8 Analyzing Performance Data

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Many governments measure performance. Some attempt to do so comprehensively, while others focus on major departments or key functions. Some rely primarily on output measures that report how much service is being provided, while others include measures that gauge outcomes and efficiency. These measures can serve two complementary purposes, if designed and managed properly: accountability and performance improvement. Too often, government agencies focus only on the former while overlooking the value of performance measures for the latter.

Typically, governments that measure performance hope, somewhat vaguely, that these measures will provide feedback to departmental officials that will be valuable to them as they attempt to manage their programs. Most of these governments are less vague about their intentions to report at least a portion of their measures to persons beyond the program or department level—senior management, legislators, media, or the public—often in their budget documents and occasionally in separate performance reports or Web site postings. The publishing of performance data reflects the government's desire to demonstrate accountability for the delivery of suitable public services.

Public reporting on the work of government is important. However, reporting summary statistics to public officials and citizens is only the first of two fundamental uses of performance data. Analyzing performance data for the purpose of service improvement is the other. In too many instances, governments do not reap the full benefit from the performance information they collect. Too often, they miss opportunities to use this information to bring improvements in effectiveness or efficiency. Fortunately, there are some relatively easy-to-apply analytical techniques that can greatly increase the usefulness of performance data for decision making.

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Chapter Objectives

The objectives of this chapter are to examine the contribution that analysis of performance data can make to government operations and to introduce several practical analytic techniques. First, we consider some instances in which the work of analysts clarified the nature of two very different problems confronting selected governments, as a preliminary step to solving those problems. We then proceed to review a series of analytic techniques suitable for addressing common governmental problems, beginning with the persistent debate over appropriate levels of staffing.

This chapter offers techniques and advice to help government decision makers reap greater benefit from their data for the following commonly encountered purposes:

- Analyzing staffing
- Using performance standards and benchmarks
- Describing data
- Analyzing demand
- Determining costs for various purposes
- Routing travel
- Adjusting for inflation to analyze revenues and expenditures
- Analyzing the costs of capital projects
- Applying useful analytical techniques for benchmarking projects

The Place of Analysis in Government Operations

Governments *need* good analysis.

In the mid-1990s, an African American motorist was beaten to death by police officers in a White neighborhood just outside Pittsburgh. Police–community relations in the Pittsburgh metropolitan area were already strained before this incident. The beating death escalated the problem to a crisis.

In a separate action, the American Civil Liberties Union filed a class action suit against the city of Pittsburgh on behalf of 52 plaintiffs alleging excessive force and verbal abuse by officers. Prompted by growing racial tension and the pressing need to find answers and solutions, the city controller in Pittsburgh conducted a performance audit to examine the nature, pattern, and disposition of complaints against officers over an 11-year period. The review of facts and figures by analysts consisted largely of the systematic sorting of tabular displays of data arranged by complainant and officer characteristics. Their analysis showed that African American complainants were as likely to object to the actions of African American officers as they were to complain about Caucasian officers. Although this finding "tend[ed]

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to negate a systemic racial interpretation" of community relations problems (City of Pittsburgh, 1996, p. 25), the analysts did not stop there. They proceeded to conduct what they termed a "bad-apple analysis" and discovered that while most officers had received one complaint or none, three officers generated a combined 83 complaints over the 11-year period of study. The controller urged the development of appropriate training and counseling strategies for officers in general, and for the high-complaint generators, a thorough review to answer the troubling question of "How, after 33 citizen complaints, could a police officer possibly be in a position to attract a 34th?" (City of Pittsburgh, 1996, p. 32).

Some analyses in government are prompted not by major societal issues or crises, but instead by an operational or resource issue. For example, the Property Maintenance Division of the City of Savannah assumed that code enforcement officers were working at the maximum manageable caseload level. However, systematic analysis focusing on careful time study and the computation of maximum manageable caseloads revealed that they were functioning at only 58.6% of capacity (Robinson, 1995). The analyst attributed much of the problem to unproductive time in the office and called for streamlined procedures, reduction of required paperwork, and improved supervision to reduce unproductive activities. Subsequent procedural and caseload adjustments were made, and 4 years later, code enforcement officers were operating at 74.8% (Ammons & Williams, 2004).

In these cases, analyses aided the efforts of policymakers and management officials to address problems. Too often, however, important decisions to expand, reduce, upgrade, or downgrade public services; decisions to change procedures or service delivery methods; and decisions designed to address policy issues are made without the benefit of careful analysis. Decision makers take considerable risk by relying on intuition, anecdotal evidence, or the hype from a reportedly successful implementation of a new system in another government. Careful analysis can help them more accurately assess current conditions and services, the likely costs and benefits of apparent alternatives, and the potential "fit" of a given option. Chances of a good decision are thereby increased and chances of a misstep, reduced.

Cynics sometimes scoff at the relevance of systematic analysis for government operations. They doubt the commitment of public sector managers and employees to improve government services. They doubt the ambitiousness and skills of government analysts to conduct relevant analyses. And they doubt the interest of public officials in the results of such analyses, if conducted. Politics, they say, trumps everything else. Why devote time and resources to analysis?

It is true that politics often takes priority—and *should* take priority—in a democratic governmental setting. It also is true that well-reasoned administrative recommendations, anchored on careful analysis, are sometimes rejected on the basis of politics alone in favor of seemingly less rational alternatives. But the cynics are wrong when they imply that public managers

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are unwilling to tackle service improvement initiatives, that government professionals are incapable of performing systematic analysis, or that thorough analysis has little chance of influencing public sector operations or major policy or service decisions. Careful analysis can inform and influence public sector decisions.

Preparation of Analysts

Much can be said about the value of advanced statistical training for analysts and the applicability of advanced analytic techniques to pressing issues facing government. In many cases, however, even less sophisticated techniques applied by careful and perceptive analysts—whether or not they have mastered advanced statistical methods—are suitable for addressing problems that confront governments and their operations. In fact, several observers note the greater tendency of governments to rely more on analysis rooted in management science techniques than analysis rooted in advanced statistical techniques (DeLorenzo, 2001; Hy & Brooks, 1984; LaPlante, 1989).

A recent study of the selection and training of analysts in the 50 largest municipal governments in the United States revealed that most major municipalities preferred analyst candidates with advanced degrees but that 80% would hire persons with only a bachelor's degree if they had the right experience (Ammons & Williams, 2004). Few cited mastery of particular analytic skills as especially important for analyst candidates. Some sought background or preparation in budget and finance, while a handful cited the value of accounting skills, computer skills, statistics, performance measurement, spreadsheets, and skill in financial calculations. Many provided training manuals to newly hired analysts; some provided in-house training; some sent analysts for training elsewhere; and several assigned new analysts to work with veteran analysts. Combinations of strategies featuring on-the-job learning were common.

