

BENCHMARK INVESTIGATION OF SMALL WATER SYSTEM ECONOMICS

Discussion and Preliminary Findings

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INTRODUCTION

The *Benchmark Investigation of Small Public Water System Economics* is one of three projects that are being sponsored by the Midwest Technology Assistance Center (MTAC). This project was begun in July of 1999 and is scheduled for completion in August of 2000. MTAC is one of nine Centers established under the provisions of the 1996 SDWAA. MTAC's mission is to provide technical assistance to small water systems in 10-Midwestern states of Iowa, Indiana, Illinois, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio, and Wisconsin

This paper reports on preliminary results of this project. The first section provides a brief discussion of the problems of small water systems and the development of benchmarking as an assessment technique in the management of drinking water supplies. The second section describes the research approach that is being used in the Benchmark Investigation and reports some of the preliminary findings.

BACKGROUND TO THE BENCHMARK INVESTIGATION

Applying Business Models to the Small System Problem

Numerous research articles, government reports, and Congressional testimony have outlined problems and challenges of small community water systems. (Boisvert, et al., 1996; Clark, 1987; Cromwell, et al. 1992; NRC, 1996; Shanaghan, 1994; USEPA 1999, 1995, 1993). While a comprehensive review of these problems would require a much longer treatment than is possible here, several intertwining themes can be identified which have led to the application of benchmarking as a tool for the financial management of small water systems.

- National drinking water quality regulatory requirements have significant cost impacts on the operation and management of water systems.
- Small water systems at a considerable economic disadvantage in water treatment and distribution, and system management because of the economies of scale in treatment and management, and diseconomies of scale in distribution to low-density systems.
- The historical, below total average cost pricing of water in the United States has resulted in consumer resistance price increases, and has left many water systems ill-prepared and ill-funded to deal with the difficult management realities of declining water quality, diminishing availability of new water sources, changing demographics, and more stringent regulations. Many smaller systems are thus less able to meet drinking water regulations.

The two tables below illustrate these themes. Table 1 shows that the cost of upgrading small water systems is more than three times higher in per household terms than the comparable cost for large systems. The estimated cost of \$3,300 per household is high enough to threaten the financial sustainability of many small systems.

Table 1 - Estimated 20-Year Need and Cost per Household

<i>System Size (pop)</i>	<i>Total Need (billion \$)</i>	<i>Cost per household (\$)</i>
Large (50,000 +)	\$58.5	\$970
Medium	\$41.4	\$1,200
Small (<3,300)	\$37.2	\$3,300

Source: USEPA (1997), pp.8 and 16

One of the major deficiencies of small systems is manifested in the number of reported violations as shown in Table 2. The frequency of reported violations for maximum contaminant levels (MCLs) is orders of magnitude higher in small systems than in medium and large systems. Monitoring and reporting violations (M&R) also demonstrate the same pattern. And while MCL violations are often considered to be the more serious of the two, a study of small systems in Pennsylvania found that it was the number of M&R violations that were statistically correlated with independent field ratings of poor water system capability. (Cromwell & Rubin, 1995)

Table 2 - Violations per 1,000 People Served (1998):

<i>Size Category</i>	<i>MCL</i>	<i>M&R</i>
<501	0.807	5.924
501-3,300	0.072	0.303
3,301-10,000	0.014	0.090
10,000+	0.002	0.293
All Systems	0.025	0.162

Source: USEPA (1999), p.7-8

State and federal regulatory agencies have pursued numerous legislative, funding, and technical assistance initiatives intended to improve the performance of small systems. In the early 1990s several states began to experiment with programs to assess the viability of small water systems. These programs were intended to address several objectives:

- To better characterize the problem so that other instruments of state policy beyond the domain of public health regulation can be brought to bear upon it;
- To identify "troubled" systems in need of some sort of help or some sort of fix to avert failure;
- To prevent other systems from slipping into "troubled" status;
- To require greater assurance of viability as a condition for approval of the formation of new systems. (Cromwell & Rubin, 1995)

