



# "Research Activities on Sustainable Sanitation in LIPI".

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The Indonesian Institute of Sciences (LIPI)

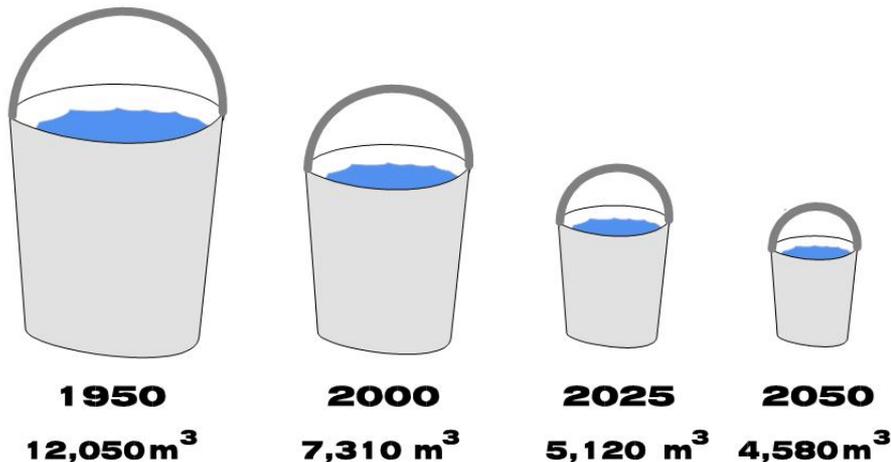
1. Research Center for Physics
2. Bureau for Cooperation and Promotion of Science and Technology

## Global Facts of Water Availability

Jacques Diouf, General Director of FAO, in World Water Day, 22 March 2007 said:

1. Water consumption is doubled globally in this one century, and in the contrary its availability drastically decrease
2. Predicted: in 2025, 1.8 billion people have to live in an absolute scarceness/shortage water

### Freshwater availability per capita in period 1950- 2050



Access to clean water is one of Indonesia's biggest problems: According to the Indonesian's Millennium Development Goals (MDGs) Report 2007, piped water is accessible to 30.8 percent of households in the country's cities and 9 percent in its villages.



# Research Funding:

Source : Science indicator 2006, Papiptek LIPI

**In Indonesia, during the 1970s and 1980s:**

- The Government had given much attention to funding S&Ts research and development.
- This was indicated by S&T intensity that reached 0.74% of GDP in 1971 and R&D intensity of 0.48% of GDP in 1972.

**From the 1990s to date:**

- Funding of S&T research and development by the government has tended to decrease steadily towards being ignored, with R&D intensity of 0.05% of GDP in 2004 (From total government spending in 2004 it was 0.35%)
- For deal with this situation, the government made a strategic regulation on research policy to synergize all sectors in strengthening S&T capability.

# NATIONAL RESEARCH PRIORITIES FOCUSING ON :

- **FOOD AND AGRICULTURE** : Food resilience through agriculture system, aquaculture, agroindustry and agrobusiness
- **ENERGY** : Sustainable energy supply through the creation and use of new and renewable sources energy
- **TRANSPORTATION** : Creating an effective and efficient Multi Mode Transportation System and Management
- **INFORMATION AND COMMUNICATION TECHNOLOGY** : Utilizing Information Communication Technology for Increasing Prosperity and Good Governance
- **HEALTH AND PHARMACEUTICAL** : Technology Utilization for Pharmaceutical Products (including Herbal medicine) and medical equipment
- **DEFENSE** : Self Resilience on Defense Technology

**Water?**

**Sanitation?**



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## Government Funding Allocation for Water and Sanitation:

- The sanitation sector received only Rp 500 billion (US\$52.88 million) of the total Rp 36.1 trillion the government allocated for infrastructure development in 2008 → From gov. total budget in infrastructure, only 1.4% for improving sanitation.
- The government allocated around Rp 7.7 trillion for the sanitation sector over the past 30 years → a number that worked out to Rp 200 to provide adequate sanitation facilities per capita per year.
- Minimum cost needed for an adequate sanitation access is Rp 47,000 per head per year!!!!
- Based on a government statement, to meet the MDGs target by 2015, Indonesia needs Rp 43 trillion (US\$4.6 billion) in clean water funding. The government currently provides Rp 500 billion.
- In order to close the funding gap, it is important to Attracting private investment in clean water → This is no easy task.



