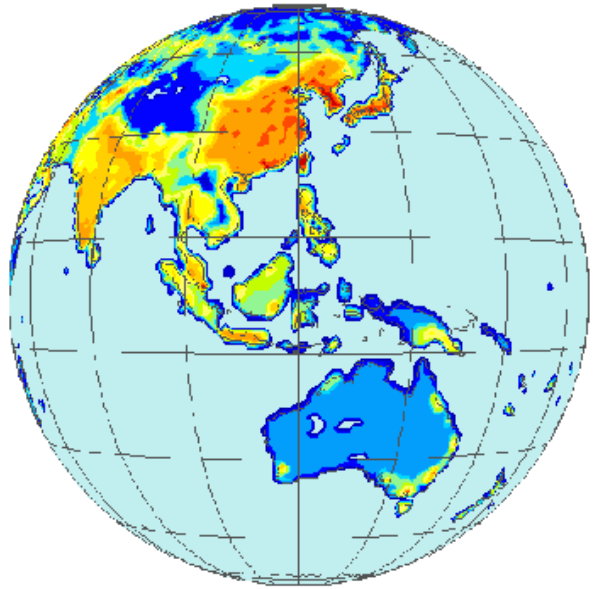
Introduction of water management in AIM/CGE



Yasuaki Hijioka

National Institute for Environmental Studies

APEIS Training Workshop

NIES, 8 December 2004

Presentation outline

- Background
  - Water issues
- Objectives of water management model development in SDB
  - Present situation of global water use
  - Millennium development goal
  - Improved water supply and sanitation
- Outline of model structure
  - Model concept
  - Model structure coupling with CGE model
  - Necessary data
  - Future task

Water issues

- Water availability (Dr. Takahashi developed the model coupling with GCM data)
  - Global warming will lead to change of the global hydrological cycle
  - Changes in the total amount of precipitation and its frequency and intensity
  - Changes in the magnitude and timing of run-off and the intensity of floods and droughts
- Water demand
  - Rapid increase of population and life style change caused by economic growth have increased water demand dramatically
- Basic water requirement for human activities
  - All peoples, whatever their stage of development and their social and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs (UN).
- Water quality degradation and health impacts (next step)
  - Wastewater treatment, Eutrophication, Diarrhea, etc…