Early viability assessment programs borrowed heavily from business and banking models. One of the key requirements of these models is that water systems must be operated as businesses that are able to account for the full cost of providing services, and operated independently of subsidies to or from other units of government. The premise of this approach is that that only by using this type of “strict economic evaluation” will managers have the correct information needed to effectively plan for the long-term future of the system. (Beecher, et al. 1992; Cromwell & Rubin, 1995)

These programs laid the groundwork for many of the capacity development provisions of the 1996 Safe Drinking Water Act Amendments and led to the popularization of the dictum that “water systems must be operated as a business” which is now widely use in many technical assistance programs (PDEP, 1999; SRCAP, undated). This approach recognizes that financial management is the key to the successful planning and operation of small water systems: "without funding, water systems cannot afford to hire good managers, but without good managers, water systems will have trouble developing a plan to increase revenues” (NRC, 1997, p.7)

Benchmarking Applications in Water Supply Management

There is a long history of financial assessment in the field of public water supply. The most common example of this type of assessment is the rating process that has developed to estimate the level of risk associated with water system bond issues. For example, Moody's Investors Service collects and publishes the median values of the indicators that they believe to be most critical to future water system performance (and thus the ability to repay debt). A small sample of these indicators are displayed in Table 3.

Table 3 – Moody’s Selected Indicators of Municipal Performance:
Water Utilities

<i>Financial Indicator</i>	<i>Median Value (1988)</i>
Operating ratio	70.1%
Interest coverage	4.08
Debt service coverage	2.18
Debt ratio	33.1%

Source: Ammons (1996), p. 87.

The business community has long employed a similar type of assessment known as benchmarking as a tool to improve organizational performance. At its simplest, benchmarking can be defined as “learning from others” (Spendolini, 1991).

Practitioners usually distinguish between two types of benchmarking. *Metric benchmarking* is defined as “the quantitative measurement of performance in terms of inputs, outputs, outcomes and the relationship between them”. *Process benchmarking* is defined as the “mapping of one’s own process and subsequent comparison of your process with those of other companies with exemplary performance in a similar process” (Kingdom, et al., 1996, p.11). Both types of benchmarking are routinely applied to the management of water systems through the American Water Works Association’s quality improvement program, *QualServe*. Of the two, metric

benchmarking is more likely to be the most useful to small water systems at this time, because of the resource demands needed to successfully operate a process benchmarking program. Some of the key metric benchmarks used in the *QualServ* program appear in Table 4.

Table 4 – *QualServe* Yardsticks for a healthy water system

<i>Ratio</i>	<i>Measures</i>	<i>Range</i>
Return of Assets (net income/total assets)	Ability to earn a reasonable return	6 to 10%
Current Ratio (current assets/current liabilities)	Ability to pay current obligations	1.5 - 2.1
Debt to equity (total debt / total equity)	Creditworthiness – dependence on debt	2.1 - 3.1
Operating Ratio (gross revenue/O&M charges)	Revenue available beyond operations cost	1.2 and above
Cash flow coverage (net income+depreciation) /(principal+interest)	Number of times current cash flow will cover obligations	1.5 and above

Source: Jordan, et al., 1997, p.38

Numerous approaches to the benchmarking process have been recommended. Several basic elements are common to every approach, and are reflected in the eight-step process used in the American Water Works Association Research Foundations benchmarking study.

1. *Select process or function for benchmarking:* - Specific areas to target must be identified.
2. *Define how to measure performance:* The set of measures used to capture performance must be focused on the function to be analyzed and small enough to be easily applied.
3. *Define explanatory factors-* Explanatory factors are those elements of a water system beyond the control of management (i.e., customer base, water source, ownership type).
4. *Define data requirements:* Data required for the analysis are selected based upon a review of the chosen performance measures, while still accounting for the explanatory factors.
5. *Select comparison organizations:* - Organizations chosen for comparison should have explanatory variables that are similar to the subject utility. Ideally, target organizations are those that have a demonstrated record of being the "best-in-class" in the area of comparison.
6. *Collect data:* The relevant data and their comparability should be ensured.
7. *Analyze data and present findings:* The presentation of findings should enable clear and meaningful comparison.
8. *Initiate performance improvement program:* The program of improvement is the essence of the benchmarking exercise. (Kingdom, et al., 1996)

