Innovative Technology Approaches to Meet the Needs of Agriculture, Water, Sanitation and Energy

Dr Cynthia Mitchell

2015 Indonesia International Water Week
1. Indonesia has incredible infrastructure challenges AND incredible opportunities

2. Following historical paths closes the door on many of those opportunities. Indonesia can and should choose a different path.

3. Taking a systemic, long-term view is the only way to make good* technology choices

* Consistent with a safe and just space for humanity
The overarching pushes from the present are significant.

Overlaying everything:

- **Population growth and development**: massive increases in quantity and quality of demand
- **Climate change**: more frequent + more intense weather events, rising sea levels

Significant (infrastructure) vulnerability
The sector-specific pushes from the present are also significant.

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<thead>
<tr>
<th>Water</th>
<th>Agriculture</th>
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<tbody>
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<td>- Leakage rates up to 40-50%</td>
<td>- Competition among agriculture for land, nutrients, and subsidies</td>
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<td>- Water seldom of potable quality</td>
<td>- Global Hunger Index – improving, but still ‘Serious’</td>
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<td>- 90% of ground water in Jakarta is contaminated with <em>E. coli</em></td>
<td>- 40% food loss and/or food waste</td>
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<th>Sanitation</th>
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<td>- Increasing consumption of electronic goods + increasing GDP = rapidly increasing demand</td>
<td>- 80% of septic tanks fail</td>
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<td>- Reduced national subsidies = increased transport costs</td>
<td>- 50% of planned capacity for local scale systems is unused</td>
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<td>- Energy losses of 18%</td>
<td>- 9 PD-PALs (versus &gt;400 water service providers)</td>
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<td>- 80% electrification and frequent blackouts</td>
<td>- Not clear whether water quality improves after intervention</td>
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History has served us well elsewhere, but has unintended impacts that we can no longer afford.
Another path is possible and necessary.

If we could re-plumb our cities in the developed world, we would do it differently now.
Indonesia has the opportunity and capacity to choose a different path. To leapfrog.

The technology and infrastructure choices that Indonesia makes in the next couple of decades are critical.
The goal and the path **together** determine the cost and the impact

The goal needs to reflect the outcome. For example for sanitation, achieve complete separation of people and pathogens by 2025. But how?

There are 3 dimensions that determine the best path:

1. **Efficiency** – are we doing the thing right?
2. **Effectiveness** – are we doing the right thing?
3. **Efficacy** – is the thing we are doing moving us in the direction we want to go? Is it helping us leapfrog?

Indonesia needs to use infrastructure and technology decision-making tools that account for all three dimensions.
What does all this mean for infrastructure planning and technology choices?

Case Study 1: Urban agriculture

Urban agriculture will be essential for feeding mega-cities. Agriculture requires water, nutrients, and land.

Urban water demand: 0.25 t/p.d

Total food demand: 7.5 t/p.d

Urban agriculture means big shifts in local water and nutrient cycles.
What does all this mean for infrastructure planning and technology choices?

Case Study 2: Avoiding the 200\textsuperscript{th} birthday of activated sludge

Per person, now

- 200 L
- 1.3 MJ
- 10 g N
- 2 g P

\begin{itemize}
  \item 0.15 kWh
  \item 2 g chemicals
  \item 200 L non-potable water
  \item 500 g sludge that’s a problem to dispose of
  \item \( N_2, CO_2 \)
\end{itemize}

What if we set out to make products from wastewater instead?

Thanks to Damien Batstone, University of Queensland
What does all this mean for infrastructure planning and technology choices?

Case Study 2: Avoiding the 200th birthday of activated sludge

Per person, soon

Membrane Photo-Bioreactor

- 0.1-0.3 kWh
- 200 L potable water
- 50 g fertiliser

200 L
1.3 MJ
10 g N
2 g P

Recover nutrients, generate energy, produce water…
Real revenue!
…Tunnelling through the cost and impact barrier

Thanks to Damien Batstone, University of Queensland
Key Messages

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3. Taking a systemic, long-term view is the only way to make good* technology choices

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Thank you and please contact us.

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