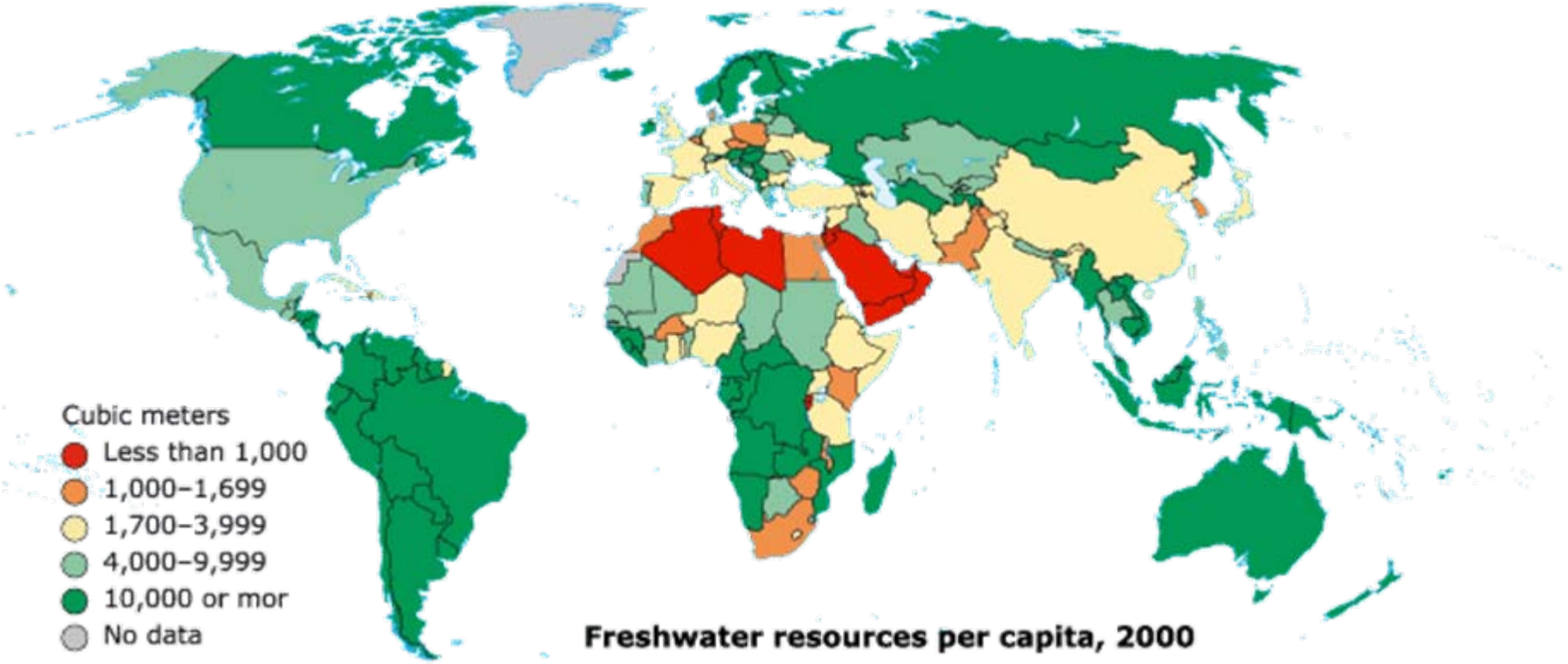
Objectives of water management model development in SDB

- Focus on water demand and water supply and sanitation services
  - Water demand
    - ✓ Basic water requirement for human activities
    - ✓ Sectoral assessment: **Domestic**, Industry, Agriculture
    - ✓ Water savings: Technology, System, Institution
      - ◆ Water savings are essential to adapt water availability decrease
  - Access to improved water supply
    - ✓ Lack of clean water is the main reason for water borne diseases
    - ✓ Connecting all households to safe water would be necessary for improving health and reducing the time spent collecting water.
  - Access to improved sanitation
    - ✓ Improved sanitation services and good hygiene practices are needed to reduce the risk of water borne diseases

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

Per capita water use (m^3/person/year)