The choice of analytic techniques varies widely among analyses focusing on government issues and operations. Some chosen analytic techniques are complex, but in many more cases, the applicable techniques are easy to learn and apply. Even a person with limited formal training in statistics and research methods can easily master many simple techniques and perform valuable analyses.

A variety of practical, easy-to-apply analytic techniques are introduced in this chapter. Each is a tool that provides the decision maker with a more reliable picture of reality and a better basis for examining options and predicting ramifications than the alternative practice of relying on anecdotes, intermittent observation, and intuition to form an impression of current conditions. Armed with these simple techniques, any agency can perform basic analysis of many of the most common operational issues.

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Addressing Staffing Questions

Among the most common analytic challenges for administrators and budget makers are questions regarding appropriate staffing levels. Suppose, for instance, that a department head claims that his staff is stretched too thin, while budgeteers are not at all sure that this contention is correct. Can some form of analysis help?

Staffing Ratios

The chief of police argues that he needs more officers. The department, he says, is woefully short of the national average for officers per 1,000 population. "The national standard is 2 officers per 1,000 residents, and we have only 1.6 officers per 1,000."[1]

Is the analytic task here merely a matter of simple arithmetic—that is, the calculation of the number of additional officers needed to reach what the chief mistakenly proclaims to be the national standard? Or are other kinds of analysis potentially more helpful?

Population as a Proxy for Demand?

As a starting point, consider the possibility that the denominator in this staffing ratio (i.e., 1,000 population) is offered as a proxy for demand. Anyone prescribing a staffing ratio of two officers per 1,000 population (one officer per 500 population) believes that a pool of 500 persons will generate a year's worth of work for an officer. Although most of the people in this pool will behave themselves, enough of them will cause trouble or become victims of crime to generate the officer's workload. Is this a reasonable prediction? Perhaps not.

Population would be a fine proxy for service demand if we could assume that any one group of 500 persons would be pretty much like any other group of 500 persons, insofar as their need for police services is concerned. However, we know that criminal behavior is more prevalent among adolescent males and young men than among senior citizens and more prevalent in poor neighborhoods than in wealthy neighborhoods. Why, then, should we accept population as a proxy for demand, without giving any consideration to other factors known to be relevant?

Why not find a better indicator of demand for police services? Perhaps we should use a direct measure of demand rather than a proxy.

Production Ratios

Many communities report "calls for service per officer" or "officers per 1,000 calls for service." Each is a more direct measure of the activity or

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production of the typical officer—and the need for more or fewer officers—than is a ratio based on population and a theoretical demand for services. Comparing actual production ratios to standards or norms among respected counterparts is usually preferable to analysis tied to weak proxies. A wise analyst remains wary of weak proxies that make sweeping assumptions about service demands in other functions as well (e.g., firefighters per 1,000 population, human resource staff per 100 employees, recreation employees per 1,000 population or per 100 participants, and pupil-to-teacher ratios).

Careful analysis might reveal that the police department (or another function being analyzed) is not understaffed after all. Despite perhaps having a lower number of employees per 1,000 population (a proxy for service demand), a low-crime community might enjoy a favorable employee production ratio (a relatively low and quite manageable number of actual units of service per employee). Such a discovery would blunt the chief's call for hiring additional officers.

Availability Ratios

How much slack time do employees have? How much should they have? The answer to the latter question differs from function to function and the nature of one's responsibility. In general, slack time is something to be minimized, a sign of waste. Only a little slack—just enough to prevent burnout and ward off backlogs during sudden rushes of activity—is considered prudent in most cases. There are, however, a few exceptions, where larger doses of uncommitted time are desirable. Consider, for instance, a supervisor so consumed by daily tasks that she has no time to observe her subordinates on the job or to hear their professional or personal concerns. A little uncommitted time could allow her to be a better supervisor. Or consider the role of a police officer. How much uncommitted time is desirable for performing that role effectively?

In recent years, many communities have embraced a strategy called *community-oriented policing*. This approach departs from the more conventional pattern of merely responding to calls for help. In community-oriented policing, officers spend time getting to know the people in the neighborhoods they patrol; they build trust and cooperation; and they work with the community to solve neighborhood problems. This level of interaction and trust is difficult to achieve if officers are forced to spend all of their time responding to calls for service or performing other assigned duties. For this reason, some law enforcement agencies track "patrol availability factor," which is defined as the percentage of total time available for "undirected patrol." Patrol availability factor is calculated by subtracting from 100% the percentages of time devoted to responding to calls for service, testifying in court, completing paperwork, and performing other assigned duties. Law enforcement agencies that are most serious about implementing community-oriented policing typically have targeted their patrol availability factor at 35% to 45%.

So, how many police officers are needed in a given community? Providing a good answer requires more than simply knowing what the resident population is and applying a prescribed officer-to-population ratio. A good answer would also take into consideration the actual demand for police services and perhaps the strategy in place to combat the occurrence of crime.

Using Performance Standards and Benchmarks

Performance standards and benchmarks serve as useful gauges for a wide range of performance dimensions. Here, we consider the applicability of engineered standards and benchmarks—in this case, the employee output ratios achieved by other leading organizations—to questions of staffing.

Engineered Standards

Often associated with the work of industrial engineers and stopwatch-wielding efficiency experts, engineered standards declare the amount of time needed by a competent worker to complete a given task. Examples relevant to government workers include "flat rates" for mechanics, prescribing the amount of time in standard hours that a given repair should require for a specified make and model of vehicle (Hearst Business Communications, n.d.; Mitchell International, n.d.); custodial time standards (Building Service Contractors Association International, 1992; U.S. Department of the Navy, 1987); and landscaping time standards (U.S. Department of Defense, 1984). Some government agencies have adopted these standards or developed their own as a method not only of judging the efficiency of their employees but also of prescribing the appropriate size of the workforce, given the anticipated workload.

A municipal fleet maintenance operation, for instance, could record the maintenance or repair job, vehicle type, prescribed standard hours, actual hours, and the name of the mechanic for each service performed in the city garage. The efficiency of the team of mechanics or mechanics individually could be calculated by dividing standard hours by actual hours (i.e., producing an efficiency rating greater than 100.0, if repairs are completed in less time than prescribed by standard hours).

Although this system of evaluating employee performance appears to emphasize efficiency over quality, the latter can be factored in, too. Quality of work can be incorporated into the calculation by tracking any vehicles brought back to the garage with problems that persist even after the initial effort at repair. When such vehicles reappear at the garage, the additional rework time should be added to the original time record. In most cases, this will push the actual hours beyond the standard hours, constituting a penalty for shoddy work the first time.