**From 2005-2014, LIPI focus in research:**

- **Renewable Energy and Water (availability and sustainability)**
- **Molecular farming and drugs**
- **Biodiversity**
- **Coastal and border area**
- **Advance material and nano-technology**
- **Social sci. and humanities**
- **Disaster and environment**

**Water & Sanitation**

Three red arrows originate from the list of research areas. One arrow starts from 'Renewable Energy and Water (availability and sustainability)' and points to 'Water & Sanitation'. Two other arrows start from 'Social sci. and humanities' and 'Disaster and environment' and also point to 'Water & Sanitation'.

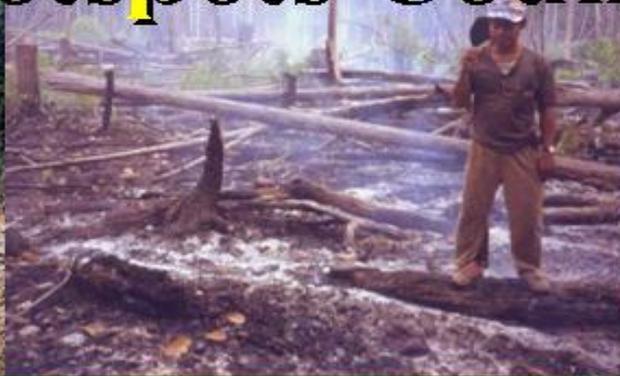


# INDONESIA

## Megadiversity

v.s.

