

# Sanitation Problems in Developing Countries and Appropriate Technology

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# **1. Water, Sanitation and SWM**

## **Environmental Issues Related with Urban Living Environment**

### **(1) Safe Water Supply**

- Drinking water quality should be free from pathogens and chemical contaminants**

### **(2) Sanitation**

- Human excreta disposal, wastewater disposal is considered. In wider meaning, other aspects such as vector and rodents control, food safety, chemical safety, indoor air pollution, electromagnetic waves, noise and vibration reduction etc. are included in “sanitation”.**

### **(3) Solid Waste Management**

- Inadequate solid waste collection/disposal causes nuisances such as vector breeding, odor, leachate, smoke, scattering wastes.**

## People's concept towards utility and environmental management

	Cost	Benefit	willingness to pay	Affordability in household expense
(1)Food	self	self	very high	40%
(2)Utility				
Water Supply	self	self	high	3%
Electricity	self	self	high	
Gas supply	self	self	medium	
(3) Environmental Mgt.				
Sanitation	self	public	low	1%?
Solid waste	self	public	low	
Pollution control	company	public	rather low	
Global environment	self	all	very low	0%?

## 2. Water related diseases

### Types of Diseases Caused by Inadequate Water Supply

- a. Water-borne Diseases: Cholera, typhoid etc.
- b. Water-washed Diseases: Trachoma, skin diseases etc.
- c. Water-based Diseases: Guinea worm etc.
- d. Water-related vector-borne Diseases: Malaria etc.



a. Cholera  
(WB 1985)



b. Trachoma  
(WB 1985)



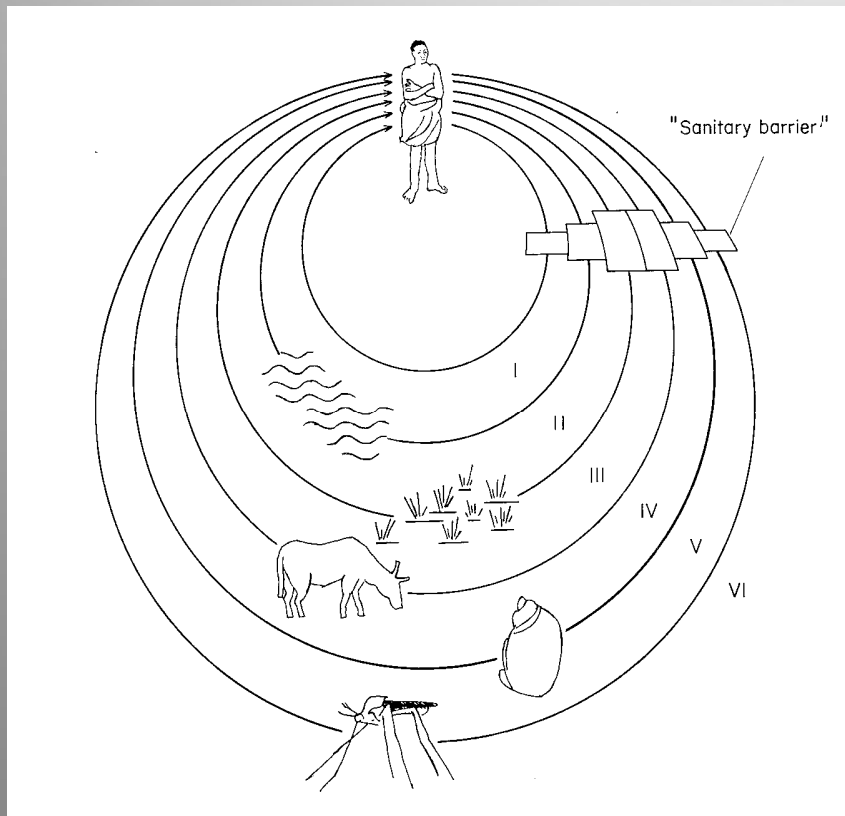
c. Guinea worm  
(WHO 1986)



d. Mosquito (Malaria)  
(WHO 1988)