Performance Marks of Others

When engineered standards are not available, some government operations rely instead on employee-to-output ratios reported by counterparts (Ammons, 2001). Usually, these ratios are far less precise than engineered standards (typically, they are expressed as outputs per full-time equivalent employee), but they nevertheless provide a rough gauge that can help an

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analyst judge whether the efficiency and staffing level of a given operation is at least "in the ballpark."

Focus on the Problem Rather Than the Presumed Solution

Too often, staffing debates skip right past the analysis of operating problems and the consideration of various options for solving these problems. Instead, they focus on a single, presumed solution: more resources in the form of additional staff. While additional staffing ultimately might be the best solution, it often is not the best place to begin the consideration.

Analysis That Considers Other Possible Solutions

When an agency head or program director declares the need for additional staff, he or she perhaps defends the request by noting the growth of the service population or other indications of increasing demand since the last adjustment to the size of the staff. This is not an unreasonable basis for asking for additional personnel, but a prudent analyst might wish to explore the ramifications of the presumed staff shortage before reaching a conclusion.

In some cases, a program director who is pressed to explain the problems created by a staff shortage might have difficulty citing specific evidence. Perhaps, in reality, expansion of the general population actually puts little additional demand on this service. Perhaps technological advances in this office have allowed the current staff to handle increasing workloads without much difficulty. On the other hand, if the program director cites long lines and a growing backlog, the analyst might wish to consider technological options or strategies to reduce demand peaks before moving on to consider increasing the size of the staff. The analyst might also wish to examine the manner in which the staff currently is being deployed, just to be sure that resources are being used to maximum effect.

Blackout Analysis

A superb example of analysis focusing, first, on the demand for service; second, on the deployment of current resources; and, third, on the need for additional personnel can be found in the work of the city auditor following a request for additional officers by the chief of police in Kansas City, Missouri (City of Kansas City, 1998). The analysis identified instances termed *blackouts,* when all patrol units on duty were engaged on service calls and an additional call would overload the system. The response to such calls would be delayed, as officers would have to be pulled from lower-priority calls. Analysts examining a year's data discovered 150 instances of blackout in Kansas City,

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usually lasting less than 3 minutes. Analysts found generally reasonable correlations between staffing patterns and calls for service by day, time, and geographical location; but analysis of instances of blackout led to a series of recommendations that included the use of nonpatrol personnel for certain traffic calls, steps to reduce false intrusion alarms, and improved practices in the assignment of compensatory time, as well as some increases in patrol staffing.

Remember the Basics and Use Them Wisely

Some of the most basic lessons in elementary statistics provide fundamental summary descriptions that give us an important glimpse at a population, all the relevant cases or incidents of a particular type, or just a sample. They tell us what is typical and how much variation exists beyond whatever is deemed typical (for additional information, see, for example, Meier, Brudney, & Bohte, 2006; O'Sullivan, Rassel, & Berner, 2003). The basic lessons about elementary descriptive statistics are simple, but sometimes administrators and even analysts in their most practical work seem to remember only one option for what is typical—the arithmetic mean—and to forget altogether about measures of dispersion.

Measures of Central Tendency

The mean (average value arithmetically), median (middle value in an ordered array of numbers), and mode (most common value) are measures of central tendency. Each identifies in its own way a value that is typical of the group. Because each has its own peculiarities, one might be a better choice in some cases and weaker in others. None is the perfect measure of central tendency; yet the arithmetic mean seems to be the default value in practice, even in cases where the median might be the better choice. A thoughtful analyst will consider the options.

Suppose the mayor asks for the average police salary. The simple and common response is to add all the salaries in the police department and divide by the number of employees. After all, that is what the "average" is. Consider, however, the possibility that in asking for the average, the mayor wanted to know the *typical* police salary. The mean will provide one version of "typical," but it will be a version distorted by the police chief's salary—an outlier in the range. The median is less influenced by extreme outliers and might be a better choice as representation of typical.

Measures of Dispersion

When we say that the fire department's mean response time to emergencies is 6.1 minutes or that its median response time is 5.8 minutes, may we assume that all response times are clustered tightly around the chosen

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measure of central tendency? We should not make that assumption without evidence to support it. We need a measure of dispersion.

Statisticians will call for the calculation of variance or standard deviation to gauge dispersion. The variance may be calculated by, first, finding the mean of the numbers involved, squaring the difference between each number and the mean, adding those squared values together, and dividing by the number of values in the set. This is the variance. The standard deviation is the square root of the variance. The formula for the standard deviation is as follows:

$$s = \sqrt{\frac{\sum_{i=1}^{N} \left(X_i - \overline{X}\right)^2}{N}}$$

Variance and standard deviation are not difficult to calculate, and many analytic techniques call for one or the other of these statistics as part of their formulas. However, the most common measures of dispersion reported in practical analyses are even simpler.

The simplest manner of reporting dispersion is to announce the range: the lowest value and highest value in the set. Here, the fire department would report that emergency response times ranged from 1.6 minutes to 17.2 minutes. A better choice would be to report the interquartile range (sometimes described as the "middle half" in presentations to lay audiences): the more limited span from the 25th percentile value to the 75th percentile value (see Figure 8.1). By excluding the first and fourth quartiles, the interquartile range eliminates unusual occurrences (outliers) and reports the range where half of all instances fall. Here, the fire department would report that the interquartile range of responses was from 3.9 minutes to 8.2 minutes.

An alternative way of expressing dispersion in a manner that will be understood easily by audiences of laypersons is to report the percentage of occurrences within a specified range (e.g., between 0 and 9 minutes). Here, the fire department would report that, say, 81% of all emergency response times were less than 9 minutes.

An appropriate measure of central tendency is important for conveying key information about a set of figures and so is a suitable measure of dispersion.

Plotting Job Travel to Diagnose Scheduling Problems

Many government services require some amount of travel to complete service delivery or collection routes, to get to job sites, or to conduct inspections. The careful design of efficient routes and the careful scheduling of service calls can conserve important resources. Simply plotting job travel can create a picture that will reveal inefficiencies or confirm that reasonable care is being given to work scheduling. Sometimes, completed work orders or job logs will give the analyst all the data needed to form this picture.