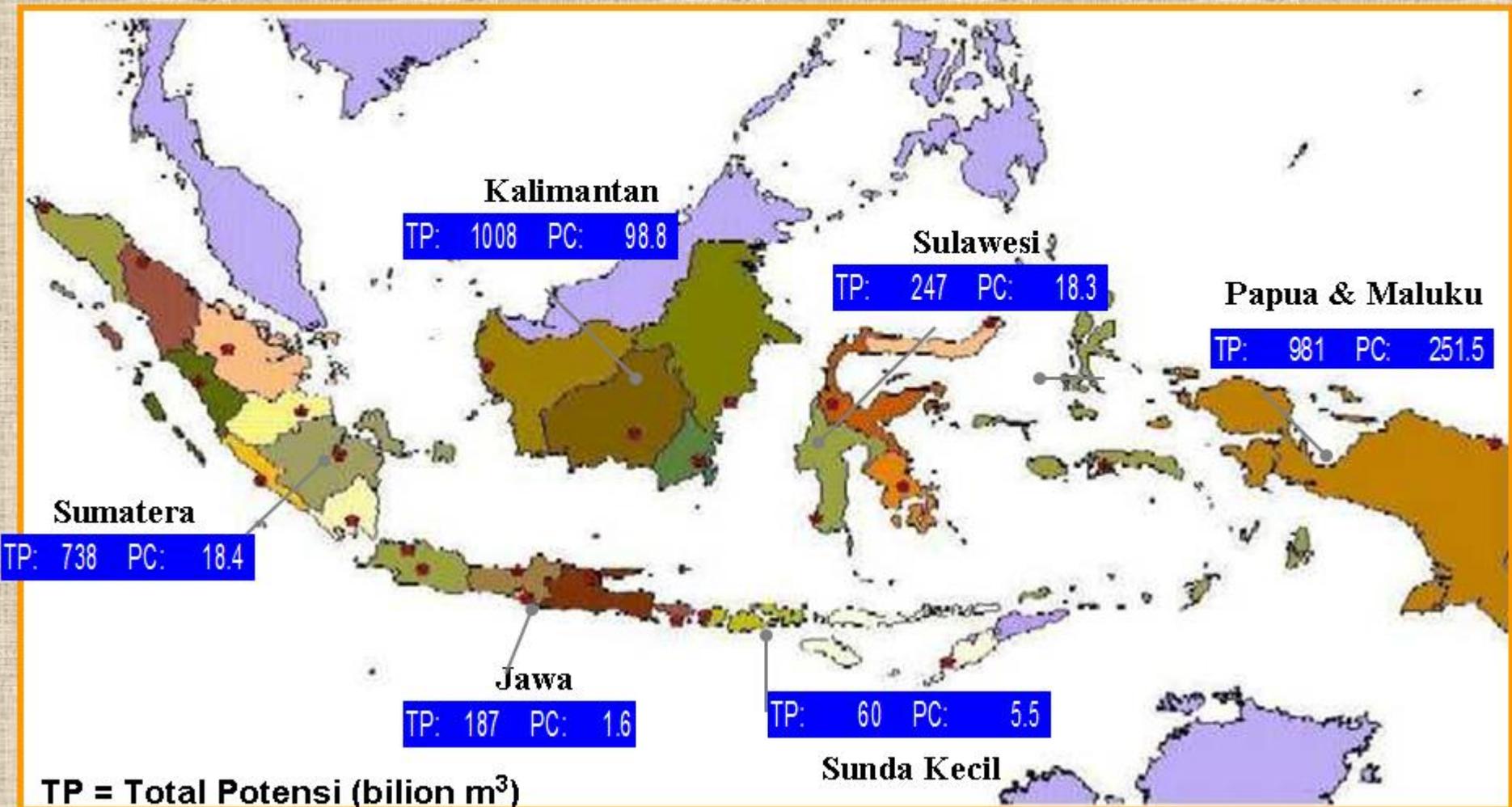
## Hotspots Country



**Destruction of Natural Resources  
by Human Activities and by Natural  
Phenomena**



# Potential Water Availability per island (TP) Water availability per capita (PC)



TP = Total Potensi (bilion m<sup>3</sup>)

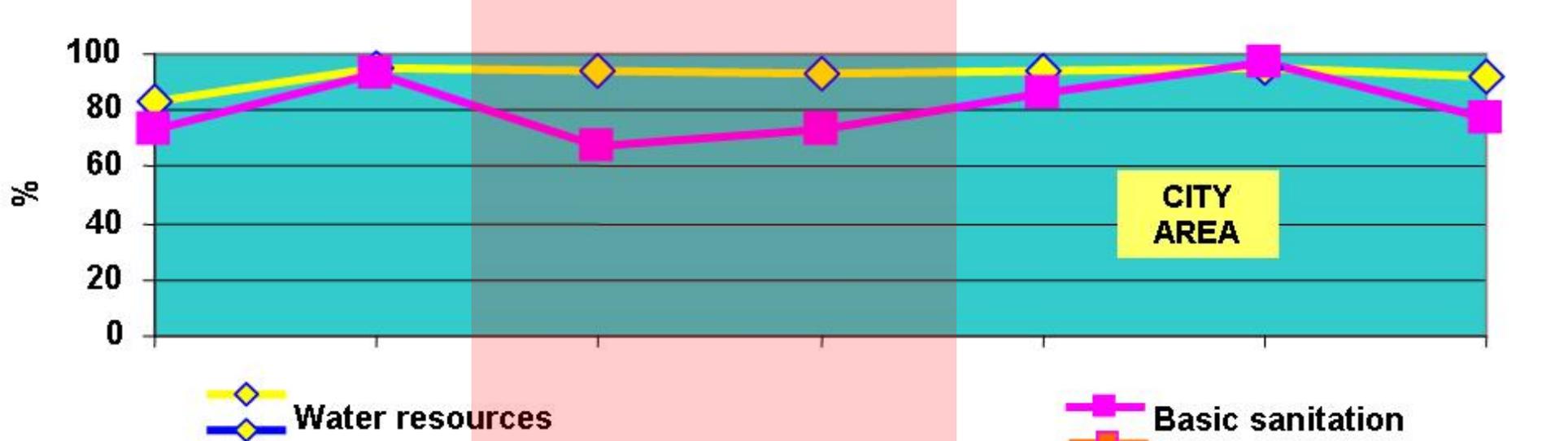
PC = per Kapita (x 1.000 m<sup>3</sup>/kap)



