

# The Role of Horizontal Subsurface Drainage in Irrigated Agriculture in the Semi-arid and Arid Regions

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**Worldwide:** 20% of the cropped land is irrigated → contributing 35-40% of agricultural outputs

Problem: waterlogging and salinity

Indicator	Unit	World	Egypt	India	Pakistan
Irrigated area	(Mha)	272	3.4	57.2	16.7
Drained Area	(Mha)	190	3.0	2.5	7.5
of which subsurface drainage	(Mha)		1.9	0.025	0.32
Salt-affected areas	(Mha)		1.0	6.7	2.4
of which waterlogged	(Mha)		0.6	4.5	1.7

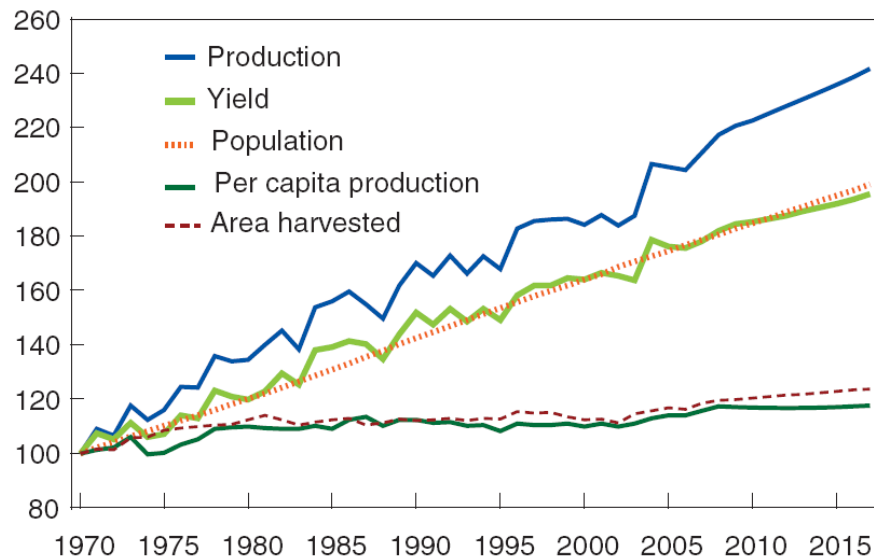
ICID, 2003



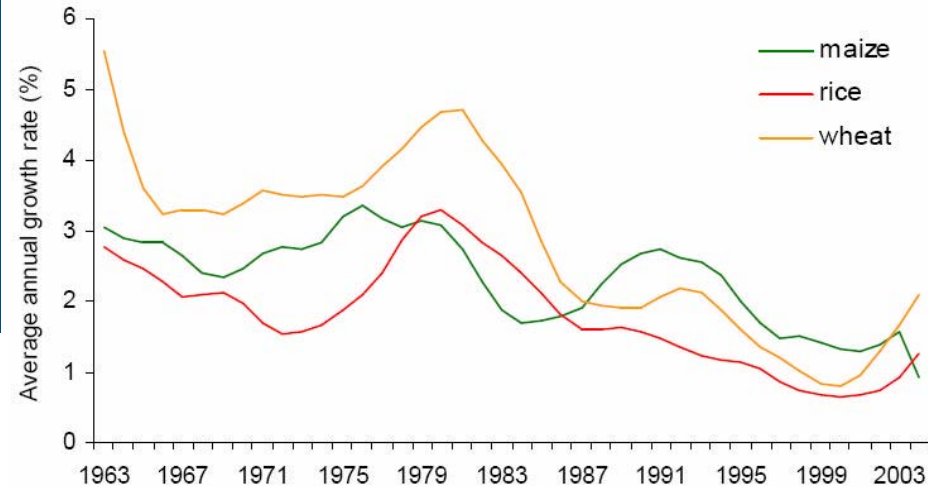
# The challenge

Food production has to be doubled in the next 25 years

Index: 1970 = 100



<sup>1</sup>Total oilseeds = soybeans + rapeseed + sunflowers.



World Bank, 2008

Majority of this increase has to come from existing agricultural lands

Trostle, 2008

# PhD Study - Research Question & methodology

## Research question:

Under which conditions is subsurface drainage a technically feasible, cost-effective and socially acceptable technology to sustain agriculture in irrigated lands?



## Methodology:

Comparing subsurface drainage practices in Egypt, India and Pakistan\*.

