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7 July 2011 @ Ensearch, Kuala Lumpur
Kumarasivam Memorial Public Lecture

Value Creation in Environmental Sustainability:

The Case of Urban Rivers

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www.utm.my/vc

INSPIRING CREATIVE AND INNOVATIVE MINDS

Presentation menu

- Kumarasivam in memory
- Framework and scholarly inquiry
- Value creation
- Future, strategy, roadmap

Professor, Environmental Bioengineering and Water Sustainability
Chairman, Environmental Quality Council, Malaysia
Member, National Water Services Commission, Malaysia (2007-2011)
Vice-Chancellor/President, Universiti Teknologi Malaysia

From imperial technical school to national entrepreneurial research university

- The oldest university in Malaysia (1904)
- Alumni more than 200,000
- More than 43% enrolment at postgraduate levels in engineering and technology in Malaysia
- 10 engineering schools
- 2000 tenured academics
- 2500 PhD students
- 5000 students Global Outreach Program
- 3000 foreign students

Year	Bachelor	Graduate
1984	3,886	2
1990	5,348	175
2004	17,897	3,291
2007	14,792	3,942
2008	14, 456	4,850
2009	14,245	6,432
2010	**13,000**	**9,100**
2011	**11,500**	**9,500**
2012	**10,000**	**10,000**

ENSEARCH
For a Better Environment

Environmental Management and Research Association of Malaysia
(ENSEARCH)

ZAINI UJANG

R&D in water sustainability: Summary

	Nanotech	Biotech	Automation	Materials	Process	Energy
Water resources		In-sewer biorector	Modeling, pollution loading	Nutrient uptake	Reuse, recycle; Small system	Close to users
Quality monitoring		Microbial techniques, surrogates	Image processing		On-line; Respirometry	Carbon neutral
Treatment technologies	Water and wastewater treatment; osmosis, biomimetic	Sewage, palm oil mill effluent	Respirometry	Sludge reuse, PHA	Process integration; Decentralised system	Low carbon; Photosynthetic mirobial system
Governance	Integration	Integration	Performance monitoring	Industrial ecology	WASDA, RISKAS	Sustainable tax
Policy	Value creation	Value creation	Value creation	Value creation	Compact; Asset light system	Environ. Performance Index

International
Water Association

NAJIB menyampaikan Anugerah Merdeka kepada Lim di Kuala Lumpur, malam tadi. Turut kelihatan (dari kiri) Dr Halimaton, Zaini dan Fatimah (berkerusi roda) serta Mohd Hassan.

Empat tokoh diiktiraf dapat Anugerah Merdeka

PERSATUAN AIR MALAYSIA
MALAYSIAN WATER ASSOCIATION

Water resources

Technology and financing

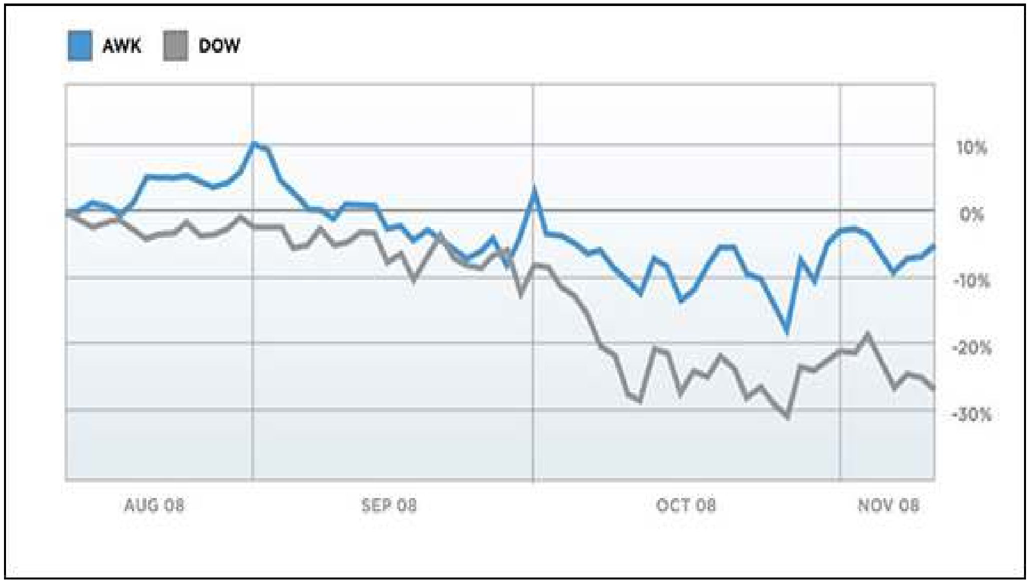
Governance & Implementation

Water War

Intellectual property & human capital

Global water business

- **US$400 billion** global market (source: Goldman Sachs)
- Global market for pumps, pipes, filters, and other purification and sanitation equipment at
- United States share of the industry amounts to roughly $100 billion in yearly sales, and growing three to four percent a year (source: Pacific Institute: *World's Water*).
- Japanese government will help the private sector tap into the water business in other countries, aiming to **garner 6% of global** markets in 2025 i.e. total of ¥31 trillion by 2025 (source: *Japan Times*, 13 April 2010)