A carefully selected set of indicators is key to successful benchmarking. A small and effective set of indicator measures should meet the following criteria:

- *Valid* – measure what they claim to measure
- *Reliable* – can make repeated measures with little variation
- *Understandable* – unmistakably clear meaning
- *Timely* – can be compiled promptly enough to be useful to managers
- *Resistant to perverse behavior* – resist efforts to “beat system” through actions that do not truly represent desired changes
- *Comprehensive* – measures capture the most important performance dimensions
- *Non-redundant* – each measure contributes something distinctive
- *Sensitive to data collection cost* – inexpensive enough in collection and analysis to be practical
- *Focused on controllable facets of performance* – emphasize measures that are immediately applicable (Ammons, 1996, p.13)

The principal objective of the Benchmark Investigation is to collect an appropriate set of such measures through the empirical analysis of data collected from small water systems in the Midwest.

ORGANIZATION OF THE BENCHMARK INVESTIGATION STUDY

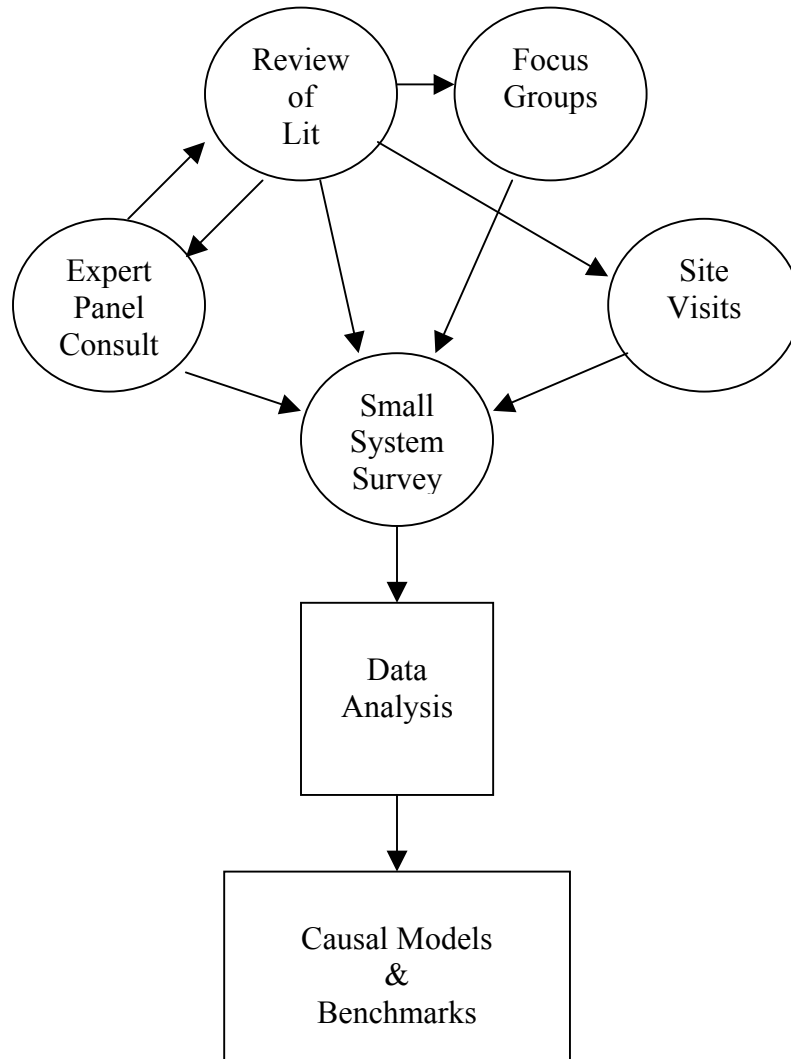
The stated purpose of the Benchmark Investigation is “to provide small systems with the information needed for the development of the long-term financial integrity of their system” which will “allow comparisons to be made to other systems.” The project has several required components:

- *a survey of representative systems in the Midwest*
- *a review of the literature*
- *consultation with technical and financial assistance centers and organizations working with small water systems*
- *data analysis to explore causal relationships between system characteristics and the cost, reliability and compliance of small water systems*
- *the development of benchmark measures*
- *dissemination of results, through National Drinking Water Clearinghouse publications and other venues*

The project team designed a five-component research plan to satisfy these requirements. The team chose an open research approach intended to facilitate the participation of several of the principal constituencies involved in the management of small water systems. The premise of this approach was that this participation was essential to ensure the quality of the information collected during the project, and that it would enhance the opportunities for the dissemination of the final product.

