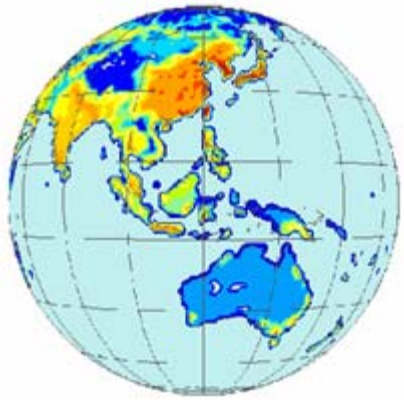
Water management model development in SDB



Yasuaki Hijioka, Yuzuru Matsuoka, Kiyoshi Takahashi, Hideo Harasawa, Hiroki Mori

NIES and Kyoto University

10th AIM Workshop, NIES, 10-12 March 2005

Objectives of water management model development in SDB

- Focus on water demand and water supply and sanitation services
  - Water demand
    - ✓ Sectoral assessment: Domestic, Industry, Agriculture
    - ✓ Water savings: Technology, System, Institution
  - Access to improved water supply and sanitation
    - ✓ Millennium Development Goals 7, Target 10: Halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation
    - ✓ VISION 21: By 2025 to provide water, sanitation, and hygiene for all
  - Current situation of access to safe water and sanitation
    - ◆ Around 1.1 billion people globally do not have access to improved water supply, whereas 2.4 billion people do not have access to any type of improved sanitation. About 2 million people die every year due to diarrhoeal diseases.
- Provision of optimal sustainable development path utilizing SDB

http://www.developmentgoals.org/Environment.htm

Category of “Improved” and “Not improved” water supply and sanitation technologies

BOX 1.5 WATER SUPPLY AND SANITATION TECHNOLOGIES CONSIDERED TO BE “IMPROVED” AND THOSE CONSIDERED TO BE “NOT IMPROVED”

The following technologies were considered “improved”:

Water supply	**Sanitation**
Household connection	Connection to a public sewer
Public standpipe	Connection to septic system
Borehole	Pour-flush latrine
Protected dug well	Simple pit latrine
Protected spring	Ventilated improved pit latrine
Rainwater collection	

The following technologies were considered “not improved”:

Water supply	**Sanitation**
Unprotected well	Service or bucket latrines (where excreta are manually removed)
Unprotected spring	Public latrines
Vendor-provided water	Open latrine
Bottled water[1]	
Tanker truck provision of water	

[1] Not considered “improved” because of limitations concerning the potential quantity of supplied water, not the quality.

Example of water management assessment

- Target:
  - Halve by 2015 the proportion of people without sustainable access to safe water and sanitation
  - By 2025 to provide water, sanitation, and hygiene for all
- Country: India, China, Thailand
- Output: Country-wise projection
  - Coverage of water supply and sanitation technologies
  - Investment, operation and management cost
  - Water supply (Water volume for domestic use)
  - Health impacts: Diarrhea disease
- Start year: 2000, Target year: 2015, 2025
- Data: GDP, Population, Improved water supply and sanitation data (Coverage, Cost, Unit water use (L/person/day), Potential risk of diarrhoeal mortality based on access to improved water and sanitation)

Household connection, Health impact

- Cost of Household connection (HC)
  - Total water use in HC = Residential water use + Commercial water use + Unaccounted for water (UFW)
  - Unit cost: $/m^3 ▸▸▸ assess effectiveness of UFW reduction
- Health impacts : Potential risk of diarrhoeal mortality
  - Assessment of relative risk potential based on access to safe water supply and sanitation

Scenario	Water supply	Sanitation	Diarrhoeal Risk
S1	HC	IS with SC	2.5
S2	IWS without HC	SC	4.5
S3	IWS without HC	IS without SC	6.9
S4	NIWS	IS with SC	6.9
S5	IWS with HC	NIS	8.7
S6	NIWS	NIS	11.0

Case 1

- Case 1: Focus on technology selection
  - Case 1.1

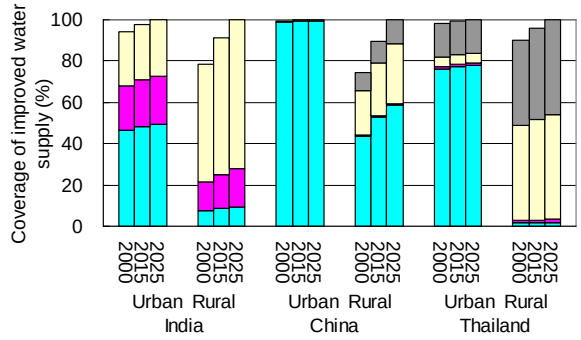
    Keep up present ratio of technologies until 2025