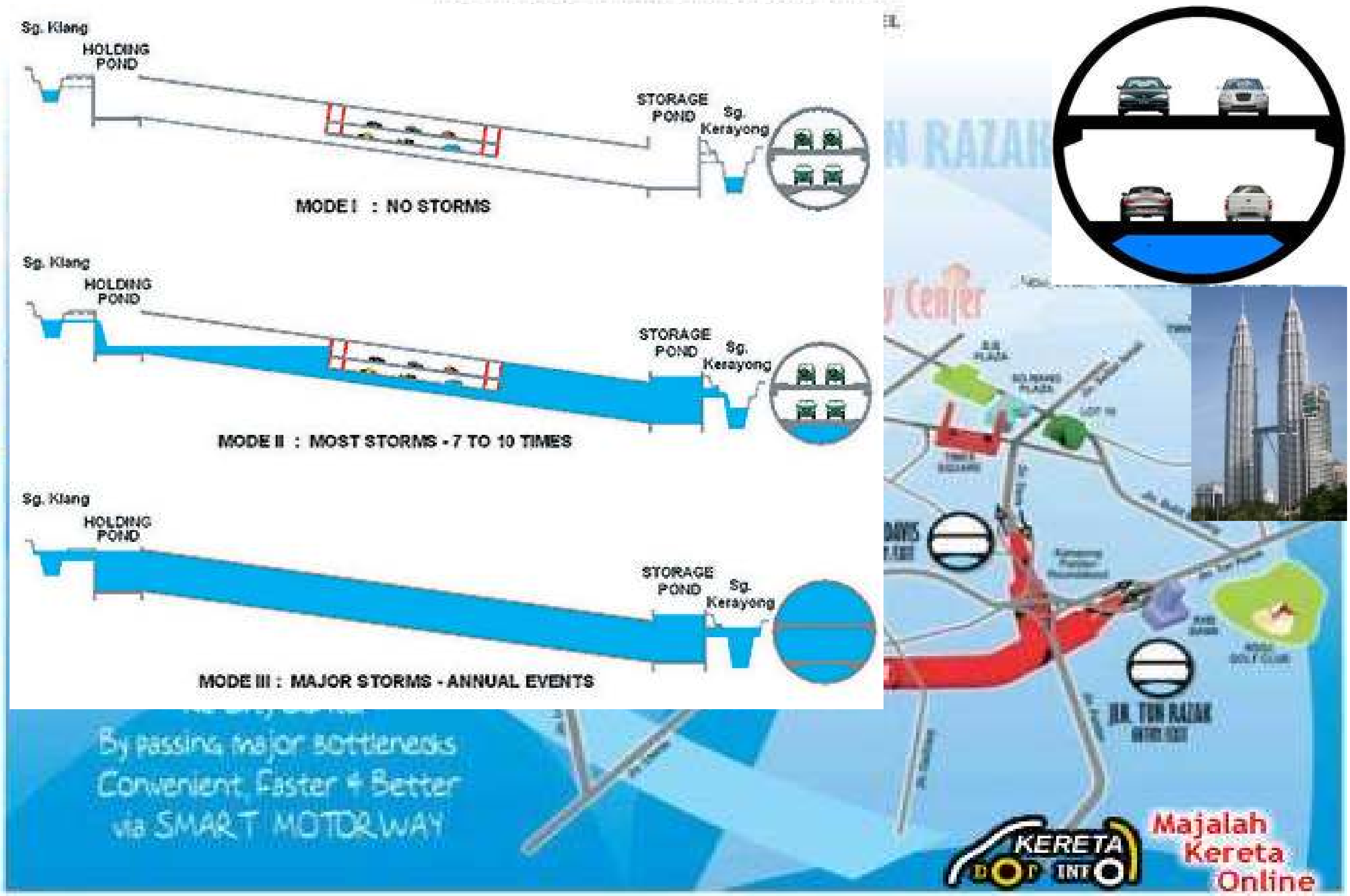
South East Asia

Population	600 m
Average GDP	>5%
Free economic zone	2015?

