Long Term Management of Infrastructure in France

Available Tools and Use Difficulties

Bernard Barraqué & Laure Isnard, CNRS
French Context : 900,000 km of water pipes …

• A lot of scattered small water utilities (above 10000) and even more for sewer ones, plus 5 million septic tanks; but large and dense cities too

• Difficult to follow them and understand their problems, in particular to implement the EU water Directives; traditional support from County level

• Since the middle of the ’90s, a detailed survey made on a representative sample of more than 2000 communes, including all cities (SOeS, ex-IFEN)

• Last report coming out this very fall provides an estimate of UFW = 22%, and of the asset renewal and of systems extensions in the last 4 years

• Results are worrying: renewal of only 0.5% of cumulated length of water pipes per year, and same for sewers. A rhythm corresponding to average 200 year life?
An Issue in all Developed countries

- All countries where piped WSS were developed a century ago are concerned

- The idea is to expand both the scale and time horizon of asset management, and assess both technical and financing needs

- Software like PARMS (CSIRO, au), Kanew (Baur&Kropp, de), WARP-NRC (ca), ENCOMS-MACOMS (Halcrow, uk)

- CARE-S / CARE-W (eu), then adapted at national level: e.g. AWARE (pt), CASSES (fr)
## Enlarging scope of evaluation (losses for customers / flooding / traffic disruption etc.)

<table>
<thead>
<tr>
<th></th>
<th>Conditions based</th>
<th>Performance based</th>
<th>Service based</th>
<th>(business) Risk based</th>
<th>Sustainability based</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Informal</strong></td>
<td>Running after breaks &amp; leaks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Core</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Advanced</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The need for tools in France

- The ministry of Agriculture wanted to provide its services at county level, in charge of water services in ‘rural communes’, a tool to assess the investments needs (GSP – Diadème)

- A public research centre of the ministry, CEMAGREF, in association with G2C consulting, develops tools to support cities’ long term asset management (e.g. CASSES and SIROCO, later adapted by Lyonnaise des Eaux’s PREVOIR); former partner in CARE W/S projects

- In reply to a consumer NGO coarse & biased evaluation of ‘water overpricing’, French Mayors’ associations requested SP 2000, their own consultancy, to assess the cost of infrastructure management and its impact on price: SIM-Eau.
Mains break forecast tool: CASSES

CASSES – developed by Cemagref Bordeaux

**AIM**: forecast the number of breaks in each section within a given future period

**METHOD**: combine a description of materials in use and their environment with a history of breaks = epidemiology-like, probabilistic multi-parameter approach of the time span between 2 breaks: $t = f(\text{section characteristics} ; \text{environment})$ following a Leyp (law extending a Yule process).

**DATA**: description of sections and history of breaks. Mandatory: laying year, type of material, and length, break dates + possible use of other data: soil corrosivity, traffic above, depth …

**DIFFICULTY**: requests a good system knowledge, if possible a GIS -> still in limbo in most cities.
In Addition to CASSES : CRITICITE

CRITICITE - Cemagref Bordeaux

**AIM** : Ranking systems’ sections according to the critical degree of its state

**METHOD** : quantify disruptions in water supply when a break occurs in a section. For a given event, combining its probability (CASSES) and its impact (CRITICITE) gives an idea of the associated risk, allowing to set renewal priorities among the sections.

**DATA** : uses the results of CASSES ; e.g. total volume of non-supplied water in the whole service due to breaks.

**DIFFICULTY** : present-day tool simplifies calculations, taking only into account customers completely deprived of water when the section is out. New version in preparation including non-supplied water to customers only partly deprived of water.
**Decision Support Tool for Systems Renewal (1)**

**SIROCO** – G2C Environnement & Cemagref - Bordeaux

**AIM** : rank and prioritize pipe sections in need for renewal, particularly in small and middle size water supplies

**METHOD** : mutualise data from various utilities within a GIS system to obtain statistically significant samples. Beyond CASSES: includes a multicriterion decision support module relying upon impacts’ criteria (service interruptions, road trafic disruption, repairs’ costs...) and opportunity criteria (need for size reinforcement, other infrastructure works, etc.)