Project Components

The project is made up of five separate components. Portions of each of the components are being performed simultaneously. There is considerable interaction between all of the components. The key component is the survey of small water systems, which requires input and feedback from the four other components.



Survey of Small Water Systems and Analysis of Data

Two data collection approaches were considered. The first was to seek out secondary data. State primacy agencies routinely collect operating data on all regulated water systems, and the financial agencies in some states mandate the submission of annual financial reports from all units of government. The small number of previous empirical studies all used this approach.

The second alternative, and the one chosen for this project, was to use the survey instrument as the primary tool to collect information from the small water systems. Several assumptions were put forward to support this approach:

- A well-designed survey may be able to identify indicators of water systems performance that have been generated by system managers, and have not been previously considered in the approaches borrowed from banking and other business sectors.
- The involvement of water systems in data collection will encourage a process of self-examination by system management and will predispose systems to implement benchmark analysis.
- The survey approach will improve the uniformity of data collect from different states.
- The mail survey will already be the primary source of data for those systems that do not submit data to state financial agencies (such as mobile home park systems).
- A mail survey is a required project component and should be used to its full advantage. Secondary data will still be available after the project’s conclusion and can be combined with the survey data in other studies at a later date.

Suggestions for the questions to be included in the survey, the information to be collected, the parameters to be used in the selection and stratification of the sample, and the implementation of the survey have been solicited during each of the other four components of the project.

Progress to date: A complete list of the community water systems in the 10 states, and their size, treatment, and ownership characteristics were obtained from USEPA Regions 5 and 7. A sample frame was created from this list based upon the feedback of the Expert Panel Consultation and the Review of Literature. The criteria used included size (<3,300 customer), ownership (local or private ownership) and primary source of supply (surface, ground, purchased). A total of 9,484 systems were identified and used as the sampling frame for the survey. The distribution of these systems by ownership type, primary water source and population size category is shown in Table 5.

Table 5. Number and Percent of Community Water Systems in Sample Frame

<i>System Category</i>	<i># of Systems</i>	<i>% of Systems</i>
Ownership Type		
Local (public)	5,577	58.8
Private	3,907	41.2
Primary Water Source		
Ground	7,796	82.2
Purchased	1,423	15.0
Surface	265	2.8
Population Size Category		
100 or less	2,379	25.1
101 – 500	3,467	36.6
501 - 1,000	1,612	17.0
1,001 - 3,300	2,026	21.4

This sample frame will be used to select a stratified, random sample of water systems in the MTAC region. A draft copy of the survey questionnaire has been prepared, and is being reviewed during site visits that are being conducted in the region. The survey will be pre-tested and mailed to approximately 1,000 systems in the Midwest.

Expert Panel E-mail Consultation

The principal purpose of the expert panel consultation was to solicit opinions on the important premises and requirements of economic benchmarking. The results of the consultation will provide guidance in the design of the survey questionnaire. A secondary purpose of the consultation was to make key members of the small water system community aware of the research project.

Panelists were selected from several different segments of the small water system community:

- Authors of research articles about benchmarking and small system economics
- State drinking water regulatory offices
- State and national offices of the National Rural Water Association
- State and national offices of the American Water Works Association
- State offices of the Rural Development Administration/Rural Utilities Services
- Regional offices of the Rural Community Assistance Program
- Rural Water Education and Research Foundation
- USEPA national and regional offices
- Financial consultants

Panelists and their email addresses were identified through a review of the literature and a search of the web sites of national and state organizations. Sixty-five participants were initially identified and included in the consultation. Participants were encouraged to send the Consultation to other “experts” and eight additional participants were identified in this way. The participation rate in the consultation was quite small, with only a dozen participants providing comments that were used in the report.