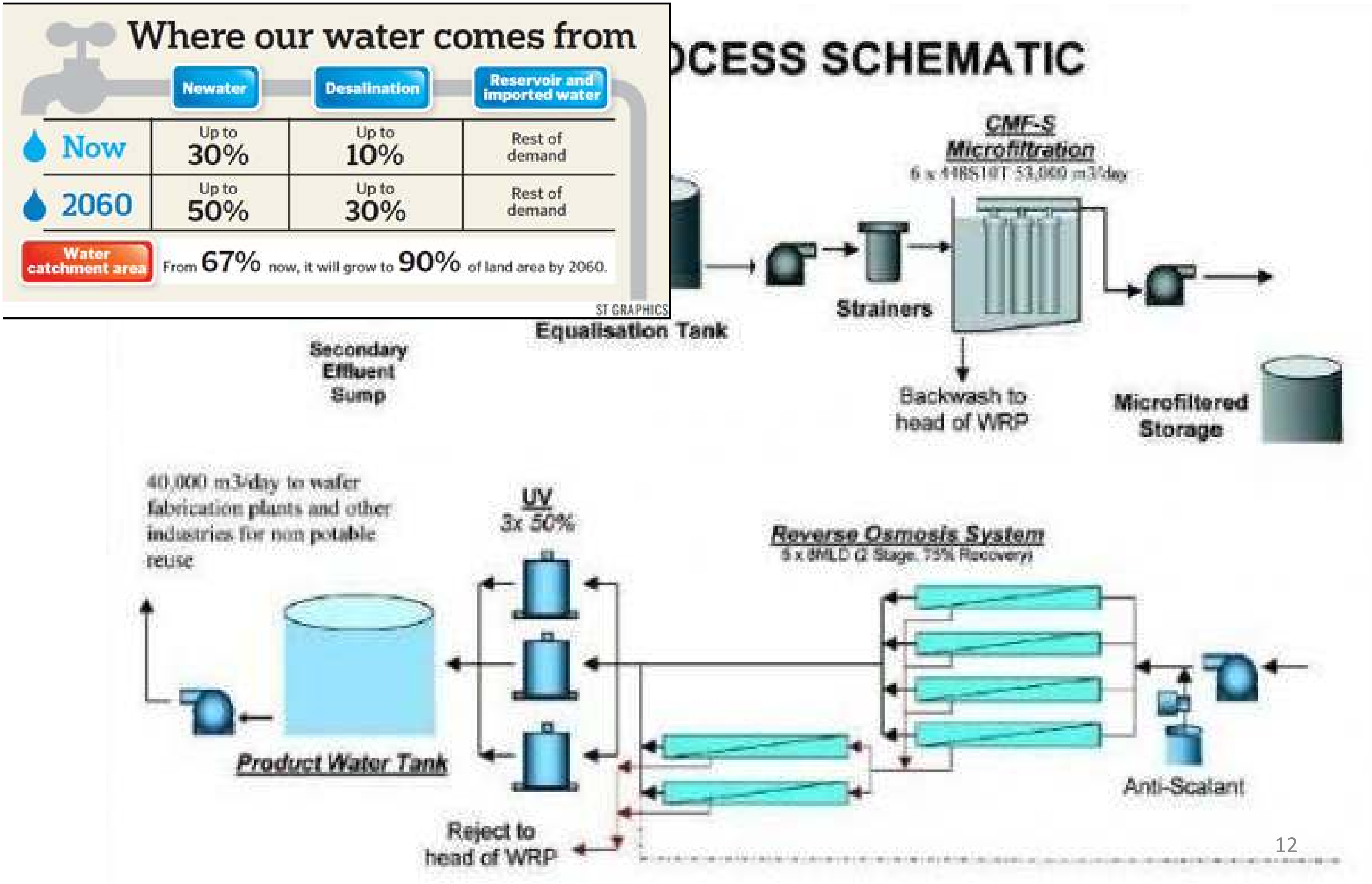
Major environmental issues

- Rapid urbanization
- Flash flooding
- Water supply due to water pollution

Innovation: Smart tunnel Kuala Lumpur

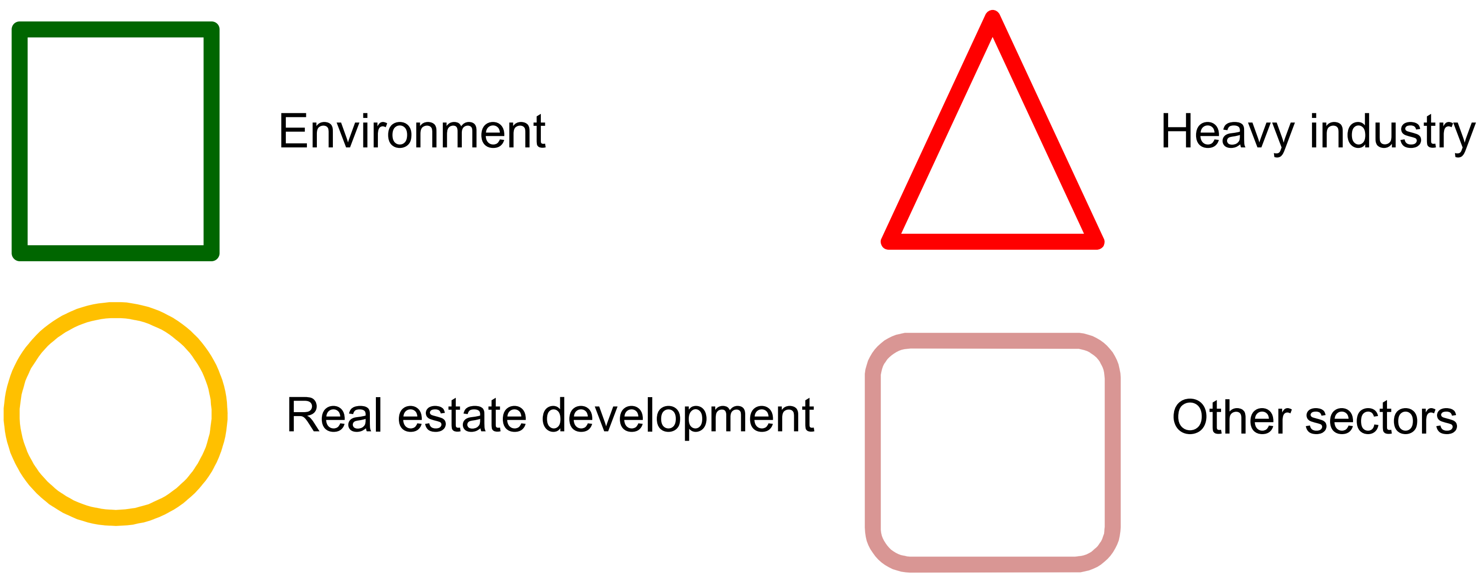


Innovation: Newater Singapore



Approaches in environmental management

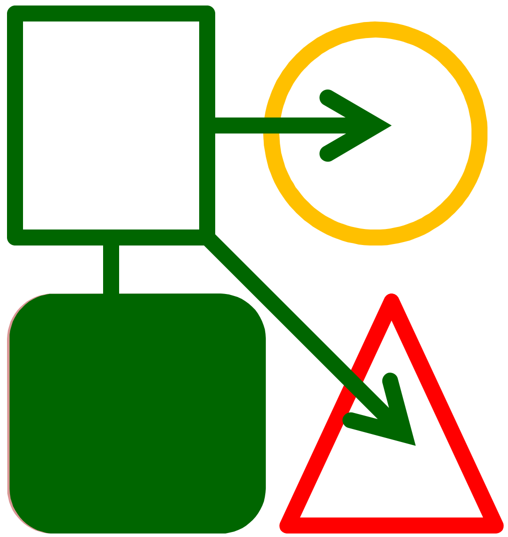
- Conventional model
- Induced model
- Sustainability model



3 approaches in environmental management

Conventional model

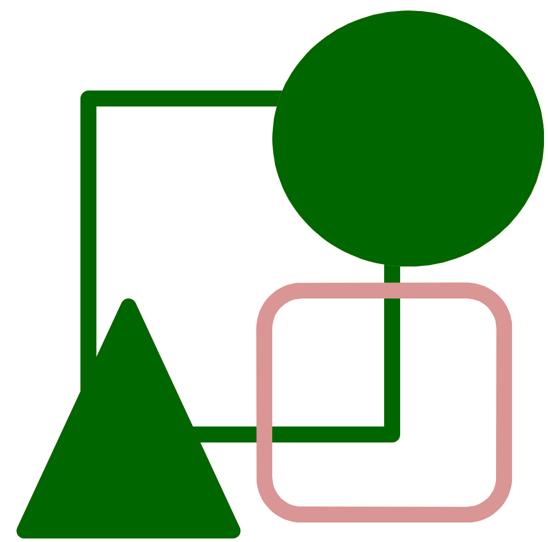
- Framework: Environment vs Development?
- Environmental pollution control
- Public health
- Sanitary engineering
  - Water supply
  - Wastewater
  - Solid and hazardous waste
  - Air pollution
  - Environmental management and policy



3 approaches in environmental management

Induced-model

- Environmental components in development programs
- Pollution control
  - Less NOx, SOx engines
  - Green incinerators
  - Low energy lighting system
  - Urban green
  - Environmental management & policy



3 approaches in environmental management

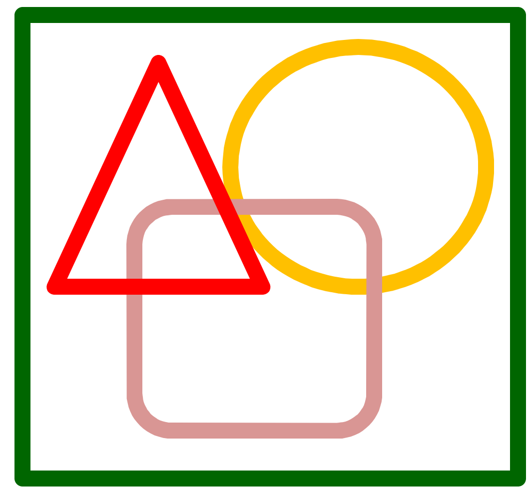
Sustainability model

- Involve all aspects
- The whole business model and engineering paradigm into sustainability, not merely pollution control
    - Renewal energy
    - Low carbon technology
    - Clean production
    - Green city
    - Green buildings

3 approaches in environmental management

Sustainability measurement?

- Cost-benefit analysis 1970s
- Matrix of selection components 1980s
- Sustainability index 1990s
- Life cycle analysis 1990s
- Ecological footprint 1990s
- Quantitative sustainability assessment 2000s

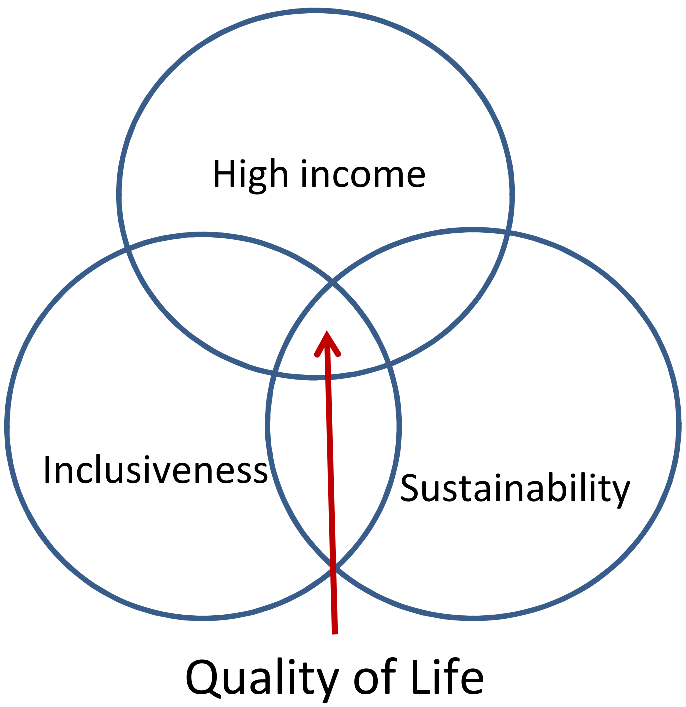


Criteria based on:

- Health
- Environment
- Economy
- Socio culture
- Technical functions

Innovation-led economy

Value creation
High-income structure



Why innovation matters?