**DATA** : uses data from CASSES & CRITICITE, plus GIS data

**DIFFICULTIES** : see below
AIM: reconstitute economic and environmental costs, and decision support for water utilities’ managers

METHOD: estimation of future value of service provision, costs calculation and comparison of various evolution scenarios. E.g. reconstituting water services costs under varying hypotheses on water demands and system performance, ECOVAL can help a utility in its investment choices in the coming years in the system.

DATA: operation costs (OPEX), investments and corresponding annual spending (CAPEX), carbon balance…

DIFFICULTIES: the approach is more global but it is less centered on long term infrastructure management (thus potentially less precise) …
Decision Support Tool for Systems Renewal (3)

(Ongoing) – Régie des Eaux of Grenoble & UMR GESTE (Caty Werey et Amir Nafi)

**AIM**: technical and financial evaluation of assets, grouped according to life time categories. Subsequently allows to plan renewal policies on the water supply system based on technical and financial data.

**METHOD**: the scale of analysis is not the single component within the assets but a group of homogeneous components. Additionally starts from residual value at a given date and not from new (replacement) value.

**DATA**: assets description (laying date, historical value, accounting life time, technical life time, failure forecasts (CASSES))

**DIFFICULTIES**: not validated yet, under construction in Grenoble.
Programming/Assessing Investment choices (1)

GSP – Diadème Ingénierie & Cemagref Strasbourg

**AIM** : supporting local water utilities, through assessing their management (a task of the corps of rural engineers): calculate the sustainable price of water and compare with existing, maîtrise bien la réalité des coûts, selon le niveau de performance et la des risques sanitaires souhaitésto sse how cost recovery is balanced with performance and water quality criteria

**METHOD** : assets valuation is starting point to estimate operation costs; benchmarking with various other utilities to question any eventual departure from what is considered fair price

**DATA** : assets’ breakdown in 3 groups : Infrastructure – Works – Machines. Basic geogr. data (name, commune,...), construction year, functions (major, secondary), localisation, technical characteristics, asset followup (purchase value, depreciation, date of first/last use), Inventory of accounting values, state/status of the renewal program…

**SHORTCOMING** : Used alone, insufficient to clearly assess the causes of a departing from the ‘fair price’
**Programming/Assessing Investment choices (2)**

**SIMserviced’EAU** – FNCCR et SP2000

**AIM**: simulate the economic dimension of water supplies management, calculating expenses and recipes, on a foresight of 20 years and according to projects

**METHOD**: Unit per unit; each utility made up of a certain number of works and tasks. For each of these, identify OPEX and CAPEX (plus change over time). Assessment of products and debts, as a partial function of tariffs et forecast of billing basis

**DATA**: need a frame to assess opex and capex for a given work or task, calculate investment and operation costs unit per unit, and simulation plan for associated renewal and depreciation,

**DIFFICULTIES**: relatively simple implementation concerning opex, but more complex and less pertinent on capex (need to understand ‘accounting life-time’ issues) + need to train water managers to use the tool
Technical difficulties

- A large number of available tools (large French companies also have theirs: Renouv’eau & Prévoir for Suez, MOSARE & VISION for Veolia)
- Address only part of the issue (technical vs financing tools), rarely for a global assessment of infrastructure management’s sustainability
- Usually not coupled with tools to forecast/foresight evolution of consumer demands
- Good knowledge of assets needed, which is not frequent; no tradition to consider assets as heritage, in particular in public utilities + difficulty to convince elected representatives of issue importance
- New statistical approaches (J. Elnaboulsi & O. Alexandre): taking into account external effects and budgetary constraints + the issue of acceptable leaks rate
Why such a limited use?

- A lot of systems laid after WW2 => ageing problems just appearing now. England & Wales concerned earlier => 5-yr Asset Managt Plans
- For engineers, renewal less appealing than extension. Additionally, subsidies of the Agences de l’eau not available for one-to-one repl.
- Elected representatives prefer to keep water prices down, => tempted to postpone investments in general
- Renewal then scheduled in years or periods when there is money left after priority investments are made (e.g. mandated by EU Directives, like phasing out lead pipes and connections). Dependence on road / street repairs / renewal rather than criticity