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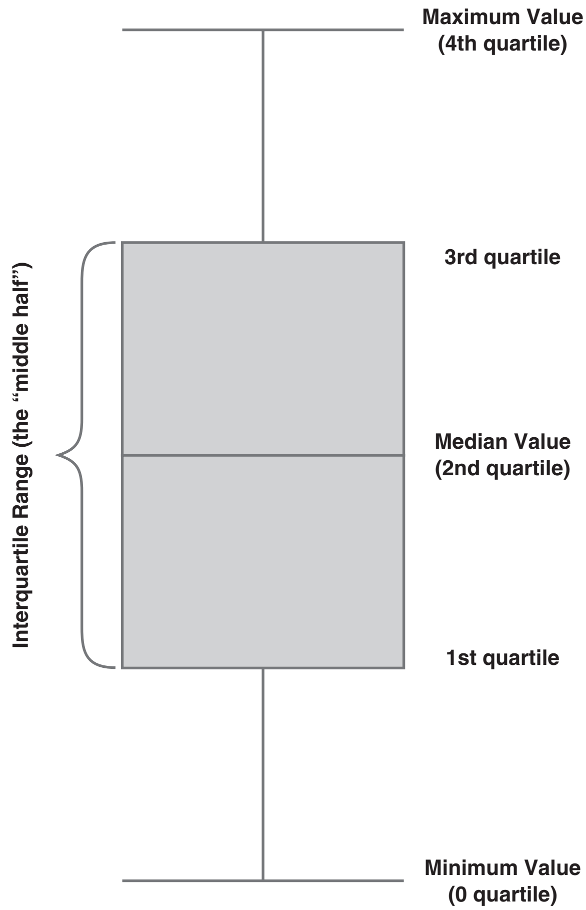

Figure 8.1 Interquartile Range, as Reflected in a Box-and-Whiskers Plot

Time in a car or pickup is necessary for conducting many jobs, but the objectives of this analysis are to avoid crisscrossing patterns across town and across the routes of other employees, to avoid backtracking, to maximize the geographic clustering of work, and to eliminate unnecessary trips. Programs seeking additional resources to improve the quality of their services can sometimes find them by pursuing greater efficiency in the use of resources they already have on hand.

Adjusting for Inflation to Analyze Revenues and Expenditures

Politicians and administrators who compare revenues from one year to another without accounting for the effects of inflation risk are understating or overstating the difference. "We are drawing more revenues from the beleaguered taxpayers

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of this community than ever before" might be a correct statement in raw dollars but hyperbole in terms of inflation-adjusted dollars—that is, in comparing the buying power of last year's and this year's revenues. The same is true for expenditures. A budget that increases spending by 5% in a given department might not feel like much of an increase when inflation is up by 8%. Arguably, it is a budget decrease—at least in constant dollars.

Just a few simple steps are all it takes to convert current dollars to constant dollars. The most popular price index to use for this purpose, although not the only one and not even necessarily the best one, is the Consumer Price Index (CPI), compiled by the Bureau of Labor Statistics (see Table 8.1). The CPI tracks price changes in a variety of consumer products and is frequently used as a guide for cost-of-living adjustments for wages and inflation adjustments for contract services.[2] The rate of change in the CPI from one year to another—for example, from 172.2 in 2000 to 195.3 in 2005, a rise of 13.4%—reflects inflation in consumer prices.

Although the CPI has the advantage of being more familiar to most audiences, a different inflation index compiled by the U.S. Department of Commerce's Bureau of Economic Analysis (BEA) might be a better choice as an inflation gauge for state and local governments. The index of "gross output of general government" for state and local consumption expenditure, found in the BEA's regularly updated Price Indexes for Government Consumption Expenditures and General Government Gross Output, is

Table 8.1 Average Annual Consumer Price Index for All Urban Consumers (CPI-U), 1995–2005

Year	*Average Annual CPI*	*Change From Previous Year*
2005	195.3	3.39%
2004	188.9	2.66%
2003	184.0	2.28%
2002	179.9	1.58%
2001	177.1	2.85%
2000	172.2	3.36%
1999	166.6	2.21%
1998	163.0	1.56%
1997	160.5	2.29%
1996	156.9	2.95%
1995	152.4	2.83%

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics (2006).

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Table 8.2 State and Local Gross Output Index (SLGOI)

State and Local Consumption Expenditures: Gross Output of General Government		
Year	*State and Local Gross Output Index (SLGOI)*	*Change From Previous Year*
2005	120.748	5.13%
2004	114.860	3.88%
2003	110.575	4.37%
2002	105.942	2.83%
2001	103.026	3.03%
2000	100.000	4.45%

SOURCE: Data drawn from Table 3.10.4, "Price Indexes for Government Consumption Expenditures and General Government Gross Output," U.S. Department of Commerce, Bureau of Economic Analysis. "Gross Output of General Government (State and Local)" is Line 48 on this table. This information may be found online by visiting http://www.bea.gov and navigating to "Interactive Data Tables," then "National Income and Product Accounts, then "All NIPA Tables," and then section "3" for government. The data displayed above were drawn from http://www.bea.gov on February 27, 2006.

based specifically on the kinds of goods and services that state and local governments purchase. We refer to this index here somewhat more simply as the State and Local Gross Output Index (SLGOI).

Quarterly and annual SLGOI figures are displayed on the BEA Web site.[3] Annual SLGOIs for state and local governments from 2000 through 2005, along with instructions for finding this information online, are shown in Table 8.2.

Converting today's dollars, or current dollars, to constant dollars is a simple matter, as shown in Table 8.3. First, the analyst selects a base year, so that today's dollars may be expressed as constant dollars for that base year. If the analyst chooses 2001 as the base year, the object would be to express today's dollars in terms of their 2001 buying power—in other words, as 2001-constant dollars. Next, the analyst will multiply current dollars by the ratio of the base-year SLGOI to the current SLGOI. The resulting figure expresses current dollars in base-year constant dollars.

Demand Analysis

The object of demand analysis is to learn whether a program's demands and resources are aligned with one another. The pattern of service demands may be plotted by time of day, day of the week, geographically, or in whatever manner is determined to be relevant. Then, the pattern of resource deployment in dollars, workers, or other relevant values is plotted on the same dimensions as

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Table 8.3 Using the State and Local Gross Output Index (SLGOI)

Formula for converting “current dollars” to “constant dollars” for a selected base year:

$$\text{current dollar revenue or expenditure} \times \frac{\text{base-year SLGOI}}{\text{current SLGOI}} = \text{current revenues or expenditures in base-year dollars}$$

the demand pattern (for additional information on demand analysis, see, for example, Thomas, 1980). A comparison of the two graphs will reveal the degree of alignment or disparity in service demands and resource deployment. If major disparity exists, strategies should be developed to increase alignment by revising the deployment of resources, altering the pattern of demand, or both.

