Measuring Productivity In State and Local Government

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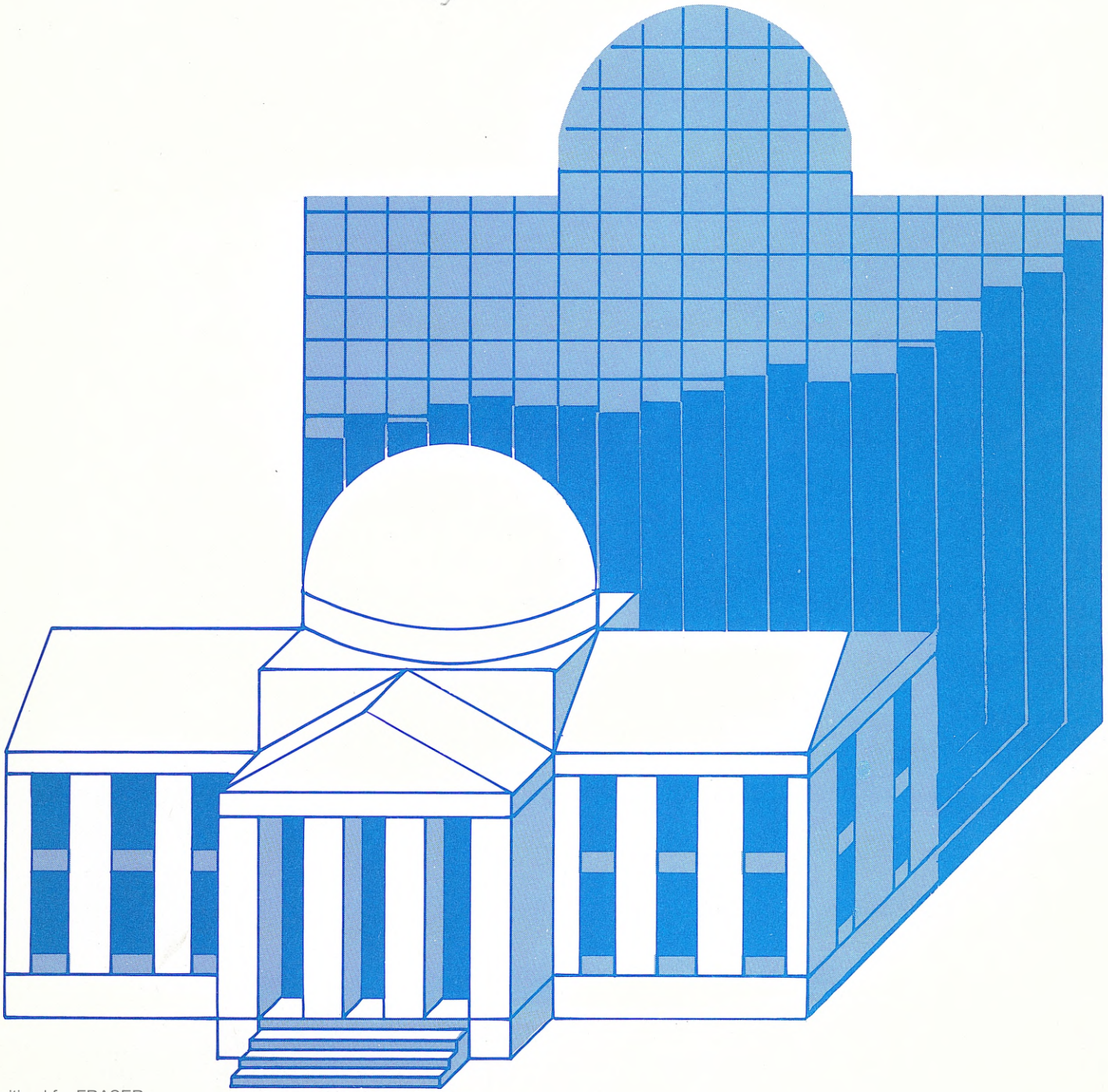

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U.S Department of Labor
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Preface

The Joint Economic Committee of the U.S. Congress, the National Research Council of the National Academy of Sciences, and the General Accounting Office have all called for further exploration into the possibility of measuring State and local government productivity. This bulletin was prepared in response to the recommendations of these organizations and the recognition that national productivity indexes are lacking for the 13 percent of the civilian labor force that is employed by State and local government.

The bulletin reviews past research in the area, discusses conceptual issues, reviews national data which could be used to calculate productivity, examines seven State and local government services, and offers recommendations for future research. While the focus is on producing *national* indexes of State and local government productivity, the concepts and procedures are equally valid for individual governments. The study was carried out during 1980–82. While some of the statements and data presented have been superseded by recent events, the basic conclusions remain unchanged.

Donald M. Fisk prepared this bulletin under the supervision of Jerome A. Mark, Associate Commissioner for Productivity and Technology. Dagmar Horna assisted in the research and tabulations, and Rita Walker typed the manuscript. Charles Ardolini, Chief of the Division of Industry Studies, Office of Productivity and Technology, and his staff reviewed much of the research and provided helpful comments. A number of individuals outside BLS reviewed parts of the manuscript; their contributions are acknowledged in the appropriate chapters.

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Chapter I. Introduction, Conclusions, and Recommendations

State and local government employment and expenditures have increased greatly over the past two decades. In 1960, these governments employed about 6.1 million workers, or 8.7 percent of the civilian labor force, and spent about $46.5 billion on the purchase of goods and services, or 9.2 percent of the gross national product. By 1980, these governments employed 13.4 million, or 12.5 percent of the civilian labor force, and spent $341.2 billion on goods and services, or 13.0 percent of the gross national product.

Despite the growth and current importance of State and local governments, no national index of their productivity is maintained such as those calculated for the private sector or the Federal Government. Nor, apparently, is there a current index for a single State or local government service.[1] State and local government productivity remains the largest unmeasured sector of the economy.

Several organizations have recommended, particularly in the 1970's, that State and local government productivity be measured. The Joint Economic Committee of the U.S. Congress, the National Academy of Sciences, and the General Accounting Office have suggested additional research to measure State and local government productivity.[2] Each group recognized the problems associated with such an undertaking but nevertheless believed its importance warranted further investigation.

Types of measures

Considerable confusion has surrounded discussions of the basic concepts and procedures used in government productivity measurement.[3] Furthermore, as the literature has expanded, definitions and concepts have become more complex. Today, public sector productivity literature variously defines productivity as efficiency, effectiveness, cost reduction, input-output, management improvement, performance measurement, methods improvement, systems analysis, work measurement, and program evaluation.[4] Because of the confusion over terms, some of the more important definitions used in this study are presented in table 1. As Jerome A. Mark notes, however, there is no best or right measure.[5] Productivity measurement requires that measures be shaped for the decision process, which leads to a variety of types of measures.

In this bulletin, government productivity measures are assigned to one of three categories based on the type of output measure. These are: (1) Measures which focus on operational issues, (2) those which focus on organizational or program outputs, and (3) those which are concerned with program consequences.

Operational measures are concerned with the internal workings or efficiency of the organization. Work measurement, which deals with resource requirements under a given technology or set of conditions, is a common operational measure. Intermediate activities, such as the number of reports produced, number of audits completed, or the number of samples tested, and utilization measures, such as equipment downtime, are other types of operational measures. Each is important for day-to-day management of government.

The second category of productivity measures, direct outputs, is the final organizational output divided by the resources used to produce the output. The direct output productivity measure is the measure most commonly computed for the private sector. Public sector examples of such measures are the "tons of solid waste collected per employee hour" for sanitation services and the "revenue gallons of water sold per employee hour" for water utilities. These measures are also known as technical efficiency measures. They do not address the issue of whether the services should be produced or relate them to some desired goal.

[1] Government enterprises, such as electric power utilities and water supply, are included in the private sector productivity indexes calculated quarterly by BLS because their outputs are sold in the marketplace. Enterprise services are included as a group; they are not separated by type of government or service.

[2] National Research Council, *Measurement and Interpretation of Productivity* (Washington: National Academy of Sciences, 1979), pp. 9–10; U.S. Congress, Joint Economic Committee, *Productivity in the Federal Government* (Washington: Government Printing Office, 1979), p. 7; and General Accounting Office, *The Federal Role in Improving Productivity—Is the National Center for Productivity and Quality of Working Life the Proper Mechanism?* May 23, 1978, p. 45.

[3] Jerome A. Mark, "Measuring Productivity in Government–Federal, State, and Local," *Public Productivity Review,* Mar. 1981, p. 21.

[4] Jesse Burkhead and Patrick J. Hennigan, "Productivity Analysis: A Search for Definition and Order," *Public Administration Review,* Jan./Feb. 1978, pp. 34–40.

[5] *The Meaning and Measurement of Productivity,* Bulletin 1714 (Bureau of Labor Statistics, 1971), p. 7.

Table 1. Terminology of government productivity measurement

Term	Definition
Activity	A task performed by an organization to produce a desired output. Examples include miles driven, trucks serviced, and meters read. Sometimes described as workload.
Consequence	The desired results of government programs or services such as improved citizen safety, increased longevity, and reduced infant mortality. Sometimes described as impact or outcome.
Effectiveness	The degree or extent to which program goals are met, such as percent of population served or percent of clients successfully treated.
Efficiency	The ratio of output to inputs such as work performed per staff hour or downtime as a percent of total hours. Includes productivity, unit costs, and technical efficiency.
Function	A government service such as police, fire, and education. "Function" and "service" are used synonymously.
Goal	A statement which describes what is to be accomplished by a program, service, or agency such as "insure a safe and secure environment."
Impact	The long-term effect of a program on a community or its citizens. Impact and consequence are used synonymously. See "Consequence."
Input	The resource used by an agency to produce a function or service. Examples of inputs are labor, facilities, equipment, and materials.
Outcome	Short-term impact or consequence of government action or outputs, such as increased income which might come as a result of job training.
Output	The result of work performed or produced by an agency. Outputs are what government produces. Examples of outputs are the number of individuals served, gallons of revenue water delivered, or tons of trash collected.
Productivity	Amount of physical output per unit of input.
Productivity index	Inverse of the change in resources used per unit of output.
Service	A government function such as police, fire, or education. The terms "service" and function" are used synonymously.
Social indicator	A measure of societal well-being such as longevity or happiness. These measures are of interest because they are considerations which governments wish to promote.
Workload	A measure of the amount of work performed, usually an intermediate output, such as the number of miles driven, or number of machines serviced. See "Activity."

The third category, consequences, addresses the issue of a program's impact on society and whether that program makes optimum use of resources to achieve its goals. This type of measure is alternatively known as outcome, impact, effectiveness, and economic efficiency. Examples of these types of measures are "deaths prevented per employee hour" for fire departments and "jobs created per employee hour" for economic development agencies. Measures such as these focus on consumers and consumption whereas operational and direct output productivity measures are concerned with production relationships.

Each of these three general types of productivity measures is important. However, the most common, at least nationally, is the second type, the direct output or technical efficiency measure. It is this type of measure which is most often computed for the private sector and the one with which this study is primarily concerned.

In many ways, the measurement of productivity in government and private organizations should be similar. Both types of organizations produce goods and services, both compete in the marketplace to purchase resources, and both use varying combinations of resources to produce a product or service.

There are important differences, however. Probably the most important is the absence of a market and a market price for most government production. Government officials, not the marketplace, decide what to produce.

Basic measurement issues

Specification and measurement of output are the most difficult problems in measuring the productivity of State and local government. The basic measure of output should be a homogeneous physical unit, with the unit measure of output related to the unit labor hours spent in its production. Where a government provides a single service, as in the case of some of the special districts—solid waste disposal and drinking water are examples—the output can be simply a count of the units of service. However, most governments produce a number of heterogeneous services, and it is often difficult to even identify the basic services.

Furthermore, most government services are composed of a number of different subservices or products which also are difficult to identify. For example, the direct outputs (not consequences) of police and education services are not easily specified. For productivity measurement, it is necessary to specify homogeneous service outputs.

In addition, if the output index is to reflect trends accurately, the service units must be homogeneous through time. In many instances, the scope and dimensions of government services are constantly changing.

Many transit systems now provide demand response service in addition to regularly scheduled bus service, and some jurisdictions have added the testing of automobile emissions to safety inspections. In both cases the service unit has changed, which requires product differentiation.

Quality and level of service considerations are also important for productivity measurement because of their potential impact on the unit of service. To distinguish service or product shifts from changes in unit labor requirements, or productivity, outputs or inputs must be adjusted or a new product identified. Movement of solid waste collection from backdoor to curbside pickup and improvement of drinking water quality to conform with environmental standards will affect unit labor requirements, and reduction of welfare error rates may affect unit labor requirements.

Selection of the proper measure of output requires a service-by-service and product-by-product approach. By dividing a service, it is possible to identify homogeneous outputs with reasonably stable unit labor requirements. The difficulties with this approach are a lack of research to identify the correct units and a lack of data to make the calculations.

Data to calculate aggregate national, State, and local government output indexes are generally lacking. The Federal Government collects some data, particularly in those areas where it has shared responsibilities, such as unemployment insurance and drinking water, and some data are collected by national associations and public interest groups. These statistics are often inaccurate and incomplete. But more often than not, national statistics are simply unavailable on State and local government output.

To collect output data through a regular survey of State and local governments would be extremely expensive. But even if the decision were made to spend the necessary funds, there is the fundamental question of what data to collect. For some services, there is a reasonably good idea of the data needed on type of output and level and quality of service for productivity measurement, but for most services this information is unknown. In short, it makes little sense to establish a data collection system at this time. However, if a system is established to collect State and local government output data, input information should be collected simultaneously.

The most frequently used measure of input is labor. Constituting over half of all State and local government operating expenditures, labor is important for public policy considerations, is easy to calculate compared with other factors of production, and is the most accessible of State and local government factor inputs. It is the measure recommended for State and local government productivity calculations.

The preferred labor measure is labor hours. However, no national statistics are available for labor hours of State and local governments; few governments even collect such data. A measure often used as a proxy for the number of hours is the number of full-time-equivalent employees. Most State and local governments maintain such statistics. Most governments also have statistics on the number of employees, a measure widely used in the private sector.

However, none of the sources of national statistics are entirely satisfactory for computing individual service labor productivity indexes. National statistics collected through the Bureau of the Census' Census of Governments, the Employment Service's ES–202 report, and the Bureau of Labor Statistics' Current Employment Statistics survey (CES–790) are not divided sufficiently to compute labor productivity indexes for individual services. In a few instances, Federal Government programs, such as unemployment insurance and the Employment Service, and professional interest groups, such as the American Public Transit Association, do collect data on State and local government employment. However, comparisons of labor data drawn from these and other sources reveal considerable discrepancies.

In summary, no single source of labor data on State and local government is adequate to compute labor indexes. Most contain errors. Construction of viable labor indexes, either total or for individual services, will require detailed comparison and adjustment of the data.

As with the private sector, cyclical and secular change can dramatically affect productivity trends. Cyclical productivity change most often occurs in services such as unemployment insurance, where inputs cannot be adjusted as rapidly as outputs change. Secular trends are found in services for which a fundamental change occurs over time, such as electric power. Generally speaking, the greater the number of years included in the productivity index, the more representative the index will be of long-term trends. Data availability will normally set the outer bounds for the years measured.

Services examined

Seven State and local services were selected for this report from dozens provided by the government. The more important government services, such as education, police, and fire, are not included because of conceptual or data problems.

For three services—electric power, State alcoholic beverage stores, and unemployment insurance—illustrative indexes are calculated. For two services —sanitation and drinking water—productivity was not calculated because national data are lacking. For the remaining two services—transit and the Employment Service—productivity indexes were not calculated because of unresolved conceptual and data issues; additional research is being conducted in these two areas. The results for each service are briefly noted below.

Electric power. Considerable research has been conducted into private electric power productivity, and considerable data are collected on private and public utilities. In 1978, about 2,200 State and local government electric power utilities employed about 66,000 workers. From 1967 to 1978, labor productivity increased an average of 3.0 percent annually, output (kilowatt hours) 4.0 percent, and labor input 0.9 percent.