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

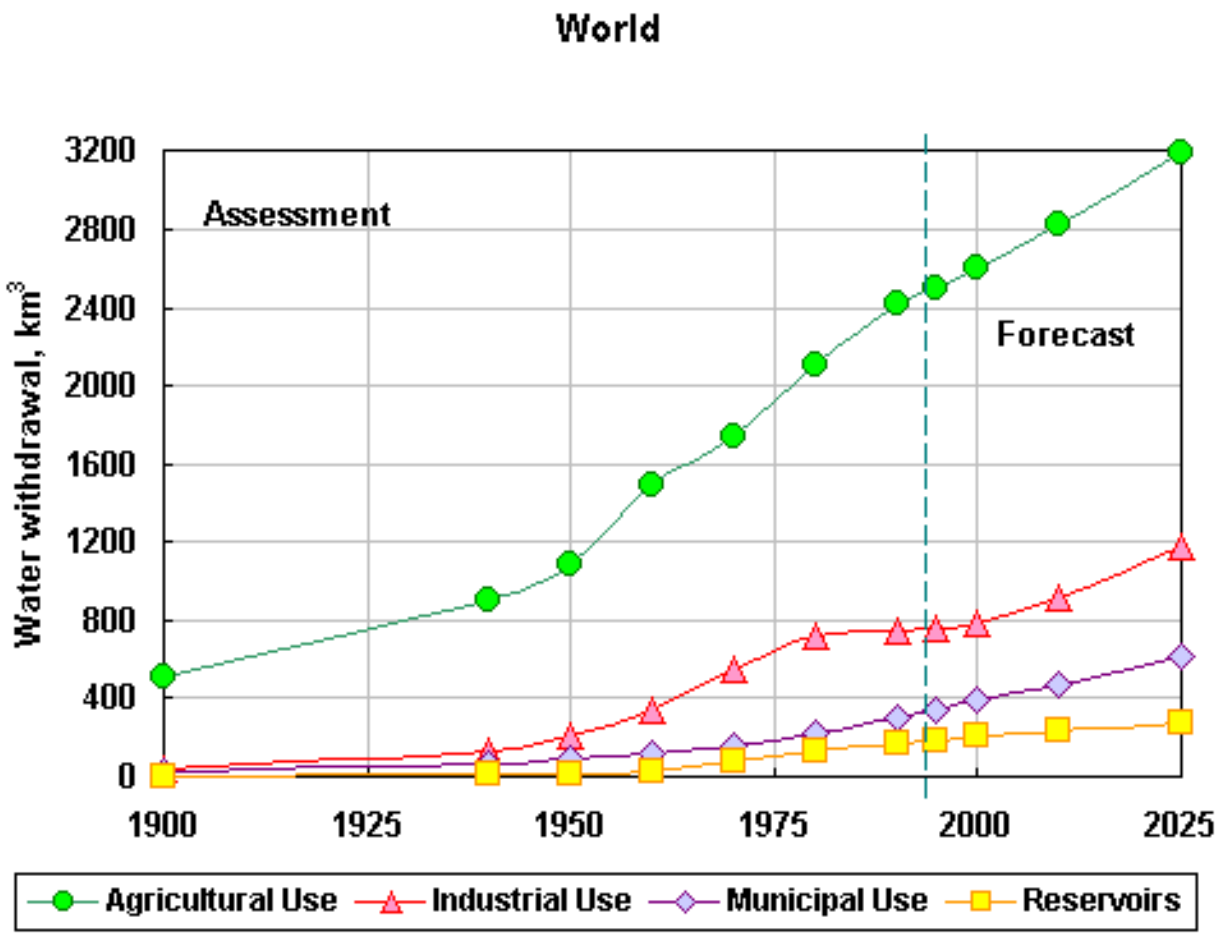


- **Per capita water use = Water availability / population**
- **Water supply condition is affected by the relationship between water demand and its availability. The demands may vary considerably between different countries and different regions within a given country depending on the sectoral usage of water.**

Global water use

(http://webworld.unesco.org/water/ihp/db/shiklomanov/summary/html/figure_9.html)

- Sectoral water withdrawal in the world
- Agriculture receives 66% of total water withdrawal in 2000
- In the future the role of agriculture will slightly decrease relative to industrial and domestic water withdrawal
- An additional evaporation from reservoirs greatly contributes



Millennium development goals (MDGs)

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

- MDGs: Goal 7, Target 10
  - Halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation
    - ✓ Clean water contributes to better health
    - ✓ Water in higher demand
    - ✓ Improved sanitation reduces health risks
- VISION 21
  - By 2025 to provide water, sanitation, and hygiene for all.