The demand pattern for ambulance services (see Figure 8.2) aligns reasonably well with the on-duty availability of ambulance units (i.e., resources) in Kansas City (see Figure 8.3). In many demand analysis cases, however, mismatches of demand and resource patterns are revealed, usually signaling the need to add resources or move resources from low-demand times or low-demand locations to high-demand times or locations. Ill-conceived hours of operation (for example, opening at 8 a.m. and closing at 5 p.m., when the demand for service is greatest from noon to 8 p.m.) and poor management practices (for instance, routinely scheduling lunch breaks during peak-demand periods or scheduling vacations during peak-demand months) often become apparent with demand analysis.

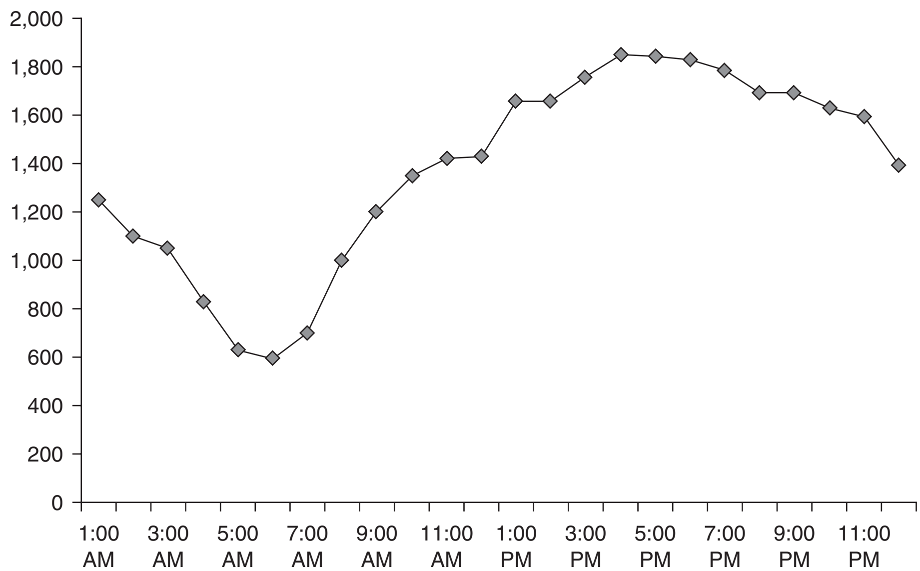

Figure 8.2 Ambulance Calls Received in Kansas City by Hour of Day

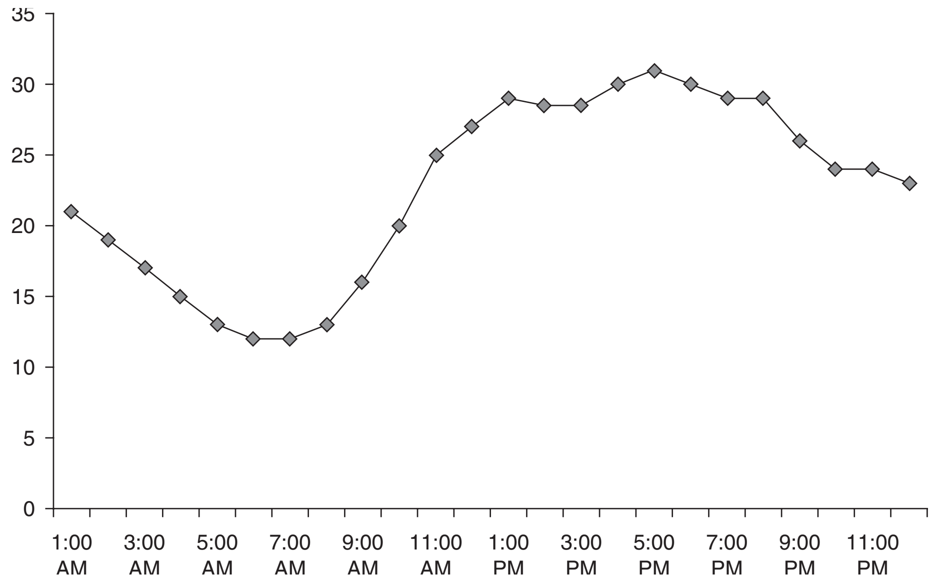

Figure 8.3 Ambulance Deployment in Kansas City by Hour of Day

Full-Cost Accounting Versus "Go-Away Costs"

Many government budgets understate the actual costs of a department or program, sometimes by a wide margin. This is not because officials are attempting to deceive anyone. Rather, it is simply because some of the costs associated with a program or department's operation have been paid in full at an earlier time or are reported in a different section of the budget. Buildings constructed decades ago but still used by the program today and vehicles purchased last year are not really "free" this year, even if the budget shows no current outlays for them, nor are the time and talents of the city manager, finance director, payroll clerk, and other "overhead services" that support the program administratively really free, even if the department's budget shows no charges for them.

Program analysts will encounter many occasions that demand the identification of the full costs of a program (e.g., Abrahams & Reavely, 1998; Brown, Myring, & Gard, 1999). Full-cost accounting will be valuable, for instance, when establishing user fees or when assessing the relative efficiency of a program compared with counterparts. In such cases, it will be important to capture all of the costs associated with the program or activity under review, meticulously dividing the costs associated with workers engaged only partially in the program or activity and including the portion of costs associated with the activity and excluding those that are not. It also requires appropriate allocations of fringe benefit costs; full accounting of all operating expenses, including a "rental" fee for building space and vehicles, even if they are owned by the department or agency; and assignment of the program's fair share of overhead costs. Worksheets are available in other publications to help the analyst identify all of these costs (see, for example, Ammons, 2002, pp. 122–136).

Although full-cost accounting is valuable in efforts to set user fees for services or to assess relative efficiency, it is a poor choice when deciding whether to contract out for a given service. Instead, "go-away costs," not full-cost accounting, should guide contracting decisions.

Full-cost accounting provides a fair statement of all of the costs associated with a program, but the decision to actually contract out the program will rarely eliminate all of these costs. In other words, only some of these costs would go away with the decision to contract for this service. Some of the costs in the full costs of the program are go-away costs, and some are not. The costs of most workers directly involved in delivering the services are go-away costs, as are most of the supply, equipment, and utility costs. But what about the overhead costs and building costs? A share of the finance director's salary, for instance, should be included in the program's full costs, but that expense will not go away with the decision to contract the service, nor will the costs associated with building space, unless a decision is made to rent out the space.

Consider an in-house program with full costs of $400,000. Suppose a contractor proposes to provide the program at an equal level of quality but at a cost of $350,000. Arguably, the contractor is the more efficient service provider, but should the government accept the bid and enter a contract for the service? The decision should be guided by consideration of go-away costs. If $35,000 of the department's $400,000 total consists of overhead and indirect costs that will not go away, the actual go-away costs are $365,000, leaving an apparent saving of $15,000 by entering the contract. But wait! If officials project a cost of $20,000 to administer and monitor the contract, the decision to enter the contract would actually cost the government $5,000, rather than saving any money at all.