# Health Problems and Related with Sanitation

## Diseases Caused by Inadequate Sanitation



- I. **Fecal-oral disease (non- bacterial)**
- II. **Fecal-oral disease (bacterial)**
- III. **Soil-transmitted helminthes**
- IV. **Beef and pork tapeworms**
- V. **Water-based helminthes**
- VI. **Excreta-related insect vectors**

Source: Feachem et. Al., Sanitation and Disease, WB, 1983





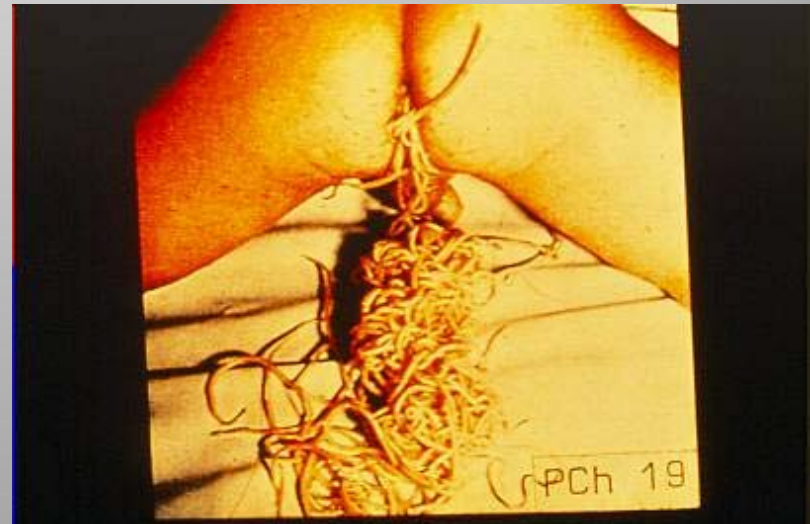
**People walking on bare feet**



**Hookworm sucking blood from intestine**



**Excreta use in agriculture (WB 1985)**



**Roundworm patient**

### 3. Environmental Problems and Health

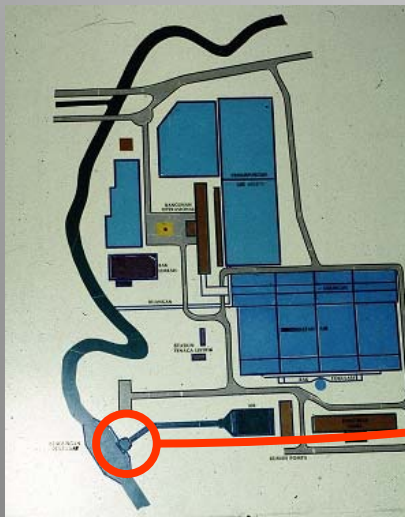
#### River Water Pollution and Need for Safe Water Supply



Dug well in Slum area (Indonesia, 1993)



Water vendors (Indonesia, 1993)



Progadong Water Purification Plant (PWPP) (Indonesia, 1993)



Contaminated Water Intake Point at PWPP (Indonesia, 1993)



## Examples of Off-site Sanitation



Construction of Sewer  
Pipes (Indonesia, 1994)



Oxidation Ditch (Indonesia 1994)

Sewage System (Wet Off-site)



Vacuum Trucks (Indonesia 1994)



Septage/ Nightsoil Treatment Plant  
(Indonesia 1994)

Cartage and Nightsoil Treatment (Dry Off-site)



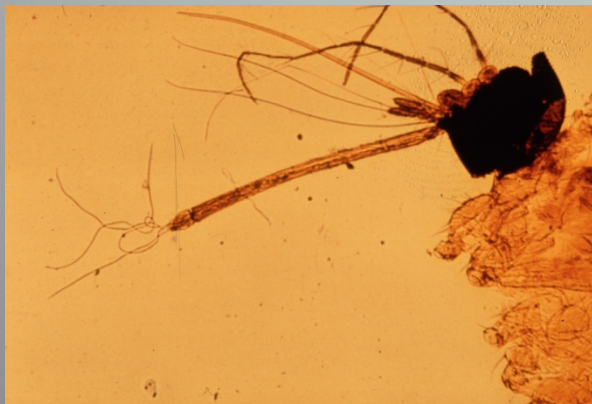
## An example of Disease Caused by Inadequate Drainage (Filariasis)