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	

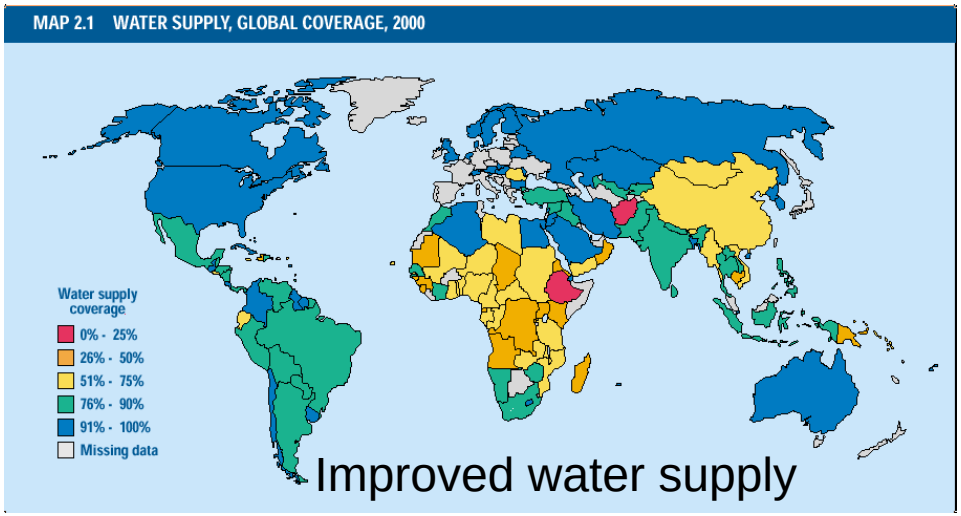
The following technologies were considered “not improved”:

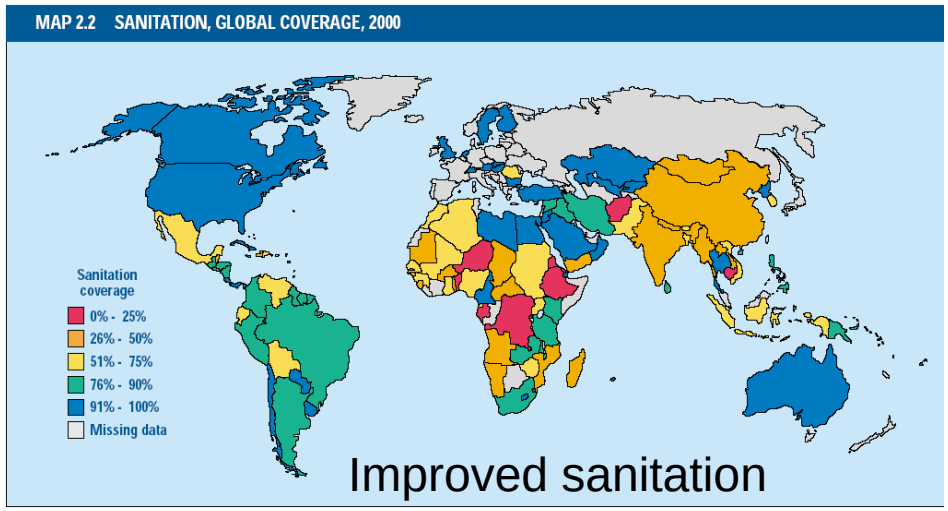
Water supply	**Sanitation**
Unprotected well	Service or bucket latrines (where excreta are manually removed)
Unprotected spring	Public latrines
Vendor-provided water	Open latrine
Bottled water[1]	
Tanker truck provision of water	

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

Access to improved water supply and sanitation

(WHO and UNICEF, The Global Water Supply and Sanitation Assessment 2000, 2000)





- The maps show clearly how sanitation coverage is much lower than water supply coverage
- Few countries in Africa have either water supply or sanitation coverage of more than 90%.
- WHO and UNICEF reported coverage data of improved water supply and sanitation
  - Country-wise data
  - Technology of improved water supply and sanitation

Development of water management model

- Target area: Global, Region, Country, County
- Unit area: Region, Country, County, City
- Basic concepts
  - Separation of urban and rural area
  - Assessment of water demand considering water supply and sanitation conditions
  - Sector: 1) Domestic, 2) Industry, 3) Agriculture
  - Water demand is basically decided by water supply and sanitation
  - Installation of improved water supply and sanitation are calculated based on environmental investment

Development of water management model

Existing model structure (WaterGAP)

- "Structural change" of water use is that the per unit water use changes with the development of economies and lifestyles.
- Domestic water intensity is a function of per capita GDP and time.
- Country-specific estimates
- With and without access to safe drinking water are considered
- Per capita water use without access to safe water: 7.3 m^3/yr (20 l/d).
- Sigmoid curve
- The second main concept used to model water use is technological change.