State alcoholic beverage sales. Seventeen State governments sell alcoholic beverages. The preferred measure of output for retail store operations is bottles; for wholesale operations, cases. A proxy measure, gallons, was used to calculate government productivity. Between 1967 and 1978, the average annual increase in productivity was 2.5 percent; in output, 3.1 percent; and in labor, 0.6 percent.

Unemployment insurance. Considerable data are routinely collected on this joint Federal-State program. In 1978, about 48,000 State employees operated the program. Two primary measures of output are: (1) Services to those applying for or drawing benefits and (2) collection of funds from employers. A weighted program output measure shows that, between 1965 and 1978, labor productivity increased at an annual rate of 1.7 percent, output at 7.4 percent, and labor input at 5.7 percent.

Solid waste collection and disposal. The preferred measure of output in this area is tonnage. No national data are routinely collected on outputs, and input data are insufficient for productivity calculations. Hence, a productivity index was not calculated. Local government had about 128,000 employees in this area in 1980.

Drinking water supply. Revenue gallons is the preferred measure of water utility output. Most utilities routinely collect gallonage data and some data are collected nationally, but there are so many questions about the accuracy of these data that no index was calculated as part of this study. In 1980, about 134,000 State and local employees worked in this area.

Mass transit. Research into mass transit operations and calculation of outputs, inputs, and productivity have a long history. For some time, the proper measure of output has been debated. On the one side are the traditionalists who favor passenger miles or a similar measure. On the other side are the transit operators who favor an availability or capacity measure such as vehicle miles. Since 1979, national data have been collected for both output measures, and for labor inputs.

Employment Service. Considerable research has been done and data collected routinely on the Employment Service (ES), a joint Federal-State operation. ES has calculated "labor productivity" for several years but has been criticized for the measure—placements—and the resulting measurements. Placements measure outcome more than output. Also, serious questions have arisen about the accuracy of data used to calculate "productivity."

Current status

These seven services illustrate the problems and opportunities that occur in computing State and local government productivity indexes. The problems are substantial and include both conceptual and data issues. However, the difficulties may not be any worse for calculating State and local government productivity than for calculating private sector service industry productivity.[6]

Both sectors produce many of the same services. There are literally dozens of such services, ranging from electric power to alcoholic beverage sales to hospitals to employment counseling. Not every government service has its private sector counterpart, but most do.

Furthermore, similar economic forces seem to be at work. For electric power, the productivity trends in the two sectors are similar; productivity is affected in both by economies of scale; and the slowdown in productivity growth is evident in both. For the Unemployment Insurance Service, the fluctuations in output mirror shifts in the number of unemployed. Also, as in the private sector, productivity increases rapidly during periods of increasing unemployment as work increases more rapidly than the number of workers (the opposite occurs during periods of decreasing unemployment). Quality apparently decreases during periods of high workload but improves as the workload drops. Productivity trends are dramatically influenced by the beginning and ending points of the index as a result of the cyclical fluctuations.

Much of the past discussion on calculating government productivity has been entangled in questions of effectiveness, outcome, and impact. Productivity analysis in these areas has become entrapped in externalities. As long as the discussion is restricted to direct outputs, the solutions are at least as tractable as in the private sector.

This is not to say that productivity can be computed for every State and local government service. Thorny problems exist in calculating State and local government productivity, just as in the private sector. However, it should be possible to compute State and local government labor productivity for many services.

A strategy for development

Development of State and local government productivity indexes must proceed service by service. A three-step process is suggested for developing each service in-

[6] Jerome A. Mark, "Measuring Productivity in Service Industries," *Monthly Labor Review*, June 1982, pp. 3–8.

dex: (1) Select the service to be examined, (2) review existing research and data, and (3) calculate the index and document the result. Once established, the index needs to be updated annually.

In selecting the service to be examined, two—often conflicting—criteria need to be weighed. One is the importance of the service judged by its cost or the number of employees. The other is the difficulty of computing a viable index. Education, for example, is the most important service in resources used but is also one of the most difficult areas in which to measure outputs. Alcoholic beverage sales, on the other hand, is one of the easier services for measuring outputs but is relatively unimportant in terms of employment. In selecting a service to be examined, these two criteria need to be balanced.

A suggested procedure for selecting a service is to compare the two criteria—importance and difficulty—using relative rankings such as those shown in table 2. Importance, for example, can be measured by the number of employees. A three-part ranking is used in the table: (1) 100,000 employees or less, (2) more than 100,000 but less than 500,000 employees, and (3) more than 500,000 employees. Difficulty can be assessed by examining the tangible nature of outputs and the availability of national output data. A three-part ranking is used: (1) Tangible outputs *and* national data, (2) tangible outputs *or* national data, and (3) *neither* tangible outputs *nor* national data. The services shown in the matrix are those listed by the Bureau of the Census, with the addition of the Employment Service and the Unemployment Insurance Service.

Although the classification system is arbitrary and the assessments illustrative, the matrix demonstrates some of the opportunities and problems in computing State and local government productivity indexes. First, computing a national index will not be easy for any important service. Second, national data and/or a tangible set of outputs exist for most services.

After the service has been selected, an initial reconnaissance will be needed to assess the feasibility of computing an index. This initial review will normally be sufficient to identify which services are good candidates for calculating productivity. An in-depth investigation, the next step in the process, will determine whether an index computation is possible.

Construction of an index requires a detailed review of research and conceptual issues, development of a list of potential output measures, evaluation of each measure, selection of the recommended measure, search for data to compute the index, development of surrogate or proxy measures if the data are not available, and, finally, documentation of the results. This bulletin illustrates, for seven services, how documentation might proceed.

Maintenance of an index requires constant vigilance and analysis. Changes may occur in the quality and level of service; intermediate outputs may be contracted out, which would reduce labor input but not output; and data series may change.

Table 2. Illustrative matrix for selecting services for computing State and local government productivity

Difficulty of computing productivity	Importance of service (number of State and local government employees)		
	100,000 or less	100,000 to 500,000	500,000 or more
Least difficult—has tangible outputs and national data	Electric power Unemployment insurance Sewerage Airports Alcoholic beverage stores	Water supply Mass transit	
More difficult—has tangible outputs or national data	Employment Service Aid to families with dependent children Food stamps Libraries Housing and urban renewal Water transportation Gas supply	Corrections Sanitation Natural resources	Highways Hospitals Police Higher education Local schools
Most difficult—has *neither* tangible outputs *nor* national data		Fire Financial administration Parks and recreation Health	General control

After the development of individual indexes, it should be possible to construct aggregate indexes for functional segments, such as for the enterprise services. This group of services warrants early examination.[7] This bulletin examines four such services—alcoholic beverage sales, electric power, transit, and water supply—which account for about two-thirds of total salary and wage expenditures of enterprise services. Services which fall into this category would be among the easiest for computing productivity. They are already included in the National Income and Product Accounts and in national private sector productivity calculations.

Income maintenance programs, such as aid to families with dependent children, food stamps, and unemployment insurance also are suitable for productivity measurement and functional grouping. The conceptual issues are tractable and data are available for the major ones as a result of the Federal role in funding and oversight.

Service groupings, such as the enterprise services and income maintenance programs, could also be used for comparison and benchmarking. Enterprise group statistics can be compared with the National Income and Product Account data. Social insurance programs (unemployment insurance, the Employment Service, and other labor programs); utilities (water, gas, electric power, and transit); and transportation (highways, air, and water) can be compared with Bureau of the Census employment groupings.

By using the building block approach, individual indexes and groups of indexes might be combined into appropriate functions, such as public works and public safety. Eventually it may be possible to develop a national productivity index for State and local government, but this is probably many years away.[8]

[7] The Bureau of Economic Analysis of the U.S. Department of Commerce assigns 15 State and local government services to this group. These services are largely sold in the marketplace and consequently have a price associated with them.

[8] A national index does not have to include every service, but, to be representative, 90 percent of the labor input should be included.

Chapter II. Background and Uses of Productivity Measurements

About 80,000 State and local governments in the United States serve their citizens through a vast variety of programs. State employees operate such diverse services as hospitals, universities, forests, hatcheries, prisons, lotteries, alcoholic beverage stores, and grain elevators. Employees of municipalities, townships, counties, school districts, and special districts sweep streets, inspect restaurants, manage golf courses, operate swimming pools, assess real estate, counsel drug addicts, put out fires, direct traffic, and teach students.

The number of employees in each of these areas varies dramatically. There were over 1 million State employees in higher education in 1977 but less than 16,000 in State alcoholic beverage stores, and more than 4.8 million in local schools but less than 100,000 in local libraries (table 3). Also, the number of paid employees ranged from 358,497 (New York City) to 0 for some special districts.

While there is great diversity in State and local government operations there are, at the same time, many similarities. Every State operates an employment service, an unemployment insurance service, a food stamp program, a university system, a court and penal system, and a highway system. And most municipalities operate fire, police, sanitation, library, and recreation services. Such similarities permit computation of national indexes for State and local government productivity.

Furthermore, the major services account for most State and local government employment—education, hospitals, police, and highway programs alone account for 70 percent (table 3).

Also, the large jurisdictions employ a significant proportion of all State and local government workers. The 10 largest States account for about 48 percent of all State employment; the 10 largest special districts, for about 25 percent of special district employment; the 10 largest municipal governments, about 22 percent of all municipal employment; the 10 largest school districts, about 12 percent of total school district employment; and the 10 largest counties, about 11 percent of all county employment.[1]

[1] See appendix A.

Research and surveys

State and local government output, employment, and productivity have been examined by a number of economists and members of the research community. Several scholars examined aspects of the subject in the latter part of the 1960's, when State and local purchases and employment began their dramatic growth.

In 1967, William J. Baumol raised the question of why the quality of life apparently deteriorated in urban areas when State and local governments spent more and more resources to solve problems. He concluded that productivity growth was extremely low or nonexistent, and furthermore, that little could be done to improve the situation. The Baumol thesis was based on a two-sector conceptual model of the economy, one sector characterized by high technological inputs and a high rate of productivity growth and the other having high labor inputs and a low rate of productivity growth. State and local government services, according to Baumol, lay mostly in the second sector.[2]

Bradford, Malt, and Oates examined the Baumol thesis from readily available data for health and hospitals, education, police, and fire. Their conclusions, which were based primarily on unit cost data, generally substantiated the Baumol thesis, that is, rising unit costs and decreasing or slowly increasing productivity.[3]

Robert M. Spann also examined the Baumol hypothesis from data for six State and local government services—police, fire, highways, general control, financial and administration, and public welfare. His approach, output measures, and conclusions generally parallel those of Bradford, Malt, and Oates. However, he argued that the lack of productivity growth in State and local government was due to bureaucratic influences, not simply to the labor-intensive nature of State and local government services. In coming to this conclusion, he compared selected private sector productivity measures with public sector statistics. He concluded that private sector services exhibited low, but positive

[2] William J. Baumol, "Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis," *American Economic Review*, June 1967, pp. 415–26.

[3] D.F. Bradford, R.A. Malt, and W.E. Oates, "The Rising Cost of Local Public Services: Some Evidence and Reflections," *National Tax Journal*, XXII, No. 2 (June 1969), pp. 185–202.

Table 3. State and local government employees by function, October 1977

Function	Number (thousands)	Percent of total	Percent of State total	Percent of local total
Total	12,765	100		
State	3,491		100	
Local	9,275			100
Education	6,703	53	43	56
Local schools	4,885	38	1	52
Higher education	1,724	14	39	4
Other education	94	1	3	–
Hospitals	1,105	9	16	6
Police	622	5	2	6
Other and unallocable	595	5	6	5
Highways	563	4	7	3
General control	502	4	3	4
Welfare	369	3	5	2
Local utilities	324	3	–	4
Water supply	121	1	–	1
Electric power	64	1	–	1
Transit	127	1	–	1
Gas supply	13	–	–	–
Financial administration	291	2	3	2
Fire protection	270	2	–	3
Corrections	224	2	4	1
Parks and recreation	217	2	–	2
Health	212	2	3	1
Natural resources	209	2	5	–
Sanitation	127	1	–	1
Social insurance	117	1	3	–
Libraries	91	1	–	1
Housing and urban development	90	1	–	1
Sewerage	86	1	–	1
Airports	19	–	–	–
Liquor stores	16	–	1	–
Water transportation	14	–	–	–

SOURCE: *1977 Census of Governments—Compendium of Public Employment* (Bureau of the Census, 1979), pp. 13–14.

gains in productivity, unlike their public sector counterparts, which showed declining productivity.[4]

Probably the most thorough examination of local government productivity to date was one undertaken by Ross and Burkhead. In addition to reviewing the research of others and setting the conceptual foundations, they attempted to estimate that part of the change in local government expenditures which was due to shifts in cost and workload and the part which was due to shifts in quality and productivity. Their empirical work examined education, welfare, police, and fire for several of the larger cities in New York State, and welfare and education for all local governments in New York State. Except for fire protection, they found little evidence of increasing local government productivity.[5]

More recently, Charles R. Hulten used the household production function to examine the change in State and local government productivity. His model, which captured the consequences (effectiveness) as well as productivity (efficiency), found that State and local government probably had a negative rate of growth in productivity between 1959 and 1979, the years for which data were available.[6]

A number of studies of individual State and local government functions have focused on a few subject areas to identify underlying economic relationships rather than develop specific productivity indexes. Solid waste collection, mass transit, and water supply, for example, have been extensively investigated, as will be discussed later in this study.

Many areas have had little investigation of the basic underlying economic relationships and no developmental work on productivity measurement. Services such as parks and recreation, elderly day care, animal control, and general management have been skipped over entirely or examined only superficially.

Although information on productivity measurement in individual State and local governments is sparse, the majority of medium- and large-size governments collect some data. A 1976 survey found that 65 percent of the cities and 50 percent of the counties collected and used efficiency measures.[7] Surveys of local governments in North Carolina and the Denver, Colorado, metropolitan area in 1978 found the figure to be over 85 percent.[8] A survey of selected governments, also in 1978, found that 68 percent of the cities and 47 percent of the counties with productivity improvement programs had measurement systems. The same survey found that 79 percent of the States with improvement programs had some type of measurement system.[9] An examination of State budgets and discussions with State budget officers in 1975 found frequent use of productivity measures although few formal systems.[10]

These and other studies suggest the following conclusions for State and local government productivity measurement. First, State and local governments collect considerable data although the information is uneven as to function and government. Some functions, particularly those with tangible products and Federal involvement, are well covered at the individual government level. Second, many studies cover individual service areas. Most are cross-sectional; a few examine time series data. Third, several studies of State and local government productivity have been made from readily

[4] Robert M. Spann, "Rates of Productivity Change and the Growth of State and Local Expenditures," in Thomas E. Borcherding, *Budgets and Bureaucrats* (Durham, N.C.: Duke University Press, 1977).

[5] John P. Ross and Jesse Burkhead, *Productivity in the Local Government Sector* (Lexington, Mass.: Lexington Books, 1974).

[6] Charles R. Hulten, *Productivity Change in State and Local Governments* (Washington: The Urban Institute, 1981).

[7] Rockham Fukuhara, *The Status of Local Government Productivity* (Washington: The International City Management Association, March 1977).

[8] *Comparative Performance Measures for Municipal Services* (Raleigh: Research Triangle Institute, December 1978); *A Demonstration of Comparative Productivity Measurement* (Denver: Denver Regional Council of Governments, December 1978).

[9] *State and Local Government Productivity Improvement: What is the Federal Role?* (Washington: General Accounting Office, Dec. 6, 1978), p. 13.

[10] *The Status of Productivity Measurement in State Government: An Initial Examination* (Washington: The Urban Institute, 1975).

available time series data. Although ad hoc and restricted to a few areas, they have generally concluded that State and local government productivity has remained stagnant or decreased over the past several decades.