Only by including go-away costs alone and excluding from consideration any costs that will remain whether the program is contracted or retained in-house will the decision be based on all the relevant information. If service quality would be equal with each option, the comparison should be between go-away costs, on one hand, and the contract fee plus contract administration costs, on the other.

Annualizing the Cost of Capital Items

Capital items last for a while; they are not consumed quickly. A wise capital investment provides benefits not just for this year, but over the whole life of the item.

Suppose we are asked to report the annual costs of a program that acquires capital equipment from time to time. We carefully tabulate expenditures for personnel, utilities, supplies, and the like, but what about those capital items?

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It would be misleading to apply all of the costs for a capital item to the year in which it is purchased and assign none of the costs to other years in which the equipment is also used.

Consider a piece of equipment purchased in 2007 and having a useful life of 4 years. If the equipment costs $40,000 and that full amount is counted in the year of purchase, this organization might appear to be a high-cost service producer in 2007 and an extremely efficient service producer in 2008 through 2010 (because it is using "free" equipment the last 3 years). In fact, neither might be true. It might be a service producer with rather average expenditures when the cost of capital items is spread across their useful lives. Two of the simplest methods of spreading the costs of a capital item over its useful life are allocations based on usage rate and allocations based on straight-line depreciation (for additional information, see Kelley, 1984).

The premise for allocating costs according to usage rate is the belief that some capital items having varying levels of use from year to year deteriorate more from use than simply from the passage of time. A machine that can be expected to last through 10,000 hours of operation—whether those hours occur in 2 years' time or 10 years' time—is a good example. If the cost of such a machine is $16,500 and it is expected to have a salvage value of $1,500, it would be reasonable to assign costs for that equipment at the rate of $1.50 per hour of operation. The annual cost would be dependent on the anticipated or actual usage of the equipment per year. The formula for usage rate allocation of cost is as follows:

$$a_i = \frac{u_i}{U}(C - S)$$

where a_i = capital expense allocation for time period i,

u_i = usage units consumed during time period i,

U = total estimated usage units in the life of the asset,

C = cost of the asset, and

S = salvage value after U usage units.

Straight-line depreciation is another method of annualizing capital costs. This method requires only an estimate of the useful life of an item rather than a projection of usage in a given year. Straight-line depreciation is a suitable method if the amount of usage per year is expected to be uniform across the life of the capital item or if deterioration of the item is perhaps as much due to the passage of time as to actual usage.

The capital costs of light rolling stock—automobiles and pickups, for instance—could be annualized using either usage rate or straight-line depreciation. If we project that the useful life of a sedan is, say, 100,000 miles, we could calculate the capital cost per mile. Alternatively, we could check the records and see that sedans in a given department are driven an average of

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18,000 to 22,000 miles per year and calculate the straight-line depreciation for this vehicle, using the following formula and an estimated life of 5 years:

$$a_i = \frac{C - S}{N}$$

where a_i = capital expense allocation to each time period,

C = cost of the asset,

N = total number of time periods in the item's expected life, and

S = salvage value after N periods.

Life-Cycle Costing

An item might have a lower price tag than all of its competitors, but that does not mean that it is the best buy or even the least expensive over the long run. The cost of owning and operating an item includes more than its purchase price alone.

The technique known as *life-cycle costing* provides a method of determining the total cost of owning an item, including costs associated with the item's acquisition, operation, and maintenance. It focuses not simply on the purchase price of the item, but on these other costs as well.

Life-cycle costing can be applied to many government purchases but is most often used to determine the lifetime costs of moderately expensive, energy-consuming equipment. Prime targets for applying life-cycle costing include motor vehicles, climate control systems, data-processing equipment, lighting systems, and similar items. Consider the case of a government that is about to purchase a 15-horsepower electric motor and must choose between a pair of competing units (see Table 8.4). The motor offered by Vendor A has the lower price tag and therefore seems less expensive than the motor offered by Vendor B. However, Motor A has a higher rate of energy consumption (14.40 kilowatts/hour) than Motor B (12.58 kilowatts/hour), a very important factor in this decision because the government plans to run the motor 10 hours a day, 5 days a week (i.e., 2,600 hours per year). As shown in Table 8.4, Motor A will actually cost $6,119 more than Motor B over their lifetimes, assuming equal maintenance costs.

To perform a life-cycle cost analysis, an analyst must account for acquisition cost, energy costs, lifetime maintenance costs, and the eventual salvage value of the item (see Figure 8.4). The acquisition cost of an item includes its purchase price, transportation costs, and installation fees, less any discounts and trade-in credits. The cost of electricity or other fuel to operate the item must be added in, as well as costs to keep it functioning (for additional information, see Coe, 1989).

In most cases, life-cycle cost analyses based solely on acquisition costs, maintenance costs, energy costs, and salvage value will be sufficient. For a

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Table 8.4 Supplementing Purchase Price With Lifetime Energy Costs

Life-Cycle Cost	*Motor From Vendor A*	*Motor From Vendor B*
Horsepower	15	15
RPM	3,450	1,160
Bid cost	$1,956	$2,935
Duty cycle	2,600 hrs./yr.	2,600 hrs./yr.
Life	15 years	15 years
Efficiency rating	78.2%	86%
Energy consumption (kilowatts/hour)	14.40	12.58
Energy costs (kwh consumption rate × $.10/kwh × 39,000 hours)	$56,160	$49,062
Life-cycle cost (bid cost + energy cost)	$58,116	$51,997
Life-cycle cost difference ($58,116–$51,997) = $6,119		

SOURCE: Ammons (2002, p. 154).

few especially large purchases, however, several other life-cycle costs could be significant and should be incorporated into the projection: *failure costs,* including downtime, production losses, and rental costs for replacement equipment; *training costs; consumable supply costs* arising from an item's use; *storage costs* for the item or for repair parts; *secondary costs* for disposal of by-products associated with the item's use; *labor costs* for operators; and *money costs,* including interest paid if a loan was necessary to purchase the item or interest forgone on money that could have been invested elsewhere if not used for this equipment purchase.