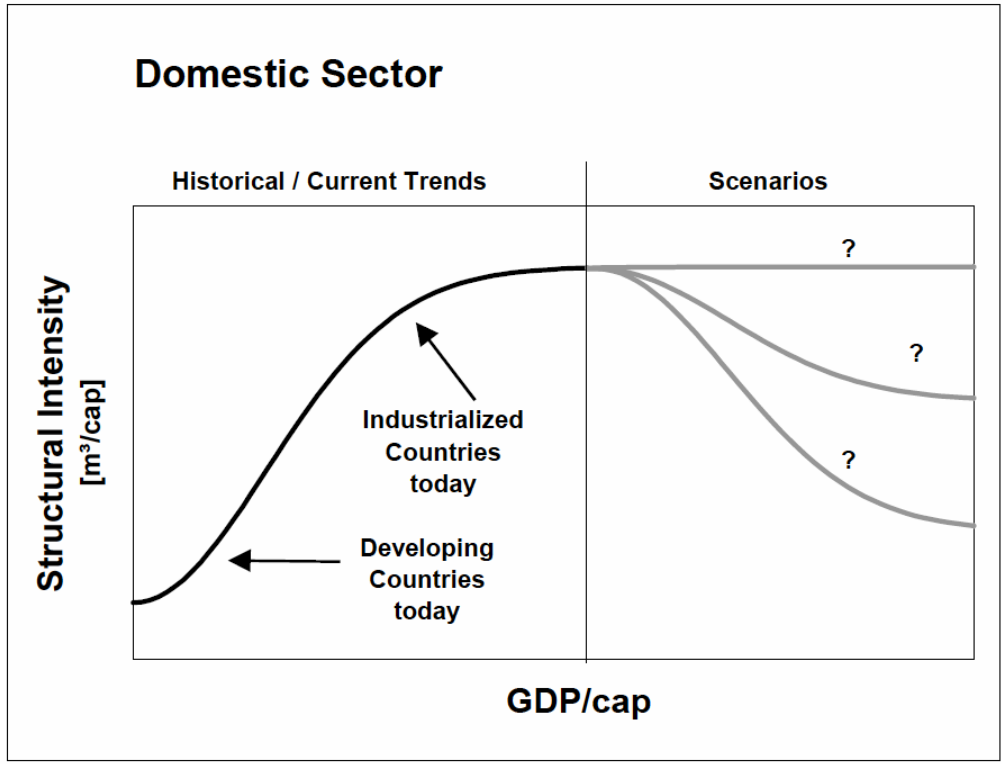