Poor Drainage (World Bank, 1985)



Mosquitoes Breeding (WB, 1985)



Infection of Microfilaria (WB, 1985)



Filariasis Patient (WB, 1985)

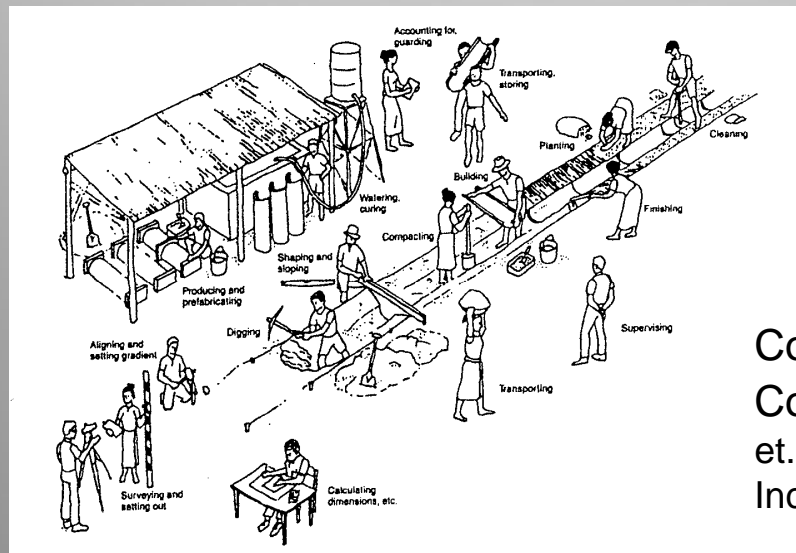
## Construction of Drainage



Vietnam, 1994



Pakistan, 1999



Construction of Drainage with  
Community Participation (Cairncross  
et.al., Surface Water Drainage for Low –  
Income Communities, WHO)



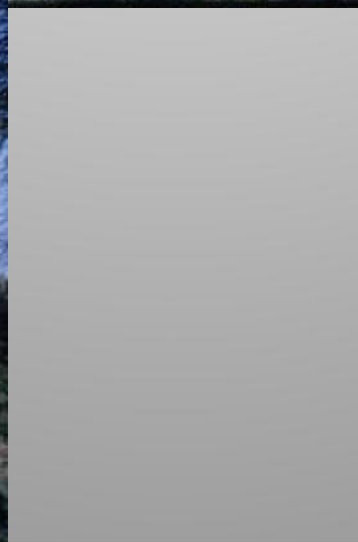
# SYRIA river flow





# JORDAN

## Wastewater Reuse







## **4. Importance of Appropriate Technology and “software”**

**Environmental Improvement cannot be achieved without the idea of “Appropriate technology” and adequate “software” as the support.**

### **(1) An Example of the Definition of “Appropriate Technology”**

- Technically viable, Economically feasible, Culturally Accepted, Environmentally Sound**

### **(2) The “Software” to Support Technology**

- Community participation, Gender issue, Capacity building, Environmental education, Promotion campaign, Intersectoral coordination, Public-private partnership etc.**

## Need for Adequate On-site Sanitation



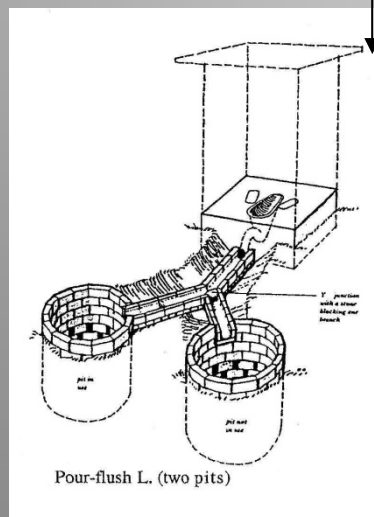
Open Defecation  
(Bangladesh, 1994)