Decisions and the use of productivity measurements

Although State and local government productivity should be measured for many reasons, the ultimate reason is better management. Four types of management decisions that could benefit from State and local government productivity measurement are: Policy formulation at the national level; program management at the Federal level; policy, planning, and programming in State and local government; and day-to-day operations in State and local government. This section discusses the kinds of decisions to be made, the types of decisionmakers who need the data, and the types of indexes needed (table 4).

National policy formulation. Productivity indexes are important tools in forecasting national income, projecting national labor demand, formulating national wage policies, and assessing the sources of national growth.[11] Projected changes in productivity, for example, are often used in forecasting gross domestic product and in setting fiscal and monetary policy. These projections often include estimated productivity changes in the private sector, but normally assume no change in the public sector. The bias that results by assuming no change in government productivity is not known but could be substantial.[12]

Labor market projections and analyses often take into account the impact of changes in productivity in the private sector.[13] The demand for labor can be dramatically affected by such changes. State and local government productivity indexes could help answer questions about how changes in State and local government productivity affect the supply of and demand for labor in the economy, how the national supply of and demand for labor affect State and local government productivity, how geographic shifts of the population affect State and local government productivity, and how new technology influences State and local government productivity and the demand for labor.

National income policies and guidelines have long taken into account changes in productivity.[14] The 1962 *Economic Report of the President* laid down guidelines for noninflationary wage behavior in the private sector, and from 1971 to 1974 changes in labor productivity were considered in allowing or disallowing proposed price increases. In 1978, wage increases above the guideline were allowed if it could be demonstrated that explicit changes in work practices led to increased productivity.[15] The general policy for public sector wage increases during this period was to permit the public sector the same average increase as the private sector. This percent has generally been tied to the estimated increase in private sector productivity.

A number of studies have sought to measure the impact of productivity on economic growth. Most of these have been analyses of the private sector.[16] Similar research on the public sector would assist decisionmarkers in formulating national policy. Knowledge concerning the relationships among State and local government productivity, the factors of production, research and development, and economies of scale would be helpful.

Federal program management. In addition to providing a valuable tool for formulating national policy, State and local government productivity indexes could help Federal program managers who are interested in State and local government. Federal managers often have such an interest because (1) State and local governments often operate Federal programs; (2) the financial health of these governments directly concerns the Federal Government and the Nation as a whole.

Most State and local governments operate some Federal programs. In fiscal 1980, the Federal Government transferred approximately $92 billion to about 65,000 State and local governments in direct Federal aid. In 1978, 492 different grant programs funnelled money to State and local governments.[17] Although the number of grant programs and total dollars funnelled to State and local government have decreased slightly, they will remain an important consideration, and the Federal Government has a legitimate concern as to how efficiently these dollars are spent.

Even if State and local governments did not operate Federal programs, their productivity and how it is changing would still concern Federal policymakers because of their importance to the national economy. State and local government purchases of goods and services accounted for about 13.0 percent of the Nation's gross national product or $341.2 billion in 1980. Some Federal agencies operate programs to improve State and local government productivity. These programs range from funding research and development to operating information clearing houses for technical assistance.

State and local government productivity indexes

[11] National Research Council, *Measurement and Interpretation of Productivity* (Washington: National Academy of Sciences, 1979).

[12] Jerome A. Mark, "Progress in Measuring Productivity in Government," *Monthly Labor Review*, December 1972, pp. 3–6.

[13] *Methodology for Projections of Industry Employment to 1990*, Bulletin 2036 (Bureau of Labor Statistics, 1980).

[14] National Research Council, op. cit., p. 27.

[15] *Economic Report of the President* (Council of Economic Advisers, January 1979), p. 81.

[16] National Research Council, op. cit., pp. 145–65.

[17] *The Federal Role in the Federal System: The Dynamics of Growth* (Washington: Advisory Commission on Intergovernmental Relations, December 1980), p. 8.

Table 4. Decisions and State and local productivity index requirements

Decision area	Decision category	Decisionmaker and data user	Type of index
National policy formulation	Gross domestic product forecasting	Congress, Federal officials, and academicians	Aggregate national indexes including State and local government
Federal program formulation	Problem identification Legislative impact analysis Budget justification and allocation Program and organization design	Congress, Federal officials, and academicians	National indexes including State and local government by service area
State and local government policy formulation	Problem identification Fiscal analysis Legislative impact	State and local government officials, Congress, Federal officials, and academicians	State and local government indexes by service area
State and local government operations	Setting goals and objectives Estimating resource requirements Budget justification Cost reduction Scheduling and control of operations Accountability Motivation for improvement	State and local government officials and academicians	Individual State and local government indexes by service area

would help answer such questions as: Where is productivity lagging? What are the sources of the decline? How can productivity improve? Is additional research needed? Does productivity vary by geographic area? If so, why? What is the relationship between productivity improvement and the financial strength of State and local governments? And so forth.

There is considerable discussion of the impact of Federal legislation and administration on State and local productivity. In 1979, an estimated 1,259 mandates were in effect, of which 223 were direct orders and 1,036 were conditions of aid.[18] Anecdotal examples abound. One report concluded that well-executed changes in the Federal grants program would raise State and local government productivity.[19] At this time, little is known of the impact of Federal legislation and its administration on State and local government productivity.

Some Federal agencies are directly involved in State and local government operations. The U.S. Employment Service (ES) and the U.S. Unemployment Insurance Service (UIS) are operated by State personnel but funded by the Federal Government. Budgets to support these operations are prepared by the U.S. Department of Labor and defended before the U.S. Office of Management and Budget and the Congress. Productivity measures have played an important role in justifying and defending these budgets. The ES includes productivity calculations in its annual budget. The UIS uses detailed work standards to justify its requests for funds to support State staff.

Productivity statistics are also used to allocate funds to the States. The ES has used productivity as one explicit variable in its allocation formula, and the UIS had used projected work and estimated work standards in making its allocations.

The Federal Government is also directly involved in the design and organization of some State and local programs. In addition to the ES and UIS, the Federal Government oversees other programs such as the Work Incentive Program, Food Stamps, and Aid to Families with Dependent Children. A better understanding of productivity would help in questions such as whether to decentralize or centralize services and how to allocate resources among various activities such as counseling, testing, and training.

State and local policy formulation. State and local government policy formulators also could benefit from productivity statistics in identifying potential problem areas, estimating fiscal effects, and assessing the impact of State and local legislation.

Some States assign operating responsibilities to local government and provide partial funding, as in the case of the Aid to Families with Dependent Children and Food Stamps programs. Many States assign the responsibility for road maintenance to local government along with receipts from gasoline taxes. States have local government oversight responsibilities, one phase of which is fiscal solvency.

[18] *The Federal Role in the Federal System*, p. 4.

[19] *State and Local Government Productivity Improvement: What is the Federal Role?* pp. 41–51.

Productivity measurement can also play an important role in State fiscal analyses. The passage of propositions 13 in California and 2-1/2 in Massachusetts led to selective employment cuts, the net effect of which is widely debated but unknown. Some States, such as North Carolina, fund many local services. Accurate productivity estimates should result in better fiscal estimates and help conserve scarce resources. Some cities, most notably New York, have tied increases in pay to increases in productivity. The measures for assessing change in productivity are generally lacking.

Finally, State legislation affects the productivity of local governments just as Federal legislation affects the productivity of State governments. Most States require detailed reports from local governments, and some restrict local government operations. Some States require analyses of the fiscal impact of any new legislation. The effect of new legislation on local government productivity is not generally known.

State and local government operations. Productivity measures and data probably find their greatest use today in the day-to-day operations of State and local governments. The following issues have been among those suggested:[20]

Setting goals and objectives. A productivity measurement system lends specificity to a process that is usually general in form and substance. Concrete data also show managers and workers how well goals are met.

Estimating resource requirements. Productivity measurement helps managers better estimate their resource requirements. For example, productivity change should be considered in estimating work force needs.

[20] "Implementing a Productivity Program: Points to Consider" (Washington: Joint Financial Management Improvement Program, March 1977), pp. 20–26.

Budget justification. Projections of resource requirements, including changes in productivity, are important parts of budget preparation and justification. Capital projects are sometimes justified by their potential positive impact on productivity.

Cost reduction. Productivity measurement provides a base for measuring change and goals.

Scheduling and control of operations. Productivity measures provide techniques for scheduling work, routing crews, monitoring work performed, and comparing direct labor with indirect.

Accountability. Productivity measurement may lend credibility to government operations by making managers more accountable and giving the public a tool with which to assess government operations.

Motivation for improvement. Productivity measurement can also provide documentation for bonuses, special recognition, group incentives, promotions, and productivity bargaining.

The focus

The four decision areas discussed require, in most cases, very different types of productivity indexes (table 4). National policy issues normally would require aggregate national indexes. Federal program formulation and management and State and local government planning and programming would benefit from national, regional, and State indexes by functional area. State and local government operations would require functional indexes by government.

This study focuses on midlevel decisions, Federal program management, and State and local government programming. Conceptual issues and data availability dictate this approach. As functional indexes are developed, it may be possible to calculate aggregate national and individual government indexes.

Chapter III. Methodological Considerations

The methodology underlying the measurement of State and local government productivity is a fundamental issue on which there is considerable disagreement. Not even the definitions and terminology are consistently applied. This chapter discusses the basic conceptual issues and presents the approach used in succeeding chapters.

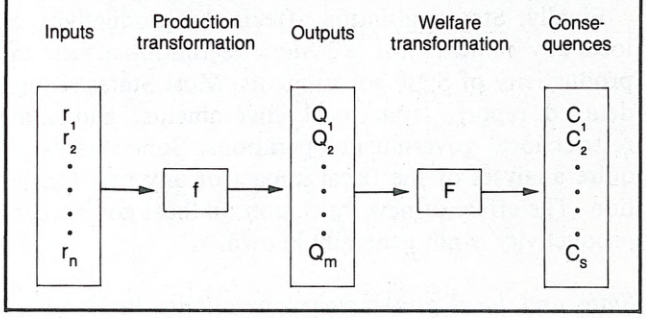
The production framework and process

The measurement of government output may be approached in two ways: One focuses on welfare aspects and considers utility functions, indifference curves, and community satisfaction; the other focuses on production possibilities and considers production frontiers and comparisons. This study deals with production possibilities. This approach assumes that government production decisions can be modeled through a production function framework similar to that used in private sector productivity analysis. It requires the general identification of output and inputs but does not require detailed specification of a production function.[1]

The basic conceptual model is the following: Government draws on a series of *inputs* to undertake a series of *activities* which result in one or more *outputs* intended to produce a series of desirable *consequences*. Inputs consist of labor, capital, and purchased materials. Activities are intermediate services or processes. Outputs are the final goods or services produced by the government. Consequences, which are sometimes known as outcome and impact, are the intended results of government action.[2] A basic model of the production process is portrayed in chart 1.[3]

In its more sophisticated form, the model includes the citizen, who is a producer as well as a consumer, and environmental and community conditions which affect service production techniques. In this model, consumers and the environmental setting are necessary parts of the production process, although their importance will depend on the service. They are likely to be much more important in education and policing than in water supply, although even water supply will be affected by these considerations. One view of the consummate model is shown in chart 2.

Chart 1. Basic model of the production process



For some government services, such as sanitation, the model can be applied in a relatively straightforward manner. Sanitation organizations use laborers, drivers, trucks, brooms, gas, and uniforms as inputs. These inputs are deployed to produce a series of activities such as sweeping streets, emptying litter cans, and picking up discarded furniture. Outputs, in this case, might be the trash collected. The consequences should be cleaner streets and neighborhoods, fewer fire and health hazards, and, presumably, happier citizens. The more sophisticated model also includes citizen inputs such as reporting of missed collections to government authorities, separating and preparing trash for recycling and disposal, carrying trash to the curb for pickup, and environmental concerns such as the topography, household density, and amount of precipitation.

For police services, inputs would include patrol officers, police cars, and communication equipment. Activities would include recruiting and training police officers, and taking calls from citizens. Outputs might include the amount of patrolling and the number of arrests. The consequences of these actions should be a safer community. The sophisticated model would include citizen behavior, citizen reports to police, and even citizen neighborhood watch activities.

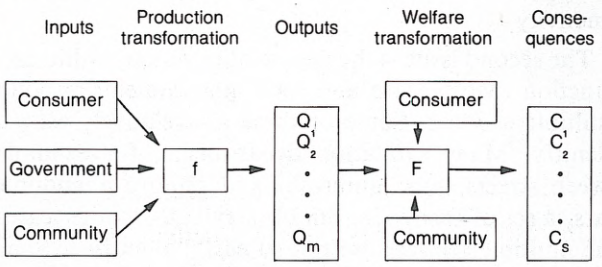
For some services, there is general agreement as to what constitutes an activity, an output, and a consequence, but for many services these are not always ob-

[1] Reino T. Hjerppe, "The Measurement of Real Output of Public Sector Services," *The Review of Income and Wealth,* June 1980, p. 239.

[2] For further exposition of this model, see: D.F. Bradford, R.A. Malt, and W.E. Oates, "The Rising Cost of Local Public Services: Some Evidence and Reflections" *National Tax Journal,* Vol. XXII, No. 2 (June 1969), pp. 185–202; Jesse Burkhead and Patrick J. Hennigan, "Productivity Analysis: A Search for Definition and Order," *Public Administration Review,* Jan./Feb., 1978, pp. 34–40; and Gordon P. Whitaker and others, *Basic Issues in Police Performance* (Washington: U.S. National Institute of Justice, 1982), pp. 92–123.

[3] Hjerppe, "Measurement of Real Output," p. 240.

Chart 2. Sophisticated model of the production process



vious (table 5). For police and fire services, the intended consequences and activities are reasonably clearcut but the outputs are not. For electric power, the activities and outputs are reasonably clearcut but the intended consequences are not. Public transit officials, for example, argue that their job is to provide service to a community and its residents. Their output is the operating transit vehicle; the community's use of the service is a consequence. This concept of transit service differs from the approach of the private sector transit manager, who would argue that the capacity provided to a city is an activity while use of that capacity is the output.[4] Although it may not always be easy to define outputs—or even to draw the line between a consequence and an output, or between an output and an activity—outputs have to be selected service by service and organization by organization.

The service and the organizational level will affect the activity, output, and consequence. The output of one organization may be an activity of another. Water meter repair, for example, would be the output of the water utility repair shop but not of the water utility. The output of a catalog unit of a library would not be the output of the library. This is similar to the intermediate output issue encountered in private organizations. The outputs of an organization's personnel, data processing, budget, and communications units are inputs for other parts of the organization.

This study deals with final organizational or government output; that is, service provided to the community and its citizens. It excludes consequences. Specifically, we are interested in the rate of change of final government output and the inputs (primarily labor) which are used to produce the output.

[4] Anthony R. Tomazinis, *Productivity, Efficiency, and Quality in Urban Transportation Systems* (Lexington, Mass.: D.C. Heath and Company, 1975); and Gordon J. Fielding and others, *Development of Performance Indicators for Transit* (Irvine: University of California, 1977).

Table 5. Examples of steps in the production of selected government services

Service or function	Activity	Output	Consequence
Corrections	Clothe inmates Serve meals Patrol cell blocks	House offenders	Reduce crime Protect society
Education	Conduct classes Give tests Serve meals Operate school buses	Educate students	Increase literacy rate Reduce unemployment
Fire	Maintain fire trucks Train firefighters	Put out fires Rescue citizens Inspect property for fire hazards	Reduce fire losses Reduce fire deaths
Food stamps	Conduct interviews Conduct audits	Issue stamps	Increase nutritional level
Library	Shelve books Catalog books	Circulate books	Increase literacy rate
Street and highway maintenance	Maintain trucks Dispatch trucks	Repair streets	Reduce traffic deaths Reduce travel time
Water supply	Read meters Repair water mains	Deliver potable water	Improve community health Generate revenue to support government

The measurement of outputs

The measurement of outputs is the single most troublesome problem in computing State and local government productivity. It is often a problem even after the output has been identified. Some of the difficulties are specific to the government activity; others are more general in nature. This section is concerned with the latter. Issues examined are the unit of measure; the extent of coverage; weighting of outputs; accounting for quality change; criteria for selecting outputs; and availability of output data.

