Small is bountiful (but messy)
Informal irrigation and new directions for food security

Gerald Lacey Memorial Lecture
20 May 2013
Charlotte de Fraiture
This lecture

1. Irrigation and food security
2. Informal or small private irrigation
3. Individualization of irrigation and its potential implications for:
   - Food security
   - Equity
   - Externalities
4. New directions
1. Irrigation and food security
Investing in Irrigation

World Bank lending for irrigation

Food security =
increase in food production
Combat famines
Investing in Irrigation

World Bank lending for irrigation

Economically less interesting
Environmental concerns
Social concerns (big dams)
Disappointing performance

Billion dollars

Food price index

years

Investing in Irrigation

World Bank lending

Billion dollars

DAMS AND DEVELOPMENT
A NEW FRAMEWORK FOR DECISION-MAKING

THE REPORT OF THE WORLD COMMISSION ON DAMS

November 2000

Economically less interesting
Disappointing performance
Environmental concerns
Social concerns (big dams)

IIMI → IWMI
Investing in Irrigation

World Bank lending for irrigation

- Price volatility & food insecurity
- Declining food stocks
- Climate change

Billion dollars

years

Food security is achieved when all people at all times have physical and economic access to sufficient safe and nutritious food to meet their dietary needs and food preferences.

World Food Summit 1996

Food security >> food production
Food security is achieved when all people at all times have physical and economic **access to sufficient safe and nutritious** food to meet their dietary needs and food preferences

*World Food Summit 1996*

**Irrigation**
- Increase food production; smooth fluctuations
- Provide rural incomes to access food
- Diversify crops
Poverty and food

The nutrition puzzle

Why do so many people in poor countries eat so badly—and what can be done about it?

Feb 18th 2012 | ROME AND SÃO PAULO | from the print edition

The toll of malnutrition
Global deaths of children under 5 by cause

2008, % of total

- Diarrhoea: 15
- Pneumonia: 18
- Prematurity: 12
- Malaria: 9
- Birth asphyxia: 9
- Other: 34
- HIV/AIDS/Measles: 3

Total deaths: 8.8m
(35% of which are associated with malnutrition)

Sources: WHO; IFPRI

Agriculture and nutrition

Hidden hunger

How much can farming really improve people's health?

Mar 24th 2011 | DELHI | From the print edition
FACT SHEET

Major Research Goals

Now, we have

Develop high-yielding, climate-resilient cereals. We are investing heavily in heat-tolerant, climate-adapted cereals to increase productivity on the tens of millions of hectares affected annually by drought.

Address animal and plant diseases. We are applying advanced technology solutions to address animal and plant diseases that threaten food security. Investments will help to protect the production of nutritious staple foods in Africa, improve productivity, and mitigate the impacts of veterinary and plant diseases on livestock and crops.

Leveraging partnerships with the private sector to facilitate the commercialization of research outcomes and ensure market access for farmers.

cattle at risk from East Coast Fever in Africa.
## PRIORITY CROPS

<table>
<thead>
<tr>
<th>Sub-Saharan Africa</th>
<th>South Asia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>Rice</td>
</tr>
<tr>
<td>Millet</td>
<td>Wheat</td>
</tr>
<tr>
<td>Sorghum</td>
<td>Maize</td>
</tr>
<tr>
<td>Rice</td>
<td></td>
</tr>
<tr>
<td>Legumes</td>
<td></td>
</tr>
<tr>
<td>Groundnuts</td>
<td>Chickpeas</td>
</tr>
<tr>
<td>Cowpeas</td>
<td>Groundnuts</td>
</tr>
<tr>
<td>Beans</td>
<td></td>
</tr>
</tbody>
</table>

### FOCUS

Our investments in three areas:

1. Agricultural Policies
2. Access and Market Systems
3. Strategic Initiatives

We must focus these areas to build a robust system that...
Investing in Irrigation