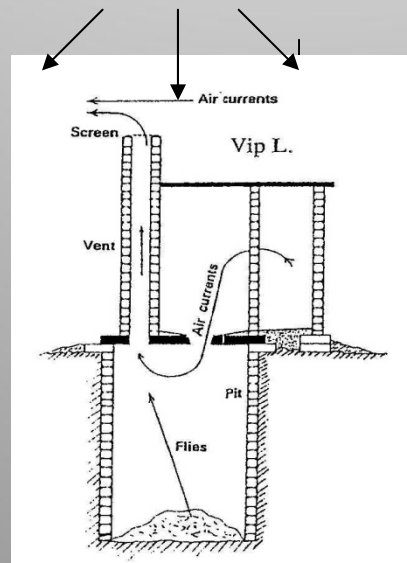
Overhung  
Latrine  
(Bangladesh,  
1994)



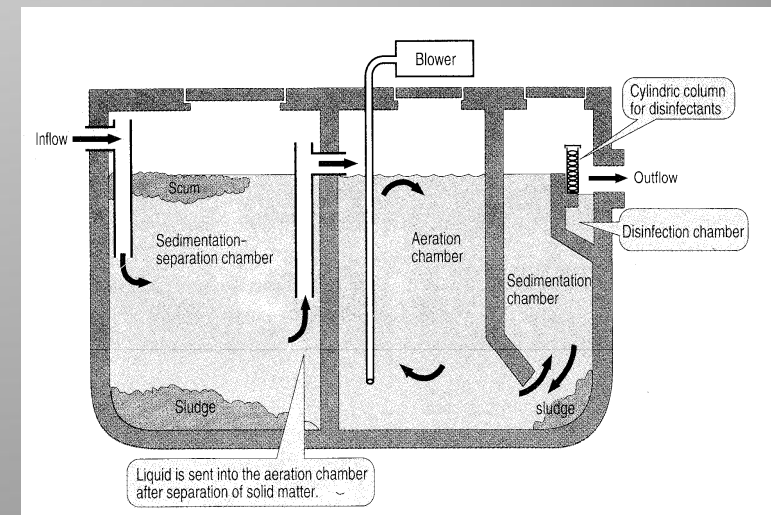
Bucket latrine  
(World Bank, 1985)



Septic Tank /  
Leaching Pit



Pit Latrine



Johkasou

# Steps of improvement

Demonstration→consolidation→expansion

Step-wise improvement

ex. Open defecation→Cat method→pit latrine

Possibility of leap frog?

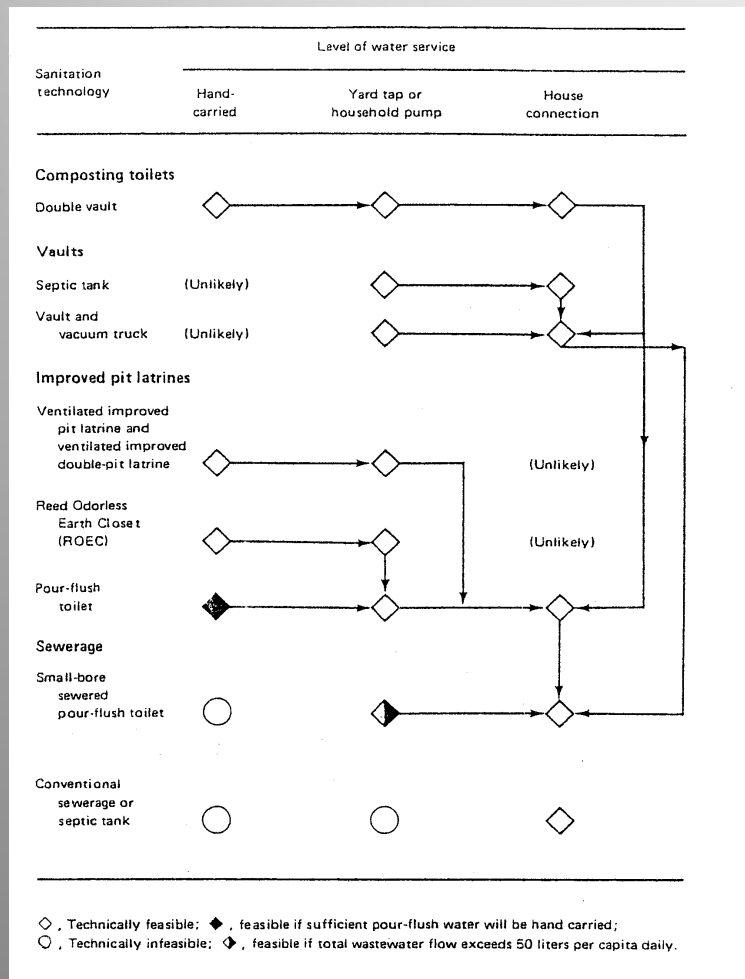
Use of upgradable technology to avoid  
duplicated investment