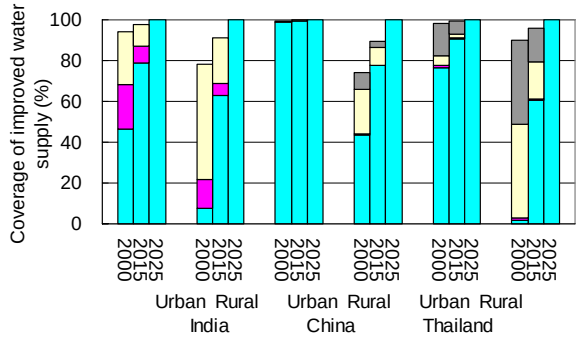
  - Case 1.2

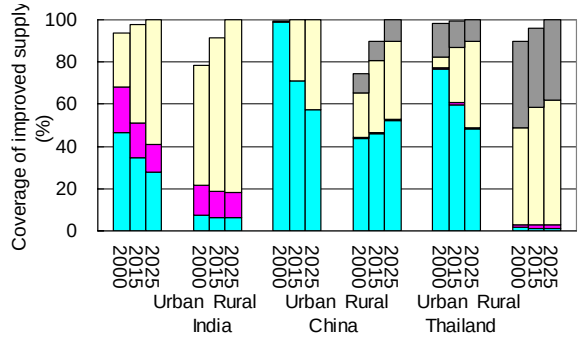
    Provide household connection and sewer connection for all by 2025

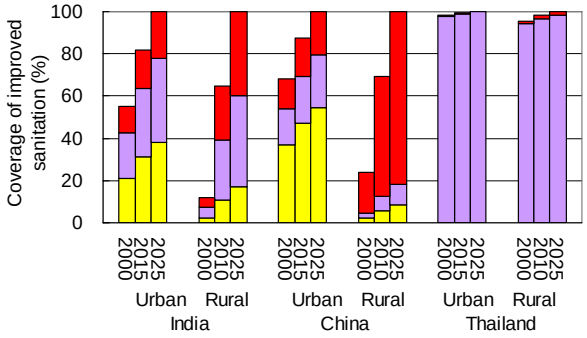
  - Case 1.3

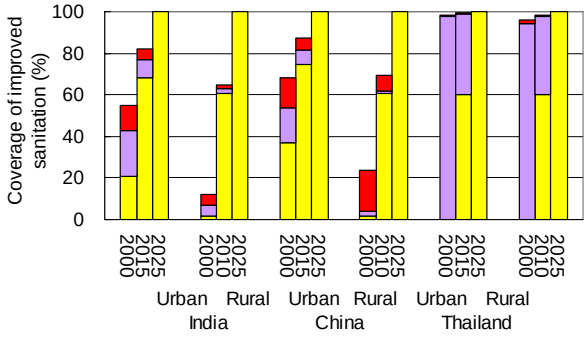
    Provide cheap technologies (Well/Pond/Borehole and VIP/Simple pit latrine) for additional people who can access to improved water and sanitation