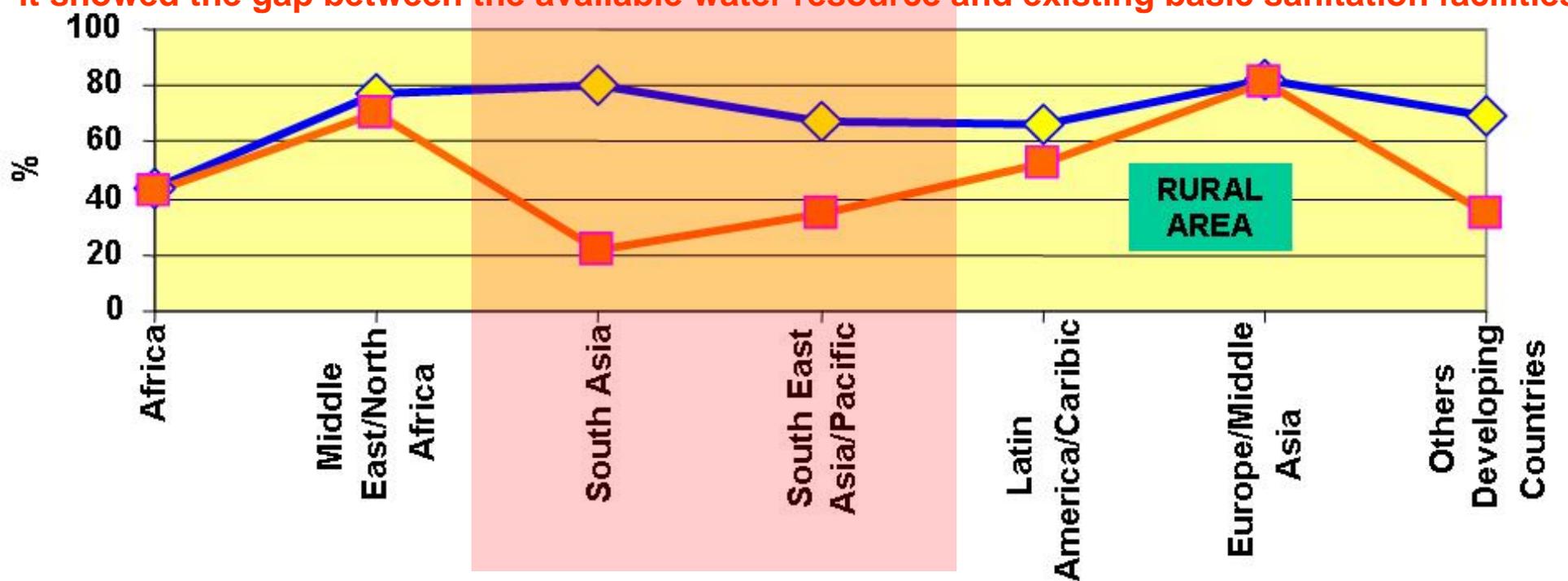
## Other global facts:

**[International Herald Tribune, Friday, April 25, 2008]:**

**Water supply shortages are becoming a problem of global proportion. In the past month (March 08), 2,000 farmers in India were arrested for stealing water; the regional government of the Spanish province of Catalonia said it was going to import water by boat and train beginning in May to provide summer supplies; the Queensland Water Commission in Australia put local residents on the toughest water restrictions; and in Atlanta, residents filed lawsuits against the municipal government in protest over faulty water pipes and failing sewer systems.**



it showed the gap between the available water resource and existing basic sanitation facilities