ex. Septic tank→Use as an intersepter tank



# Environmental Problems and Measures to be Taken

## Relationship between Water Supply and Sanitation



1. When water is hand carried, appropriate sanitation method is latrines without the use of water
2. If water is available at households, pour-flush toilets becomes available
3. House connection of water supply pipes enables conventional sewage system

Appropriate Technology for Water Supply and Sanitation

—A planner's Guide, World Bank, 1980

# Importance of “Incentive”

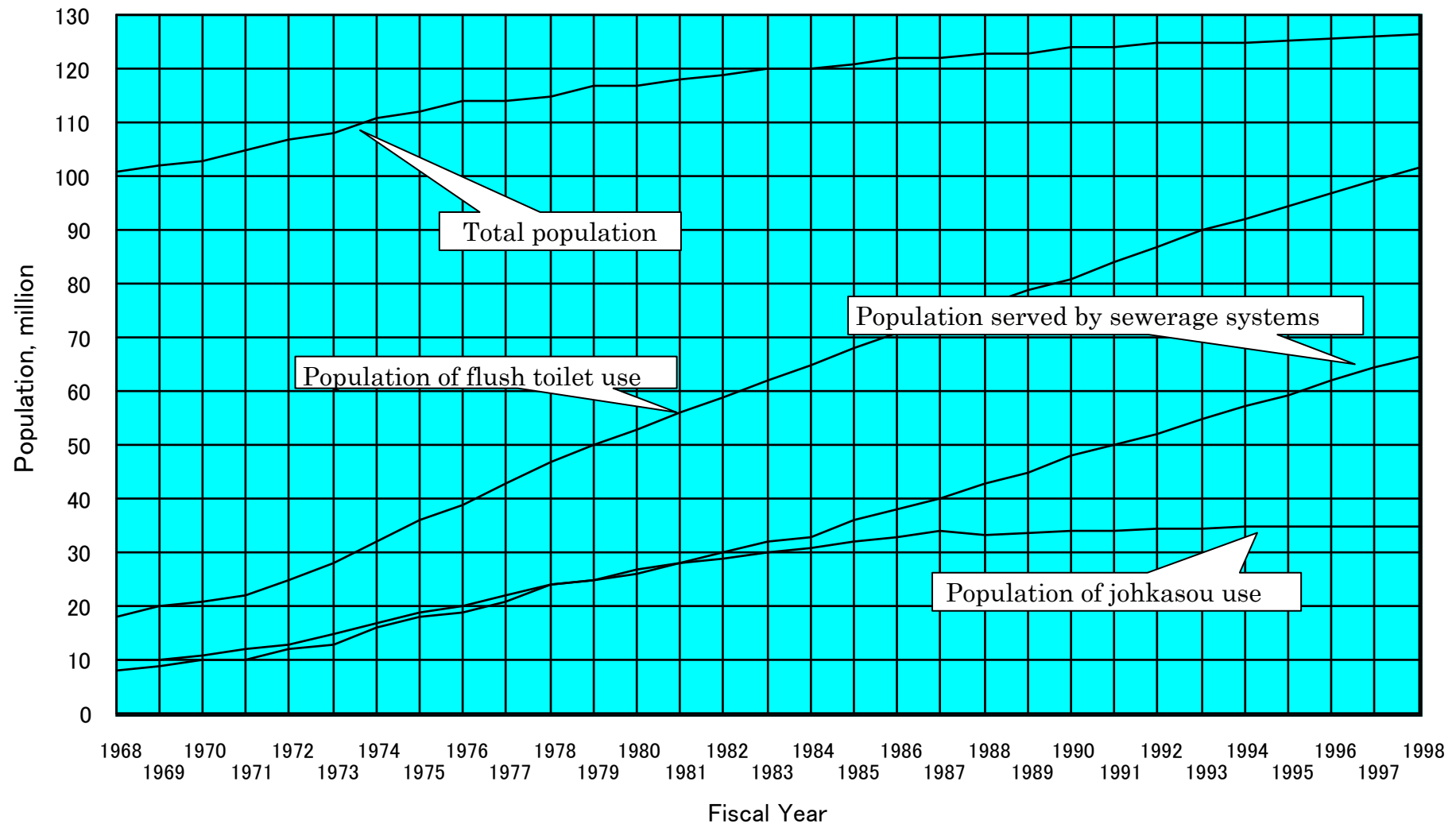
Money, leisure time, happiness, reward etc.