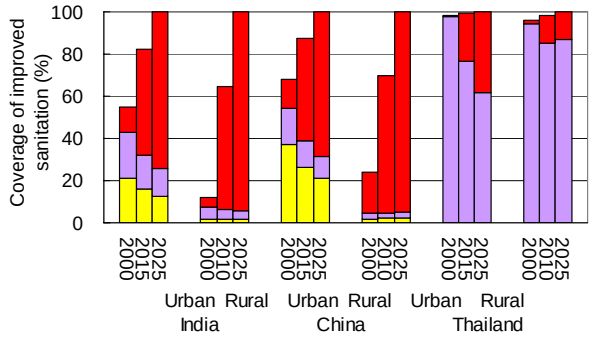


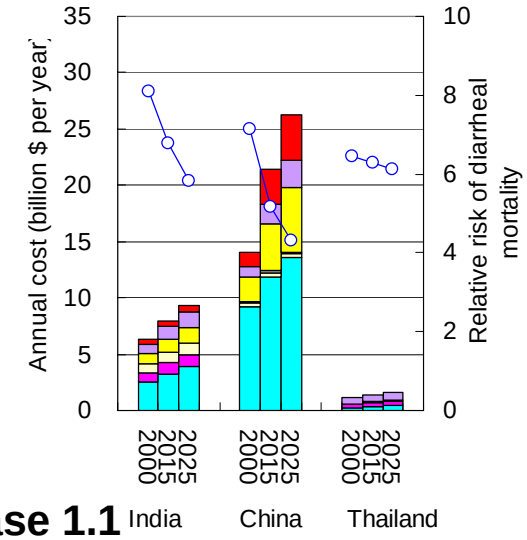




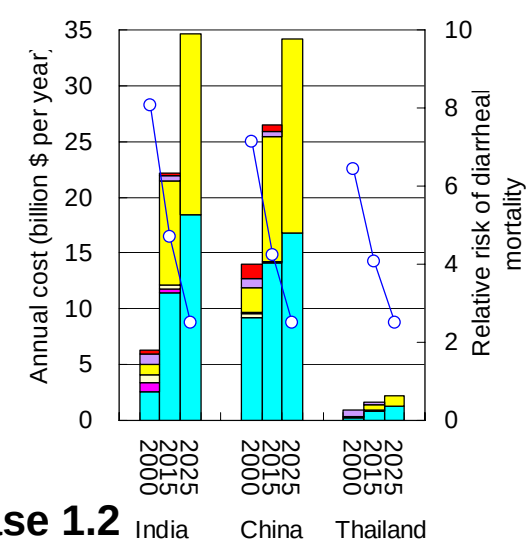




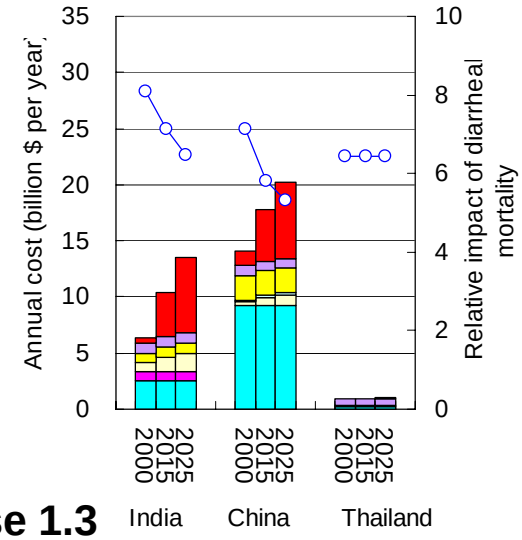




Case 1.1



Case 1.2



Case 1.3

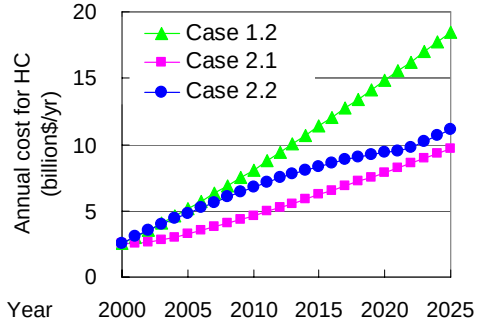
Household connection
Public standpoint
Well/Pond/Borehole
Rainwater
Sewer connection
Septic tank
VIP/Simple pit latrine
Diarreha

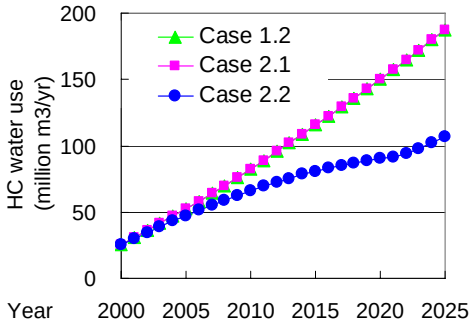
Case 2

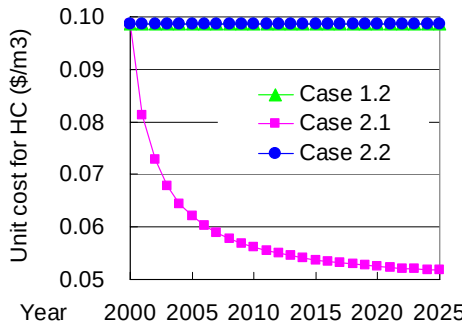
- Case 2: Application of SDB for Case 1.2 (Provide household connection and sewer connection for all by 2025)
  - Efficiency of water supply management
    - Annual cost = Investment cost + O&M cost
      - O&M cost (C_t) = 10% of annual cost
      - Actual O&M = C_t/m_t, $m_t = 1-m^0*\exp(1-\beta t)$
      - m^0 is estimated by “Number of staff/connection”
  - Reduction of Unaccounted for water
    - Unit cost: 1% reduction ▸▸▸ 0.22$/person/year
    - Minimum UFW ratio: 10%

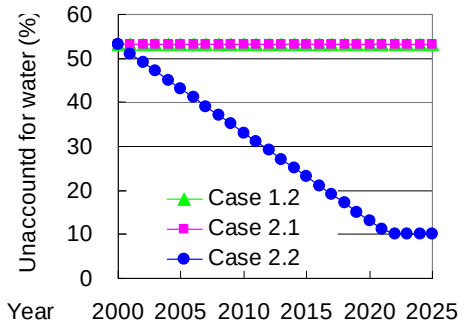
  - Case 2.1: Improvement of water supply management (β =5%)
  - Case 2.2: Improvement of UFW (Reduction rate = 3%/yr)