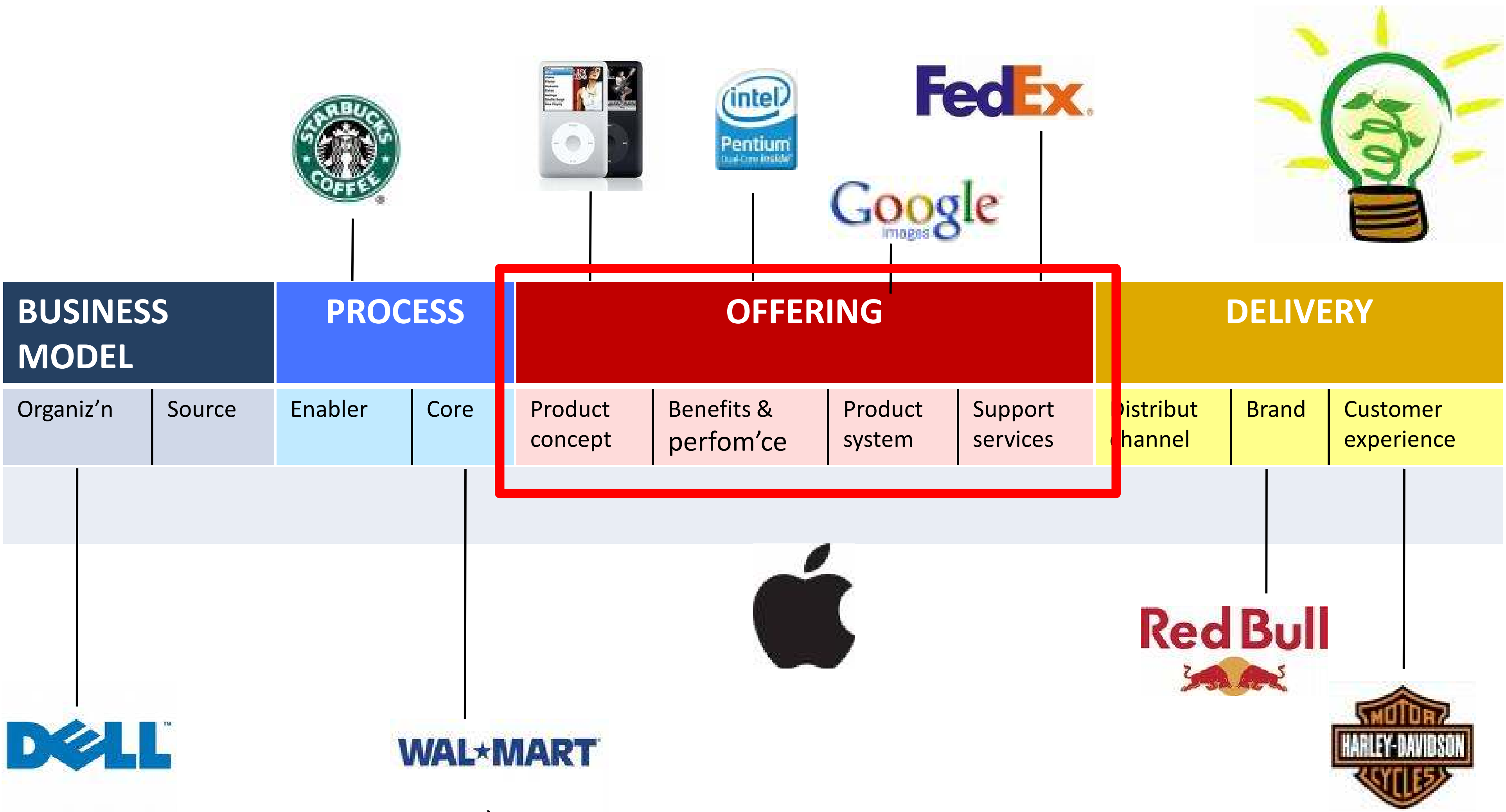
Quantum leap

Competitive edge

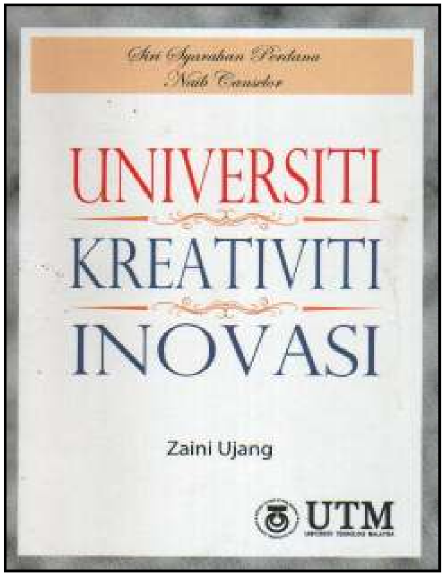
Survival

Improvement

Innovation-led economy



Adapted from Prof. Deschamps (2009)



INSPIRING INNOVATION AND CREATIVE MINDS

Zaini's **7 Pillars of Innovation**

Area of concerns

Do it! Do it!

Benefits

Empowerment

Green

Champions

Feedback

Biggest public health enemy?

Area of concerns

Benefits

Champions

Do it the innovative ways!

- **Principle**: All God's creatures have roles and benefits to human being.
- Question 1: Can we **find benefits** from Aedes mosquito?
- Question 2: Can we **create new values** from the mosquito?

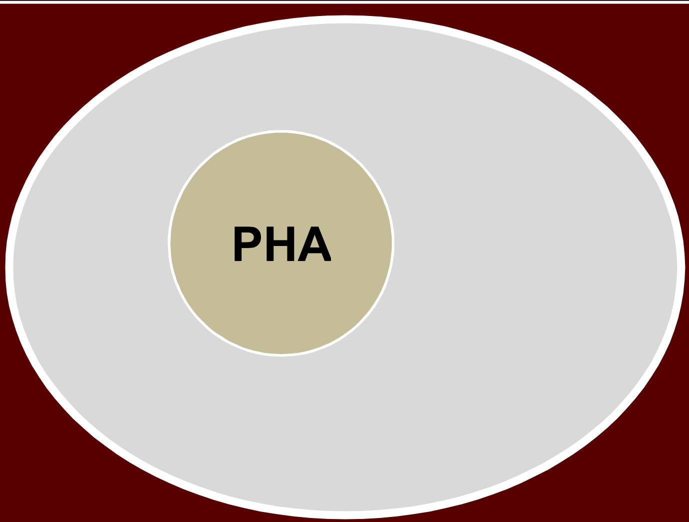
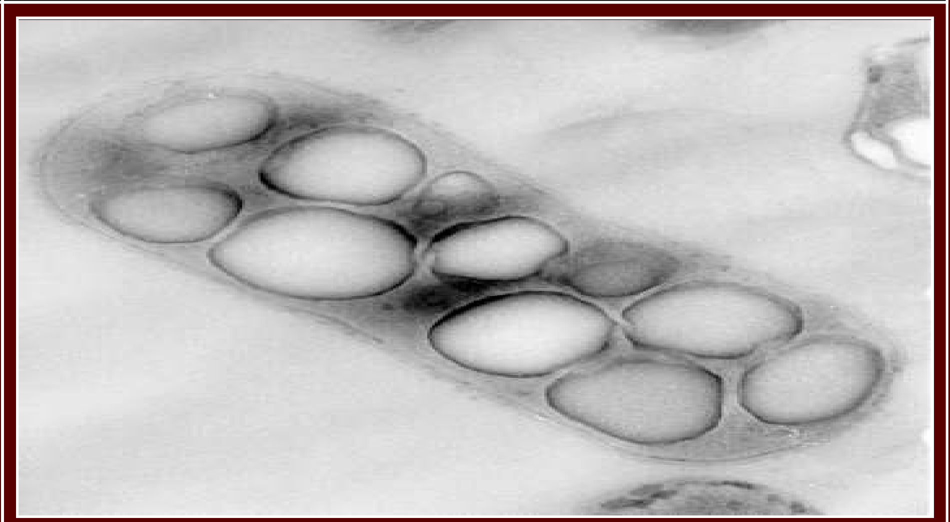
Do it! Do it!