Unit of measure. The basic output measure(s) of an organization should be a homogeneous physical unit. Furthermore, whenever possible, the measure should be related to unit labor hours spent in its production. Because of the problems in defining and measuring government output, a series of outputs should be examined and tested.[5]

Street cleaning illustrates some of the issues. Two commonly used measures of street cleaning output are cubic yards collected and curb miles swept. The curb miles swept will be about proportional to labor requirements needed for sweeping. Also, the quality of service—cleanliness—should be related to the output and input. On the other hand, cubic yards collected will not be as closely related to labor inputs. In fact, the inverse is likely: As streets are swept more frequently, the cubic yards increase but at a much slower rate than labor inputs. The result is decreasing productivity. Curb miles is the preferred measure of output in this case.

In the private sector, when physical data are not readily available, value data are often used as the measure of output. In such cases, price changes must be removed from the value data to obtain an index of real output. Removing the price change facilitates calculation of output where the industry produces and sells a number of products or where the industry lacks a discrete, tangible product.

In the public sector, the primary problem with using price-adjusted value as the measure of output is that, in most cases, market prices are lacking. Without direct pricing, estimating output in real terms is impossible.[6] Exceptions may be "enterprise" services, such as water and electric power, which are sold in the marketplace much as services are sold in the private sector. They account for about 6 percent of total State and local government employment. But even for the enterprise services, value is not always a good measure of output since prices are administratively determined and many have little relation to the costs of production. Transit, for example, is heavily subsidized, and the subsidies are adjusted frequently. Thus, physical measures are preferable, even when measuring enterprise service productivity.

The second issue is the degree of coverage within each function. Most State and local governments produce multiple services. Some of these are relatively easy to identify. Many sanitation departments, for example, sweep streets, pick up trash, and remove abandoned cars, a set of easily identifiable services. In other cases, the multiple services are not so easily identified. Some electric utilities, for example, conduct energy audits and provide recreation services as well as electric power.

There are two approaches to the construction of output indexes for multiple-service organizations. One is to identify each organizational product. For sanitation, this might be trash pickup (measured by tons removed), street sweeping (measured by curb miles swept), and abandoned car removal (measured by the number of cars removed). A separate index could be calculated for each product or service; these, in turn, could be combined into a single sanitation index by using input weights.

The other approach is to identify the dominant output. The index for the dominant or primary output would represent the entire function. This approach is valid when secondary outputs are unimportant (at least when the impact on productivity calculation is marginal) or when growth in uncovered output would about parallel the growth in covered output. The tons of trash removed is probably a reasonably good measure of sanitation service output, since most cities spend most of their sanitation resources on household collection. Street sweeping and abandoned car removal are normally small consumers of resources and may be safely ignored.

Whether single or multiple products are used to measure organizational output depends on whether the sample product is representative of total output, the importance of the sample product, data availability, and the importance of multiple products to decisionmakers. The dominant output approach normally is used when the primary product accounts for at least 90 percent of the labor input.

The third issue is accounting for only that part of the output actually produced during the output cycle (e.g., year). This is not likely to be as significant an issue for State and local government as it is in the private sector where the production of a single item, such as an office building or an airplane, may take several years to complete. Most State and local government service outputs are started and completed in the same year. If the product is not completed within the year, an estimate must be made of what part of the final output is produced in each year so that outputs and inputs match.

The fourth issue in service output is including only the work the organization actually does, since many services

[5] Jerome A. Mark, "Industry Indexes of Output Per Man-Hour" *Monthly Labor Review*, November 1962, pp. 1269–73.

[6] John P. Ross and Jesse Burkhead, *Productivity in the Local Government Sector* (Lexington, Mass.: Lexington Books, 1974), p. 35.

are purchased from other governments and private contractors. Government, like private industry, is confronted with "make or buy" decisions. Many communities have contracts with private firms for household trash collection, day care, mental health, custodial services, and data processing. Government-produced outputs must be separated from contracted outputs. In most cases, the separation is relatively straightforward if data are available. Where one service is provided partly by the government and partly by a private contractor, separation of output is more difficult. This mode of operation is becoming increasingly popular. Even more troublesome is the contracting for intermediate services such as custodial or data processing. A problem arises when inputs reflect the shift from public to private or vice versa, but outputs do not. Identifying such shifts is important for calculating trends.

Output weights. Calculation of a multiple-service output index or a single service with multiple outputs will require aggregation of individual measurements and indexes. In combining indexes, it is generally preferable to use weights—labor weights for labor productivity indexes. However, labor weights are not always available, and surrogates are often used. Several different approaches have been used in private sector measurement.[7]

For construction of most State and local government output indexes, labor weights are not only preferable, they are necessary. Except for government enterprises, most government services do not have unit value statistics.

Quality of service. Quality change is a major concern in developing output and productivity indexes. It is particularly important in measuring government output. The justification often given for increases in government expenditures is that the quality of service has improved—streets are kept cleaner, snow is removed faster, and police respond more rapidly to calls for assistance. Conversely, some feel that productivity gains are made at the expense of quality. One study of New York City concluded that output (quantity) had increased but performance (quality) had deteriorated.[8] In the police department, 36 of 37 measures of output quantity examined increased, but most measures of quality, such as the proportion of crimes solved, decreased.

[7] National Research Council, *Measurement and Intepretation of Productivity* (Washington: National Academy of Sciences, 1979), pp. 68–70.

[8] David Greytak, Donald Phares, and Elaine Morely, *Municipal Output and Performance in New York City* (Lexington, Mass.: Lexington Books, 1976).

[9] See, for example, Frankin M. Fisher and Karl Shell, *The Economic Theory of Price Indices* (New York: Academic Press, 1972), and Jack E. Triplett, "Robert Gordon's Approach to Price Measurement," BLS Working Paper 101 (Bureau of Labor Statistics, April 1980).

There is considerable debate as to what changes in quality mean and how they should be handled analytically in index construction.[9] Of the two general approaches, one is based on consumption, the other on production. For consumption, a quality change is reflected in a change in consumer utility; for production, a quality change is reflected in a change in resource requirements. This study is concerned with the latter.

It is helpful to divide production quality changes into those which should be reflected in the output indexes and those which should not. The latter type includes those arising from events external to the production process. For example, waiting time by clients might increase because of an influx of new clients, or mass transit commuting times might decrease because of the opening of a new road. Adjustments are not appropriate in such cases.

When production and unit labor requirements change, adjustments need to be made in the output index. An example would be a shift from backdoor to curbside collection of solid waste, which requires citizens to carry their trash to the street, a task formerly done by government collectors. In fact, the government has introduced a new service or changed the level of service. The production process has been modified and unit labor requirements have shifted as a result of this change in service.

Some classify changes in quantity or volume of production as quality shifts. From the standpoint of citizens, adding branch libraries or recreation centers may improve quality since citizens will not have to travel so far to a facility. From a production standpoint, they are simply an increase in the quantity or volume of production.

One way to adjust for a quality shift is to adjust the index. In the example of the shifting from backdoor to curbside collection, the input index would be adjusted to include the work of the citizen (labor hours) in transporting the trash from the back door to the curb. The output index would remain the same.

The second approach to a quality shift is to identify the new service and create a new index. In this case, the new service would be curbside collection; the old service, backdoor collection. The two productivity indexes would be linked to create a single index.

The impact of a change in quality on productivity measurement can vary depending on the output measure chosen. For street cleaning, the more frequent the cleaning, the cleaner the streets. If the output measure is curb miles swept, unit labor requirements will remain about constant, productivity will remain about constant, and the quality of service and output will be about proportional. However, if the measure is cubic yards collected, more frequent cleaning will result in a decrease in cubic yards collected with each additional cleaning. In other words, unit labor requirements will increase, productivi-

ty will decrease, and quality of service and output will not be proportional.

Clearly, quality should be examined function by function. For some functions, the issues and variables, if not the solutions, are straightforward, while for others they are complex and certainly not obvious.

Unfortunately, identifying the crucial quality considerations in State and local government services is not always easy. Although some research and discussion of quality and its measurement have taken place over the past decade, little research has been done on the absolute or relative impact of quality change on productivity costs and unit labor requirements. Lacking systematic research, the process has to be ad hoc.

The suggested approach for handling quality in State and local government productivity measurement is as follows:

1. Identify service output.
2. List quality considerations for the output measure.
3. Assess each quality factor for its potential impact on unit labor requirements.
4. Create a quality index time series if the impact is potentially important.
5. Track the quality index through time.
6. Adjust the input index or link a new productivity index with the old index if the quality index changes.

Criteria for selecting outputs. Eight criteria are presented below for selecting measures of State and local government output.[10] The first four are essential; the last four are desirable.

1. *Outputs must reflect the final product (service) of the organization.* To determine productivity, the output must be the product or service leaving the organization, not the intermediate products. Output must reflect the work rather than the consequences of the work.

2. *Outputs must be measurable.* Absolute (cardinal) numbers are required. Arguments that government services cannot be measured usually fail to distinguish among the measurement of intermediate products, final outputs, and consequences of government service. Whether or not a service can be measured has to be considered function by function.

3. *Outputs must be repetitive.* Construction of an output index requires a repetitive or recurring set of services or products. The level and quality of service can change, since they can be adjusted, but the basic service must be repetitive.

4. *Output data must be accurate and comparable.* Much output data currently collected, at least at the national level, is incomplete, inaccurate, and inconsistent from period to period. Construction of a viable output index requires accurate, comparable data. Comparability is more important than absolute accuracy in preparing a time series.

5. *Output calculations should use existing data and data collection procedures.* Two issues are involved here—whether the records exist in State and local government, and whether a procedure currently exists to collect national data. In either case, existing data and data collection procedures should be used whenever possible, as new procedures will likely be costly and time consuming.

6. *Outputs should be easily understood.* An index which is simple and easily understood is most likely to be accepted, supported, and used. Esoteric measures and complex quality adjustments should be avoided.

7. *Outputs should be physical measures.* The lack of a market price for most government services precludes use of a deflation procedure when physical quantity data are difficult or impossible to obtain. Even for services that have a market price, such as government enterprises, physical output measures are preferable because prices are often subsidized and set by administrative decree.

8. *Output units should reflect the labor units spent in their production.* Since unit labor weights are used in constructing individual service indexes and functional groupings, the output measure should reflect base-year unit labor requirements.

Availability of data. There is no single source of national data on State and local government outputs; data have to be collected function by function. National data are available for a few functions, such as electric power and unemployment insurance.

More data are available at the State and local level. Many governments routinely prepare statistical tabulations and performance reports from which output indexes can be constructed.

The measurement of inputs

This section discusses the number and type of factor inputs used to measure productivity, presents the labor measures most often used, reviews some of the thorny questions surrounding these measures, presents criteria which should be used to select inputs, and discusses data currently collected that might be used to calculate national labor indexes for State and local government.

[10] For a slightly different list, see Brian Usilaner and Edwin Soniat, "Productivity Measurement," in George Washnis, ed., *Productivity Improvement Handbook* (New York: John Wiley, 1981), p. 95.

Number and type of inputs. Productivity measures are often characterized by the number and type of inputs. A common categorization is in terms of single factor or multifactor productivity.[11] In reality, there is a continuum of inputs or factors: The number and type of resource inputs included should reflect the use to which the measure is put.

A single factor productivity measure, the most common type, relates one resource, most often labor, to output. However, it does not measure the specific contribution of the factor to output. Rather, it expresses the joint effect of interrelated influences, such as management, technology, and regulation, as well as the factor input, on overall output.

Multifactor productivity relates two or more inputs to output and also reflects the joint effect of many influences. However, it eliminates the impact of the substitution of one factor for another on overall production. Examples of multifactor inputs are labor and capital; labor, capital, and energy; or labor, capital, energy, and materials.

This study focuses on single factor productivity, specifically labor productivity, for several reasons. First, labor is of primary importance in public policy issues. Salaries and wages constitute about 40 percent of all State and local government expenditures and 55 percent of all current expenditures. Its importance varies by type of service (table 6). Salaries and wages, in fiscal 1977, constituted 75 percent of the expenditures for police programs but only 9 percent for electric power. Fringe benefits would raise these proportions. Second, labor is relatively easy to calculate when compared to other factors of production. Third, labor data have been collected for many years and generally are the most accessible of State and local government factor inputs. Fourth, labor indexes are calculated for many parts of the private sector, for some parts of the Federal Government, and for some foreign countries. State and local government labor-based indexes would permit comparisons with these other sectors.

Three ways of defining and measuring labor input for State and local government productivity calculations are: Number of hours, number of full-time-equivalent employees, and number of persons. Hours can be further divided among hours paid, hours at work, and hours actually producing output.

Number of hours. The preferred measure is the number of labor hours. Labor input hours should simply be the total hours applied during the period for which outputs are measured.

Ideally, the labor hour measure would be the actual time worked to produce one or more outputs. The usual practice, however, because of definitional and data problems, is to use hours paid. That is, labor input normally includes actual hours worked plus time on the job which is paid for but not worked, plus paid time off the job. Hours on the job but not worked might include coffee breaks, training, and washup time. Hours off the job but paid might include vacation, holidays, and sick leave. Calculations using hours paid tend to understate true productivity. If the difference between hours paid and hours worked is increasing, labor productivity trends are understated.

The converse—hours worked but not paid—also needs to be considered. Many people, including managers, teachers, and coaches, work hours for which they are not paid. These hours should be counted too, for if they are increasing (or decreasing), productivity trends will be overstated (or understated) if not included.

Many practical problems arise in measuring the hours of State and local government workers. Should standby hours of police, fire, and public works officials who are home but subject to call be included? Sometimes employees are paid for standby time but more often they are not. What about employees who are paid by the task, such as collecting the trash on a specified route? When they finish the task they are permitted to go home. Irrespective of the actual hours worked, the employees are paid for a fixed, previously agreed upon number of hours. Should the hours worked or hours paid be included? Should extracurricular activities and

Table 6. State and local government expenditures for salaries and wages as a percent of total expenditures by function, fiscal year 1977

Function	Percent
All functions	39
Police	75
Fire	74
General control	67
Social insurance	66
Financial administration	64
Education	61
Corrections	60
Hospitals	58
Libraries	52
Sanitation	52
Natural resources	46
Transit	43
Health	43
Parks and recreation	41
Water transport	28
Highways	24
Airports	24
Housing and urban development	24
Water supply	22
Sewerage	15
Gas	12
Welfare	10
Liquor sales	9
Electric power	9

SOURCE: Computed from data taken from *1977 Census of Governments—Compendium of Government Finances* (Bureau of the Census, 1979), pp. 29 and 33.

[11] Multifactor productivity has also been referred to as total factor productivity.

Table 7. State and local government activities included in three labor hour measures

Activity	Hours paid	Hours at work	Hours worked
Paid vacation	x	–	–
Paid holidays	x	–	–
Paid sick leave	x	–	–
Jury duty	x	–	–
Military leave	x	–	–
Standby[1]	x	–	–
Meal hours[2]	x	x	–
Washup time	x	x	–
Rest and coffee breaks	x	x	–
Union business	x	x	–
Training	x	x	–
Production	x	x	x

[1] Some governments pay for standby time, such as to water supply and electric power employees.

[2] Some workers, including police officers and firefighters, receive pay for meal times.

citizen meetings be counted? Teachers often supervise activities outside school and attend meetings for which they may not be paid. How should these hours be counted? Most of these issues relate to a specific government function or service and should be addressed in that context.

The relationships among State and local government activities and hours paid, hours at work, and hours worked are shown in table 7.

Employee years. Government labor indexes often reflect the number of employee years or the number of full-time-equivalent employees, since the number of employee hours is rarely available. An employee year commonly equals 2,080 hours (40 hours per week times 52 weeks per year) and includes all paid time including overtime, vacation, holidays, and sick leave. Part-time employment is usually computed on a full-time-equivalent base, such as two half-time employees equal one full-time equivalent. Seasonal employment is also usually computed this way; for example, four summer employees equal one full-time equivalent. Overtime can be handled in the same manner but is more often simply ignored. A full-time-equivalent index could produce a rate of change exactly the same as an hours index, depending on the computational rules. In most instances it approximates the hours index.