India

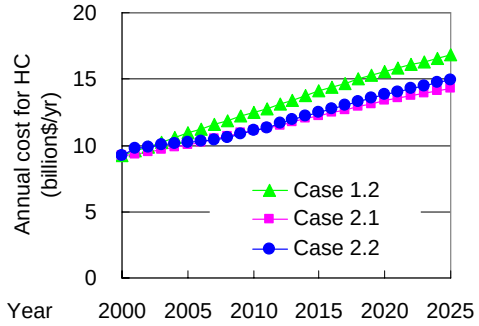


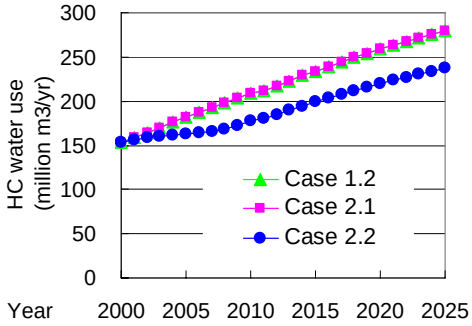


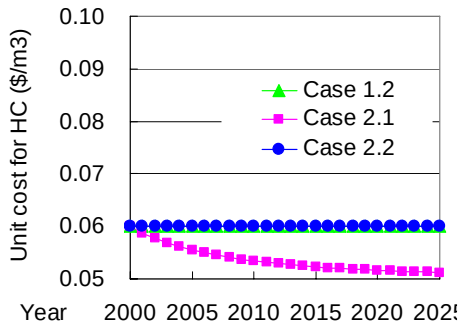


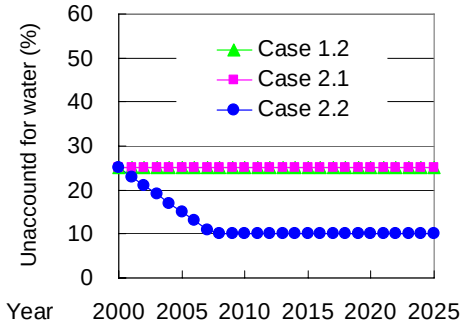


China

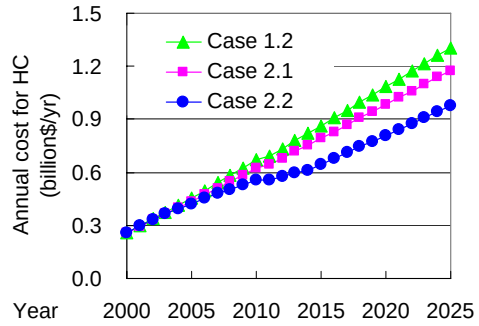


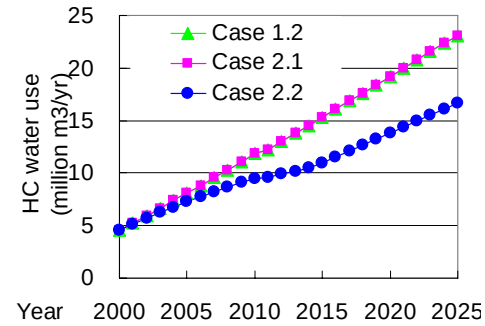


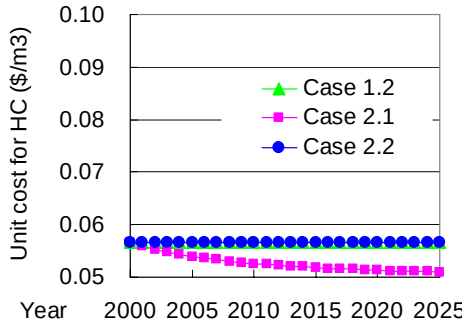


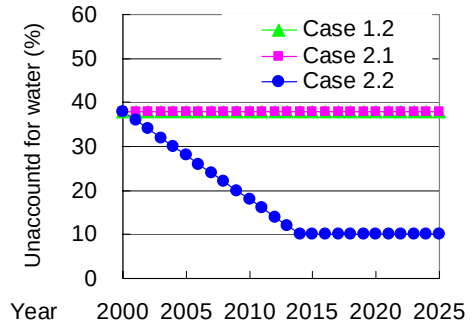


Thailand









Annual cost for HC | **Annual HC water** | **Unit cost for HC** | **Unaccounted for water**

Future task

- Domestic water use
  - ✓ Detailed data collection
  - ✓ Parameter evaluation
- Industrial water demand
- Agricultural water demand
- Water pollution
- Installation of water reuse system