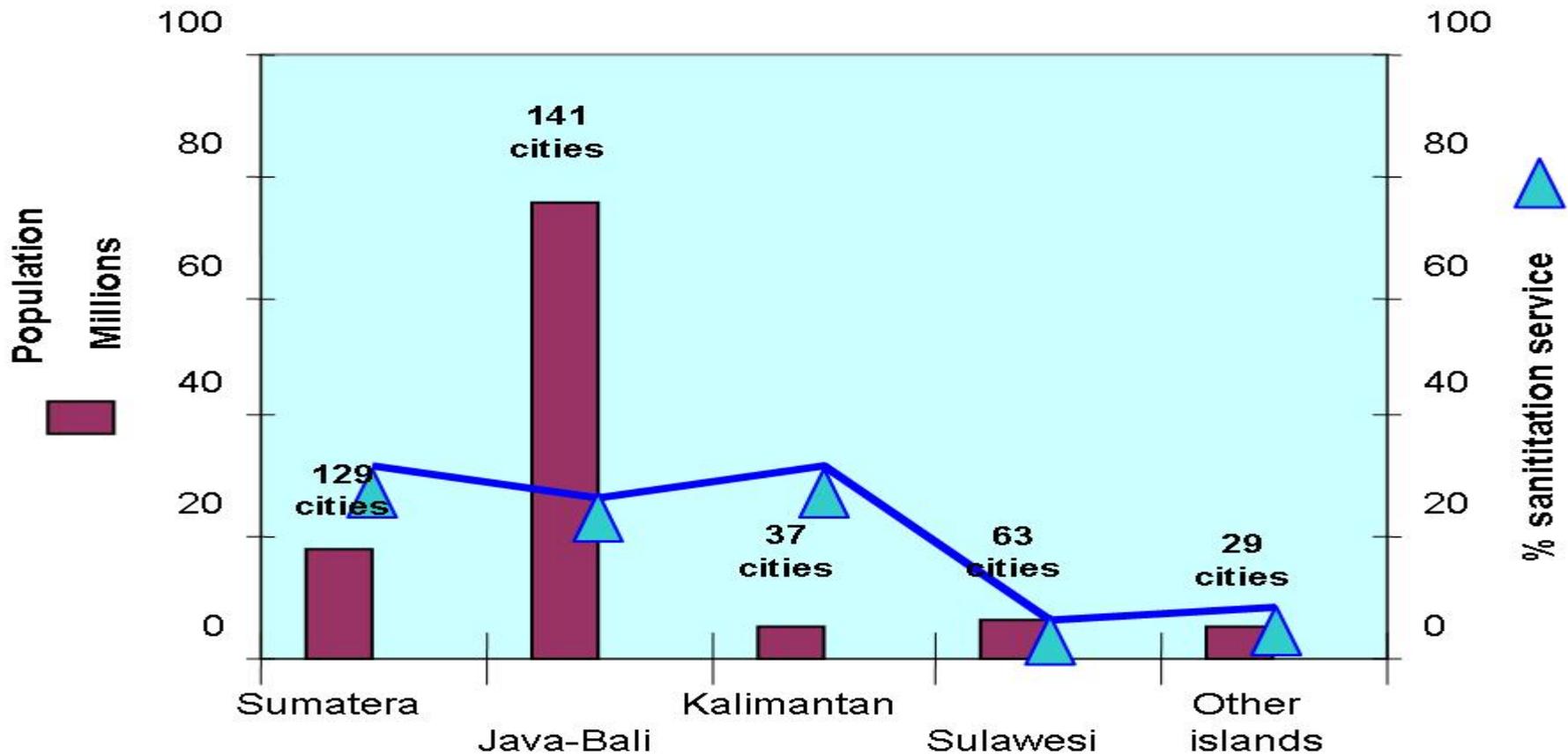
Source Data: Water Supply and Sanitation Business Strategy Fiscal 2003-2007, The World Bank and Water Supply & Sanitation Sector Board, September 2003



# Indonesian Institute of Sciences

About 40% population in Indonesia are living in urban or cities area, and the rest are in rural or villages (Total Population on 2005: 223 million). From total population, about 69% are living in Java island, which is only about 10% from the total lands in Indonesia.

Coverage of wastewater treatment services in cities from 3 big islands (Sumatera, Java, Kalimantan) were 26-32%. Less services is appeared in most cities in eastern part of Indonesia (Sulawesi and other islands; which is less than 9%.



(Source: Depkimpraswil/Ministry of Public Work, 2000. In: Buku Laporan Akhir Pekerjaan: Penyusunan PJM Air Minum dan Kesehatan Lingkungan 2005 - 2010, Tahun Anggaran 2004, Depkimpraswil).



## Human needs vs Lifestyle

**Population ↔ urbanization → and social change (poverty vs lifestyle).**

- The increase in population number will automatically change 'demand' for basic needs.
- Urbanization causes pressure on land exploitation and triggers urban poverty and overexploitation of limited natural resources.
- In the meantime, poverty issue itself restricts the people from access to appropriate living resources (drink water, housing and food) so that distressing the natural resources.

**Change in lifestyle due to improved education and economy. As comparison, water consumption in cities reaches 132 liter/individual/day whereas in rural areas the amount is 25 liter/individual/day. Such difference is 5 times larger, which means that 1% increase in urbanization rate equals 5% increase in water consumption.**

**Therefore, there should be more effective approach for any policy to this poverty and lifestyle issues !!**



**WATER:**

**AVAILABILITY**

**ACCESSABILITY**

**QUALITY**

**POVERTY**

**Situation in Indonesia**



City	Water Price (official) (US\$/m <sup>3</sup> )	Price by Water Seller (US\$/m <sup>3</sup> )
Nairobi, Kenya	0,30	1.50-2.00
Port au Prince, Haiti	1.00	5.50-16.50
Jakarta, Indonesia	0.09-0.50	1.50-2.50
Lima, Peru	0.15	3.00



**The Poor must pay more...  
...and get less...**



LIPI

## Toilet in ordinary household in Indonesia:



Water is  
always  
needed!