Empowerment

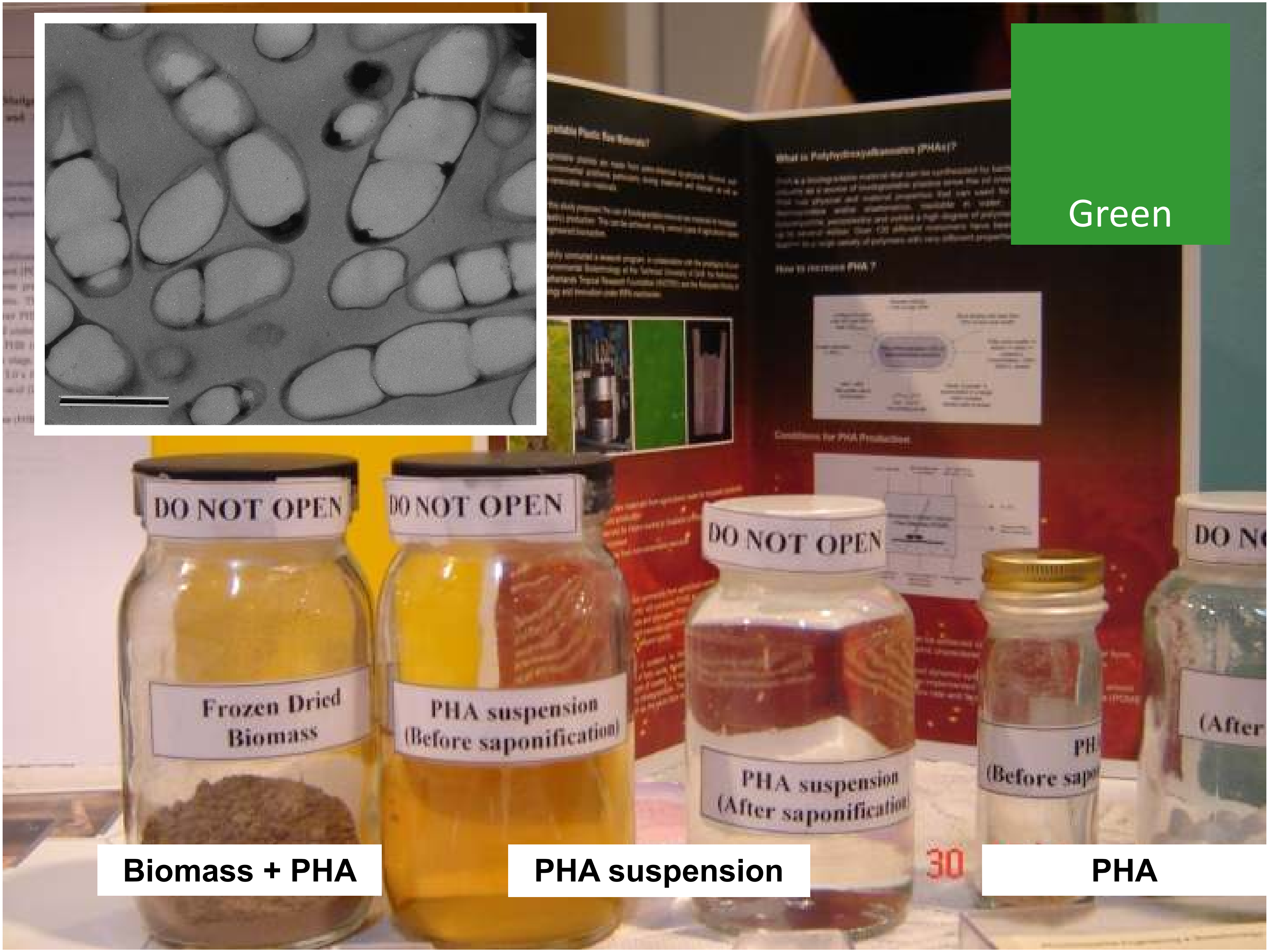
Green

Feedback

Accumulation of PHA in Phosphorus Accumulating Organisms (PAO) from wastewater

Aerobic	Anaerobic
	
PHA minimum	PHA maximum

Salmiati, Ujang Z., Salim M.R., Md Din M.F. and Ahmad M.A. (2007). "Intracellular biopolymer production using mixed microbial cultures from fermented palm oil mill effluent (POME)". *Wat.Sci.Tech*. **56** (8) 179-185.


Green
DO NOT OPEN
Frozen Dried
Biomass
DO NOT OPEN
PHA suspension
(Before saponification)
DO NOT OPEN
PHA suspension
(After saponification)
30
Biomass + PHA
PHA suspension
PHA

Working with MIT's Tony Sinskey

Innovation

Value matrix from waste to wealth

Waste	Conversion	Wealth
Dangerous	Technology	Desirable
Toxic	Risk assessment	Safe to health
“Waste”	Value management	Resource
Pollutants	Technology	Commodities
Costly to treat	Technology	Cheap raw materials
Legally “Toxic”	Regulation	Legally “commodity”
Taboo	Marketing	High demand by-product
Haram	Branding	Halal

Can we create value in urban river?

Can we create value in urban river?

- Principle: River is a civilizational landmark
- Question 1: Can we **find benefits** from river pollution prevention?
- Question 2: Can we **create new values** from the urban rivers?

Area of concerns

Champions

Do it! Do it!

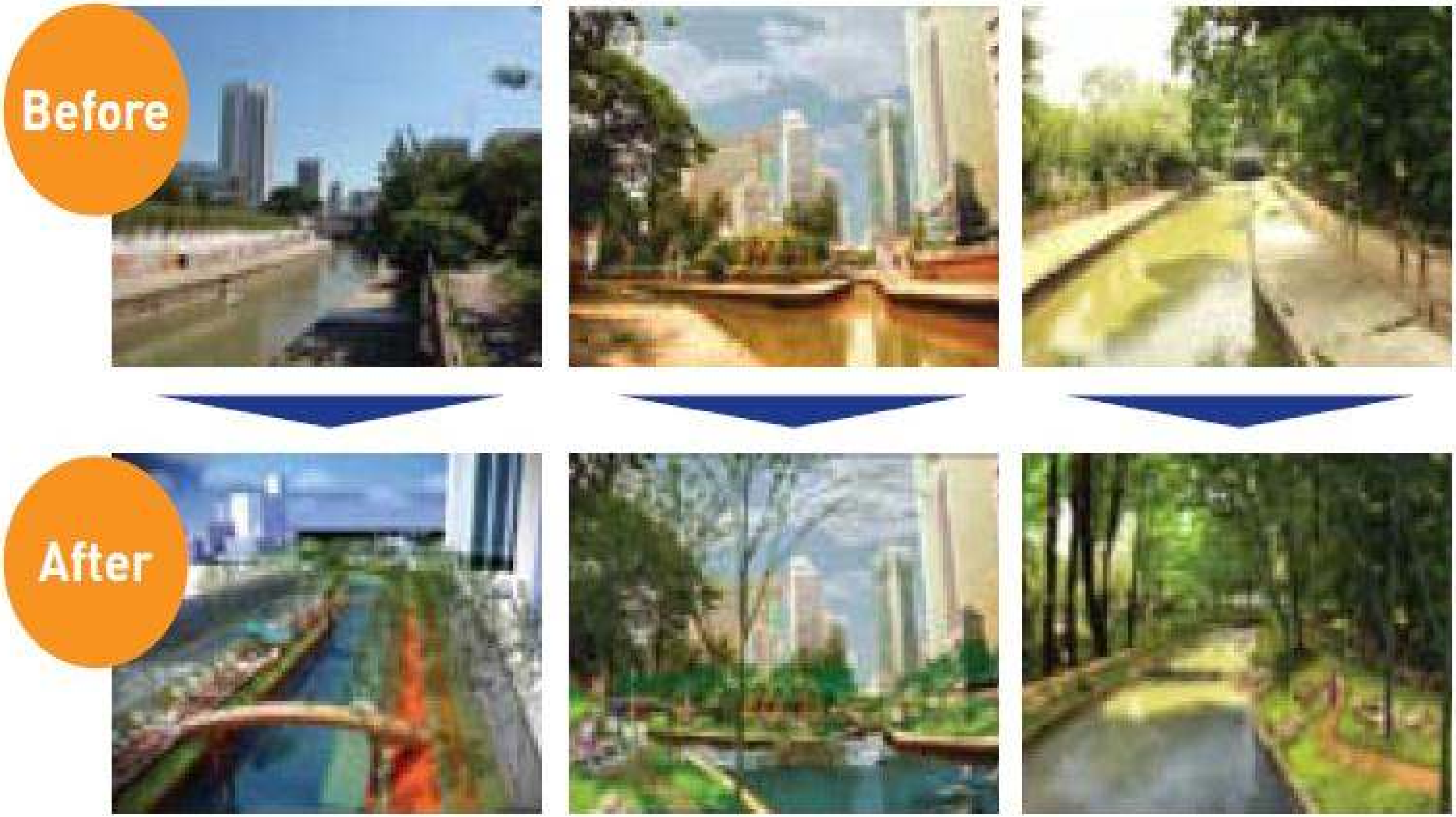
Green

Benefits

Empowerment

Feedback

Klang River rehabilitation



Klang bus stand

Masjid Jamek

City Hall

Thames, London


Newcastle Riverside, UK

Millennium Bridge, Newcastle UK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1985-2010 | MERSEY BASIN CAMPAIGN