Source: Based on World Bank and Food and Agriculture Organization data.
2. small private irrigation
Small private irrigation
Small private irrigation
Small private irrigation
Small private irrigation
• Initiated and financed by smallholder farmers themselves
• Owned and managed individually or in small informal groups
• Dynamic, market driven, hardly regulated
• Until recently limited recognition and support from governments, NGOs and donors
• Diversity of water sources: rivers, lakes, reservoirs and shallow groundwater (in SSA mostly surface water; SA groundwater)
• Cash crops grown for local markets: crops
  • dry season vegetables (SSA); Boro rice (South Asia)
• Small areas (often less than 1 ha)
• Low entry costs (not necessarily low cost)
• More and more motorpumps: 1-10 HP irrigating < 2 ha
  - Cheap imported from China (or India)
• Financed from savings or informal loans
• SSA: additional income few hundred dollars
• Spreading in unplanned way in rapidly growing sector
Some numbers

Å India: over 25 million privately owned wells, providing 70%+ of all irrigation water, most of irrigated area is under privately owned wells
  (interdependency with canal irrigation: seepage & conjunctive use)
Å Bangladesh: more than 85% of irrigated area is under privately owned wells
Å Indonesia: small pumps for irrigation from 1.1 to 2.2 million from 1998-2002
Å Thailand: 3 million small pumps in irrigation (in 2000)
Å Vietnam: 800,000 pumps

Pieces of evidence; no systematic database or inventory
Some *(guesstimated)* numbers- SSA

Å Nigeria ï 75% of irrigated area under small private irrigation; Niger ï 55%; Kenya - 15%
Å Tanzania 600,000 farmers involved
Å Ghana

### Comparison of Ghana’s Formal and Smallholder Irrigation Sectors

<table>
<thead>
<tr>
<th>Type – technology</th>
<th>No. of farmers</th>
<th>Area under irrigation</th>
<th>Investment costs USD per ha</th>
<th>Main crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public irrigation schemes</td>
<td>11,000</td>
<td>7,185 ha</td>
<td>10,000 – 15,000</td>
<td>Rice</td>
</tr>
<tr>
<td>Small reservoirs</td>
<td>25,000</td>
<td>6,000 ha</td>
<td>6,000 – 15,000</td>
<td>Rice/vegetables</td>
</tr>
<tr>
<td>Motorized pumps</td>
<td>160,000</td>
<td>120,000 ha</td>
<td>500-1000</td>
<td>Vegetables</td>
</tr>
<tr>
<td>Buckets, watering cans</td>
<td>335,000</td>
<td>66,000 ha</td>
<td>&lt;25</td>
<td>Vegetables</td>
</tr>
<tr>
<td>Treadle pumps</td>
<td>&lt; 100</td>
<td>&lt; 20 ha</td>
<td>500</td>
<td>Vegetables</td>
</tr>
</tbody>
</table>
3. Individualization of irrigation
- implication for food security
- equity issues & conflicts
- externalities & environmental concerns
- management of water resources
*Small private irrigation is profitable ($2500/ha)
* Additional cash income is (partly) used to buy food
Women involvement
Part of vegetables are for home consumption
## Farmer - Hand Watering - Dry Season

<table>
<thead>
<tr>
<th>Costs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>hired farm labor</td>
<td>$250</td>
</tr>
<tr>
<td>seeds</td>
<td>$100</td>
</tr>
<tr>
<td>fertilizer</td>
<td>$150</td>
</tr>
<tr>
<td>pesticides</td>
<td>$75</td>
</tr>
<tr>
<td>equipment &amp; fencing</td>
<td>$20</td>
</tr>
<tr>
<td>Credit costs</td>
<td></td>
</tr>
<tr>
<td>Variable cost per ha</td>
<td>$595</td>
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</tbody>
</table>

### Revenues

<table>
<thead>
<tr>
<th>Area</th>
<th>hectares</th>
</tr>
</thead>
<tbody>
<tr>
<td>area</td>
<td>0.2</td>
</tr>
<tr>
<td>crop type</td>
<td>vegetables</td>
</tr>
<tr>
<td>yield</td>
<td>4450</td>
</tr>
<tr>
<td>crop price</td>
<td>$0.53</td>
</tr>
<tr>
<td>gross crop revenue</td>
<td>$2359</td>
</tr>
<tr>
<td>net crop revenue</td>
<td>$1764</td>
</tr>
<tr>
<td>variable costs per farmer</td>
<td>$119</td>
</tr>
<tr>
<td>net crop revenue per farmer</td>
<td><strong>US$ / season 353</strong></td>
</tr>
</tbody>
</table>
Using a motor pump it can be even more profitable (larger area)