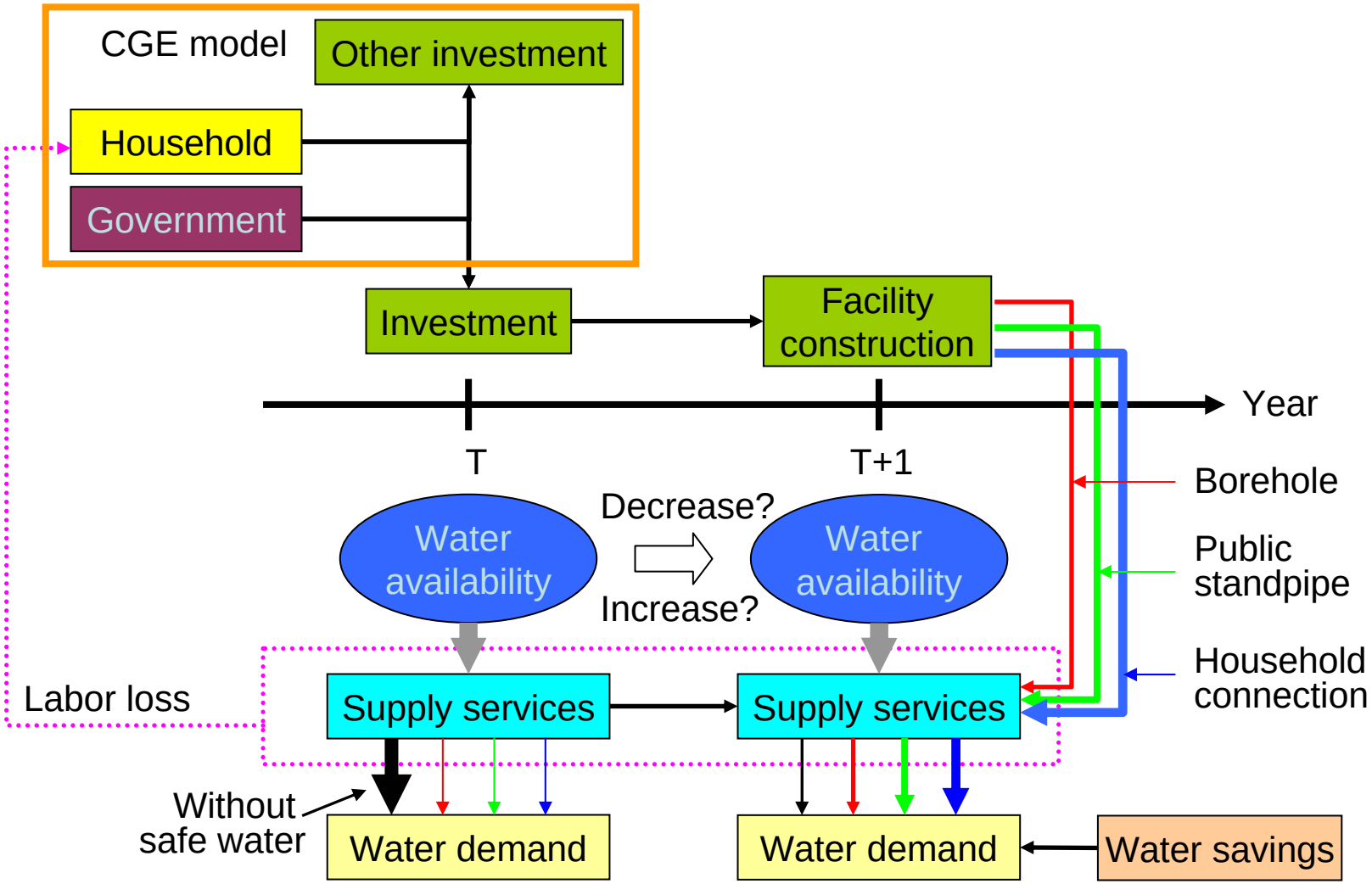


