TECHNOLOGY DEVELOPMENT AND THE MANAGEMENT OF IRRIGATED AGRICULTURE

Reinventing irrigated agriculture with farmers

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For quality of life

Water Management in Agriculture

Meet challenges of food production and sustainability

- *Adapt yesterday's irrigation to tomorrow's needs amd society*
- *Fight poverty by improving access to ag. water*
- *Manage agriculture to enhance ecosystem services*
- *Increase water productivity*
- *Respond to climate change*

STILL

- We need irrigation systems that work and profitable farming

HOW TO FIND CHANGE OPTIONS THAT GET THESE TAKEN UP

Presentation

(photo FAO)

- Look inside title
- Management of irrigated agriculture
- technology development

Case studies of research collaboration for change

- Netherlands (Harm Boesveld)
- Argentina (Daniel Prieto)
- Peru (Bernita Doornbos)

- What approaches should we build

- to work with farmers
- Work together
- Embed our knowledge with users

Managing irrigated agriculture

- More than water application and quantity applied
- Farmers performance preferences: timing, predictability, amount, quality, tractability, hassle
- Agro-ecological requirements

- Understand how field use relates
- - to system supply
- - the household (gender and power) and agrarian condition of the farmer

- Recognize profitability and value of production to farmers

- not only productive questions of yield quantity and quality

- Managers of irrigated agriculture are farmers, together with
- system managers (WUA, agency) and input and market suppliers
- politicians and policy makers who also shape the water and production context

Technology

Material object created by society

- hard system dependent on a soft system (institutions, knowledge…)
- has technical characteristics and service characteristics (what they can deliver)
- has technical content and embedding content

- socially constructed, has social conditions of use, social effects

Technology development

Social process- different actors interact continuously to shape technology outcomes

But which actors? Whose knowledge and preferences?

(scientists, agency engineers, farmers, WUA, politicians)

We can look at – Technology)Research (R), Uptake (U), Exchange (E)

Contexts of innovation and participation

1 ***Economic development and modernization***

Innovation concerns new activities improving linkages between resource use and production. Promotion of new technologies or institutions, vulnerable to blue print models and preferences of what is best

2 ***Joint planning and problem solving***, Participatory Technology Development. Innovation is shown in changed behaviours of people involved, in generation and transfer of knowledge. Technology is client driven and accountable, but still may face challenges of technical bias

3 ***Social inclusion, improved equity and reduced vulnerability***. Innovation is delivery of different benefits to different people, involving organised effort to increase control over resources and regulative institutions, with conscientisation of actors working for change.

Case study 1

Decision support for irrigation application for Dutch fruit growers

Motivations

Could raise production, influence fruit production. Control vegetative and reproductive growth

(also perhaps change water consumption)

Water and fertigation context

Approach

- Already a meteorological network in orchards for monitoring to help fruit quality and disease control
- Farmers wanted a decision support system for water supply, asking for a water balance approach they could also follow and link with other operations
- Phased approach 1991-2005 (15 years)

- Model designed. (IRRY) – grower friendly tool', orchard specific data climate. Crop, soil, groundwater, calculations with met data (not soil measurements)
- Tested at research station, many cultivation aspects explored, high involvement of fruit growers and extension services
- Pilot in 6 farms 1995-98, intensive supervision, demonstrations, publications, very careful control and calibration. Joint involvement, researchers, growers, commercial companies, subsides (saving water)
- Introduction project 1998-2005, supervised by extension services. Of the 41% responding to project study, 73% changed water application

Important circumstances

- Growers felt need
- There was yield improvement, giving economic gain
- Built on existing infrastructure and people
- Little new investment needed, some subsidies
- Close cooperation and communication between growers, researchers and extension services, structured process
- Time available and continuity
- Science present but user-friendly diverse output, spin-offs in technology, science and collaboration

T – R(+) U(+) E(+)

Case study 2 Argentina

- ‘Modernization’ of the Proyecto Rio Dulce Argentina

- Partial modernisation, effects on water delivery undocumented. View of under- utilisation of water, poor economic performance, small farmers not taking up recommendations on scheduling and crop production

- Staff of National Institute of Agricultural Technology (INTA)

- moving from agronomic research at field level to understand system water delivery to field, and farmers’ interests in new technologies.

- Working with staff of UER Provincial irrigation agency in charge

1996-2006

- Studies including PhD into performance done in collaboration with irrigation agency, flow measurements and field interviews (benchmarking but for farmer practices. Many students also involved)

Proyecto Rio Dulce, Santiago del Estero

System developing from old acequias, now large system

Partly modernized some sectors to quaternary level, some to tertiary level: elsewhere unlined canals. Local WUAs with operators (tomeros),

functioning of management and production affected by liberalization

Potential 120000 ha: 6880 permanent water rights 65% holdings <10ha, 1%>100ha. Land abandoned, low productivity and mechanization

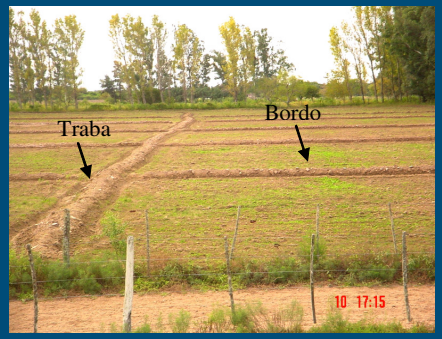
Surplus water allocated annually (PRETAs)