The method used in the consultation can be described as a modified Delphi approach. It consisted of two rounds of email messages. In the first round, panelists were sent a short background description of the problems of small water systems, and the proposed use of financial benchmarking as one strategy to address these problems. A series of questions and statements about the development and use of benchmarking, and a list of pertinent documents and publications followed the background section. Panelists were asked to respond/react to the questions and statements in any way they saw fit. The email message requested that panelist submit their replies within one week (responses were actually collected for nearly two weeks). The responses from the panelists were next summarized, and a working list of survey questions, based upon the summaries, was developed.

In the second round of the consultation, panelists were sent the summary of the first round responses along with the working list of survey questions. They were once again asked to

respond as they saw fit. The responses of the second round were combined with those of the first round, and a series of recommendations for further research was developed based upon this information. A report of the consultation was prepared as part of the project's Interim Report and is available on the MTAC web site.

Preliminary Findings: The input of the Expert Panel was used to support some of the basic decisions of the project team, such as the definition of small water systems (only community systems less than 3,300 customer, including the auxiliary systems) and the categories used to distinguish systems for benchmarking purposes (source, size, ownership). Panelist recommended a number of potential benchmark measures and suggested publications for inclusion in the literature review. Panelists also provided their observations of the factors that were most critical to the success or failure of community water systems.

Review of Literature: Annotated Bibliography

The main purpose of the literature review is to collect the information that to guide the design and implementation of other components of the project. The final draft of the literature review will also be made available as a resource for the members of the small water system community.

The review of the literature was completed using the usual library tools of electronic catalogs and periodical indexes. Popular web browser search engines were also used to locate documents published on the Internet, particularly on the web sites of government agencies and non-governmental organizations that work with small community water systems. The Expert Panel Consultation component of the project was also used as a means to solicit from the researchers, consultants, non-governmental organizations, financial and technical assistance centers, and state and federal agencies.

Publications selected for review pertained to one or more of the following topics:

- the "small system problem"
- the economics of small community water systems
- statistical surveys of community water systems
- approaches to small system self-assessment
- benchmarking techniques and measures - empirical benchmarking studies
- empirical studies exploring the causal relationships between system performance and water systems characteristic

The range of publications reviewed includes books, research reports and technical studies, government publications mandated by law, self-instruction manuals, Internet documents and pamphlets.

An annotation is prepared for articles included in the review. The variety of types of publications included in the bibliography required a flexible approach in the preparation of annotations. Wherever possible, each annotation includes a bibliographical caption, states the purpose of the investigation or publication, describes the empirical data used, causal relationships, key findings, and the important conclusions and recommendations for establishing

benchmarks for small public water systems. The length of the annotations varies from a few sentences to a few pages. Wherever available any indicators of financial performance, and their recommended benchmarks are included in the annotation, most often in the form of a list or table.

A first draft of the review of literature with more than 50 citations was prepared as part of the project Interim Report and is available on the MTAC web site. Citations and annotations continue to be added to the review, as new resources are located during the completion of other components. A final draft of the review will be compiled near the end of the project. The final review will consist of three parts: an overview, annotated bibliography, and list of relevant topics.

Preliminary Findings: The review of literature located four empirical approaches to the development of metric benchmarks for water systems (that appear in nearly a dozen publications). Three of these were specifically intended for use by small water systems. The review located a very large number of self-assessment manuals that primarily use lists of questions to guide managers through an examination of the financial well being of their systems. Very few studies have yet found that test causal models of water system performance.

Focus Groups

Focus group research is a qualitative technique that collects information about the diversity of experiences, situations, and responses of individuals. Focus groups typically involve an informal discussion, among a selected group of homogenous individuals, in a non-threatening environment. The discussion is directed by a moderator, and guided by a pre-selected series of questions, on topics of interest to the focus group sponsor. Researchers act as the link between the participants and the sponsor.