\* Based on lessons learned over the last 25 years in a number of research, education and advisory projects in these countries

# Are the subsurface drainage systems technically sound?

## 1. Need for ssd can be reduced by:

- Improving or restoring surface drainage
- Identifying areas in need for drainage by looking to the soil & hydrological conditions

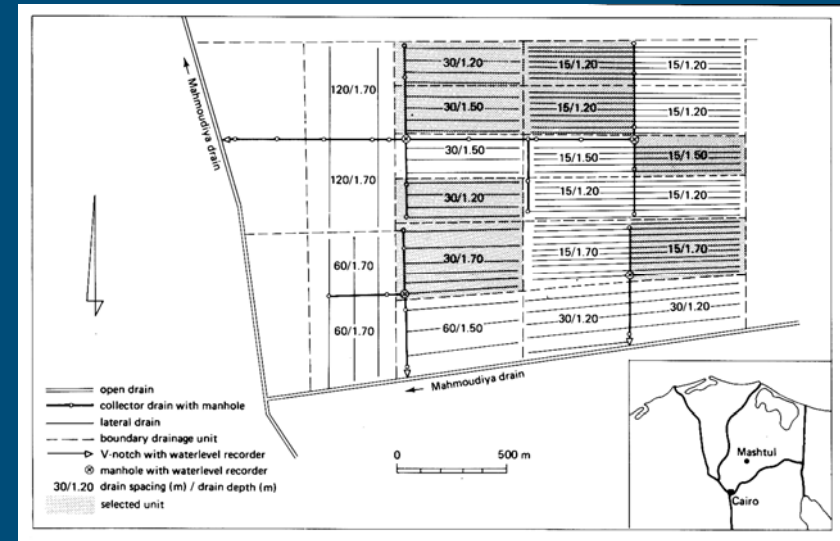
## 2. Need for operational control

(not only for areas with rice in the cropping pattern)

- Savings in irrigation water
- Reduction of drainage effluent

## 3. Reduction in design criteria:

	discharge	drain depth
	(mm/d)	(m)
Egypt	1.0 → 0.9	1.20 - 1.40
India	2.0 → 1.0 to 1.5	1.75 → 0.5 - 1.5
Pakistan	3.5 → 1.5	2.25 - 2.40 → 1.50 - 2.10



(Ritzema et al, 2007)

# Are the subsurface drainage systems technically sound?

(cont).



Nijland, 2000

## 4. Implementation practices:

From manual to large-scale implementation

→ improvements in:

- equipment
- materials
- planning
- organisation
- human capacity

# Are the subsurface drainage systems cost-effective?

## Installation costs for large-scale installation:

Egypt: € 750/ha

India: € 770 – 815/ha

Pakistan: € 1200/ha



# Are the subsurface drainage systems cost-effective?

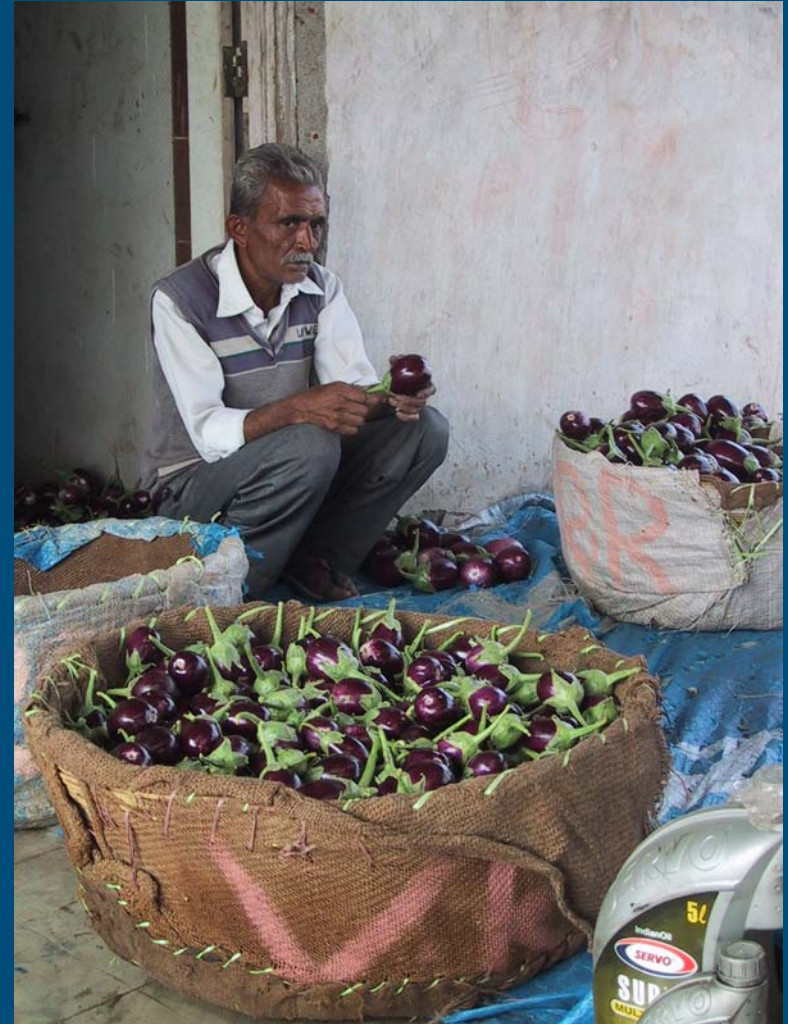
(cont.)

