Financing water and sanitation services – insights from public finance theory and from history

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EU Water framework directive (2000/60/DCE) : “... principle of recovery of costs of water services including environmental and resource costs... and in accordance with the polluter pay principle”
– FCR in Europe adopted officially for environmental reasons but in fact also to guarantee the financial equilibrium of WSS through autonomous revenues and to encourage accounting rules based on a correct depreciation and provision

– Full Cost Recovery should not be an objective per se: the objective should be to avoid both inter-generational and intra-generational externalities (Massarutto 2004-2007)

• This does not require to exclude any contribution from other financing source
Today’s policy debate: who pays?

- 1990’s: full cost recovery principle: Tariff (+ Transfers)
  - E.g. 2000 - Europe: Water Framework Directive


- Marseille 2012 World Water Forum: Tariff still considered as « the central part » (Gurria 2012)
Today’s policy - OECD 3T’s framework
Endogenous and exogenous revenues

• **Endogenous revenues (= Tariff):**
  – both fiscal or non fiscal
  – including the sanitation levy (*redevance d’assainissement*)

• **Exogenous revenues:**
  – **General taxation at local level (= Taxes)**
  – Money coming from an upper government level (= Transfer)
  – Money coming from other sectors ?
  – Money coming from land value capture tools ?

(Massarutto 2002, 2004)
Impure public goods (Samuelson)

- **Degree of Club-locking / level of exclusion from the club**: cost recovery through endogenous or exogenous revenues? Technical possibility to exclude? Is exclusion desirable?

- **Toll-finance (Tariff) or Tax-finance?** « a matter of judgment, depending on the specific case » (Musgrave 1959) : a normative choice

- **Merit goods** (Musgrave 1959) : goods considered so meritorious that their satisfaction is provided for through the public budget over and above what is provided for through the market and paid for by private buyers.

- **An intermediate solution** : ear-marked taxes or levies – redevances ou impôts affectés (Musgrave 1959)–
The urban & demographic challenge in Paris

Throughout the 19th century Paris was faced to a demographic revolution driven by massive flows of immigrants (D. H. Pinkney 1953; Marchand 1993, 35).

546,856 inhabitants in 1801
• 1,053,262 in 1851,
• 2,714,068 in 1901
• 2,871,429 in 1926.

Such a fast and wild demographic growth implied strong negative externalities in terms of poor sanitary conditions.

In 1831 the cholera “attacked 39,000 persons in the city and killed 18,000 of them, including the prime minister himself. It struck again in 1849 and this time 19,000 Parisians died.” (D. H. Pinkney 1955, 129).

Progressively the link between the lack of access to clean water and sanitation, the epidemics and life expectancy in the urban environment was made explicit in the scientific and decision-makers circles.
Paris 1807-1926: two snapshots

• 1807:
  – 8000 m$^3$/day of drinking water (mainly pumped from the Seine)
  – home-delivery by water carriers
  – 24km of sewers

• 1926:
  – 1,323,960 m$^3$/day of water
  – majority of buildings had household water connections
  – 1300 km of sewers

• How such an improvement was made possible?
Urban growth and autonomous municipal finance

- Economic and industrial development:
  - High demographic growth (migration)
  - Urban expansion and transformation => Infrastructure challenge

- Autonomous and constrained municipal finance
  - Mainly excise duties (droit d’octroi) – regressive
  - Budget balance obligation (ordinary expenses)
  - Budget control by an upper level of government

- No transfers from central government
  => local exogenous revenues only

- Need to borrow to finance capital expenditures
Short run financing tools – deficit financing

• Debt globally managed at municipal level
• Little sector-specific watsan debt
• Municipal fiscal revenues given as collaterals
• Borrowing authorization by an upper level of government
• Fixed interest rate and long payback (50-80 years)

=> key role played by inflation

• Municipal bonds (particularly in Paris)
• Loans with banks / state-owned lending institutions (particularly in Milan)