# Public Toilet

**WATER QUALITY**



Water is  
always  
needed!



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Water and Sanitation →

## Facts of Clean Water Infrastructure in Indonesia:

From around 306 PDAM (waterworks) in Indonesia, they serve:

1. Only 33 million (39%) urban people and 9 million (8%) rural people → 47%

2. With sub-standard quality,

3. Low consumption (14m<sup>3</sup>/ month /house hold) → <90 l/person/day

4. Average pipeline leakage of 40%.

✓ 400,000 m<sup>3</sup> domestic waste is dumped daily directly into rivers and land without pretreatment → 61 % is on Java

✓ It is estimated that 70-75% of water pollutant comes from domestic. (organic waste and fecal).

✓ In year 2002, data from Ministry of Health showed 5,789 case of diarrhea with 94 death.

✓ Centralized sewerage system exists only in 7 cities, providing service to 973,000 population (0,5% of the total population in Indonesia)

Miserable

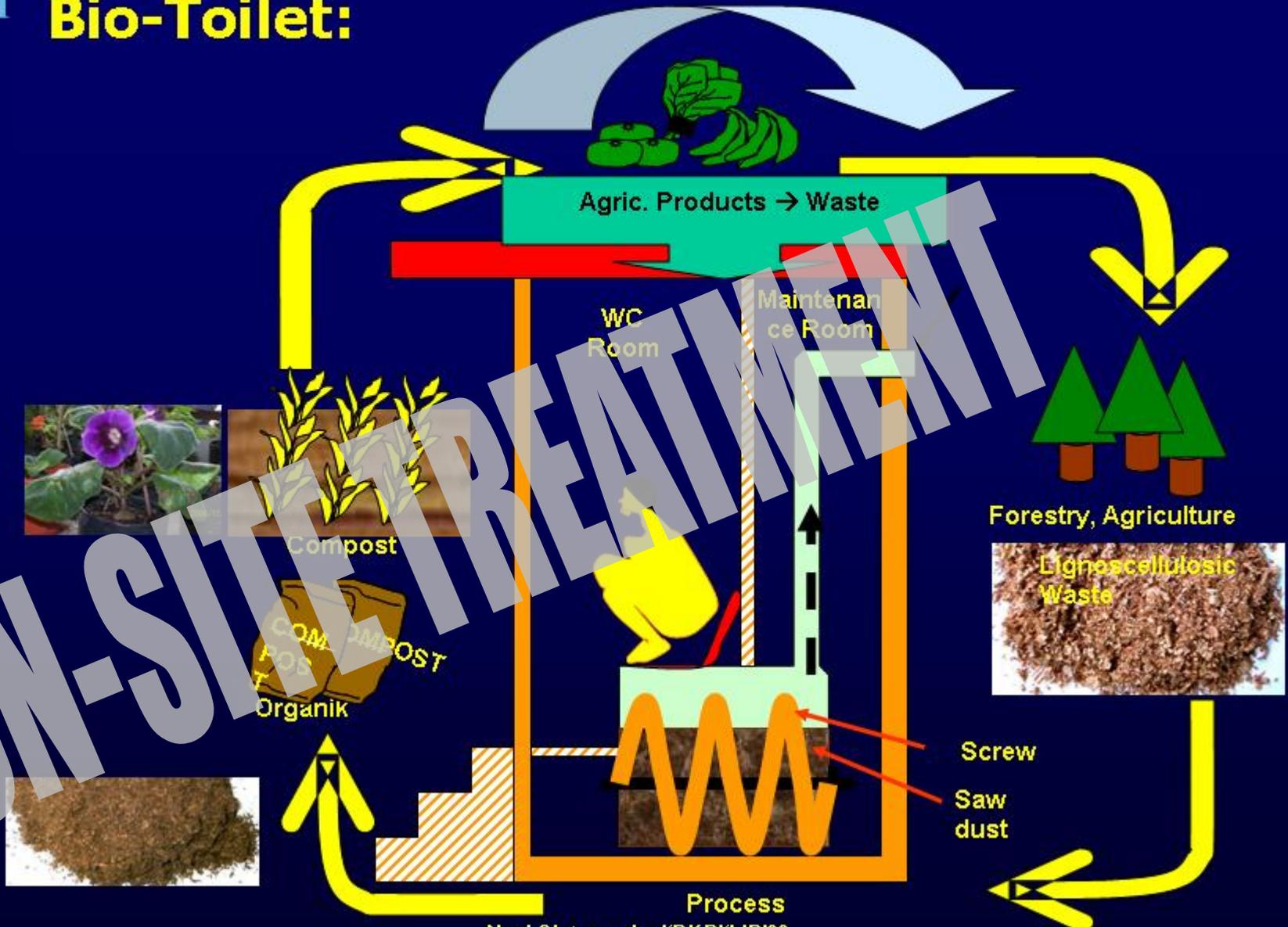
# Population and Sanitation

- ❑ **>90% of population have no Centralized sewerage system**
- ❑ **Final human waste disposal system in the cities: 63,07% septic tank, 16,70% to rivers/lakes, 14,44% to the ground, 5,79% to pond/beach/ others (EPS 2002).**
- ❑ **Septic tanks generally come in infiltration pit or directly into river/drain age ditch. Consequently river and groundwater of the urban are generally contaminated by *E.coli* bacteria.**

## **Bandung City spend (1990s):**

- **1,8 million \$US for 314 km new piping system.**
  - **4,4 million \$US for centralized WWTP**

### Bio-Toilet:





# Bio-Toilet

**Cap. 25-40 persons/day**



**Cap. 10-15 person/day**



# CHANCES of BT in Indonesia:

- **A “new” technology: “common” room with a modern touch.**
- **Environmentally sound technology: Save the water; increase quality of sanitation ECOSAN; 3R (reduce-recycle-reuse)**
- **Refresh the “old” latrine mode**

# BT → APPROPRIATE FOR:

- **Public Toilet in slum area with restricted access to clean water.**
- **Dry region: people used to have very simple latrine or just using field area.**
- **Fishery village: to improve health quality**
- **Public facilities: park, botanical garden.**

**Not appropriate for personal household**

# People's Perception on BT- Technology

**A challenge to use/have it**

- **Room's design: interesting, simple, clean and dry**
- **Toilet Bowl: hole is too big → insecure to watch the process directly.**