Analytic Techniques Useful for Benchmarking Projects

The desire for excellent services and state-of-the-art operations leads some organizations to adopt a technique known as *benchmarking*. Benchmarking in the public sector can take different forms. The form adopted by many governments entails comparing performance statistics from their own operations to relevant benchmarks, often in the form of performance standards or performance targets or results achieved by leading counterparts. If the government's performance record is generally consistent with the benchmarks, the comparison offers reassurance that the operation is on track. On the other

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The basic life-cycle cost formula is	
life-cycle costs	**= acquisition cost + lifetime maintenance costs + lifetime energy costs – salvage value**
Where	
acquisition costs	= purchase price + transportation cost + installation cost – trade-ins and discounts,
lifetime maintenance costs	= anticipated costs of keeping the item in operable condition,
lifetime energy costs	= energy consumption rate × cost of energy × duty cycle × life of the item, and
salvage value	= anticipated worth at the end of the item's projected life.
The components of the lifetime energy costs are	
energy consumption rate	= the rate at which energy is consumed (kilowatts/hour),
cost of energy	= dollars per energy unit (cents per kwh),
duty cycle	= annual number of hours item is used (number of hours in use per day × number of days in use), and
life	= length of time until item is replaced (number of years in use based on the duty cycle).

Figure 8.4 Formula for Life-Cycle Costing

SOURCE: Adapted from League of California Cities, *A Guide to Life-Cycle Costing: A Purchasing Technique That Saves Money* (Sacramento: League of California Cities, December 1983, pp. 3–4). Adapted by permission of the League of California Cities.

hand, if substantial performance gaps become evident, the organization might be prompted to conduct further analysis leading to operating changes.

Organizations performing this kind of benchmarking sometimes turn to regression analysis to control for selected variables when identifying top performers (for a technical explanation of regression, see, for instance, Schroeder, Sjoquist, & Stephan, 1986). A regression program will calculate the relationship between two or more variables using data from multiple observations. The program will draw a regression line through the scatterplot of observations that approximates this relationship.

Suppose that an analyst is focusing on the unit cost of a given service and suspects that economies of scale come into play—that is, the cost per unit declines among governments serving larger populations. Regression analysis would confirm or refute the suspected relationship between cost and scale. If the relationship is confirmed, points on the regression line could be considered to represent the expected value of unit cost at various population levels along the line. Observations that deviate the most in a favorable direction from the line reflect the organizations that are most efficient in providing this service when controlling for population.

Some governments adopt a different form of benchmarking, patterned after the approach followed in the private sector. Corporate-style benchmarking

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is narrow in scope, focusing on a single key process in a given organization. It is more analytic than the other form of benchmarking in that it systematically examines the steps in a selected key process, not simply the results being achieved. Furthermore, it is prescriptive, not merely diagnostic. The purpose is to identify "best practices" among top performers and adapt those practices for the benchmarking government's own use.

Governments that are engaged in corporate-style benchmarking select a key process (e.g., emergency dispatching, the reservation process for renting civic center space, the handling of citizen complaints, the requisition process for government purchases) and identify outstanding performers of that process—that is, organizations that are achieving superior results. They attempt to persuade top performers to cooperate as benchmarking partners, sharing information on the details of their process. The basic steps in this type of benchmarking are depicted in Figure 8.5.

A slightly more detailed description of corporate-style benchmarking, developed for the application of this technique in the public sector, includes seven steps:

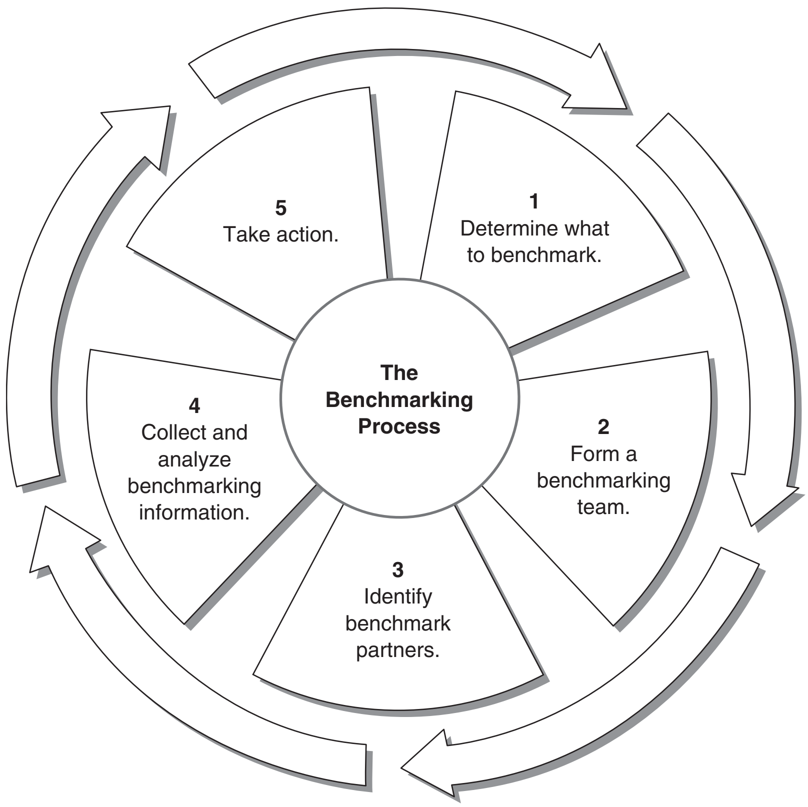

Figure 8.5 The Benchmarking Process

SOURCE: Spendolini (2000).

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- Decide what to benchmark
- Study the processes in your own organization
- Identify benchmarking partners
- Gather information
- Analyze
- Implement for effect
- Monitor results and take further action as needed (Southern Growth Policies Board and Southern Consortium of University Public Service Organizations, 1997).

Each step in the benchmarking process is important, but the steps of particular relevance to this chapter are those dealing with the gathering of information about the process being studied and the analysis of that information. How can this information about the process as conducted by the government and its benchmarking partners be compiled and recorded systematically, so that important differences contributing to superior results might be revealed? Process flow charting can help.

In *process flow charting,* all the steps in a routine procedure are recorded in sequence. Each detailed step is categorized and given one of five labels: operation, transportation, inspection, delay, or storage (see Figures 8.6 and 8.7).

Rudimentary process flow charting requires very little specialized knowledge. It does require meticulous attention to detail and perceptiveness, for the analyst strives to eliminate unnecessary or duplicative operations and inspections, reduce transportation and delay components, and generally streamline the process. Each step is scrutinized: What is the purpose of this step? Why does it come here in the sequence? Could it be performed more effectively by someone else? The analyst will consider the possibility of cheaper, faster, or more reliable alternatives. In the context of corporate-style benchmarking, the process flow chart for the government will be compared with the charts of benchmarking partners to reveal differences in procedures and draw the analyst's attention to prime options for change (for additional information on benchmarking, see Keehley, Medlin, MacBride, & Longmire, 1997; Spendolini, 2000; for more on process flow charting, see Aft, 2000; Haynes, 1980; Summers, 1998).