Number of employees. An index of the number of employees is sometimes computed when data are not readily available to compute an hours or a full-time-equivalent index. This type of index simply counts the number of employees who produced the output without concern for the time each employee worked. It approximates the actual hours expended to produce the outputs. An index of the number of employees will understate the change in labor input when the number of hours worked per person increases, such as in overtime, and will overstate the change in labor input when the number of hours worked per person decreases. The greatest divergence between an hours index and an employee index will probably occur when part-time employment increases or decreases.

Most State and local governments use part-time employees extensively. In October 1980, they employed 10.3 million full-time and about 3.0 million part-time workers. Part-time employment made up 23 percent of the total. Part-time employment varies substantially by service. In 1980, it was only 3 percent for transit, 5 percent for corrections, and 6 percent for sewerage, but 42 percent for local libraries and 49 percent for higher education.

Seasonal employment such as for snow removal, leaf pickup, park maintenance, and swimming pool operation often can create measurement problems when calculating an index of the number of employees. The primary problem is the period of coverage. Employee counts are commonly published for one date such as December 31 each year, but an employee count on July 30 or October 30 may be quite different because of seasonal variations. To overcome the problem of seasonal employment, the preferred approach would be to use a weekly or monthly average of the number of employees to calculate the index.

Comparison of the three approaches. Whether the three approaches to labor measurement—hours, years, and employees—would produce markedly different labor trends in the public sector is not known. In the private sector, labor trends for hours and employees differ, but only slightly over the long run.

Several government occupations, especially firefighting, have moved toward a shorter workweek over the past decade, and at least one State government, New Hampshire, has shortened the workweek of its employees. An employee-hour index would reflect such changes, but indexes of employee years or number of employees would not. Whether the shift in the hours worked is sufficiently large to affect a national productivity index is not known.

The three indexes did not vary greatly for the services examined in this study. Data problems caused more variation than the type of index. However, in some services, such as fire protection, the type of labor index may substantially affect labor trends and productivity calculations.

Volunteers. Volunteers are used by most governments, although the extent of use varies considerably.[12] Volunteers are common in services such as fire, education, hospitals, museums, and recreation but are

[12] Martha A. Shulmann, "Alternative Approaches for Delivering Public Services," *Urban Data Service Reports,* Vol. 14, No. 10 (Washington: International City Management Association, October 1982), pp. 8–9.

relatively rare in others such as public utilities and transit (table 8).

Conceptually, a labor index should include volunteer participation. Volunteers contribute to output just as do paid employees. The treatment of volunteer labor should depend on the projected uses of the productivity data. Some uses would require that volunteers be separately identified.

However, the way volunteer labor is accounted for will, in most cases, be moot. Probably in no more than four or five State and local government service areas are volunteers even potentially important. If the ratio between paid and volunteer labor remains constant in these areas, their inclusion or exclusion will not affect labor trends. Further, in the real world of data collection and measurement, identifying volunteer labor input or output is extremely difficult. Records on volunteers are almost nonexistent in State and local government. Productivity calculations usually include the output generated by volunteers but not their inputs. However, the decision will need to be made service by service.

Changes in work force composition. Labor is often treated as a homogeneous input although clearly it is not. Depending on the mix, labor inputs can produce very different levels of output. If the mix changes, the level of output can be affected. For example, police departments increasingly require new recruits to have some college education. The rationale behind the requirement is the creation of a police force which can better deal with the public and today's complex society.

Table 8. Estimated use of volunteers by State and local government function

Function	Use of volunteers
Fire protection Parks and recreation	More than 10 percent of total employed
Education Libraries	Less than 10 percent but more than 1 percent
Airports Corrections Electric power Financial administration Gas General control Health Highways Hospitals Housing and urban development Liquor stores Natural resources Police Sanitation Sewerage Social insurance Transit Water supply Water transportation Welfare	Less than 1 percent

SOURCE: Based on discussions with State and local government experts.

Supposedly, more education will increase police output. However, an increase in output from additional education is not an increase in productivity but an improvement in labor input—i.e., a shift in the composition of the labor input.

The method generally used to adjust for changes in labor force composition is pay differentiation. This requires information on the change in pay by occupation through time, data which are not readily available from State and local governments. Although often discussed in private sector productivity measurement, changes in labor force composition are of secondary concern at this time for State and local government and are not considered further.

Criteria for selecting inputs. Five criteria are suggested for identifying input data, specifically labor inputs. Criteria which are essential for productivity measurement are presented first, followed by those which are desirable.

1. *Inputs must match output.* Calculation of productivity requires that the resources applied match the measured organizational output. For organizations with multiple outputs, like the typical city government, this will require careful identification of resources used to produce the outputs.

2. *Inputs must be measurable.* Absolute numbers are required.

3. *Input data must be accurate and comparable.* Much of the labor data collected on State and local government operations is inaccurate and inconsistent from period to period. Comparability is more important than absolute accuracy. Data checks and analysis must be part of the construction of any index.

4. *Input calculations should use existing data.* New data collection procedures will likely be time consuming and costly to develop and maintain, and burdensome for those providing the data. Existing data and collection procedures should be used whenever possible.

5. *Inputs should be easily understood.* General acceptance, support, and use of an index are more likely if the construction is straightforward and easily understood. This is one reason that labor indexes are widely used.

Availability and accuracy of labor statistics. Every State and local government collects labor statistics for use in its day-to-day operations. Two types of labor measures, the number of full-time-equivalent employees and the number of employees, are most common; less common is the number of hours. Most State and local govern-

ments should be able to prepare labor indexes by function and for the government as a whole.

Preparation of national or regional labor indexes is not as straightforward. Some labor data are collected and published by function by trade associations, public interest groups, and Federal agencies. The International City Management Association, the American Public Works Association, the American Water Works Association, and others routinely collect statistics on public employment for specific functions and sometimes for government as a whole. Federal agencies such as the Department of Labor, the Department of Justice, and the Department of Health and Human Services often collect data on the number of State and local government employees for the programs they fund and coordinate.

In addition, there are four sources of national State and local government employment statistics: The Census of Governments; the Current Population Survey (CPS); the Current Employment Statistics survey (CES 790); and unemployment insurance reports (ES 202). The characteristics of these surveys are discussed below and summarized in table 9.

Census of Governments. The best known and probably the most widely used national statistics on State and local government employment are produced by the U.S. Bureau of the Census. Sample data are collected and published annually. Every 5 years (years ending in 2 and 7), the Census Bureau takes a complete enumeration and publishes the results. Statistics are collected and published on the number of employees (full time and part time), number of full-time-equivalent employees by major function, and salaries and wages.

Several problems arise in using these employment statistics to calculate government productivity. First, the statistics are for a single month, October, of each year. Second, the functional classification system used by Census is very broad—e.g., police, fire, employment security—probably too broad for productivity calculations. Third, the information is not available until 6 to 9 months after the reference date. Fourth, no information is collected on hours, whether hours paid, hours worked, or hours at work.

Current Population Survey (CPS). Data collected by the Current Population Survey are used primarily to calculate the monthly employment and unemployment statistics. A number of other statistics, such as hours worked and pay, are collected. The two strengths of the survey for productivity measurement are its timeliness and the information on hours worked. However, the CPS has a number of problems for State and local government productivity measurement. First, it contains no information on services or functions. Second, it is impossible to separate the employment data by type of government. Third, the employment counts for State and local government as taken from the CPS are markedly different from those obtained from other sources. In short, the CPS has too many major limitations for productivity calculations to be considered further in this study.

Current Employment Statistics survey (CES 790). The CES survey is used to collect data monthly from establishments in nonagricultural industries and government on the number of employees, average hours worked, and average hourly and weekly earnings. About half of all State and local government employment is covered. Employment statistics are broken down into eight functional areas for State government and into seven areas for local government. One advantage of the CES 790 data for productivity measurement is its timeliness; preliminary data are published about 3 weeks after reporting. Another advantage is that they include hours worked. However, the CES survey has several deficiencies. First, statistics on hours are collected for nonsupervisory employees only. Second, statistics are not available for many government functions. Third, the sample size does not permit presentation of data below the national level. Fourth, and most important, coding of the data by government function is very poor.

Unemployment insurance reports (ES 202). Since January 1978, all State and local government employees have been covered by unemployment insurance. As a result, State and local governments record monthly employment and wages and report the data quarterly to the U.S. Unemployment Insurance Service. Since the ES 202 is linked to financial reports, it should provide the most accurate statistics available on the number of persons employed by State and local government, by State, county, and Standard Metropolitan Statistical Area.

Although the ES 202 reports are comprehensive, they lack detail. The primary problem insofar as productivity calculations are concerned is the inadequate division by function—most employees are assigned to the general government category. Furthermore, no information is collected on hours and type of worker. The attraction of the ES 202 report lies not in its current form but in its potential if the coding by function were improved.

Data accuracy. Data collected by the Census of Governments and the unemployment insurance reports were compared with data obtained through personal contacts with individual governments for three functions—electric utilities, drinking water, and State liquor stores. Considerable variability was evident. The variance resulted from differences in categorizing functions, in assignment of work activities to functions, and from clerical mistakes.

Table 9. Four national surveys used to collect State and local government employment data

Characteristic	Census of Governments	Current Population Survey	Current Employment Statistics survey	Unemployment insurance reports
Initial year	Prior to 1967	Prior to 1967	Prior to 1967	1978 for all government
Coverage by government function	About 30 major functions	None	Local—8 functions State—7 functions	None nationally; Standard Industrial Classification for a few States
Coverage by government unit	States, Standard Metropolitan Statistical Areas, cities, towns, school districts	National	National	States, Standard Metropolitan Statistical Areas, counties; no city data
Definition of employee	All paid persons	All employed persons 16 years or older, paid or unpaid	All paid persons	All paid persons
Frequency of survey	Annual—October of each year	Monthly	Monthly	Monthly—reported quarterly
Reference period	Payroll period containing October 15 of each year	Survey week containing 12th of each month	Payroll period containing 12th of each month	Payroll period containing 12th of each month
Timeliness of publication	About 9 months	3 weeks	3 weeks (for preliminary data)	About 9 months
Sample size	All governments every 5th year—sample other years	About 60,000 households	About 12,000 governments	All governments
Nonresponse	Unknown	3–5 percent	About 9 percent	None
Benchmark	Quinquennial Census for sample survey	Decennial Census	Quinquennial Census of Governments	None
Data collected	Number of full- and part-time employees Monthly earnings in October	Employment and hours at work Annual earnings in March Weekly earnings in May	Employment and hours for nonsupervisory employees, full and part time	Total employment Total wages
Method of collection	Mail survey (some interviews)	Household interviews	Mail survey shuttle form	Byproduct of administrative reporting
Information on employee quality	No	No	No	No
Information on volunteers	No	No	No	No
Suvervisory vs. nonsupervisory employees	No	No	Yes	No
Information on part-time employees	Yes	No	Yes	No

Three conclusions are to be drawn from this examination: First, no single data source is likely to be entirely acceptable. Second, major errors are likely in each data series. Third, viable labor-based input indexes will require detailed data comparison and adjustment irresspective of which data set is used.

Other issues

This section discusses productivity comparisons, frequency of measurement, geographic coverage, period coverage, service definitions, and the productivity index itself, important issues which were only briefly touched on in the preceding review.

Productivity comparisons—levels and trends. Underlying all productivity measurement is comparison—comparison through time, comparison of producing units, or comparison of producing units through time. Most private sector productivity measurements are time comparisons, such as, "Productivity increased by x percent between 1967 and 1982." Trends are routinely computed for industries, for groups of industries, for individual countries, and for groups of countries.

Similarly, State and local government productivity trends might be calculated and stated as, "Municipal electric power productivity increased by x percent between 1972 and 1978." Productivity trends could also be

computed, for example, for sanitation services in New York City between 1967 and 1978, or for the Unemployment Insurance Service in the Southern States between 1963 and 1978.

Some productivity measures focus on absolute levels: "Each employee produces on the average x tons of steel or y cars." Local government level measures might be, "w tons of trash collected" or "x miles of street swept per employee." Comparisons of levels could be made between jurisdictions or regions, or with the Nation as a whole.

Trends and levels are complementary. A city service might have a low level of productivity but a high rate of change, or vice versa. A true picture of productivity requires examination of both levels and trends. However, the data and analyses required to compute trends are much less demanding than those required to calculate absolute levels. This study focuses on productivity trends.

Frequency of measurement. Productivity trends are normally calculated annually, although some national estimates are produced quarterly. In view of the cost and the doubtful benefit of more frequent measurement, State and local governments should probably focus on annual measurement, at least initially.

Benefits which would accrue from more frequent measurement depend primarily on the decisions to be made. Until these decisions can be specified, there is little point in developing other than annual measures. Furthermore, monthly or quarterly productivity movements might not even be detectable for most State and local government services.

In addition, seasonal adjustments may have to be made if quarterly or monthly calculations are to be useful. This, of course, requires knowledge about seasonal fluctuations, which is generally lacking.

Finally, some State and local government services, such as education, have outputs that require more than one month or one quarter to produce and, thus, to measure.

Geographic coverage. State and local government as defined for this study includes the 50 States, the District of Columbia, and all cities, counties, special districts, townships, and school districts. There are, in total, about 80,000 State and local governments.

Data sources are not consistent in their geographic coverage. Some sources include trust territories as well as the 50 States, others include only the larger jurisdictions. Whether trust territories are included is probably not important since they are such a small part of the total. Focusing on only the larger jurisdictions, however, will introduce bias into productivity calculations if economies of scale are present. Large municipal electric power utilities, for example, are growing somewhat faster than smaller utilities.

When national data are not readily available, representative data may be collected by sampling. The sample would have to be balanced for size, geographic distribution, and any other factors which might affect productivity. Consistency through time, among jurisdictions, and between inputs and outputs is crucial in such cases.

The size and location of a jurisdiction can affect productivity. Some government services, such as water, sewerage, electric power, and refuse collection, benefit from economies of scale.[13] Other services, such as police and recreation, evidently do not. Garbage collection and street repair are affected by topography and climatic conditions.

Productivity measurements are much more useful to national, State, and local government decisionmakers if they are available by location. For some services, such as solid waste collection, no national output data are readily available; for others, such as electric power, only national data are available, and for still others, such as unemployment insurance, both State and national data are readily available.

Time period coverage. Two types of time periods need to be considered in formulating a productivity index: (1) Number of years to be covered by the index, and (2) whether the calendar or fiscal year is used.

The *number of years covered* by a productivity index, and the beginning and ending years, can have a marked effect on the overall rate of change. Generally, the longer the time span, the less important the beginning and ending years. Also, a longer time span would normally be more representative of long-term trends.

Cyclical fluctuations can affect long-term productivity trends. Such fluctuations occur when inputs do not change as rapidly as outputs. Unemployment Insurance Service (UIS) outputs, for example, parallel the unemployment cycle, and inputs usually lag behind changes in outputs, as discussed later in this study. The result is a productivity index which will shift significantly depending on the years included in the index. To avoid arbitrary cutoff dates, and to reflect long-term trends more accurately, average annual growth rates might be calculated from peak to peak, trough to trough, or midpoint to midpoint.

Sudden shifts in the economy can also influence calculations of long-term rates of productivity change. State and local government electric power productivity dipped markedly with the increase in energy prices in 1973 just as it did in the private sector.

The second time-related issue is whether the *calendar or fiscal year* should be used. Most productivity indexes

[13] William F. Fox, *Size Economies in Local Government Services: A Review* (U.S. Department of Agriculture, Economics, Statistics, and Cooperative Service, 1980).

are based on the calendar year. The Federal Government's productivity measurement system, however, uses the Federal Government's fiscal year of October 1–September 30.

The question is more complicated for State and local government. For a single government, or a group of governments with the same fiscal year, there is no problem. The Bureau of the Census, for example, asks all State and local governments to use the July 1–June 30 fiscal year in reporting financial data.