Status symbol

Myanmar's success story

## Case study –Japanese Johkasou

- Incentive for people was “water flush”
- Existence of care takers
- Subsidy from government



# Ring latrine in Bangladesh

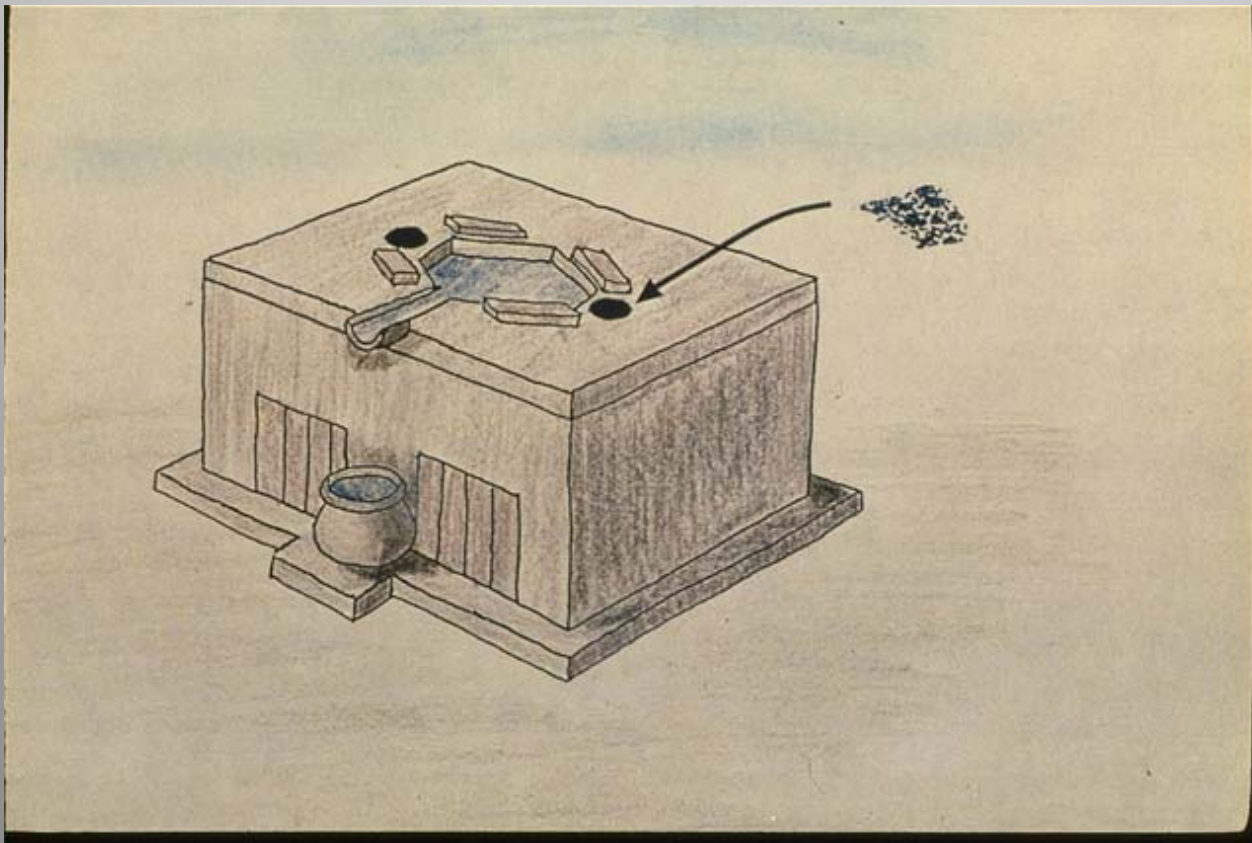
- Attitude change is not needed
- Incentive for ring manufacturers
- High population density helped commercialization
- Status symbol





