Metodología de indicadores de gestión y evaluación del desempeño en la prestación del servicio de agua y saneamiento: Modelo PURC

IMTA/PURC/ADERASA/ANEAS Seminario 13-14 de Mayo de 2010

Sanford Berg
Director of Water Studies
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Regulatory Challenges (FAQ)

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Outline

I. Why Benchmark?

II. Participatory Survey

III. Benchmarking to Facilitate Conflict Resolution
I. Why Benchmark?
Symbolic and Substantive Importance

- Water and sanitation have come to symbolize the huge gap between promise and performance.
- Negative health impacts & social unrest occur when serious reforms are delayed and investments deferred.
- Reports identify weak performance and governance.
- The political economy of infrastructure: “Those who make tough decisions will not receive credit during their terms in office: Political patronage vs. long term performance”.

Objectives: financial sustainability, network expansion, cost containment and service quality.
Importance of Benchmarking

Performance comparisons are necessary but not sufficient for sound policy.

Benchmarking is an important tool for:

- Documenting past performance,
- Establishing baselines for gauging improvements (and identifying feasible targets),
- Making comparisons across service providers and over time,
- Promoting Transparency, and
- Introduces incentives.
Creating Appropriate Yardsticks

Regulators want to achieve outcomes comparable to those achieved with "best practice".

Reward outstanding performance

Identify & Penalize weak performance

Understand the Impacts of Decentralization

*Benchmarking provides* **Yardsticks**
Meetings

2nd Mexico National Young Water Professionals Conference, Queretaro, Mexico April 10-14, 2010 (IWA and UNAM)

1st International Water Association Development Congress
November 15-19, 2009, Mexico City

1st International Forum Water Sector and National Competitiveness: "Drinking Water and Sanitation Services in Urban Areas"
September 02 - 04, 2009, Mexico City

FORO IBEROAMERICANO DE REGULACIÓN (FIAR)
24 y 25 de Julio de 2008, Ciudad de México, México
More Meetings


Seminario Internacional de Gestión y Regulación de los Servicios de Agua Potable y Saneamiento: La Experiencia Mexicana e Internacional
July 25-27, 2007 (IMTA, Conagua, ANEAS)

XIX Congreso National de Hidraulica La Gestion Integral del Aqua, Asociación Mexicana de Hidraulica, Cuernavaca,
November 8-10, 2006

World Water Forum, Mexico City, March 16-22, 2006

What will be the impact of Today’s SEMINAR?
Can an Index Capture Complexity?

A single index of utility performance will be neither comprehensive nor fully diagnostic.

- Physician can have information on a patient’s temperature, pulse, height and weight.
- Patient is in trouble: dangerous fever and/or is significantly overweight.
- Blood tests provide more detailed information
- Diagnosing and treating mental health issues would require other diagnostics and treatments... Still, temperature and weight provide useful information.
## Partial Performance Indicators: Uganda National Water & Sewerage Company

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Coverage</td>
<td>48%</td>
<td>70%</td>
</tr>
<tr>
<td>Unaccounted for water</td>
<td>51%</td>
<td>29%</td>
</tr>
<tr>
<td>Percent Metered</td>
<td>65%</td>
<td>99.6%</td>
</tr>
<tr>
<td>Active Connections</td>
<td>63%</td>
<td>94%</td>
</tr>
<tr>
<td>New Connections/year</td>
<td>3,317</td>
<td>23,312</td>
</tr>
<tr>
<td>Total Connections</td>
<td>50,826</td>
<td>148,312</td>
</tr>
<tr>
<td>Turnover (Revenue)</td>
<td>US$ 11 million</td>
<td>US$ 34 million</td>
</tr>
</tbody>
</table>
Results of NWSC Incentives Based on Benchmarking

State-Owned Enterprise achieved success by:

- Understanding past and current performance
- Establishing open communication between workers, managers & executives
- Developing achievable goals & sound strategies
- Increasing accountability for workers & managers
- Designing incentives & rewards to encourage efficiency (bonuses of 50% if targets met)
- Reviewing progress and readjusting strategies

South East Asian Water Utility Network- Benchmarking Survey

- Designed for compatibility with IBNET
- Calculated 82 performance indicators in 4 main areas
- Compared overall performance with OPI’s
Study of Central American Water Utilities (PURC/IADB Study, 2007)

Outputs

1) **Volume of water**: produced, billed and lost
2. Number of water **connections** and sewerage: total, residential, with meter
3. **Total population**, population served, number of inhabitants per connection
4. **Network length** – for water and for sewerage
Inputs

**Number of workers** and their cost (or expense): total, by contract and fixed.

Volume of **energy** and its cost (kWh or another unit).