However, State and local government fiscal years vary. The U.S. Department of Transportation collects data from over 300 transit systems with fiscal years ending on March 31, April 30, June 30, September 30, and December 31. As discussed in a later chapter, electric power data are reported by calendar year; Unemployment Insurance Service statistics by the Federal fiscal year.

The closing month of the "productivity" year is not important for trend determinations. The same month should be used each year, and the inputs and outputs should cover the same period.

Service specifications and definitions. Definitions of services unfortunately vary among governments and through time. Public works, for example, may be specified as a single unit; may be broken into major components such as sanitation, water supply, and street maintenance; or may be divided into subservices such as solid waste residential collection, street sweeping, street flushing, and so forth.

For single measurements or studies, definitions can usually be adjusted to meet analytic needs and data availability. For preparation of a national, aggregate productivity index, a formal classification system is needed.

Most of the summary data in this study are based on the classification system and definitions of the Census of Governments (see appendix B). This structure has been used for years by the Bureau of the Census, State and local governments, and the research community.

However, even this classification system has several deficiencies for productivity measurement. First, the service categories are too broad. Second, governments differ in the manner in which they structure, and thus report, their operations. The functions assigned to police departments or even State alcoholic beverage control agencies vary from jurisdiction to jurisdiction.

The Standard Industrial Classification (SIC) system, in contrast to the Census of Government system, is very detailed. It includes all goods and services produced by private and public establishments. State and local government is a small part of the SIC (appendix B lists State and local government services included). SIC categories are not widely used in State and local government data collection and analysis.

Both the SIC and Census of Governments classification systems should be helpful in structuring productivity analysis, collecting data, and making comparisons. However, for some services, neither classification scheme will be satisfactory, and further specification will be necessary. Appendix B presents an initial attempt at a cross-classification of these two systems.

The productivity index. This study aims to develop a procedure for developing two basic types of State and local government indexes—one, a series of productivity indexes for individual government services such as fire, police, water supply, personnel, and purchasing; and two, an index of total State and local government productivity.

To compute the total State and local government productivity index, output indexes for individual functions must be developed. After these outputs have been developed, a total national aggregate State and local government *output* index may be computed. The total State and local government *productivity* index would be the sum of the final outputs weighted by their inputs. The index would not include intermediate outputs. However, all inputs would be included, intermediate as well as final.

The mathematics of the productivity index is simple and straightforward.[14] The index should compare the quantity of service in the current year with the base year, each weighted by the employee hours expended per unit produced per unit of labor input in both periods.

If State and local government produced a single output, the index would simply be the reciprocal of employee hours spent to produce a unit of output over the two periods of time or:

$$I_u = \frac{1}{I_r} = \frac{L_i}{L_o}$$

Where

I_u = unit employee hour index

I_r = output per employee hour index

L_i = unit employee hours in current period

L_o = unit employee hours in the base period.

[14] *BLS Handbook of Methods,* Bulletin 2134–1 (Bureau of Labor Statistics, 1982), p. 102.

The same ratio would be used for a single service such as sewerage or water.

Where more than one service is produced in a functional area, such as sanitation, or where several functional areas are combined, a composite index is required:

$$I_u = \frac{Q_o L_i}{Q_o L_o}$$

Where

I_u = unit employee hour index

Q_o = quantity in the base period

L_i = labor hours expended in current period

L_o = labor hours expended in the base period.

This particular form, the base-period composite, is used in the following chapters.

Chapter IV. Measuring the Measurable: Three Case Studies

This chapter presents illustrative national productivity measures for three State and local government services—electric power, alcoholic beverage sales, and unemployment insurance. These three services were selected for examination because each has a reasonably well-defined set of outputs, and output and employment data are available for calculating a productivity index.

Each service is discussed briefly, a synoposis is presented of past research, potential output measures and data to calculate output indexes are considered, labor input data are examined, several productivity indexes are calculated, and suggestions are made for future research. The specific approach, geographic area, and time period covered vary by service, depending upon data availability. Though the following examples illustrate how national productivity indexes might be calculated, they should not be taken as representative of State and local government outputs, data availability, or productivity.

Electric Utilities

Electric utilities are a good starting place for an investigation of the feasibility of calculating State and local government productivity indexes because they are easily identifiable, they have a measurable set of outputs, and the larger ones report annually to the Federal Government. Moreover, productivity indexes have long been calculated for private and cooperative utilities so there is a large analytical and institutional base of knowledge on which to build.

Institutional considerations

Of the three basic types of electric utilities—private, cooperative, and government—the private or investor-owned utility accounts for about three-fourths of all production and sales.[1] The 250 investor-owned utilities sell about 78 percent of the kilowatt hours, serve about 76 percent of the customers, and own about 73 percent of the Nation's electric plant and equipment (table 10).

The second type consists of Rural Electrification Administration (REA) cooperatives, which expanded dramatically into the rural areas in the 1930's under the sponsorship of the Federal Government. Today, about 900 cooperative systems sell about 7 percent of the Nation's electricity, serve about 10 percent of the customers, and own about 7 percent of utility plant and equipment.

The third type, the government-owned utility, sells about 16 percent of all kilowatt hours, serves about 14 percent of the customers, and owns about 20 percent of the plant and equipment. The two basic types of government-owned utilities are Federal and State/local. The Federal Government is primarily a generator and wholesaler of electric power. It produces about 11 percent of the Nation's power and owns about 8 percent of the plant and equipment, but serves less than 1 percent of final users.

State and local electric power systems include all government systems other than those operated by the Federal Government—State, special district, city, and county operations. The 2,200 State and local systems, also called municipal systems, account for about 14 percent of the Nation's customers, 12 percent of kilowatt sales, and about 12 percent of electric plant and equipment investment.

In 1977, State and local systems sold about one-third of their kilowatts to residential users, one-third to industrial/commercial users, and one-third to other users such as other public power authorities, railroads, and highway and street lighting authorities. Generating capacity was divided among steam (52 percent), nuclear (8 percent), hydroelectric (33 percent), and internal combustion engine (7 percent).[2]

The primary factor input into State and local power operations is capital, which accounted for about 43 per-

NOTE: This chapter has benefited from the comments of Edwin Adelman, Charles Ardolini, Horst Brand, Arthur Herman, Clyde Huffstutler, James Urisko, and Martin Ziegler of the Bureau of Labor Statistics; Steven Barsby, Consultant; Susan Clark of the National League of Cities; John Flynn of the New York State Legislative Staff; Paul Fry of the American Public Power Association; Harry Hatry of the Urban Institute; John Humphrey of the Unemployment Insurance Service; James Jarrett of the Council of State Governments; Raymond Long of the National Association of State Budget Officers; Gary Marshall of the Distilled Spirits Council of the United States; and Allan Stevens of the Bureau of the Census.

[1] Some authorities divide the utilities into two types—privately and publicly owned. Cooperatives are considered as privately owned.

[2] *Statistics of Publicly Owned Electric Utilities in the United States–1977* (U.S. Department of Energy, Energy Information Administration, 1979), pp. 6–7.

Table 10. Distribution of kilowatt hours sold, customers served, and plant and equipment owned by type of utility ownership, 1978

(Percent)

Type of ownership	Kilowatt hour sales	Customers served	Plant and equipment owned
Total	100.0	100.0	100.0
Private (investor)	77.6	76.2	73.3
Cooperative (REA)	6.6	10.2	7.1
Government	15.8	13.6	19.6
Federal	3.6	(1)	8.0
State and local	12.2	13.6	11.6

[1] Less than 0.05 percent.

SOURCE: *Public Power*, Jan./Feb. 1980, p. D-3.

cent of all utility expenditures in 1977. Salaries and wages accounted for about 9 percent (16 percent of current operating expenditures). Fuel, materials, supplies, and purchased power accounted for the remaining 48 percent (table 11).

State and local systems are scattered throughout the United States. The District of Columbia, Hawaii, and Montana are the only jurisdictions which have no State or local government power system. For the 48 States with one or more systems, the average number of employees was 1,220 and the average revenue was $146 million in 1976. California led the list with 9,600 full-time-equivalent employees and $1,063 million in revenue.[3]

According to the Bureau of the Census, State and local utilities had gross revenue of $7,142 million in fiscal year 1977. The American Public Power Association (APPA) estimates the figure at $7,059 million (excluding Puerto Rico) for calendar year 1977.[4] The 19 largest utilities accounted for 57 percent of total dollar sales. The 160 largest reporting units accounted for about 95 percent, according to information published by the U.S. Department of Energy.[5]

Kilowatt hour sales to the ultimate customer is the statistic most often used to measure electric utility output. In 1978, State and local systems sold 234,478 million kilowatt hours.[6] The 10 largest systems accounted for about 35 percent of the kilowatt sales and the 25 largest for about 50 percent. The largest 160 accounted for almost 90 percent.[7]

The coverage of utility statistics varies. Bureau of the Census financial and employment statistics include all State and local government electric power operations; before 1980 the Census employment statistics included only local employees.

[3] Number of employees from *1977 Census of Governments—Compendium of Public Employment* (Bureau of the Census, 1979); revenue from *1977 Census of Governments—Compendium of Government Finances* (Bureau of the Census, 1979).

[4] *Public Power*, Jan./Feb. 1980, p. D-2.

[5] *Publicly Owned Electric Utilities—1977*, p.16.

[6] *Public Power*, Jan./Feb. 1980, p. D-2.

[7] *Publicly Owned Electric Utilities—1977*, p. 16.

The Federal Energy Regulatory Commission (FERC), the Energy Information Administration (EIA) of the U.S. Department of Energy, and the American Public Power Association (APPA) include all State and local government utilities in their statistics. EIA, for example, defines a "municipal" power utility as "a city, county, irrigation district, drainage district, or other political subdivision or agency of a State competent under the law thereof to carry on the business of developing, transmitting or distributing power."[8]

The Standard Industrial Classification (SIC) system also includes all "companies and systems engaged in the generation, transmission and/or distribution of electric energy for sale."[9] This definition is used in the BLS data and productivity analysis of investor-owned and cooperative utilities.

The discussion and calculations that follow focus on State and local government electric utilities whether they generate, transmit, or distribute power. Utilities in the U.S. territories are excluded, however. These are included in the EIA and the APPA statistics, but not in those compiled by Census.

A potential problem, particularly for data collection, is the utility that covers more than a single service. Combined electric-gas utilities are common in the private sector, and a separate classification is given to them in the SIC. The problem is likely to be even more common in local government, where utilities may be combined in a single agency. In Los Angeles, for example, water and power are combined; in Memphis, water, light, and gas are combined.

Research and statistics

Research and statistics abound on electric utility operations. This stems from the public's interest in utility regulation and rate setting, the great debates of the 1930's over public vs. private power, and the more recent interest in the safety of nuclear power and the effect of acid rain, all issues that lend themselves to economic analysis. Universities, private consulting firms, utilities, and government regulators routinely study the industry.

Productivity measurement has attracted a moderate amount of interest on the part of economists. Jacob Gould was one of the first to attempt an electric utility productivity index.[10] Gould calculated productivity indexes for 1899–1942 for the total electric utility industry, public and private. He measured output of kilowatt hours, both unweighted and weighted by class of service; and inputs of labor, fuel, and capital.

[8] Ibid., p. 1.

[9] *Standard Industrial Classification Manual* (U.S. Office of Management and Budget, 1972), p. 218.

[10] Jacob Martin Gould, *Output and Productivity in the Electric and Gas Utilities—1899–1942* (New York: National Bureau of Economic Research, 1946).

Table 11. Finances of State and local government electric utilities by type of government, fiscal year 1977
(Millions)

Government	Revenue	Expenditures					
		Total	Capital	Interest on debt	Current operations		
					Total	Salaries and wages	Other
Total	$7,142	$9,313	$3,167	$856	$5,289	$861	$4,428
States	377	982	630	175	177	41	136
Municipalities	5,353	5,377	909	345	4,123	587	3,536
Special districts	1,273	2,804	1,619	329	856	217	639
Townships	127	131	7	2	121	15	106
Counties	11	19	1	5	12	2	10

NOTE: Because of rounding, detail may not add totals.

SOURCE: *1977 Census of Governments—Compendium of Government Finances* (Bureau of the Census, 1979), p. 33.

Kendrick and Barzel calculated indexes of private electric utility productivity. Barzel's work covered 1929–55 for partial and total factor productivity.[11] He derived kilowatt hour class weights through regression analysis. The Kendrick indexes were for total factor productivity and covered 1948–69.[12]

Dragonette and Jaynes of BLS calculated and published an index of labor productivity for the electric and gas industry in 1965 which covered 1932–64.[13] This index of investor-owned and cooperative electric utilities is updated yearly and has recently been divided between gas and electricity.[14] The Bureau also calculates an index of Federal electric power productivity as part of its Federal productivity measurement program.[15] No index is routinely published for State or local government electric power productivity.

Much of the research has focused on utility regulation. Recently, it has centered on the role productivity should play in regulation, particularly in rate setting. Kendrick discussed the issue in several papers.[16] Rodney Stevenson considered conceptual issues, including partial and total factor productivity, rates of technological change, econometric modeling, and management audits. He also presented a private electric utility productivity index. Total factor productivity was estimated using five factors—capital, labor, fuel, purchased power, and material and supplies.[17]

Howard Axelrod called for the use of a series of partial productivity ratios targeted to different functions.[18] He suggested kilowatts per man hour and total capitalized cost per kilowatt hour for measuring power generation productivity, and the number of bills processed per man hour and the number of complaints answered per man hour for assessing customer account productivity.

Research papers by Iulo and Pace are also widely cited in the literature.[19] Both authors used econometric techniques to identify the variables most responsible for differences in utility unit costs. Neither study found that employee hours play a significant role.

Lastly, J.W. Wilson and Associates conducted a study for the U.S. National Bureau of Standards which focused on helping States improve their electric utility regulatory process.[20] As part of the study, they reviewed electric utility productivity measurement and associated problems.

Several points stand out in the research:

1. The principal measure of output is the kilowatt hour, often weighted to reflect the different classes of service.

2. No input measure is dominant. Labor is often used, apparently because of the difficulty in measuring capital and fuel, the two factors most favored in theoretical discussions.

3. The research has focused on private utility measurement, particularly as related to regulatory issues.

[11] Yoram Barzel, "Productivity in the Electric Power Industry —1929–1955," *Review of Economics and Statistics*, November 1963, pp. 395–408.

[12] John W. Kendrick, *Postwar Productivity Trends in the United States* (New York: National Bureau of Economic Research, 1973).

[13] Joseph E. Dragonette and Philip W. Jaynes, "Output Per Man-Hour, Gas and Electric Utilities," *Monthly Labor Review*, January 1965, pp. 34–39.

[14] *Productivity Measures for Selected Industries—1954–81*, Bulletin 2155 (Bureau of Labor Statistics, 1982).

[15] *Measuring Federal Productivity* (U.S. Office of Personnel Management, 1980).

[16] John W. Kendrick, "Efficiency Incentives and Cost Factors in Public Utility Automatic Reserve Adjustment Clauses," *Bell Journal of Economics*, Spring 1975, pp. 299–313; and "Some Productivity Issues in the Regulated Industries," in *Public Utility Productivity*, Walter L. Balk, ed., (Albany: New York State Department of Public Services, 1975), pp. 3–9.

[17] Rodney E. Stevenson, "Regulating for Efficiency in the Public Utility Industry" and "Productivity in the Private Electric Utility Industry," in *Public Utility Productivity*.

[18] Howard J. Axelrod, "Measuring Electric Utility Productivity," in *Public Utility Productivity*, pp. 57–69.

[19] William Iulo, *Electric Utilities—Costs and Performance* (Pullman, Washington: State University Press, 1961); and Joseph D. Pace, "Relative Efficiency in the Electric Utility Industry" (Ann Arbor, University of Michigan, 1970).

[20] J.W. Wilson and Associates, *The Measurement of Electric Utility Productivity*, Vols. I and II (National Bureau of Standards, 1980).