B/C ratio: 1.2 to 3.2

IRR: > 20%

Pay-back period: 3 to 5 years

Increase in the value of the land



# Is subsurface drainage an accepted practice?

## Egypt:

- EPADP: planning, design, implementation
- WAU's: operation

## India:

- CADA's
- Farmer

## Pakistan:

- WAPDA:
- PID: operation
- Water boards and

**Conclusions:**

- Top-down
- Farmers see the benefits
- Farmers are willing to contribute
- Farmers cannot do it on their own
- Farmers do not have the means

# Conclusions

- Is SSD technical feasible? Yes, but ...
- IS SSD cost-effective? Yes, but ...
- IS SSD socially accepted? Not yet, ....

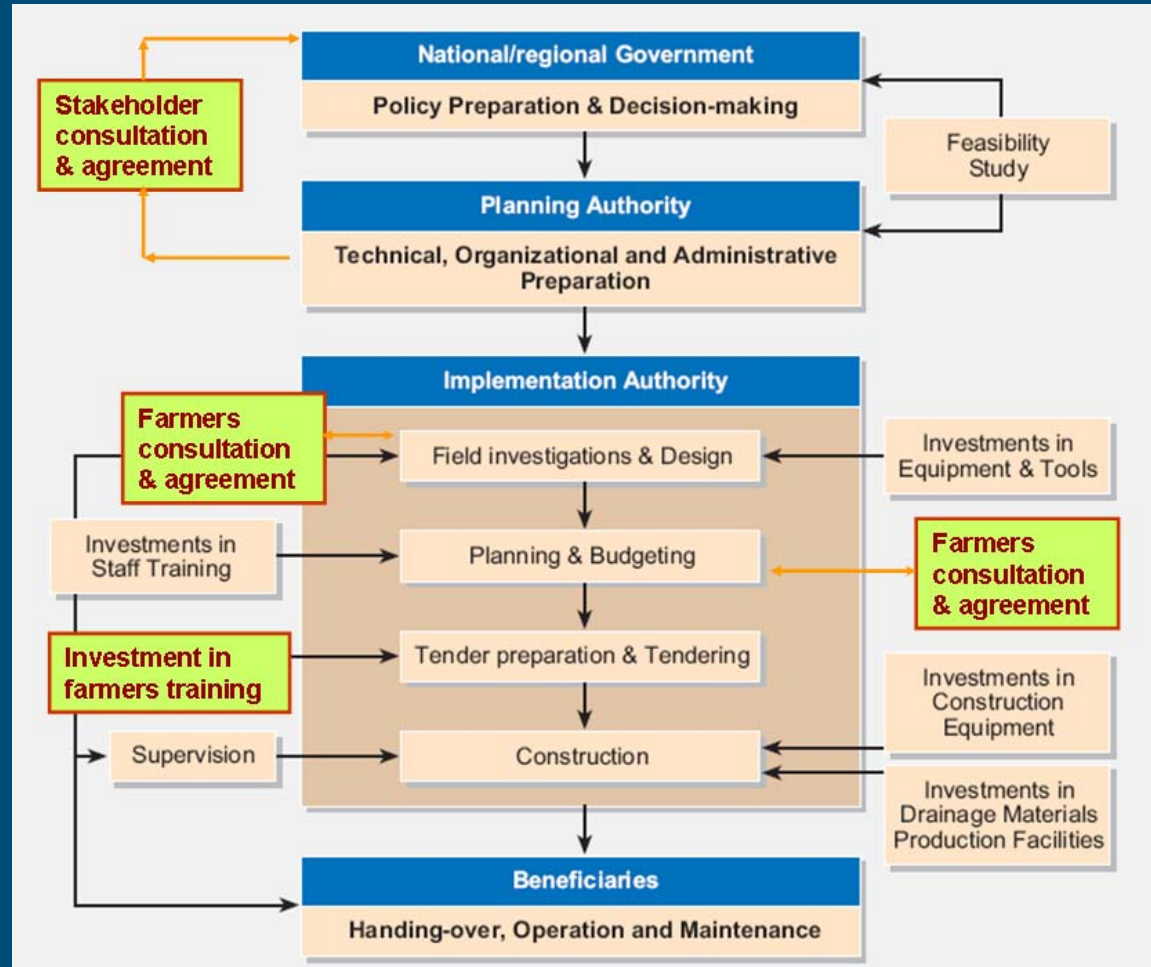


## The Way Forward



# Recommendations – the way forward

- A better balance between top-down and bottom-up
- A shift from standardization to flexibility
- A need for location-specific knowledge
- Capacity development by linking research, education and



Is there a role of horizontal subsurface drainage in irrigated agriculture in the semi-arid and arid regions?



My answer is  
**YES**



and your  
answer?

**Thank you for listening**