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<td><strong>costs</strong></td>
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<tr>
<td>irrigation cost</td>
</tr>
<tr>
<td>duration irrigation</td>
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<tr>
<td>irrigation costs/ha/season</td>
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Using a motor pump it can be even more profitable (larger area).
Equity issues

- In Ghana and Burkina Faso pump owners are male and belong to richest 20%
- In Bangladesh 90% of farmers cultivating > 2 acre own pump; only 6% of those with less than 0.4 acre have pump
- However smallholders access through water markets and pump rentals in South Asia, in SSA markets less developed
Governance and externalities

A Case study Korsimoro: small reservoir in Burkina Faso
Dam Rice area
32 ha rice downstream
285 hectares vegetables upstream
rented 1000 farmers, 67 individuals & 43 groups of about 20
Self-organization among vegetable farmers
Informal structures formalized
Upstream/downstream farmers partially same people
Conflicts between users: fishermen, pastoralists, rice farmers & vegetable farmers
Conflicts among vegetable farmers
Korsimoro case study

- Using small motorpumps is flexible, profitable, gives an additional income in the dry season (food security, poverty alleviation) more so than downstream.

- Pirates:
  - Take water unregulated
  - Don’t pay water fees
  - Don’t do maintenance
  - Pollute the water (fish get affected)
  - Block pastoralists’ access to reservoir
  - Cause erosion (?)

- Pioneers:
  - Add value to underperforming reservoirs
  - High level of self-organization
Korsimoro case study

Â Who is responsible for the dam?
Â Who gets priority?
Â How are conflicts resolved?
Â Should donors/government construct canal infrastructure downstream?
Â Should future irrigation infrastructure be designed differently to accommodate pumping from reservoirs or canals?
Â What is the role of irrigation departments?
Â Is small private irrigation energy-smart?
4. New directions?
Implications for water resources management

Millions of individual smallholders withdrawing water for agriculture from nearest source (GW, lakes, rivers, reservoirs, canals), growing numbers
Profitable, low investment, no large infrastructure, no communal management, no reliance on government or Water Users’ Association, no permits, no red tape
In South Asia: huge positive impact on poverty alleviation

- Common pool resource: tragedy of the commons (groundwater)
- Unregulated, unplanned, equity issues
- Small is not more beautiful: environmental risks
- High risk of over-abstraction and pollution
- Use of untreated waste water around cities (Accra), health concerns
- Many millions of individual water users are difficult to regulate, practically & politically
- Conflicts between water users and uses
- Changing role of irrigation departments. Who is in charge?
New directions: supporting small private irrigation?
Interventions to enhance small private irrigation sector

Equity: Improve technology access
- Pilot financial instruments
- Provide loan capital
- Support rental markets
- Explore irrigation service providers concept
- Link financing to existing rural development programs
- Improve understanding of gendered farming systems for better targeting of AWM technologies and financing options

Efficiency: Catalyze the value chain
- Provide better technical information to farmers and dealers
- Educate about marketing
- Promote ‘try-before-you-buy’ schemes
- Provide crop storage facilitates
- Develop registry of dealers
- Provide credit to dealers to enlarge stocks

Efficiency: Create policy synergies
- Align energy, import and water polices
- Review tax policies, import duties
- Create awareness about and simplify exemption procedures
- Privatize procurement and marketing of irrigation equipment

Environment: Take a watershed approach
- Consider multiple agricultural water management investments
- Develop systems to promote cooperation
- Undertake community based planning and monitoring of investments
- Develop alternative energy sources
Summing up

• Small private irrigation contribute significantly to income and food security

• It an ongoing, growing trend. Spontaneous. It works

• Large potential for poverty alleviation

BUT

• Unregulated, unplanned spread poses risks

• Need to reconsider water management institutions

• We need to think how best support this trend
  • Maximize benefits in terms of income and food security
  • Minimize externalities (environment, equity, conflicts)
When the wind changes direction there are those who build walls and those who build windmills.