4. Little interest has been shown in State and local government productivity measurement, and no productivity index has been calculated.

Although no productivity index exists, considerable data are available on State and local government electric power operations. The EIA, the APPA, the Bureau of the Census, investment firms, and individual utilities all publish some data in this area. Statistics on the number of customers, kilowatt hour sales, revenues, number of generating stations, miles of transmission lines, plant cost, and allowances for depreciation and amortization are routinely collected and published. Data which could be used to construct a State and local government productivity index are reviewed in the following sections.

Outputs

The output measure used most often is kilowatt hours sold. Other measures are the number of customers, kilowatt hours generated, percent of capacity used, generator capacity, dollar sales, and net profit. The relative strengths and weaknesses of the different measures are seldom discussed in the literature.

William Iulo, one of the few researchers who has examined the different measures, offers four reasons for using kilowatt hours:

1. The measure is familiar to industry and the public and has long been used by both.

2. Data are readily available. All utilities collect and keep, and most report, statistics on kilowatt hours sold.

3. The kilowatt hour is a standard physical unit which is not affected by price changes.

4. Kilowatt hours are a rough indicator of the industry's ability to produce electric energy.

The only argument Iulo offers against the use of the kilowatt hour is that production costs per kilowatt hour are not always similar though this may be implied.[21]

The previous chapter listed the criteria used in this study to select State and local government output measures. The kilowatt hour satisfies the four essential criteria and three of the four optional criteria. The only criterion not met is the one noted by Iulo: Kilowatt hours are not always proportional to the cost (labor hours) spent in their production.

Production costs vary by class of service. Capital requirements to construct distribution systems for industrial users are normally less than those required to service residential customers per kilowatt hour delivered. Similarly, the labor required to maintain and service industrial/commercial distribution is likely to be less than that required for residential service.

[21] Iulo, *Electric Utilities—Costs and Performance*, p. 30.

Weighting output. Because production costs vary, differentiating or segmenting output to account for the different classes of service is common practice. BLS, for example, uses three basic weighted aggregates—residential, commercial/industrial, and other—to estimate labor productivity of investor-owned utilities.[22] Wilson and Associates propose a seven-way break —residential, commercial, industrial, street and highway lighting, public railroads and railways, interdepartmental, and sales for resale.[23]

Weights should reflect the input being measured: A labor productivity measure should use unit labor inputs, and a capital productivity measure should use capital input weights. However, appropriate statistics are not always available, and it has become common practice to use average price per kilowatt hour for each class of service (revenue divided by kWh's sold) as the weight. Insofar as labor and capital requirements and costs are proportional to price differentials, price weights are useful.

Iulo has shown that the relationship between unit cost and unit revenues is good.[24] Both BLS and Wilson use unit revenue as weights, and this procedure is suggested for State and local government output measurement.

Utility weights have been calculated for 1967, 1972, and 1977 (table 12). For 1967 and 1972, weights were calculated for residential, commercial/industrial, and other. For 1977, additional data made it possible to divide the commercial/industrial field between small and large producers.

Quality of service. Quality of service has not been an issue for most researchers. Whether this lack of concern is due to conceptual difficulties, data problems, a feeling that quality is not an important issue, or a combination of factors is not known. Researchers who have studied the quality issue have singled out the following as important:

1. *Reliability.* This factor concerns the number, length, and duration of supply interruptions. Interruptions can be caused by factors such as weather, disaster, lack of equipment, or lack of fuel. Building redundancy into the system increases reliability.

2. *Voltage.* Lack of proper equipment or insufficient generating capacity may cause voltage fluctuations which result in damage or malfunction of user equipment. Installing additional equipment can control voltage fluctuations.

3. *Aesthetics.* The aesthetic factor most often discussed is placement of utility lines—above vs.

[22] Dragonette and Jaynes, "Output per Man-Hour," pp. 34-39.
[23] Wilson and Associates, *Electric Utility Productivity*, Vol. II, p. 16.
[24] Iulo, op. cit.

Table 12. Weights for calculating output indexes for State and local government electric utilities by class of service, 1967, 1972, and 1977

Class of service	Dollars per kilowatt hour		
	1967	1972	1977
Residential	$0.0149	$0.0163	$0.0293
Commercial/industrial	.0116	.0132	.0253
Small	n.a.	n.a.	.0328
Large	n.a.	n.a.	.0211
Other	.0147	.0168	.0345

n.a. = not available.

SOURCE: Computed from *Statistics of Publicly Owned Electric Utilities in the United States*, selected issues (U.S. Department of Energy, Information Administration).

below ground. Placing utilities below ground increases initial costs. Its impact on operating costs is open to debate.

Adjustments for quality have not been attempted in this study.

Generation vs. sales. Because State and local government utilities are not closed systems, a problem may arise in calculating productivity when State and local government utilities generate and sell power to non-State and nonlocal utilities, and purchase and distribute power that other utilities generate and transmit. North Platte, Nebraska, for example, sold 178 million kilowatts in 1978 to ultimate consumers but generated no electricity itself. The New York State Power Authority, on the other hand, generated 34 billion kilowatt hours in 1978 but sold only 14 billion to ultimate consumers; it sold the remaining kilowatt hours to other utilities.

The difference between generation and sales to the ultimate consumer becomes a problem when the ratio between generation and sales is changing, as it is with State and local government electric power utilities. In 1967, State and local government utilities generated 101,672 million kilowatts and sold 142,928 million kilowatts to ultimate consumers, a difference of 29 percent. In 1978, 228,645 million kilowatts were generated and 234,478 million kilowatts were sold, a difference of about 2 percent. While growth has been considerable in both generation and ultimate sales, the gap has been closing.

Although the growth of State and local government generating capacity vis-a-vis sales to ultimate customers has been large, the impact on productivity apparently has been limited. Labor productivity with, and without, the incremental change in employees working in generation differ by less than 1 percent for large utilities, the only group for which data are readily available. Any bias as a result of increasing generation is downward. That is, productivity gains are understated, since output is calculated as a function of final sales to customers while inputs include all the labor needed to distribute, transmit, and generate electricity.

Statistics. Statistics on kilowatt hours sold to ultimate consumers by government utilities have been collected for many years. Today, EIA collects and publishes information annually on approximately 160 of the largest State and local utilities. The APPA also collects and publishes kilowatt hour statistics on State and local utilities.

The EIA and its predecessor organizations, particularly the Federal Power Commission, have published statistics on publicly owned utilities since 1946. However, reporting requirements and tabulation procedures have been modified so that year-to-year summary comparisons are likely to be misleading. Also, the number of utilities reporting each year depends on the reporting requirements and whether the utilities abide by such requirements.

The new EIA series starting with 1974 includes those utilities which have consistently filed annual reports and have annual operating revenue of at least $5 million. The new series includes abut 160 utilities and reporting units. (The old series included 511 utilities; the new series lists the utilities in Tennessee which purchase their power from the TVA under a single heading, "TVA providers.")

The EIA statistical reports include, in addition to summary data, details for individual utilities on the number of customers, kilowatt hour sales, revenues, production expenses, assets, liabilities, profit and loss, generation capacity, and the number of miles of transmission lines. Kilowatt hour sales are divided by class of customer so that unit revenue weights may be developed.

Insofar as national output measurement is concerned, a limitation of EIA statistics is that they do not indicate the extent of their coverage. But if one accepts the APPA estimates for total kilowatt hour sales by State and local utilities, the EIA statistics account for about 90 percent. Another limitation is that the sample excludes the smaller utilities, which may bias productivity calculations.

The APPA collects kilowatt hour sales monthly from the 29 largest municipal utilities. It uses these statistics, data collected by EIA, and data from the private sector to estimate the annual sales of kilowatt hours to ultimate users. APPA is the only known source of published data on total State and local government sales.

Several problems arise in using APPA estimates to calculate national State and local electric utility output. First, the figures include kilowatt hours sold in American Samoa, the Canal Zone, Guam, Puerto Rico, and the Virgin Islands. Statistics for these five territories can be subtracted from the total, however, to obtain the estimated kilowatt sales in the United States. Moreover,

the Puerto Rico Electric Power Authority is the only large utility located in the territories, and its output can be easily removed from the summary statistics, as has been done in the statistics presented here.

Second, APPA statistics are not separated by class—residential, commercial, highway lighting, and so forth—or by geographic area. As noted, a class division is needed to assign unit revenue weights. If that computation is not made, which the preceding discussion suggested was desirable, this type of information is not needed. Geographic information is valuable for matching and comparing statistics from various sources.

Third, and more troublesome, the error associated with the APPA estimate is not known since the true universe is unknown. However, comparison with other data suggests that they are reasonably good estimates of the universe.

Output indexes. Three output indexes are presented here (table 13). Two are based on APPA statistics. One is an index of local and State kilowatt sales to ultimate customers with statistics for Puerto Rico removed. The other reflects only local government electric power kilowatt sales. In addition to Puerto Rico, sales of the major State authorities have been removed so that the index would match Census local government employment statistics. In addition, a third output index has been constructed for 33 large State and local government electric utilities for which data were readily available.[25] The kWh statistics were taken from Federal Government sources and data provided by the utilities.

The average annual rates of growth for these three indexes are 4.0, 3.7 and 6.0 percent, respectively. The first two indexes, as expected, are very similar; the large utility index grows about 50 percent faster than the other two. These statistics will be used later in this section to calculate electric power productivity.

Table 13. Three output indexes for State and local government electric utilities, 1967–78
(1977 = 100)

Year	Kilowatt hour sales to ultimate customers		
	Local and State	Local utilities	Large utilities
1967	63.6	65.2	54.4
1968	69.1	71.6	57.4
1969	75.5	77.8	62.5
1970	81.5	84.2	67.4
1971	87.3	90.4	70.7
1972	88.3	91.6	76.2
1973	90.0	93.0	83.5
1974	91.1	93.8	83.1
1975	91.5	94.6	85.1
1976	96.2	99.0	90.1
1977	100.0	100.0	100.0
1978	104.3	103.3	106.2
Average annual percent change[1]	4.0	3.7	6.0

[1] Average annual rates of change in this and all subsequent tables are based on the linear least squares trend of the logarithms of the index numbers.

SOURCE: Local and State utilities—January issues of *Public Power* (Puerto Rico statistics are excluded). Local utilities—local and State utility index with major State utility sales excluded. Large utilities—compiled from Federal and individual utility sources.

Labor inputs and employee costs

The previous chapter listed three labor measures to be used in calculating State and local government labor productivity: Number of employees, number of full-time-equivalent employees, and number of employee hours. Data to calculate these measures are not always available.

Sources of data. The three sources of data on publicly owned power system employment are: (1) The individual public power systems, (2) the American Public Power Association (APPA), and (3) the Bureau of the Census.

Although all public power agencies collect and maintain data on employment, and some publish them annually, these statistics are mostly simple counts of the number of employees. A review of a number of annual reports did not find any statistics of the number of hours worked, part-time employment, or seasonal employment. Discussions with government utility officials suggest that in most cases data are readily available on the number of employees but not on employee hours.

APPA collects some employee data in its survey of utility salaries. The salary survey, initiated in 1957, was conducted every other year until 1977, when it became an annual survey. The 1979 survey collected information from 358 State and local utilities. Data collected include the number of permanent employees, salaries of selected officials, and the number of years since the nonsupervisory engineers received their degrees. Other statistics include kWh sales, kWh purchases, and generating capacity. Data on sales to ultimate consumers are not collected. The APPA statistics can help in data analysis and evaluation but by themselves are not sufficient to construct a viable labor index.

The Bureau of the Census is the only organization that routinely collects and publishes time series data on public power utility employment. It publishes figures on both total employment and full-time-equivalent employment. However, several problems arise in using these data to measure electric utility labor productivity.

First, Census did not include State employees in its electric utility series until 1980. Since output statistics include both State and local kilowatt hours, the labor input series must include both State and local governments. The 1980 Census figures show 3,000 State power employees; other data suggest that the figure is closer to

[25] See appendix C for a list of the utilities included.

4,000. The important consideration for trend determinations is relative growth, not absolute numbers.

A second problem is that Census employment is collected for only one month—October—of each year. These statistics do not capture seasonal employment. If the October/seasonal proportion remains constant, the October statistics will be satisfactory for trend determinations. A set of October/seasonal statistics is needed to establish whether there is constancy.

A third problem is that Census statistics are available for only aggregate and full-time-equivalent employment. No data are collected on the number of hours, nor are the statistics broken down between operations and force account (construction) employees.

Another potential problem, discussed briefly earlier, is the assignment of government personnel to the power function when, in fact, they work in other or multiple-service areas—e.g., gas, water, and sewerage. Overhead personnel are a special case. In labor data collected for this study, however, the inability to allocate personnel was not a significant problem. Only one of the 33 large utilities indicated it was difficult to allocate personnel. Two large utilities not included in the sample also indicated that they were unable to provide the employee data by function. The extent of the problem for the smaller utilities is not known, but Census personnel do not feel that it is significant. Census suggests that when governments have this type of problem, they should allocate personnel using revenue figures.

Although statistics are not available to compute an hours index, other sources suggest that such an index would parallel the total employee index and the full-time-equivalent employee index. Census full-time-equivalent and total employment show a high degree of correlation (table 14). Between 1967 and 1978, both grew at the same annual rate—0.7 percent. For trend comparisons, the two measures should not differ a great deal. Also, private electric utility trends for labor hours and total employment closely parallel each other during the time period examined here (table 15).

Table 14. Two employment measures for local government electric utilities, 1967–78

Year	Number of employees (thousands)	Full-time-equivalent (thousands)	Full-time-equivalent as a percent of number of employees
1967	59	57	96.6
1968	58	56	96.6
1969	55	54	98.2
1970	58	56	96.6
1971	59	58	98.3
1972	59	58	98.3
1973	61	60	98.4
1974	62	60	96.8
1975	62	60	96.8
1976	61	59	96.7
1977	60	58	96.7
1978	62	60	96.8

SOURCE: Employment data from *Public Employment*, annual issues (Bureau of the Census).

Table 15. Two employment indexes for private sector electric utilities, 1967–78

(1977 = 100)

Year	Employees	Employee hours
1967	82.3	82.6
1968	84.1	84.6
1969	86.5	87.4
1970	89.8	90.4
1971	90.8	91.2
1972	93.3	94.1
1973	96.5	98.3
1974	98.9	99.7
1975	97.4	96.6
1976	98.0	97.8
1977	100.0	100.0
1978	105.1	107.0
Average annual percent change:		
1967–78	2.1	2.0
1975–78	1.3	1.3

SOURCE: Donald M. Fisk, "Pilot Study Measures Productivity of State, Local Electric Utilities," *Monthly Labor Review*, Dec. 1981, p. 46.

Employment indexes. Three employment indexes were computed (table 16). The first, based on Census statistics, is for total local government electric power employment. The second index attempts to capture State as well as local government employment by adding employment for the four largest State systems. This index should approximate total State and local government electric power employment since local governments constitute over 90 percent of electric power employment and the four State systems constitute over 90 percent of State electric power employment. The third index, based on statistics provided by the utilities, reflects employment in 33 large, publicly owned utilities.

The average annual rates of growth for the three indexes are 0.7, 0.9, and 1.6 percent for the local, local/selected States, and large utilities, respectively. The first two indexes are quite close, as expected, but the third grows at almost twice the rate of the other two. These indexes are used to calculate the productivity indexes presented later.