- **Reactor: interesting for students or the youth to learn the process directly. For common people, this room is an evidence of odorless process and to get the usable end product.**
- **Some people afraid to touch the used sawdust.**
- **Why the price of BT is so expensive??**

## User's Demand:

- **Multi toilet holes/bowls in one BT-reactor**
- **Water must be available, even in very restricted amount, for cleaning up the body (after toilet use).**
- **The possibility to have BT in coupling with “bath and wash-clothes” facilities**
- **BT vs the existing toilet system (septic tank): comparing the cost**



## **Development and improvement of BT:**

- **Building a “multiple” bowls in one BT-reactor.**
- **Progressive public awareness about this technology via TV and other media, exhibition in Sanitation Year (2008).**
- **Concentrating to apply the BT for public toilet (min. 5 households) and for dry region → Ministry of Public Works (2008) has inc. BT in the SANIMAS policy. Municipal Water Work in Bandung City want to apply BT in the area, where it is difficult to build sewerage piping.**



# **Steps on keeping Sustainability of such kind of on-site Toilet technology (BT):**

- **A good social approaches on preparation to apply BT: depend on region, availability and accessibility of clean water, community preparedness for self management → increasing the participation of community!!!**
- **Showing the data of: quality of their sanitation (water pollution, infant mortality on diarrhea, etc.)**
- **It is also important to observe the habits and economic capacity of the people regarding their adaptability to alternative sanitation system.**
- **Availability of ligno-cellulosic waste.**
- **Involving other economic activities in BT's management: garbage collection-separation-recycling-reuse, compost seller, flower plants**

# Economic Products???

## JATROPHA PLANTS



**+BT**  
**sawdust**

**+BT**  
**sawdust**



# Cost of BT vs Septic Tank??

It's difficult to compare "apple to apple"

How to calculate the advantage of On-Site Treatment BT → to compare with other system?

1. Recycling organic wastes directly back to nature (compost)
2. Elimination of pathogenic microorganisms.
3. Reduction of wastewater (reduce water as media to transport the waste; reduce water usage)
4. Water reservation and efficiency.
5. No need of piping.
6. Possibility to develop small scale enterprise



# ACKNOWLEDGMENT:

- To Prof. Dr. N. Funamizu for his continuous collaboration through discussions and supports.



Don't let it happened.....

