environment. Rather, a minimum number of pre-conditions must be met, at local, regional and strategic levels, before the technology is likely to have wide appeal such that commercial marketing can be sustained. The project, programme or entity must provide sufficient human and financial resources to train and support farmers who adopt AMIT. Regular training and support visits to users for at least the first two seasons of use are essential. The project, programme or entity must have a strategic aim to be present and involved for approximately 5 years.

Implications of Research Findings

AMIT technology is attractive in the Indian context because it places a low cost product in the market place that competes directly with the price of other 'commercial' hardware after state or national price subsidies have been claimed. AMIT makes drip irrigation available to the many thousands of farmers who cannot satisfy the requirements of the subsidy system. It may prove difficult to transfer such low prices (affordability) into many African states where national plastics production capacity is much more limited.

The market-oriented approach itself can offer advantages in getting technology to poorer farmers, in a specific enabling environment. The approach certainly overcomes the constraints of state and federal subsidy systems that exist in India. However it is not 100% reliant upon market forces and should not be promoted as if it were. Major reliance is placed upon a promoting body that must provide considerable and lengthy investment in product development, market chain establishment, promotion and on-going technical and agronomic support. The costs of this agency are not recouped from the commercial marketing of the technology but represent the 'aid' input (a form of subsidy) into the process. Furthermore, there is heavy reliance on local NGOs. They play an essential role in increasing access to the poor but their subsidising of the 'market approach' must be recognised.



Test site with elevated drums

The project has been successful in testing claims that AMIT technology can be delivered through the market to millions of poor farmers throughout the world offering them water saving kits and providing significant livelihood benefits.



Mr Tapera wanted more information on spacing

Our findings are of relevance to this lobby and should be used to qualify such claims and to improve the targeting and implementation of such on-going work. Of particular importance here is the recently established Global Network for Low-Cost Micro-Irrigation.

The final report is available on our website at http://www.itcltd.com/final_reports.htm

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