- 1985 with a 25-year lifespan, the Mersey Basin Campaign was charged with facilitating the clean up of the River Mersey and its tributaries in the Northwest of England.
- River Mersey, 70 miles from its start, at the confluence of the Rivers Tame and Goyt in Stockport, to where it meets the Irish Sea at New Brighton. On its journey west, through south Manchester and Warrington towards Liverpool's famous Pier Head, it passes through 29 local authority areas.
- Five million people live within its catchment.
- A successful clean up required the engagement and participation of myriad different organisations, authorities and communities. What was needed was an organisation that could bring everyone together.
- The Campaign grew out of the then Secretary of State for the Environment, Michael Heseltine's visits to Liverpool in 1981.

The relationship between water quality and economic regeneration in the Mersey Basin

Abstract A report to Northwest Water, the Environment Agency and the Mersey Basin Campaign. The report explores the role, both actual and potential, of investment in improved water quality in the stimulation of economic activity, particularly in traditionally rundown inner-city areas adjacent to rivers and canals. This is part of the recasting of the region's image, with good water quality central to the vision of a 'green and pleasant region', and the creation of a credible setting for growth and investment. The study covers the economy, environment and policy setting in the Mersey Basin, economic regeneration and property development.

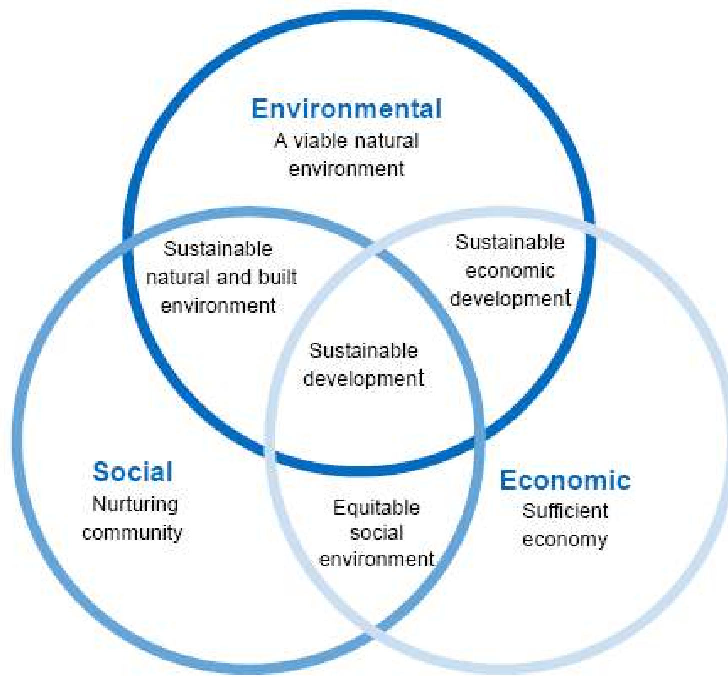
Permanent link http://merseybasin.org.uk/archive/items/MBC151.html

Theme Strategic


NORTHWEST
BUSINESS
ENVIRONMENT
AWARDS

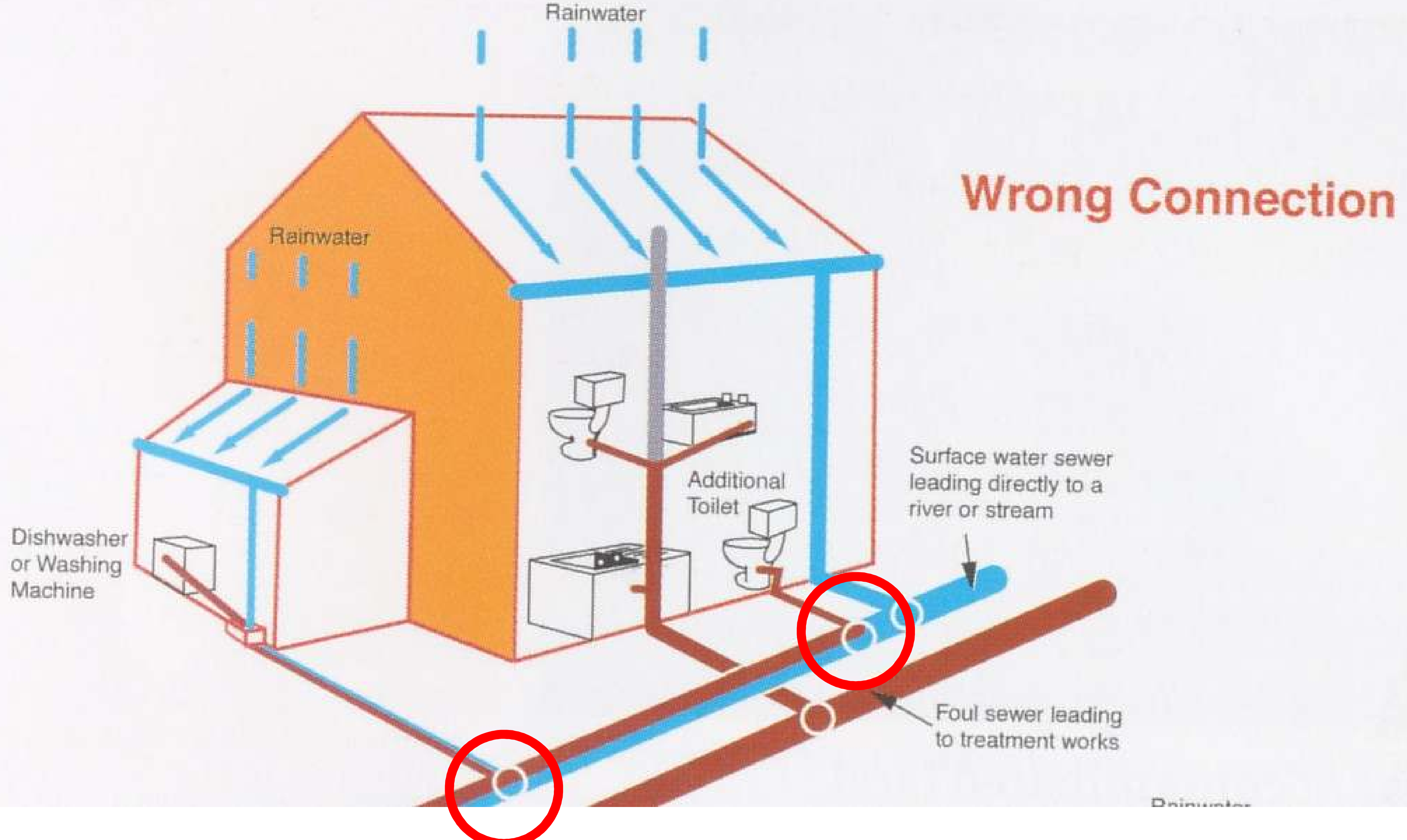
Progress in environmental management

- Pollution control (phase 1: 1970s-1980s)
  - Law, regulation, agency
  - Pollutant-target
- Pollution prevention (phase 2: 1990s-2000s)
  - Market-driven
  - Green technology
- Low carbon economy (phase 3: 2010s-2020s)
  - Ecological footprint
  - Sustainability
  - New paradigm



Two Separate Systems Two Separate Tasks

Pollution control (phase 1: 1970s-1980s)



Pollution loads of municipal wastewater (sewage)

Parameters	Black water or Urine+faeces (%)	Grey water (%)
BOD_5	32	68
COD_{mn}	36	64
SS	47	53
Nitrogen	75	25
Phosphorus	75	25

Grey water = bathing, washing, kitchen, etc.