MTAC has requested that the research team “convene focus groups involving different segments of the small public water systems community in the Midwest to assess the potential value of systematic benchmarking.” The focus groups will be used to identify performance indicators that are currently in use, the familiarity of benchmark measures and techniques, and their perceived usefulness by members of the small water system community.

The project’s focus group plan identified three different segments of the small water system community: small system managers, technical assistance organizations, and state and federal drinking water agencies. One focus group has been planned for each. In order to facilitate the participation of focus group members with the least inconvenience, each focus group will be “piggy-backed” onto conferences of the each participant group.

The first of the three focus groups was held in conjunction with a small water system workshop hosted by the Illinois Section of the American Water Works Association. Nine water system superintendents participated in the focus group session. A brief report of the first focus group was prepared following the session. It is available on the MTAC web site. The second two focus groups have been scheduled.

Preliminary Findings: While the interpretation of a single focus group can only be preliminary, and should be treated with cautions, several observations can be made from the first groups session:

- System managers use a wide array of measures to describe their systems.
- While there appeared to be little familiarity with formal benchmarking, there was plenty of informal awareness of what was happening with other systems in the region, and almost all of the participants were aware of how their systems ranked on a locally generated annual water rate study.
- There was considerable interest in having a set of comparative measures available. These were seen as particularly useful to managers as a tool for educating governing bodies on the need for rate hikes and water system improvements.

Small Water System Site Visits

Several of the reports included in the literature review discussed the minimal record keeping procedures of many small community water systems. Prior knowledge of the availability of records will dictate both the choice of questions to be included on the mail survey questionnaire and the measures that are available to water systems managers to use as benchmarks. Thus, a site visit component was included in the project design.

Site visits will target all of the different size, water source and ownership categories in the sample frame. Because of the time and cost of making on-site visits, only the states immediately surrounding Illinois have been targeted. In order to reduce the inconvenience of the visits to water system personnel, the research team is attempting to coordinate all site visits with scheduled visits of technical assistance staff members of state Rural Water Associations and state Community Assistance Program representatives.

- assess the type and availability of operational and financial records
- determine the degree of benchmarking that is already taking place and the criteria used by system managers in their selection of systems they use for comparison
- determine the probable response to the mail survey and solicit information on ways to ensure a satisfactory return rate

Members of the research team have conducted three preliminary site visits in the Southern Illinois region. Reports were prepared after each of the visits. Technical assistance providers have been contacted in Missouri, Illinois, Indiana, and Ohio. Site visits are being scheduled in coordination with these providers and will be conducted during the month of February.

Preliminary Findings: Several observations can be made from the few preliminary site visits:

- Systems seem to have adequate records of the income taken in by their systems.
- Systems expense records were less detailed, not available in a summary format, and difficult to disaggregate from other municipal categories (for example, how can the cost of the Village Clerk's time spent on water system business be estimated).
- None of the systems visited could estimate the value of system assets or depreciation. Only one of the three had a reserve fund.

- None of the systems had experience with benchmarking, although all thought that it would be useful to them in the management of their systems.
- Managers of each water system requested other types of technical and financial assistance during the site visit.
- The managers of the three systems said that they DO NOT respond to mail survey questionnaires sent to their water systems. The only suggestion made for improving the response rate of small water systems was to “send money”.

SUMMARY

Only a few general comments are possible at this stage of the Benchmark Investigation.

Based on the work completed, it appears that the managers of small community water supply systems are not yet familiar with benchmarking techniques but are enthusiastic about the prospect of receiving the technical and managerial assistance that is the envisioned in the study.

In terms of the research techniques employed in the study, the expert panel consultation provided an expeditious assessment of the major issues of small water systems and was a promising technique. However the level of participation was limited (only 12 panelists). The follow up contacts indicate that the email contacts should have proceeded with phone calls to agencies and organizations to identify the exact people to target. Focus group interviews have proven to be a useful technique, which can be recommend for other types of small system research. Finally, the site visits are a critical part of the survey process. They allow for in-depth examination of many of the issues and concerns of small water system managers. The site visits have also reinforced the expectation that it will be very difficult to obtain a large response rate to the survey questionnaire from the managers of small community water systems.

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