- Paid in advance, Annual crops, Enough capacity in canals,
- Taken up by large land owners through canals to land at end/ outside the core system

- Crops: Extensive crops- Cotton, wheat, maize, soybean; Vegetables;
- Forage (alfalfa, annual pastures)

Field irrigation

(photos D. Prieto)



- Traditional basin irrigation
- large flows controlled by bunds
- Issue of labour, time, so preserve approach, farmers argue application uniformity is acceptable
- Low income/profitability, off farm employment, limiting change
- Water application is a substitute for other resources (labour capital)
- Practices possible due to availability of water, relationships with tomeros, skills of tomeros

Case study ‘modernisation’ Argentina

contour field bunds,
Local internal control structures

happening in ‘’unmodernised’’ zones

Entrepreneurs
Economies of scale
Acquiring/consolidating land
Able to buy water under PRETAS
Old canals more easily changed
Access to equipment, labour

Findings and follow up

- Farmers irrigation practices still largely traditional, large pre-irrigation, few and large gifts (276mm). Unlikely to change without new options and support . Effective for them
- Farmers self-mobilise as necessary for maintenance, canal cleaning etc
- Care needed to preserve rights of small farmers v. large interests
- Irrigation pattern helped functionality of larger system
- Technical modernisation has not reversed impoverishment of small farmers
- On annual basis PRD is well supplied with water (RWS1.9) and adequacy is high (2.3). However important differences between zones
- **System runs well, responsive staff, flexibility result of management not optimized technology**
- Monthly analysis of performance can bring important insights, shows uneven distribution in year, suggest to use indicators relevant to farmers
- **Low potential in performance to outsiders, but 'resilience' visible to how farmers and agency staff adapt to new policies and crises**

‘Technology development’ processes

- Joint- research and development

–research-operational agency interaction uncommon

- Built on scientific and engineering guidelines
- Generated new monitoring proposals
- Needed planning and political support, funding and manpower time critical (measurement, follow-up, network building)

Technology R (+/-) U (+/-) E (+/-)

Case study 3 Highland Peru

- Sprinkler irrigation in Cusco region, Peru (3100-4000m)
- *Intervention-led take up of systems (Vilacanota) since 1990*
- *Spontaneous uptake by small farmers (Paucartambo)*
- Need for institutionalised learning about appropriate technology choice, design and use practices

- Independent research, plan for university-university linkages also support from and professional networks/individuals

- Longer term association Netherlands-Peru technical assistance, capacity building projects

Intervention-led projects for community systems

- Participatory approach evolved over time
- Engineers needing to understand farmers practicalities and preferences of operation
- Engineers emphasized water savings that would improve area and yield, farmers saw new crops and from changed water availability and changes in labour needs and operations
- Local water institutions critical to enable change

Spontaneous uptake

(photos Bernita Doornbos)

- Interests from hacienda times
- Changes in credit options
- Now wide availability of diverse hardware in local towns 1990s
- Able to use local sources, small plots, fits labour and household
- Can target new crops
- Experimentation in type, nozzle alteration, may share
- Still little advice on actual best operational practices
- Local institutions still critical for land and water access

Technology development taken up

- Sprinklers could usually be adapted into community irrigation systems, farmers also interested in their behaviour
- They enable tapping of new market opportunities (early potato, white maize)
- Community level organisations strong and interested to help (water rights, scheduling, equipment choice and use)
- Fitted into the production system of the household and labour deployment (men and women)
- Knowledge shared between farmers
- There are concerns about overapplication, soil degradation from use practices

As technology development project?

- Technology uptake shaping science, being open to designing new methods as necessary.
- Scientific and process dimensions – need more effort for documentation and embedding, actual training also limited
- Found ourselves outside technological performance criteria and scientific methods as difficult areas – science linkages challenging for individual approach
- Contact and feed back to private sector not easy, also lack of critical mass among researchers
- T (U+) R (+/-) E(-/+)

Conclusions

- There are many technology developments in the management of irrigated agriculture going on
- Farmers are resilient and innovative, need to understand social conditions shaping their actions, they are the field managers, backed by agency staff, researchers, politicians and policy makers (understand the soft systems, service characteristics and social embedding of the technology)
- Good partnerships are critical, users and knowledge providers, scientists, professionals and professionals
- Planning with resources and commitment is key

Social conditions of technology development

Farmers take up ideas, express requests, when

- Profitable livelihoods emerge, transaction costs are low
- Socioeconomic disparities are low
- There is equitable and flexible/'easy' distribution of water
- There is no indebtedness or exploitation under local organizations
- There is an "accountable" service provider who operates a system well
- Incentive structures for managers and service providers to ensure better water delivery and market opportunities, and farmers to accept and follow rules and rights

A challenge

Jose Flavio Sombra Saralva emphasized the importance of new engineers for Brazilian irrigation

So, what would be the characteristics of a ‘Brazilian irrigation School, or WINOTEC Irrigation School?

Particular choices of technology and service provision approach, design criteria, irrigation concept)?

Good science with social communication of knowledge?

Innovative designs but also user friendly?

Plural approaches – hi-tech and community-based?

Efficient but environmentally sound system

Reflexive engineering…..?

Thank you

photos IFAD

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