<table>
<thead>
<tr>
<th>Year of issue</th>
<th>Amount collected MF</th>
<th>nominal MF</th>
<th>Interest rate</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1875</td>
<td>220</td>
<td>250</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>1876</td>
<td>129</td>
<td>120</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>1886</td>
<td>249.75</td>
<td>277.5</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>WSS: 60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1892-94</td>
<td>200</td>
<td>231</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>WSS: 27</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>1894-96</td>
<td>-</td>
<td>161.5</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>WSS: 117.5</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Land value capture tools as exogenous revenues

• Public land acquisitions and resale policy in Paris under Haussmann
  • Very powerful 1852 expropriation decree
  • Powerful (and creative) borrowing tools to bypass the city’s borrowing constraints
    - Caisse des travaux
    - Bons de délégations

• Integrated urban renovation operations
  Water supply network and sewers’ costs financed by land added value

• Land acquisition & resale not largely implemented in Milan
  • No powerful expropriation legislative tools available
  • No capacity to mobilize quickly large amounts of money

Source: Massias, Eau de Paris
Paris: water infrastructure & financing tools

**Water distribution and sewerage networks (1853-1869)**
- Haussmann’s era
- Time spreadable investments
- partly financed through ordinary municipal funds

- often built in the context of integrated urban renovation operations which transformed Paris

- network costs absorbed in the global cost of these larger operations

- financed through « Land value capture mechanisms » (Caisse des Travaux and Bons de délégation)

**Strategic supply devices (Aqueducts, Tanks) + champs d’épandage**
- Lump sum investments
- Municipal bond issuing

**Financing water infrastructure after 1880**
- Multipurpose Municipal bonds
- Two specific loans for water infrastructure (1872 and 1908)
- City’s fiscal revenue as a collateral
- 1894: sanitation levy used as a collateral
- 1908: water tariff used as a collateral temporarily (first three years)
PARIS: Share of the yearly costs of the Water, Sanitation and Canals services (1865-1930) covered by Tariff revenues [%]

OPEX:
-Tariff” revenues were not even sufficient to cover the Canals and Sanitation costs.
-water service had larger “Tariff” revenues which entirely covered internalized OPEX costs.
-total “Tariff” revenues were covering OPEX costs meaning that a cross subsidy between the three services was taking place.

CAPEX
-Tariff revenues (for WSC service as a whole) covered at least 70% of the total costs (65% in 1872) and more than 100% after 1893.
-“external OPEX costs” (in particular energy costs and engineers’ salaries) absorbed by the city overall budget.
Milan’s WSS - share [%] of the yearly total costs (OPEX + debt's service) covered by endogenous revenues

- Below 50% until 1899
- Above 70% after 1901
- Roughly 100% after 1906
Key role played by inflation: the lenders as end-payers?

Estimated debt service in Milan in thousand Lira (1888-1944), comparison with or without inflation indexation

Estimated debt service in Paris in MF (1890-1944), comparison with or without inflation indexation
Some lessons from history?

• When talking of decentralisation: importance of municipal financial autonomy / municipal debt

• Integrated financing approach for the whole municipal infrastructure and not for the water sector only

• A variety of exogenous revenues can be used:
  • Well thought land value capture policies?
  • Cross-subsidies from other public services?

• Water and sanitation as merit goods to be incentivized through law enforcement / subsidies?

• Historical evidence shows a large contribution from exogenous revenues in the initial expansion phase of the service

• Best mix of endogenous/exogenous revenues is a normative choice – one policy does not fit all situations!
« Chaque fois que la ville perce une rue, l’égout allonge un bras »,
« Every time that the city opens a street, the sewer streches out an arm »
Victor Hugo, Les Miserables


www.cairn.info/revue-flux-2014-3-page-44.htm

The Economics of Infrastructure Provisioning, The Changing Role of the State, https://mitpress.mit.edu/books/economics-infrastructure-provisioning
Key trade-off questions for watsan services

1. Voluntary or compulsory membership to the club?
2. Cost recovery based on endogenous or exogenous revenues?
3. Club part of the LGU (Local Government Unit), autonomous or corporatized?
4. Endogenous revenues: tariff or fiscal nature?
5. Endogenous revenues: metered, flat fee, two part tariff?
6. Exogenous revenues: Local or National?
7. Local or national planning and management of investments?
8. Who borrows?
9. Who is the end-payer of the investments costs?
10. Spatial equalization mechanism?
Une grille d’analyse à garder en tête