Figure 3 (a). Conceptual model of structural change in the domestic sector.

Alcamo, J., et al., World Water in 2025 Global modeling and scenario analysis for the World Commission on Water for the 21st Century, 2000

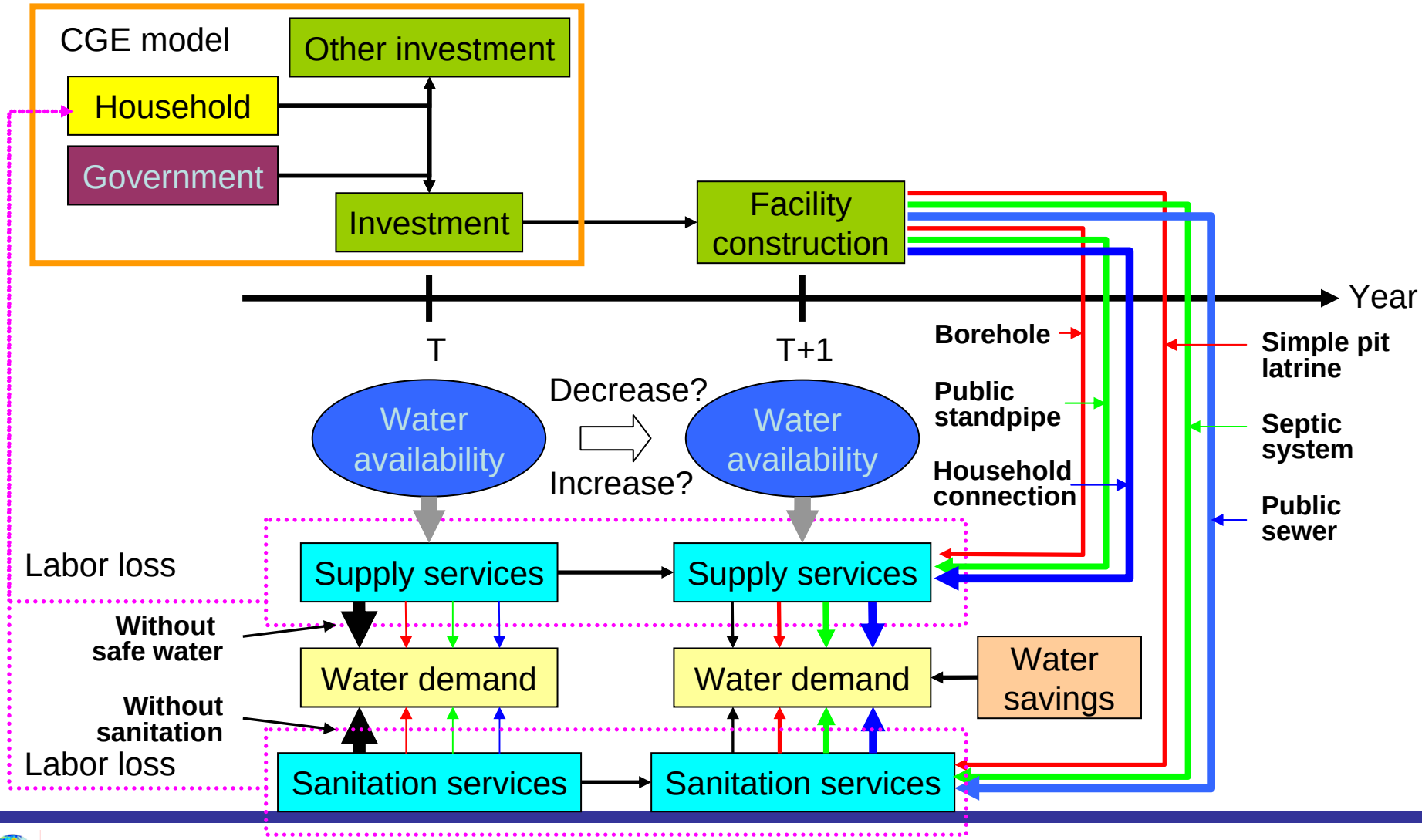
Development of water management model

Model Structure (1)



Development of water management model

Model Structure (2)



Necessary data (Domestic)

- Total population
- Number of people served by the water supply technology
- Number of people served by the sanitation technology
- Per capita water use by the water supply technology
  - Per capita water for component usage by the water supply technology

- Initial, management and operational cost by the water supply technology
- Initial, management and operational cost by the sanitation technology
- Life time and capacity by the water supply technology
- Life time and capacity by the water sanitation technology

- Water saving efficiency, cost and life time by device
- Behavioral water saving efficiency
- Institutional water saving efficiency

Development of water management model

Future task

- Domestic
  - Institutional water savings
    - ✓ Decrease of UFW (Unaccounted for Water) by improvement of managerial and operational efficiencies
    - ✓ Promotion of water saving behaviors by environmental education
  - Assessment of benefits due to water supply and sanitation improvement
    - ✓ Annual number of diarrhoeal cases avoided
    - ✓ Treatment casts saved due to less cases of infections diarrhea
    - ✓ Saving the time to collect water
- Industrial water demand
- Agricultural water demand
- Water pollution
- Installation of water reuse system