Infrastructure asset management of urban water systems

The AWARE-P integrated approach

2011-09-28
Why IAM?

- Promote adequate levels of service;
- Strengthen long-term service reliability;
- Improve sustainable use of water and energy;
- Manage service risk, taking into account users’ needs and risk acceptance;
- Extend service life of existing assets;
- Improve investment and operational efficiency;
- Justify investment priorities.
Key strategic objective for the company:  

*Improve sustainable use of water and energy, while reducing carbon footprint*

Our networks:

- undesirable failure rates;
- high energy costs due to pumping;
- water supply: high losses; pressure/capacity shortages at peak hours in some sectors;
- wastewater: flooding/overflows in some sectors, even under moderate rainfalls.
Questions are due:

- How would we act?
- How can we prove that our decisions address the stated strategic objective?
- How can we quantify the impact of our decisions and actions?
• Probably start by an updated and reliable inventory of the existing assets
  – compile as many reliable records as possible of their condition and failure history.
• Try to identify the locations where there are pressure problems, flooding and overflows
  – also look at pump efficiency and energy consumption.
• Assess the relative importance of each asset.
• Combine such information and prioritize interventions within budget constraints.
This would contribute to the first question.

- *How would we act?*

What could be done about the other two?

- *How can we prove that our decisions address the strategic objective?*
- *How can we quantify the impact of our decisions and actions?*
These are the types of issues that the proposed approach is designed to tackle in a structured, aligned and transparent way.
An integrated IAM approach

Helps answer:

• Who are we & what service do we deliver?
• What infrastructures do we own / operate?

• Where do we want to be in the long term?
• How do we get there?
Operational
Tactical
Strategic

Planning and decision levels

Dimensions of analysis

Performance  Risk  Cost

Information  Engineering  Management

Competences
At each level

- A structured PDCA loop
A word on…

- Objectives
  - (e.g. environmental sustainability)
- Criteria
  - (e.g. water usage efficiency)
- Metrics
  - (e.g. real losses per service connection)
- Targets
  - (e.g. 100 l/conn./day)
Improve the sustainable use of water and energy while minimizing carbon footprint

<table>
<thead>
<tr>
<th>Assessment metrics</th>
<th>Current situation</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>In 5 years</td>
</tr>
<tr>
<td>Criteria 1: “Sustainable use of water”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real losses per connection (l/connection/day)</td>
<td>250 (poor performance)</td>
<td>150</td>
</tr>
<tr>
<td>Wastewater reused (%)</td>
<td>0 (poor performance)</td>
<td>5</td>
</tr>
<tr>
<td>Criteria 2: “Sustainable use of energy and minimization of carbon footprint”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standardized energy consumption (kWh/m³/100 m)</td>
<td>0.6 (fair performance)</td>
<td>0.40</td>
</tr>
<tr>
<td>Excessive energy per revenue water (^{(1)}) (kWh/m³ revenue water)</td>
<td>0.15 (poor performance)</td>
<td>0.10</td>
</tr>
</tbody>
</table>
At each level

From level above

Objectives > assessment criteria > metrics > targets

Diagnosis

Produce Plan

Implement Plan

Monitor Plan

To level below

From level below

Objectives > assessment criteria > metrics

Diagnosis

Produce Plan

Implement Plan

Monitor Plan
Through decisional levels...

Alignment

People involvement

Empowerment

Feedback
Back to our case…

What would we have done differently?

1. Clarify our understanding of the organization’s vision, objectives, targets and strategies, and keep them as long-term direction.
   – our understanding – and the Board’s understanding

2. From there, and based on our knowledge of infrastructure and its performance, define our own tactical objectives and targets.
3. Begin with a global, birdseye view of our systems

4. Followed by a subsystem-level evaluation

5. And finally an asset-by-asset analysis

We would have a clearer diagnosis and would have been driven to alternative designs that are globally more effective.
Planning workflow

define

current

for each alternative

objectives → criteria → metrics → targets

formulate → model → diagnose → assess

formulate → model → diagnose → assess
• We might have also found out that the present layout and diameters are not ideal.

• Perhaps some well–devised structural changes would have a higher priority than spending entire budget on *like–for–like* replacement of poor condition assets.
A path to a better system

- Asset condition and relative importance would still inform the alternatives under consideration – those components in most need of replacement would still be replaced...

- ...but with the broader view of a path to a better system, rather than to a collection of better parts.
Decisions

- Systematic assessment and comparison of alternatives – for the relevant scenarios, based on the pre-selected metrics and targets, would have facilitated communication and negotiation among internal and external stakeholders.
Ultimately

- Decisions will be less subjective and more easily accountable to the board or to the elected politicians.
- Their impact on corporate objectives will be better assessed.
- The utility will be able to improve monitoring of results, learn from them and act accordingly.

Practical applications and business cases in *Marques et al. (2011)*, *Cardoso et al. (2011)* and *Carriço et al. (2011)*.
www.aware-p.org

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Thank you