1. Des coûts couverts par des revenus endogènes ou exogènes au service?
2. Mode d’organisation du secteur : autorité organisatrice, opérateur, régulateur
3. Nature juridique du service: régie simple, régie autonome, statut d’entreprise?
4. Nature juridique des revenus endogènes : tarif ou redevance à caractère fiscal ?
5. Modalités technique de collecte des revenus endogènes: basées sur un compteur? Au forfait? Tarif avec part fixe et part variable?
6. Source des revenus exogènes : échelon local, échelon national?
7. Quel échelon institutionnel a la maîtrise de la planification et de la gestion des projets d’infrastructure?
8. Qui emprunte? Avec quelle garantie?
9. Qui est le payeur final de l’infrastructure?
10. Y a-t-il des mécanismes de péréquation spatiale? Ceux ci permettent-t-ils des économies d’échelles sur les coûts financiers?
A model of the financial flows of the water and sanitation service – 3 T’s

- **Landlords**
- **Compagnie Générale des Eaux**
- **Domestic water users**
- **Phone and telegraph**
- **Outskirts municipalities**
- **Canal navigation users**
- **Public administration water users**

**Revenues**
- CGE’s fee
- Water bills
- Water, sanitation and canals
- « Tariff » revenues

**Costs**
- O&M
- Debt service
- Water, sanitation and canals
- City’s global accounting sections

**Loans**
- Loans specific funds for extraordinary expenses
- Loans payback (t=2)

**Funds**
- Loans funds (t=0)
- Lenders / eventually with bank intermediation

**Payments**
- Sanitation levy
- Sewer servitude fee
- Sanitation contribution
- Canal tariff
- Water bills
- City of Paris
- City of Paris

**Additional Notes**
- New investments
- City of Paris

**Definitions**
- Domestic water users
- Compagnie Générale des Eaux
- Landlords
Water tariff and sanitation levies: compulsory or voluntary membership to the service?

Sanitation

- sanitation levy with a fiscal nature (ear-marked => considered as an endogenous revenue)
- sanitation made compulsory (1894 in Paris) => Club with coerced membership and no exclusion

Water in Paris

- *Compagnie Générale des Eaux* (CGE) was entrusted through the 1860 agreement of *régie intéressée*
- 1870’s lower water tariffs were approved
- 1870’s free installation of standpipes to bring water to all floors was proposed by the city to all un-connected building
- After 1894 only meter subscriptions and service with compulsory membership (at least at first but rejection by the conseil d’Etat in 1896)

Water in Milan

- Voluntary membership but a 1896 ministerial decree made compulsory to have domestic water connection; before WWI 81% of the houses were connected.

Obbligation to connect even if not tightly enforced spread the idea that the water and sanitation service was an essential CCU to be member of.
# Land value capture tools (1/2)

<table>
<thead>
<tr>
<th>Capture from (Who is the payer?)</th>
<th>Voluntary tools</th>
<th>Mandatory tools</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developers</td>
<td>Joint development</td>
<td>- Development exaction and impact fees</td>
<td>Expansion areas / integrated urban renovation operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Public land acquisitions and resale</td>
<td></td>
</tr>
<tr>
<td>The community</td>
<td>No</td>
<td>- Betterment levies</td>
<td>Built up areas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- General tax on land value gains</td>
<td></td>
</tr>
<tr>
<td>Within</td>
<td>- Internalization (integrated urban developer)</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Linkage capture</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: author’s elaboration based on concepts from various sources (ReUrba 2006; Peterson 2009; Brugnoli 2010)
Land value capture tools (2/2)

A) Tools applying to urban areas still to be built (urban extension or urban renovation)
   i. Selling public land
   ii. Public-private partnerships based on public land
   iii. Selling building rights
   iv. Land readjustment/ urban redevelopment
   v. Exactions/ development/ impact fees
   vi. Community benefit agreements

B) Tools applying to existing built areas:
   i. Betterment levies / special assessment
   ii. General tax on land value gains
   iii. General property tax
   iv. Tax increment financing

Source: Albrecht, CGLU

What about specific land value capture tools applying to the water sector?
Impure public goods and water

Water resources, rival in consumption but often not excludable, appear to be “common pool resources” while network water services which are mostly excludable but not rival will be defined as “toll goods” or “club goods”.