**Capital stock**: non-current assets, accumulated depreciation, annual depreciation, km of pipe

**Administrative Expenses, Financial Expenses, Operating costs, Total Costs**
Water Quality and Service

**Water quality**: any variable defining water quality according to each country, such as percentage of residual chlorine.

**Continuity**: number of hours a day customers receive water service

Number of complaints
Number of network leaks

% Bills paid

% Water accounted for

% metered customers

% coverage
Other Studies

- **Brazil**: SNIS data
- **Peru**: SUNASS data
- **Mexico**: IADB book (1999)
  
  *Spilled Water: Institutional Commitment in the Provision of Water Services* (Savedoff & Spiller)
  
  - Ozuna and Gomez (chapter)
  - Sample 200 companies
  - “Firms are generally quite inefficient . . . .”
  - “Municipal Utilities operate more efficiently than state-level . . . .”
Eficiencia media 0,610
### ADERASA Study Sample (2003-2008)

<table>
<thead>
<tr>
<th>Country</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
<th>07</th>
<th>08</th>
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<tr>
<td>Argentina</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>5</td>
<td>41</td>
</tr>
<tr>
<td>Bolivia</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
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<tr>
<td>Brazil</td>
<td>9</td>
<td>9</td>
<td>0</td>
<td>6</td>
<td>8</td>
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<td>103</td>
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<tr>
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<td>5</td>
<td>33</td>
<td>37</td>
<td>38</td>
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<td>151</td>
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<tr>
<td><strong>Mexico</strong></td>
<td><strong>0</strong></td>
<td><strong>0</strong></td>
<td><strong>9</strong></td>
<td><strong>3</strong></td>
<td><strong>2</strong></td>
<td><strong>1</strong></td>
<td><strong>15</strong></td>
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<tr>
<td>Paraguay</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>14</td>
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<tr>
<td>Peru</td>
<td>9</td>
<td>9</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>9</td>
<td>57</td>
</tr>
</tbody>
</table>

(16 nations total)
II. Encuesta de Reguladores, Administradores y Partes Interesadas

1. Identificar patrones en amenazas y oportunidades
2. desarrollar estrategias que permitan reunir y analizar datos para los operadores del agua.
3. identificar las razones de la falta de progreso en esta importante área.
4. estimular conversaciones y debates en esta reunión.
Asuntos Políticos (1-5)

a. Falta de visión política por parte de los líderes nacionales (el agua no es una prioridad)
b. Falta de compromiso por parte de líderes municipales locales
c. Falta de consenso popular sobre la naturaleza de problemas de agua/saneamiento
d. Falta de consenso popular sobre opciones públicas preferidas
e. Tenencia corta de administradores de servicios públicos por razones políticas...
f. Otros (1:no importante ....5:extremadamente importante)
Asuntos de Regulación/Administración

f. Marco legal (regulatorio) inadecuado para la recolección de datos, el monitoreo de rendimiento y la oferta de incentivos

g. Sistemas de gobernabilidad débiles (escasa transparencia y participación ciudadana)

h. Falta de recursos para la recolección de datos (condiciones financieras débiles de los servicios públicos)

i. El cambio de personal en los directorios de los servicios públicos debilita el profesionalismo

Otros: 1:no importante ....5:extremadamente importante}
Asuntos de las Partes Interesadas

j. Revelar información sobre las pérdidas de agua, cuentas sin cobrar, y otros indicadores sería perjudicial políticamente

k. Los alcaldes y administradores municipales de servicios públicos temen la pérdida de poder

l. Falta de confianza de los empleados de servicios públicos por temor a la pérdida de sus trabajos o a responsabilidades adicionales

Otros: 1:no importante ....5:extremadamente importante)
Asuntos de Benchmarking

m. Compartir la información del benchmarking podría resultar en informes que injustamente critican a ciertas entidades de servicios públicos en particular.  

Verdadero______ Falso______

n. Mi organización actualmente recauda e informa sobre datos financieros y operativos de los servicios del agua.  

Verdadero______ Falso______

o. Mi organización no cuenta con una plantilla de empleados profesionales que tengan la capacitación necesaria para la preparación de informes detallados sobre el rendimiento mensual.  