Activated Sludge Model 2

$$\text{COD Total} = S_A + S_F + S_I + X_I + X_S + X_H + X_{PAO} + X_{PHA} + X_{AUT}$$

Fermentation products (acetate), S_A; Readily biodegradable substrate, S_F; Inert soluble non-biodegradable matter, S_I; Inert suspended non-biodegradable matter, X_I; $\mathbf{S_S = S_F + S_A}$; Heterotrophic biomass, X_H; Phosphorus-accumulating organisms, X_{PAO}; Organic storage products of PAO, X_{PHA}; Autotrophic, nitrifying biomass, X_{AUT}

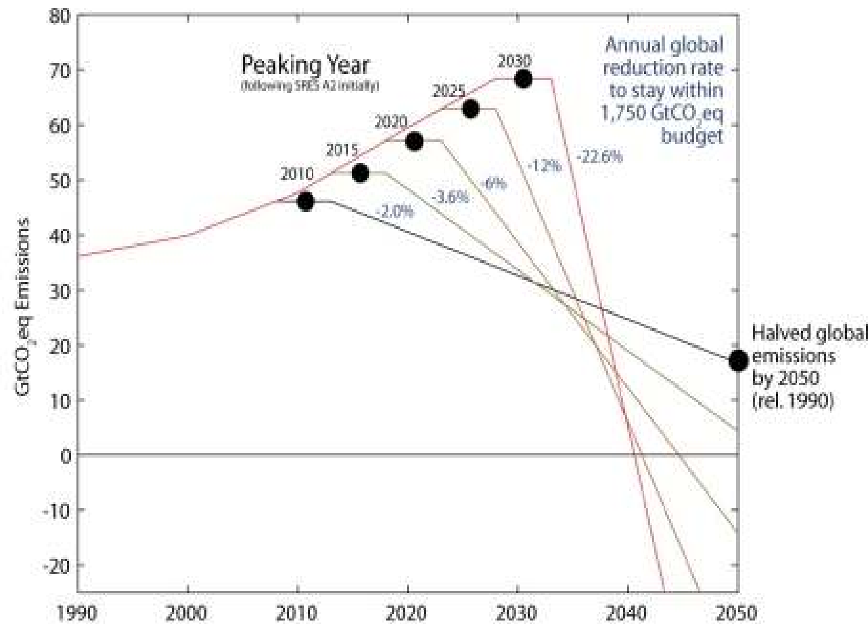
Kumarasivam › Inquiry › Value › Future

Action needed

“Carbon neutral economy”

Countries	Reduction target by 2020	CO_2 Basis
United States	17%	2005
European Union	20%	1990
China	40%	2005
India	24%	2005
Japan	25%	1990
Russia	20%	1990
Canada	25%	1990
Australia	25%	2000
Norway	30%	1990
MALAYSIA	**40%**	**2005**

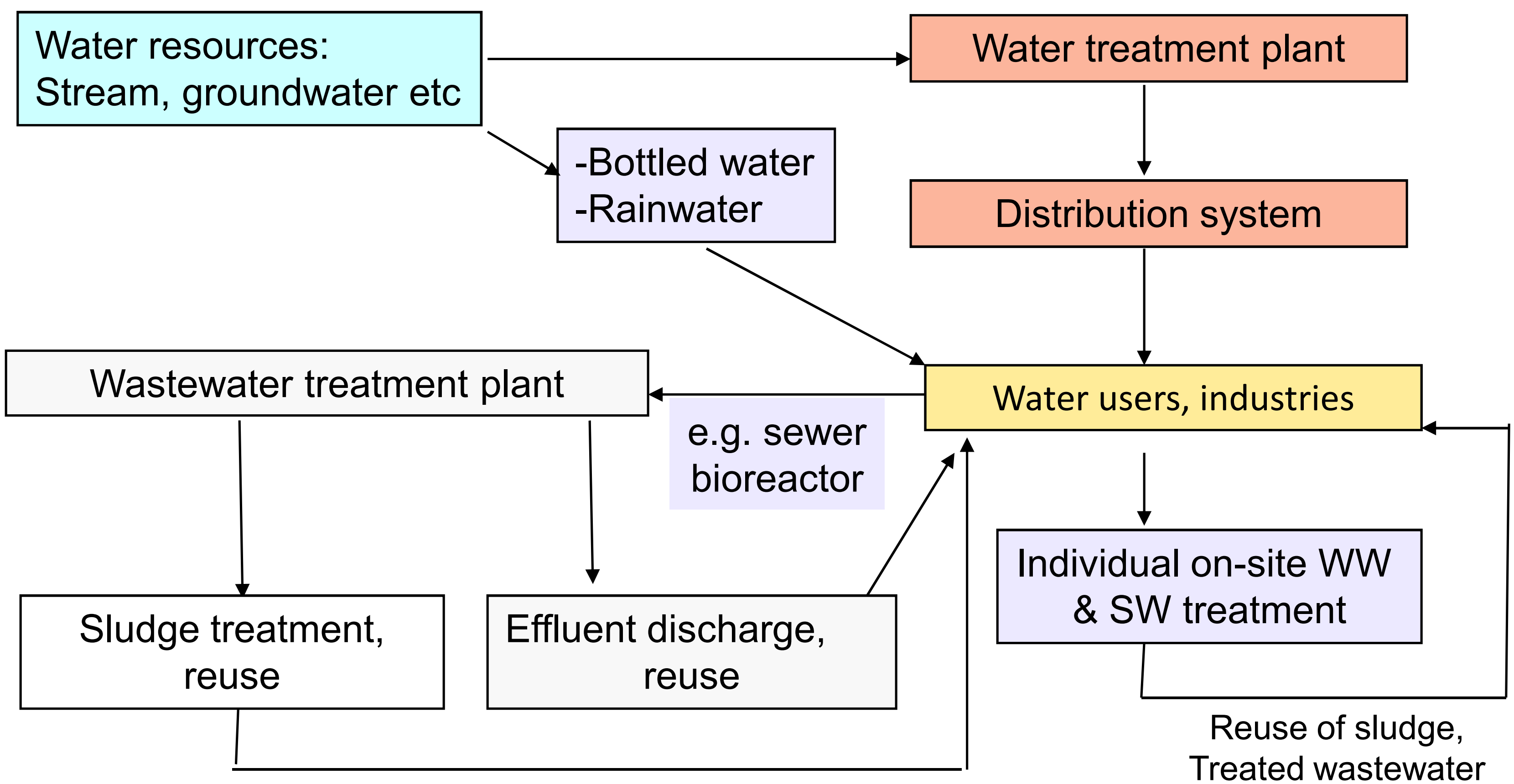
Low carbon economy (phase 3: 2010s-2020s)



Low carbon economy (phase 3: 2010s-2020s)

Sustainable water system?

(Small, decentralised, close-loop, low energy, low eco-footprint)



Sewer technology

PRESENT
Collection

- From generation
- Convey to wastewater treatment plants
- Catchment enlarged
- Combined: sewage, industrial, sullage etc.