# Vietnamese compost toilet

- Culturally accepted (traditional use of human excreta)



WB(1985)

# Indian public toilet

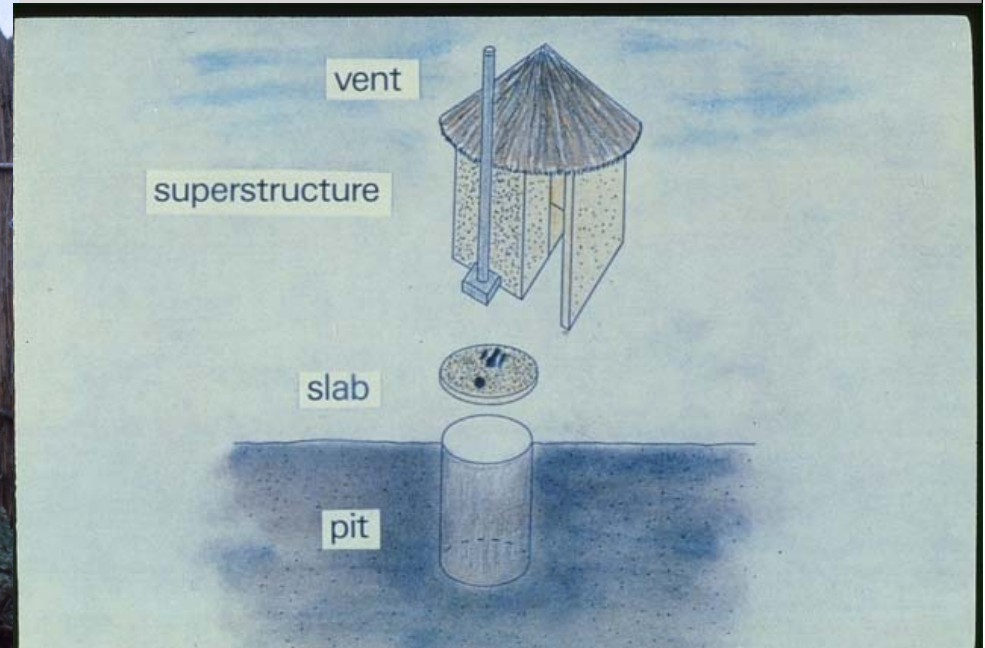
- Payable public toilet and inhibition of private ones





- *VIP latrine in Zimbabwe*

*Incentive for users:  
status symbol*



(WB, 1985)

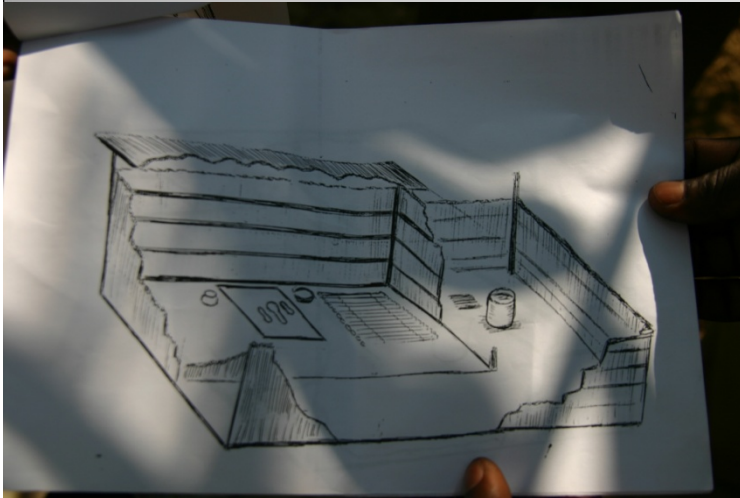






# Mozambique

- Poverty and low population density are constraints



# MCK in Indonesia

- Water related facilities are combined
- Run by the community