Verdadero ____ Falso______
Four Most Important Factors in Regulation (Sappington)
Four Most Important Factors in Regulation (Sappington)

1. Politics
Four Most Important Factors in Regulation (Sappington)

1. Politics

2. Politics
Four Most Important Factors in Regulation (Sappington)

1. Politics
2. Politics
3. Politics
Four Most Important Factors in Regulation (Sappington)

1. Politics
2. Politics
3. Politics
4. Economics
Improving health: “Do No Harm”

- Benchmarking specialists produce and critique studies that utilize various methodologies.
- Rankings can be manipulated by choice of variables, model specification, sample size, time frame, and treatment of outliers.
- Results can be misinterpreted and misused.
- The stakes are high: affected parties have an interest in the relative and absolute performance comparisons.
- No matter how poor performance is, someone is benefitting from existing arrangements.
Politics plays a significant role in the reform process: successful changes require the full commitment of policy makers to financial and political objectives.

Separate and well-identified functions and responsibilities are important elements for institutional design.

Reforms must occur both internally and externally to promote successful outcomes.

Benchmarking is a valuable tool for improving water utility performance.

(Padowski)
III. Benchmarking to Facilitate Conflict Resolution

1. **Authority Conflicts**: lack of clarity of roles

2. **Cognitive (Factual) Conflicts**: disagreements regarding current or historical facts and causal linkages

3. **Value Conflicts**: conflicting priorities and different weights on outcomes

4. **Interest Conflicts**: stakeholders benefit differentially from decisions

(from Shabman, 2005)
Sources of Conflict and Sector Performance

1. **Authority Conflicts**: lack of clarity of roles

2. **Cognitive (Factual) Conflicts**: disagreements regarding current or historical facts and causal linkages

3. **Value Conflicts**: conflicting priorities and different weights on outcomes

4. **Interest Conflicts**: stakeholders benefit differentially from decisions

(from Shabman, 2005)
1. Authority Conflict

“Authority” conflicts reflect different views regarding where decisions will or ought to be made.

Who decides?

✓ Jurisdiction may not yet be assigned or the issue might be addressed by multiple agencies.

✓ Stakeholders will go jurisdiction-shopping—selecting the agency or the level of government most likely to support its interests in policy design and implementation.

✓ Appeals procedures within the judicial system can delay implementation. In such situations, benefits delayed are (effectively) benefits denied.

✓ Issues include: Finance Ministry vs. Water Ministry, Environmental Regulator vs. Sector Regulator
Authority Issues Facing Regulators

Who decides where to expand networks?
Who funds network expansion?
Who determines when prices are financially sustainable?
Who monitors water quality?
Who sets water quality standards?
Who decides environmental requirements?
Who makes water resource allocation decisions?

<table>
<thead>
<tr>
<th>Number Of New Connections</th>
<th>Change in Index of Water Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1  2  3  4  5  6  7  8  9</td>
</tr>
<tr>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>4000</td>
<td></td>
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<tr>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td></td>
</tr>
</tbody>
</table>
Regulator: Conflict Resolution--Authority

- Seek Changes in the Law—legal clarity
- Cooperate with Sister Agencies (avoid turf wars)
- Establish Task Forces to Address Issues
- Educate the Courts and Promote Transparency
- Improve Appeals Procedures
2. Cognitive Conflicts

✓ "Cognitive" conflicts are disputes over factual matters: “What is?”

✓ For example, How many new connections can be made with $300,000?

✓ Technical disagreements reflect cognitive conflicts. Such conflicts can be reduced through comprehensive data collection and analysis.
Regulator: Conflict Resolution--Facts

✓ Benchmarking Studies:
  – Input Data (physical and monetary)
  – Output Data (connections, water delivered, continuity, quality)

✓ Financial Sustainability Studies
  – Income Statements
  – Balance Sheets
  – Cash Flow Statements

Examine Incentives and Estimate time to reach “the” frontier
3. Values Conflicts

✓ “Values” conflicts are more ideological in nature, reflecting the different preferences or values of groups. What should be?

✓ Is there a political consensus over the weight assigned to particular outcomes, especially outcomes involving non-monetary impacts?

✓ Targets: Preferred outcomes depend on citizen attitudes.

✓ Issuance of Municipal Bonds: Private Participation?
Regulator: Conflict Resolution--Values

- Public Education
  - Publish Performance Comparisons
  - Identify Trade-offs
  - Report to the Legislature or City Council

- Promote Citizen Participation
  - Talk Radio
  - News Conferences
  - Citizen Advisory Boards

Limit the Rhetoric: Articulate a Vision
4. Interest Conflicts

✓ “Interest” conflicts reflect the differential impacts of policies on various stakeholder groups: “Who benefits from the policy?”