FUTURE
Treatment

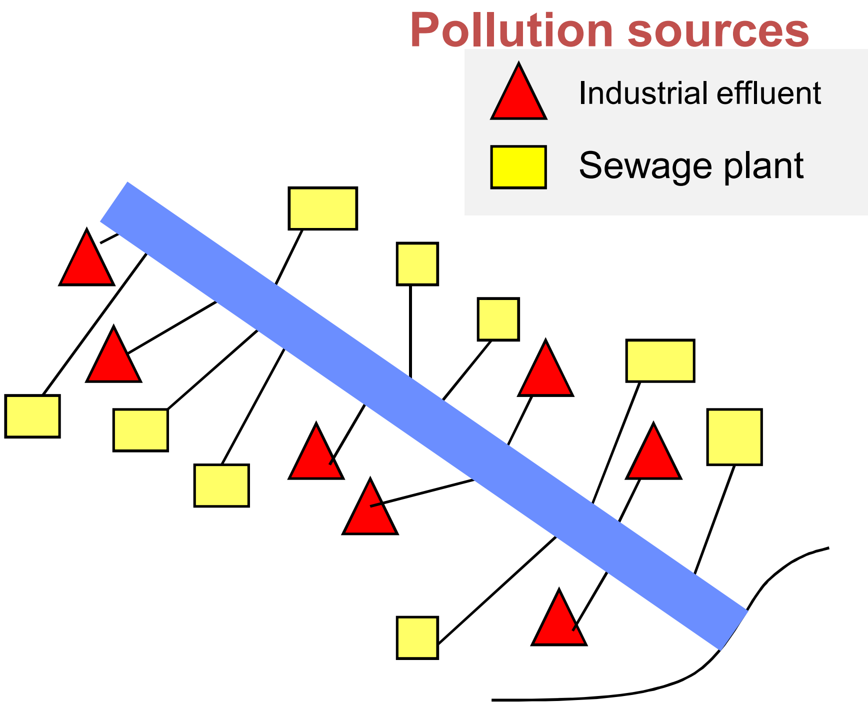
- Long and big diameter of sewer
- Sewer reactor for organic transformation
- Pretreatment for nutrient removal plants
- Sewer biotransformation

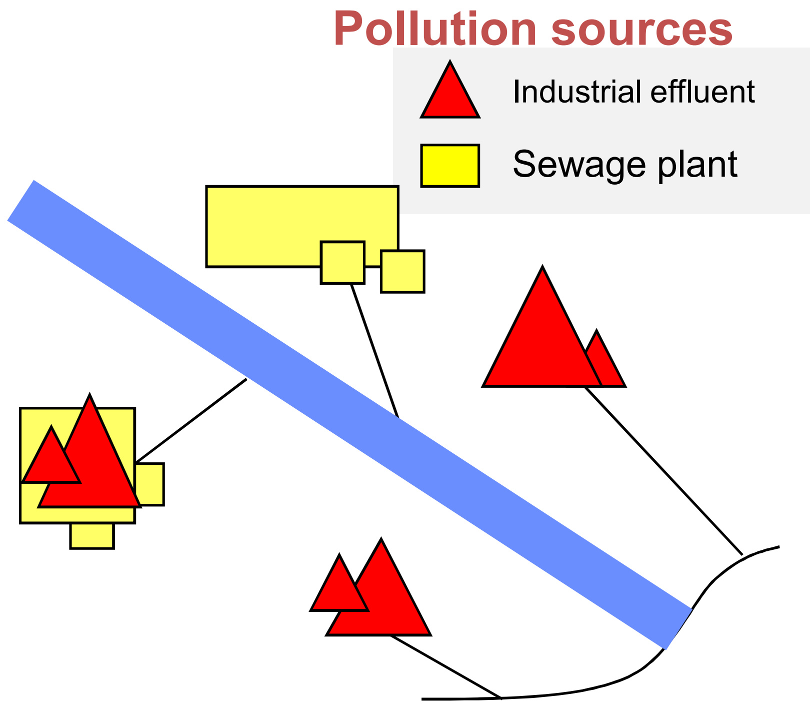
Activated Sludge Model 2

$$\text{COD Total} = S_A + S_F + S_I + X_I + X_S + X_H + X_{PAO} + X_{PHA} + X_{AUT}$$

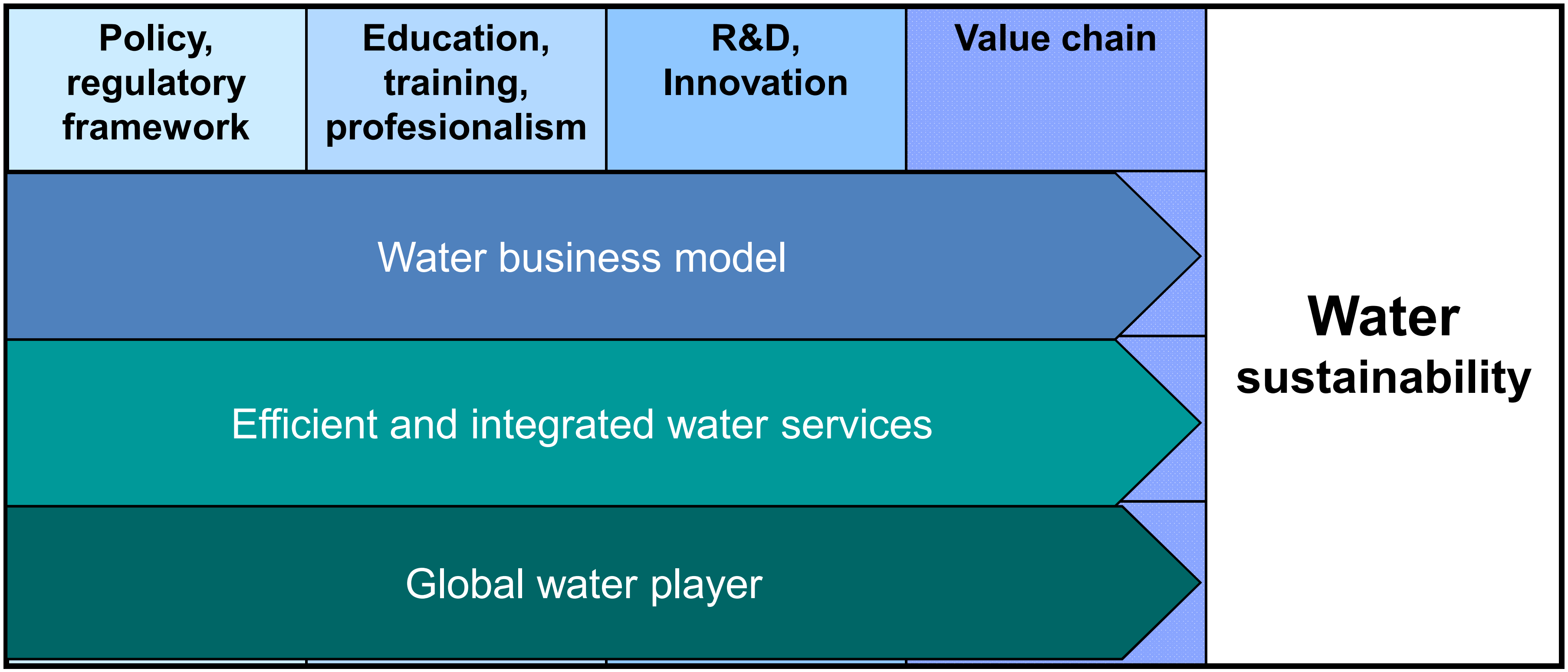
Fermentation products (acetate), S_A; Readily biodegradable substrate, S_F; Inert soluble non-biodegradable matter, S_I; Inert suspended non-biodegradable matter, X_I; $\mathbf{S_S = S_F + S_A}$; Heterotrophic biomass, X_H; Phosphorus-accumulating organisms, X_{PAO}; Organic storage products of PAO, X_{PHA}; Autotrophic, nitrifying biomass, X_{AUT}

How "small" is a small system?





Framework for water sustainability



Kumarasivam → Inquiry → Value → Future

http://www.utm.my/vc/speeches

Thank you!

I am grateful to take questions now …

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