<table>
<thead>
<tr>
<th>Rival</th>
<th>Non-excludable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excludable</td>
<td>Non-excludable</td>
</tr>
<tr>
<td>Private good (e.g. drinking water supply)</td>
<td>Free access or “common pool good” (e.g. groundwater aquifer when individual pumping for irrigation is not monitored)</td>
</tr>
<tr>
<td>Club good (non-rival until a “saturation threshold” is reached) (e.g. networked services, with the threshold linked with the capacity of the system; recreational use of a water body, if monitoring of access is feasible)</td>
<td>Public good (flood management, resource and ecosystem protection, hydrological monitoring, storm-water drainage)</td>
</tr>
</tbody>
</table>

Source: (OECD 2009, 25)

“An additional category that is relevant for some water services is that of “merit goods”, whose consumption has a “general interest” dimension. This concept is also linked with that of externalities. The consumption of merit goods tends to be below the social optimum for two possible reasons: (i) positive consumption externalities are not taken into consideration by private consumers; or (ii) individuals are myopic and maximise short-term utility, not taking into consideration their private long-term benefits.

Some components of WSS services have important consumption externalities providing a complex set of benefits at community, regional and even national levels. A typical example is that of basic sanitation services and wastewater collection, for which willingness to pay tends to be lower than their societal value as households cannot fully take into account the additional community benefits that their use of these services entails.” OECD 2009 p 25
Reasons behind FCR in Europe: between environmental and financial sustainability

A) More equitable cost allocation based both on polluter pay principle and on internalization of externalities

B) Adoption of tariff formulas encouraging a more sustainable use of water resources

C) To guarantee the financial equilibrium of WSS through autonomous and stable endogenous revenues => more stable collaterals for repayable finance

D) To make compulsory for WSS to adopt accounting rules based on a correct depreciation and provision for long life time infrastructure assets

Inspired from Massarutto 2002; 2004; 2006
<table>
<thead>
<tr>
<th>Environmental sustainability</th>
<th>Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discourage depletion of critical natural capital</td>
<td>Guarantee that “merit uses” have due access to water resources under fair and equitable conditions</td>
</tr>
<tr>
<td>• Guarantee ecological functions of water natural capital</td>
<td>• Identify “water needs” (↔ basic environmental functions)</td>
</tr>
<tr>
<td>• Minimize the recourse to “supply side”</td>
<td>• Keep level and dynamics of prices below the threshold that makes it unaffordable for some users</td>
</tr>
<tr>
<td>• Minimize the alteration of natural outflow patterns</td>
<td>• Achieve an equitable and democratically accepted way to share the cost of managing water resources</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Financial sustainability</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guarantee long term reproduction of physical assets</td>
<td>Guarantee that water is allocated to its most beneficial uses and economic resources are not wasted</td>
</tr>
<tr>
<td></td>
<td>Allocative efficiency: available water should be allocated in order to privilege uses with the highest social value</td>
</tr>
<tr>
<td></td>
<td>Allocative efficiency: the cost of provision of water services (to non-merit uses) should be confronted to their value</td>
</tr>
<tr>
<td></td>
<td>X-efficiency: costs should be as close as possible to the minimum (intended in dynamic terms)</td>
</tr>
<tr>
<td></td>
<td>Not encourage over-capacity, over-staffing, gold-plating etc</td>
</tr>
<tr>
<td></td>
<td>Cost coverage should be intended as for efficient costs only</td>
</tr>
<tr>
<td></td>
<td>Regulation should ensure an optimal allocation of risks among shareholders, users and taxpayers</td>
</tr>
</tbody>
</table>

Source: Antonio Massarutto