✓ If the situation is actually a zero-sum game, one group benefits at another’s expense (unless there is compensation).

✓ Special Interests: The political economy of regulation suggests that when the beneficiaries of a particular policy are concentrated (and per capita benefits are high) the beneficiaries will lobby.

✓ If losers are diffuse (and the per capita damages are low), the result is a policy that benefits well-organized stakeholders—even when the costs to the losers outweigh the benefits to the winners.
Pipe suppliers want to sell pipe. Unions seek particular work rules. Should more than $300,000 be invested? What should prices be to different groups?

Un-served citizens want “D”

Current Customers want “F”

Which Group has Political Power?

Would some recommendations lead to being inside the “frontier”??
Regulator: Conflict Resolution--Interests

✓ Do not pretend there are no conflicts
  – View from the Balcony—step back from stakeholders

✓ Take a Leadership Role in Identifying Benefits and Costs
  – Eg. OFWAT and EU Environmental Standards
  – Collected compliance cost information from utilities
  – Presented costs of meeting targets: current deadline vs. delay

Politicians make Final Decision (Accountability)
Regulators provide Leadership in Resolving Conflicts
## Conflict Resolution Matrix

<table>
<thead>
<tr>
<th></th>
<th>Technical Work</th>
<th>Adaptive Work</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conflict Over Facts</strong></td>
<td></td>
<td>Conflict Over What is important</td>
</tr>
<tr>
<td><strong>Conflict Over Distribution of Gains &amp; Costs</strong></td>
<td></td>
<td>Conflict Over Jurisdiction or Authority</td>
</tr>
</tbody>
</table>

Addressed By Research

Addressed by Engaging People with Adaptive Challenges in Research And Dialogue

From Mark Jamison
Informal Survey: Consider how you would answer the following:

1. **Authority**: Is ANEAS or Conagua used to help resolve key issues or is it by-passed? Are you in the middle of “turf wars”?

2. **Facts**: Has benchmarking been used to improve sector performance? Are contracts and targets based on reality?

3. **Values**: Do organizations help clarify how the targets reflect goals or stated political objectives?

4. **Special Interests**: Have policy decisions been inconsistent due to the influence of special interests? Does performance suffer?
Steps for Conducting Production or Cost Benchmarking Studies

1. Identify objectives, select methodology, and gather data;
2. Screen and analyze data;
3. Utilize specific analytic techniques;
4. Conduct consistency/sensitivity tests;
5. Develop policy implications.

(more detail in the Appendix)
Concluding Observation: No Quick Fix

- Seek credibility, legitimacy, & efficiency.
- Infrastructure problems are going to be managed, not solved.
- Benchmarking presents a promising route for comparing performance and creating incentives.
- Continue forums for sharing experience, exploring new ideas, and clarifying important policy issues.

www.purc.ufl.edu Leadership in Infrastructure Policy
Muchas Gracias

When all is said and done, more is said than done.
Appendix

- Metric Benchmarking
- Methodologies
- Steps in Conducting Benchmarking Studies
  1. Identify objectives, select methodology, and gather data
  2. Screen and analyze data
  3. Utilize specific analytic techniques
  4. Conduct consistency/sensitivity tests
  5. Develop Policy Implications
Elements of Metric Benchmarking

- Collect Data and Establish baselines (past performance) as a starting point.
- Prepare quantitative comparisons using cross-sectional and time-series analysis.
- Identify Relative Performance (ensure that firms face comparable conditions).
- Devise incentives so cost-savings are ultimately passed on to customers.
- Promote managerial strategies to achieve best practice.
Data Collection: Global and National

- Water/sewerage system operations,
- Network capacity,
- Financial flows, and Outputs.

Consistent data are essential for good management and for public policy oversight.


Five Benchmarking Methodologies

- Core Indicators and a Summary or Overall Performance Indicator (partial metric method),
- Performance Scores based on Production or Cost Estimates (“total” methods),
- Performance Relative to a Model Company (engineering approach),
- Process Benchmarking (involving detailed analysis of operating characteristics), and
- Customer Survey Benchmarking (identifying customer perceptions).
Specific Core Indices, such as water delivered per worker, quality of service (continuity, water quality, complaints), unaccounted for water, coverage, and key financial data (operating expenses relative to total revenues, collections).

- partial measures provide the simplest way to perform comparisons: trends direct attention to potential problem areas, with data generally available from company annual reports.