Symbol	Name	Defnition
○	Operation	An item is acted upon, changed, or processed.
⇨	Transportation	An object is moved from one place to another.
□	Inspection	An object is examined to be sure quantity and/or quality is satisfactory.
D	Delay	The process is interrupted as the item awaits the next step.
▽	Storage	The item is put away for an extended length of time.

Figure 8.6 Process Flow Chart Symbols

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Process Chart

Present Method ☐
Proposed Method ☐

SUBJECT CHARTED ______________________________ DATE ________________

____ CHART BY ______________

____ CHART NO. _____________

DEPARTMENT ___________________________________ SHEET NO. _______ OF ______

Dist. in Feet	Time in Mins.	Chart Symbols	Process Description
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
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		○ ⇨ □ D ▽	
			Total

Figure 8.7 Process Chart

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Conclusion

Careful, systematic analysis of a perceived staff shortage, an outdated service fee that no longer recovers full costs, a volatile service demand pattern, or another operational issue or problem improves the likelihood of an accurate diagnosis and a good solution. Will recommendations based on facts and careful analysis carry every decision? Not every time—not in an environment where tradition, emotion, and politics matter, too. Still, good analysis will carry some decisions and, in other cases, can at least influence the decision process. Progressive governments count on conscientious analysts and administrators to bring the products of careful analysis to the decision table to be sure that analysis provides all the influence it can.

Notes

1. A standard of this sort is mentioned frequently in various communities during budget deliberations, but such prescribed ratios are on shaky ground. According to the International Association of Chiefs of Police, "Ready-made, universally applicable patrol staffing standards do not exist. Ratios, such as officers-per-thousand population, are totally inappropriate as a basis for staffing decisions. . . . Defining patrol staffing allocation and deployment requirements is a complex endeavor which requires consideration of an extensive series of factors and a sizable body of reliable, current data" (http://www.theiacp.org, displayed February 6, 2006). Among the factors considered relevant are number of calls for service, population density, and transience of population.

2. For CPI information online, see the U.S. Bureau of Labor Statistics Web site at http://www.bls.gov/cpi/.

3. For SLGOI information online, see the U.S. Bureau of Economic Analysis Web site at http://www.bea.gov.

References

Abrahams, M. D., & Reavely, M. N. (1998, April). Activity-based costing: Illustrations from the state of Iowa. *Government Finance Review, 14,* 15–20.

Aft, L. S. (2000). *Work measurement and methods improvement.* New York: Wiley.

Ammons, D. N. (2001). *Municipal benchmarks: Assessing local performance and establishing community standards* (2nd ed.). Thousand Oaks, CA: Sage.

Ammons, D. N. (2002). *Tools for decision making: A practical guide for local government.* Washington, DC: CQ Press.

Ammons, D. N., & Williams, W. A. (2004). Developing and applying analytic capabilities in major American cities. *Public Administration Quarterly, 27,* 392–409.

Brown, R. E., Myring, M. J., & Gard, C. G. (1999, Summer). Activity-based costing in government: Possibilities and pitfalls. *Public Budgeting and Finance, 19,* 3–21.

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Building Service Contractors Association International. (1992). *Building Service Contractors Association International production rate recommendations*. Fairfax, VA: Author.

City of Kansas City. (1998, January). *Kansas City, Missouri, police department patrol deployment: Blackout analysis*. Kansas City, MO: Office of the City Auditor.

City of Pittsburgh. (1996). *Performance audit: Department of public safety office of professional standards*. Pittsburgh, PA: Office of City Controller.

Coe, C. K. (1989). *Public financial management*. Englewood Cliffs, NJ: Prentice Hall.

DeLorenzo, L. (2001). Stars aren't stupid but our methodological training is. *Journal of Public Administration Research and Theory, 11,* 139–145.

Haynes, P. (1980). Industrial engineering techniques. In G. J. Washnis (Ed.), *Productivity improvement handbook for state and local government* (pp. 204–236). New York: Wiley.

Hearst Business Communications. (n.d.). *MOTOR labor guide manual* (updated annually). Troy, MI: Author.

Hy, R. J., & Brooks, G. H. (1984, Fall). An assessment of evaluation skill needs in state evaluation agencies in the south. *Review of Public Personnel Administration, 5,* 25–33.

Keehley, P., Medlin, S., MacBride, S., & Longmire, L. (1997). *Benchmarking for best practices in the public sector*. San Francisco: Jossey-Bass.

Kelley, J. T. (1984). *Costing government services: A guide for decision making*. Washington, DC: Government Finance Officers Association.

LaPlante, J. M. (1989). Research methods education for public sector careers: The challenge of utilization. *Policy Studies Review, 8,* 845–851.

League of California Cities. (1983, December). *A guide to life-cycle costing: A purchasing technique that saves money*. Sacramento, CA: Author.

Meier, K. J., Brudney, J. L., & Bohte, J. (2006). *Applied statistics for public and nonprofit administration*. Belmont, CA: Wadsworth.

Mitchell International. (n.d.). *Mechanical labor estimating guide* (updated annually). San Diego, CA: Mitchell International.

O'Sullivan, E., Rassel, G. R., & Berner, M. (2003). *Research methods for public administrators*. New York: Addison Wesley Longman.

Robinson, C. L. K. (1995). *The effects of caseload on code enforcement case completions*. Paper submitted for Master of Science in Administration degree, Central Michigan University, Mount Pleasant, MI.

Schroeder, L. D., Sjoquist, D. L., & Stephan, P. E. (1986). *Understanding regression analysis: An introductory guide*. Newbury Park, CA: Sage.

Southern Growth Policies Board and Southern Consortium of University Public Service Organizations. (1997). Benchmarking best practices. *Results-oriented government, Module 2*. Research Triangle Park, NC: Author.

Spendolini, M. J. (2000). *The benchmarking book* (2nd ed.). New York: AMACOM.

Summers, M. R. (1998). *Analyzing operations in business: Issues, tools, and techniques*. Westport, CT: Quorum Books.

Thomas, J. S. (1980). Operations management: Planning, scheduling, and control. In G. J. Washnis (Ed.), *Productivity improvement handbook for state and local government* (pp. 171–203). New York: Wiley.

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U.S. Department of Defense. (1984). *Roads, grounds, pest control, & refuse collection handbook: Engineered performance standards* (NAVFAC 0525-LP-156–0016). Washington, DC: U.S. Government Printing Office.

U.S. Department of Labor, Bureau of Labor Statistics. (2006, February 7). *Consumer Price Index table.* Available at http://www.bls.gov/cpi/home.htm#tables

U.S. Department of the Navy. (1987). *Janitorial handbook: Engineered performance standards* (NAVFAC 0525-LP-142–0061). Washington, DC: U.S. Government Printing Office.