Overall Performance Indicator (OPI) combines the specific core indices into a summary index
- OPI used by SUNASS (the Peruvian water regulator) is the sum of nine specific indices.
Performance Scores Based on Production or Cost Estimates

Rankings can be based on the analysis of production patterns and/or cost structures.
Production function studies (requiring data on inputs and outputs) show how inputs affect utility outputs (such as volume of water delivered, number of customers, and service quality). Utilities that produce far less output than other utilities (who are using the same input levels) are deemed to be relatively inefficient.

Cost functions show how outputs, inputs and input prices affect costs; such models have heavy data requirements. Excessively high costs would trigger more in-depth studies to determine the source of poor performance.
Requires the development of an optimized economic and engineering model

Idealized benchmark specific to each utility—incorporating the topology, customer demand patterns, and density of the service territory.

“Artificial” firm has optimized its network design and minimized its operating costs

Production relationships can be obscured through a set of assumed coefficients used in the optimization process.

Chile and Argentina used this approach to establish infrastructure performance targets.

US telecom interconnection pricing and battles of “models”
Process Benchmarking

- Focuses on individual production processes
- Detailed examination of facilities and their operations
  - Identifies stages of the production process needing attention: pumping up, intake, transport, clarification and filtration, purification and treatment.
  - Studies of distribution processes (network design, pipeline construction and maintenance), sales processes (meter reading, data processing, billing, collections, and customer relations), and general processes (planning, staff recruitment and retention, and public relations).
- Provides a mechanism for identifying potential benchmarking partners, undertaking benchmarking visits, and implementing best practices

Customer Survey Benchmarking

- Customer Complaints: one indicator
- SERVQUAL identifies five dimensions of service quality as perceived by customers:
  - **External characteristics** (tidy workplace, employee appearances),
  - **Reliability** (meeting deadlines, consistency in interactions),
  - **Responsiveness** (providing service promptly),
  - **Consideration** (personnel who are courteous, friendly, and helpful),
  - **Empathy** (giving individual care and attention).

Parasuraman et al. (1985) *Journal of Marketing*
Steps for Conducting Production or Cost Benchmarking Studies

1. Identify objectives, select methodology, and gather data;
2. Screen and analyze data;
3. Utilize specific analytic techniques;
4. Conduct consistency/sensitivity tests;
5. Develop policy implications.
Step 1. Identify Objectives, Select Methodology and Gather Data

- Decide issues to be addressed, time period to be analyzed, and types of comparisons.
- Choices will reflect capabilities, initial understanding of data availability, and preliminary methodological choices.
- The objectives of any benchmarking study will depend on most important policy issues under consideration.
- Staff requirements can be substantial.
Step 2. Screen and Analyze Data

- **Screen data**
  - timeframe,
  - sample size, and
  - statistical techniques.

- **Check data quality**
  - inconsistent definitions,
  - missing data or
  - extreme data values

- **Analysis is an iterative process**
Step 3. Utilize Specific Analytic Techniques

Based on data and objectives, choose technique

- Core Overall Performance Indicators
- Total Factor Productivity Indices
- Relative Performance using Data Envelopment Analysis (DEA)
- Relative Performance using Statistical Techniques

Utilize specialists for sophisticated models

“A Primer on Efficiency Measurement for Utilities and Transport Regulators”, by Coelli, Estache, Perelman, & Trujillo, World Bank Institute
Metric Methodologies: Four Categories

Core Overall Performance Indicators (OPIs combine partial indicators of operating or financial performance; these are summary indices),

Total Factor Productivity Indices (an index number approach using output per unit input—multiple inputs are taken into consideration to gauge efficiency levels and changes),

*Relative Performance using Data Envelopment Analysis (a non-parametric technique that makes no assumptions about the functional form of production or cost functions),

*Relative Performance using Statistical Techniques (parametric approaches that involve assumptions about functional relationships)
Data Envelopment Analysis (DEA)

- Linear programming technique applied to a selected set of variables to calculate an efficiency coefficient for each water utility.

- Adapted from the multi-input, multi-output production function,
  - Production Function: how much output can be produced with a given basket of inputs.
  - DEA benchmarks firms only against the best producers (so it is a non-parametric frontier analysis). Differs from OLS that bases comparisons with respect to an average producer.

- Applied to cost functions as well
Production Observations

Each X represents data for a water utility

One observation far from the frontier!
Unit Cost Observations

Each X represents an observation on a water utility.
Frontier Analysis

Unit Cost

Output

Frontier Analysis
Statistical Analysis

Identify relationship between firm performance and market conditions and characteristics of the production processes.

- Coefficients: the roles of multiple variables
- Calculated expected cost, given actual output.
- Predicted versus actual cost can provide a measure of relative performance.

Widely used econometric techniques include

- *Ordinary Least Squares (OLS)*
- *Corrected OLS (COLS)*
- *Stochastic Frontier Analysis (SFA).*
Unit Cost Averaging

Compare to “average”, but here
Scale (output level) seems to matter
Linear Regression

\[ AC = a - b \cdot Q \]

- Functional form
- Variables
- Error terms
"Error" difference between Actual and Predicted Cost: define as inefficiency or as noise?
Frontier Regression

Unit Cost

Output

\[ AC = a - bQ \]

Error terms (random noise?)
- Corrected OLS
- Stochastic Frontier Analysis (SFA, with multiple components of error term)
Model Specification

Functional forms:
- Linear or non-linear, logarithmic
- Interpretation of error terms

Cross Section, Time Series, Panel?

Excluded Variables?
- Service Quality
- Customer Density? Age of network?
- Topography, Hydrology, Ownership
- Input prices (for Cost function)
Relative Inefficiency (frontier/non-linear)

Unit Cost

Relative to Predicted Cost

Develop
- Scores
- Rankings

Frontier Analysis

X X X X X

Y Z

Output
Cost Example: Ofwat Water Service Model (Y = Opex*)

Operating expenditures (less “exceptionals”, rates, third party services, abstraction charges, pumping costs)

\[ \ln Y = 3.57 + 0.471 \ln X_1 + 0.468 \ln X_2 - 1.575 \ln X_3 \]

\[ X_1 = \text{water delivered in Ml/day} \]
\[ X_2 = \text{length of main in km} \]
\[ X_3 = \text{proportion of water delivered to measured non-households} \]

(Chaplin, United Utilities)
## OFWat Trade-offs: Performance Benchmarking (X Factors)

### Change in Price Cap: CPI \( - X + K + Q \)

<table>
<thead>
<tr>
<th>OPEX Analysis</th>
<th>A: excellent</th>
<th>B</th>
<th>C: As Expected</th>
<th>D: Higher than Expected</th>
<th>E: Expected</th>
<th>Capital Expenditure Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
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</tbody>
</table>

- **A**: excellent
- **E**: very weak
- **AA**: clearly outstanding

**CPI**: Consumer Price Index
- **X**: Productivity Adj.
- **K**: Capacity Adjustment
- **Q**: Environmental Adj.
Example: NVE Benchmarking

Cross-Sectional Comparisons (200 utilities)

Changes over Time
- Physical Quantities (kWh delivered, wires, share low voltage, # customers)
- Cost Structure (endogenous/exogenous, cost components’ shares)
- Cost per physical unit

League Tables--public information/caps

Jan Moen: Norwegian Hydro Resources and Energy Admin.
Step 4. Conduct Consistency/Sensitivity Tests

Accuracy and robustness of inefficiency estimates are important due to financial or social impacts.

- Cost Function vs. Production Function
- Functional form (linear, nonlinear)
- Outputs and inputs (e.g., network length vs. fixed assets)
- Alternative methodologies (e.g., DEA vs. SFA).

Need to check whether estimated inefficiency scores or rankings are sensitive to the benchmarking method,
Step 5. Develop Policy Implications

Analyze scores and rankings
Explore in greater detail the potential determinants of inefficiencies across firms and over time.
Firms should not be ranked as poor performers if they operate under conditions that differ from those of the other firms.
Identify the impact of factors like region, population density, regulatory environment, ownership structure, and network vintage.
Seek public comments.
Design incentives to improve performance.
Creating Appropriate Yardsticks

Regulators want to induce outcomes comparable to those achieved under competition.

Pass-Fail Standards?
Reward outstanding performance
Penalize weak performance

Benchmarking provides Yardsticks
Benchmarking is Part of the Regulatory Tool-kit

The application of the techniques summarized here can improve service quality, expand networks, and optimize operations.

Any benchmarking study will have limitations, but sound studies can be used to place the burden of proof on other parties who might argue that the analysis is incomplete or incorrect.

Over time, data availability will improve and studies will be strengthened as professionals gain experience with these quantitative techniques.
Summing Up

Rankings can serve as catalysts for better stewardship of water and other resources.

If regulators cannot identify historical trends, determine today’s baseline performance, and quantify relative performance across utilities, then as an Indian regulator said, they may as well be writing “pretty poetry”.

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