Salaries and wages. During 1967–78, employee salaries and wages increased at an average annual rate of 7.8 percent (table 17). This index, computed from data taken from *Public Employment*, an annual publication of the Bureau of the Census, is for salaries and wages paid to full-time local government personnel in October of each year. The criticisms of Census employment statistics discussed earlier apply equally here—they include only one month of data and exclude State employment. An additional criticism is that fringe benefits are not included. This exclusion will bias labor cost trends if

Table 16. Three employment indexes for State and local government electric utilities, 1967–78

(1977 = 100)

Year	Local utilities	Local and selected State utilities	Large utilities
1967	98.1	96.2	86.7
1968	96.5	94.7	87.2
1969	91.5	90.0	89.6
1970	96.5	95.0	92.5
1971	98.1	96.7	96.2
1972	98.1	96.9	96.2
1973	101.5	100.3	98.0
1974	103.1	102.1	99.9
1975	103.1	102.3	99.8
1976	101.5	101.1	99.7
1977	100.0	100.0	100.0
1978	103.1	103.7	103.2
Average annual percent change	.7	.9	1.6

SOURCE: Local utilities—data to compute index from ***Public Employment***, annual issues. Local and selected State utilities—data for local government employees from ***Public Employment***, annual issues; data for State government employees provided by individual utilities. Large utilities—data to compute index provided by individual utilities.

Table 17. Index of average salaries and wages of local government electric utility employees, 1967–78

(1977 = 100)

Year	Index
1967	48.6
1968	50.3
1969	55.3
1970	58.6
1971	62.1
1972	66.0
1973	74.6
1974	79.3
1975	87.3
1976	96.3
1977	100.0
1978	105.6
Average annual percent change:	
1967–78	7.8
1967–72	6.6
1973–78	7.5

SOURCE: Data to compute index from ***Public Employment***, annual issues.

the ratio of fringe benefits to salaries and wages is changing through time.

Productivity indexes

Three illustrative productivity indexes for electric utilities are presented in this section. One covers local government; another, local and selected State government; and the third, large, government-owned utilities. All three draw on the data and investigative approaches presented in the preceding discussion.

Local government index. Local governments sell most of the kilowatt hours supplied by government to ultimate customers in the United States; the States play a relatively minor role. Although precise statistics are not available, more than 90 percent of total kilowatt hours and total State and local government employment result from local operations.

The local government index shows a 51-percent growth between 1967 and 1978, an annual increase of 3.0 percent (table 18). The average annual increase for kilowatt hours and employment during 1967–78 was 3.7 and 0.7 percent, respectively. This index is unweighted since only aggregate kilowatt hour sales are available.

The main question surrounding this index is data accuracy, which was discussed earlier. Kilowatt hour sales were taken from APPA statistics, from which State sales to final customers were removed. State kWh sales were taken from State and FPC/FERC/EIA data, and should be accurate. The employment statistics were taken from the Bureau of the Census; the strengths and weaknesses of that source of data have been noted.

Local and selected State government index. An illustrative index was also calculated for all local and selected State government utilities. Twenty-one State-owned utilities were identified. Four—Power Authority of the State of New York, South Carolina Public Service Authority, Grand River Dam Authority, and Lower Colorado River Authority—accounted for almost all employment and sales to ultimate customers. These four utilities were combined with the local government indexes to arrive at the local and selected State government index. This index should include 99 percent of all State and local government employment and kilowatt hour sales to ultimate customers.

The results of these calculations show that local and selected State government productivity increased by about 52 percent from 1967 to 1968 (table 19). The average annual increase in output per employee was 3.0 percent; in kilowatt hours, 4.0 percent; and in employees, 0.9 percent. The index is unweighted.

Table 18. Indexes of output, employees, and output per employee for local government electric utilities, 1967–78

(1977 = 100)

Year	Output	Employees	Output per employee
1967	65.2	98.3	66.3
1968	71.6	96.7	74.1
1969	77.8	91.6	84.9
1970	84.2	96.7	87.1
1971	90.4	98.3	92.0
1972	91.6	98.3	93.2
1973	93.0	101.7	91.5
1974	93.8	103.3	90.8
1975	94.6	103.3	91.5
1976	99.0	101.7	97.3
1977	100.0	100.0	100.0
1978	103.3	103.0	100.0
Average annual percent change	3.7	.7	3.0

SOURCE: Output, table 13; employees, table 16; output per employee, calculated.

Table 19. Indexes of output, employees, and output per employee for local and selected State government electric utilities, 1967-78

(1977 = 100)

Year	Output	Employees	Output per employee
1967	63.6	96.2	66.1
1968	69.1	94.7	73.0
1969	75.5	90.0	83.9
1970	81.5	95.0	85.8
1971	87.3	96.7	90.2
1972	88.3	96.9	91.1
1973	90.0	100.3	89.8
1974	91.1	102.1	89.2
1975	91.5	102.3	89.4
1976	96.2	101.1	95.2
1977	100.0	100.0	100.0
1978	104.3	103.7	100.7
Average annual percent change	4.0	.9	3.0

SOURCE: Output, table 13; employees, table 16; output per employee, calculated.

Table 20. Weighted indexes of output, employees, and output per employee for 33 large government electric utilities, 1967-78[1]

(1977 = 100)

Year	Output	Employees	Output per employee
1967	54.4	86.7	62.7
1968	57.4	87.2	65.8
1969	62.5	89.6	69.7
1970	67.4	92.5	72.8
1971	70.7	96.2	73.5
1972	76.2	96.2	79.2
1973	83.5	98.0	85.1
1974	83.1	99.9	83.1
1975	85.1	99.8	85.2
1976	90.1	99.7	90.3
1977	100.0	100.0	100.0
1978	106.2	103.2	102.9
Average annual percent change	6.0	1.6	4.4

[1] See appendix C for list of utilities included.

SOURCE: Output, table 13; employees, table 16; output per employee, calculated.

Large, government-owned utility index. A productivity index was also calculated for 33 of the largest publicly owned utilities. The two State and 31 local government systems included account for about 45 percent of all municipal electric utility employment and 55 percent of all kilowatt hour sales to ultimate customers. They cannot be considered representative of all government-owned utilities because of their large size.

Between 1967 and 1978, the index for these 33 utilities increased by 64 percent, or an annual increase of 4.4 percent (table 20). The average annual increase for kilowatt hours was 6.0 percent; for employment, 1.6 percent.

The kWh's were taken from FPC/FERC/EIA publications and were weighted for class of service—residential, commercial/industrial and other—as discussed. There is very little difference between the weighted and unweighted indexes.

The employment data used in the index reflect the average number of employees. These statistics, for the most part, were provided by the individual utilities, and were checked against Census data insofar as possible.

Comparison of productivity indexes. The local and local/State indexes show much the same productivity growth between 1967 and 1978; both increased at exactly the same average annual rate—3.0 percent (table 21). Similar trends are to be expected for these two indexes, since over 90 percent of local/State government electric utility kWh sales and employment are those of local government.

The 33 large utilities, which are a subset of the local/State government index, showed a markedly faster rate of productivity increase—4.4 percent—between 1967 and 1978. This, too, is to be expected since economies of scale are important in electric power generation and distribution.

All three indexes showed a dramatic drop in output and productivity in 1973–74, in response to the oil embargo and the recession. Also, productivity growth peaked in 1969 in all three indexes.

Although uncertainty surrounds some of the data used to calculate the indexes, the output index, the three input indexes, and the three productivity indexes move together quite well, and any differences, such as with the large utility index, are easily explained. Thus, even though the precise increase in local and State government electric utility labor productivity over the past decade may be open to question, the general movement is clear.

Comparison with private utility index movements. Indexes that BLS routinely calculates for investor-owned and cooperative electric utilities grew somewhat faster than those for State and local government utilities during 1967—78 (table 22.) However, this may be a function of size. Large public system output and productivity grew faster than that of private utilities.[26]

Productivity growth slowed in both the public and private sectors in the early 1970's. Between 1967 and 1972, private utility growth dropped from 5.5 percent to 2.4 percent. The comparable figures for State and local governments were from 6.7 percent to 2.8 percent.

In neither government nor private electric utilities did productivity increase fast enough to offset the increase in salaries and wages. The result was an increase in average kWh unit cost, particularly in the latter part of the period. In State and local governments, unit cost in-

[26] The average number of employees in State and local government utilities was about 30 per system; in the private sector, 435; and in large public systems, 925.

Table 21. Three productivity indexes for State and local government electric utilities, 1967–78

(1977 = 100)

Local	Local utilities	Local and selected State utilities	Large utilities
1967	66.3	66.1	62.9
1968	74.1	66.4	66.0
1969	84.9	83.9	69.9
1970	87.1	85.8	73.0
1971	91.9	90.2	73.6
1972	93.2	91.1	79.4
1973	91.5	89.8	85.3
1974	92.8	89.2	83.3
1975	91.5	89.4	85.4
1976	97.3	95.2	90.6
1977	100.0	100.0	100.0
1978	100.0	100.7	103.1
Average annual percent change	3.0	3.0	4.4

SOURCE: Local utilities, table 18; local and selected State utilities, table 19; large utilities, table 20.

Table 22. Average annual rates of change for government and private electric utility output, labor input, and productivity, 1967–78

(Percent)

Type of utility	Output (kwh)	Labor input (number of employees)	Productivity (output per employee)
Local government utilities	3.7	0.7	3.0
Local and selected State government utilities	4.0	.9	3.0
Large government utilities	6.0	1.6	4.4
Private utilities	5.8	2.1	3.7

SOURCE: Local government, table 18; local and selected State government, table 19; large government, table 20; private, Donald M. Fisk, "Pilot Study," p.46.

creased 7.8 percent annually in 1967–78. Between 1967 and 1972, the rate of increase was 6.6 percent or about the same as output per employee. But between 1973 and 1978, the average annual increase was 7.5 percent while the rate of increase in output per employee dropped to 2.8 percent per year.

For private utilities, the average annual increase was 9.4 percent. Between 1967 and 1972, the rate of increase was 6.7 percent, about the same as government and slightly ahead of the 5.5-percent increase in output per employee. However, between 1973 and 1978 the rate of salary and wage increase jumped to 8.7 percent while the increase in output per employee dropped to 2.4 percent.

Suggested research

Further analysis of State and local government electric productivity should focus on multifactor productivity. The Bureau of the Census estimates that in fiscal year 1977 labor accounted for only 9 percent of State and local government utility expenditures. Capital expenditures were estimated at 43 percent. A 1973 study of investor-owned utilities found labor to be 15 percent and capital 48 percent of total expenditures.[27] For a better understanding of productivity and cost movements in the electric power industry, it would be necessary to examine capital, fuel, and other factor inputs.

[27] Stevenson, in *Public Utility Productivity*. These percentages undoubtedly have shifted in recent years as fuel costs have increased.

State Alcoholic Beverage Control Operations

All States and many local governments regulate alcoholic beverage sales. States license sellers, tax sales, regulate advertising, set the legal age for purchase of beverages, and establish the hours and days of sale. In addition, about one-third of the States operate retail or wholesale alcoholic beverage stores. These operations are the focus of this section.

Alcoholic beverage operations have not captured the attention of productivity measurement specialists, unlike electric power production. Productivity measurements do not exist for either the private or public sector. However, the service is straightforward, at least on the surface; the outputs are tangible; and data are routinely collected on many aspects of State alcoholic beverage operations.

Institutional considerations

States which operate their own stores using government employees are known as control or monopoly States. Those States which use private sellers are known as license States. There are 18 control States and 33 license States including the District of Columbia (table 23).

Although States are often divided into these two groups, there is a broad spectrum of institutional arrangements, from almost completely private operation to total government control and operation. These can be grouped into the following fairly distinct categories:

1. Private retail and wholesale operations, in effect in more than half of the States.
2. Private retail and government wholesale, as in Mississippi and Wyoming.
3. Private and government (municipal) retail and private wholesale, as in Minnesota.
4. Government (city and county) retail and private wholesale, as in North Carolina.
5. Government and private agency retail and government wholesale, as in Ohio.
6. Government retail and wholesale, as in Alabama and Virginia.

This study focuses on those States included under 2, 5, and 6 above. North Carolina and Minnesota are not

Table 23. Type of control of alcoholic beverage sales by State

State	State operations (control/ monopoly)	Private operations (license)	State	State operations (control/ monopoly)	Private operations (license)
Alabama	x	–	Montana	x	–
Alaska	–	x	Nebraska	–	x
Arizona	–	x	Nevada	–	x
Arkansas	–	x	New Hampshire	x	–
California	–	x	New Jersey	–	x
Colorado	–	x	New Mexico	–	x
Connecticut	–	x	New York	–	x
Delaware	–	x	North Carolina	x	–
District of Columbia	–	x	North Dakota	–	x
Florida	–	x	Ohio	x	–
Georgia	–	x	Oklahoma	–	x
Hawaii	–	x	Oregon	x	–
Idaho	x	–	Pennsylvania	x	–
Illinois	–	x	Rhode Island	–	x
Indiana	–	–	South Carolina	–	x
Iowa	x	–	South Dakota	–	x
Kansas	–	x	Tennessee	–	x
Kentucky	–	x	Texas	–	x
Louisiana	–	x	Utah	x	–
Maine	x	–	Vermont	x	–
Maryland	–	x	Virginia	x	–
Massachusetts	–	x	Washington	x	–
Michigan	x	–	West Virginia	x	–
Minnesota	–	x	Wisconsin	–	x
Mississippi	x	–	Wyoming	x	–
Missouri	–	x			

discussed because local rather than State personnel operate stores, and data are not readily available.

The 17 control States (18 including North Carolina) account for about 30 percent of the U.S. population and 25 percent of the spirits sold in the United States. In 1977, State alcoholic beverage sales totaled over $2 billion.

Five States accounted for 65 percent of the revenue and 70 percent of the employment in fiscal 1977 (table 24). Pennsylvania alone accounted for 20 percent of the revenue and 31 percent of the employment.

Most State alcoholic beverage control commissions are responsible for four functions—wholesale sales, retail sales, enforcement, and licensing (table 25). Each of the 17 control State commissions operates wholesale or retail alcoholic beverage facilities. Sixteen of the 17 State commissions license others, such as wineries and restaurants, to sell alcohol. Fourteen of the 17 are responsible for enforcement of State alcoholic beverage laws and regulations; three States assign the responsibility to their departments of public safety.

This investigation includes wholesale as well as retail sales. Two of the 17 States operate only wholesale operations; the other 15 operate a combination of wholesale and retail. All of the 15 State retail operations sell spirits; 13 of these sell wine as well as spirits, and 5 also sell beer. Spirits account for about 75 percent of all gallons sold in State stores, wine about 25 percent, and beer less than 0.01 percent. Ten of the 15 States that operate retail stores use agency (private) stores to augment their operations.

The agency arrangement is an important issue in calculating productivity. Usually, private retail merchants operate agency outlets in addition to their normal sales. Control States have long used agents to serve the population of sparsely populated areas where a "full-service" State store could not be justified. Ohio, for example, permits agents only in towns with a population of less than 10,000. Agents are usually paid

Table 24. Distribution of alcoholic beverage control revenue and employees by State, fiscal year 1977

(Percent)

State	Revenue	Employees
All control States	100	100
Pennsylvania	20	31
Michigan	15	4
Ohio	14	13
Virginia	8	11
Washington	8	7
Oregon	5	2
New Hampshire	5	3
Alabama	5	7
Iowa	5	5
Mississippi	3	1
West Virginia	3	6
Montana	2	3
Utah	2	1
Maine	2	2
Idaho	1	2
Vermont	1	1
Wyoming	1	1

SOURCE: Computed from *1977 Census of Governments—Compendium of Government Finances* (Bureau of the Census, 1979), p. 39; and *1977 Census of Governments—Compendium of Public Employment* (Bureau of the Census, 1979), pp. 33–83.

a percent of their gross sales, although some States pay a fixed fee or negotiate a price with the individual merchant. In all cases, prices of alcoholic beverages are set by the State.

Several States have begun to substitute agents for State stores. Oregon, for example, has reduced the number of State stores from 20 in 1976 to 6 in 1980, and would have used agents entirely except for the intervention of the State legislature. Maine, Montana, and Utah have also substituted agents for State-operated stores.

Utah uses three different forms of agency arrangements. In the first, agents operate beverage stores just as they might a State store, but do not hire State employees. In the second, merchants contract to sell alcoholic beverages in addition to their regular product lines. In the third, resort or hotel owners operate an agency store as a convenience to their guests, usually at no cost to the State.

Synopsis of State operations. Alcoholic beverage operations vary markedly from State to State. A brief description of operations in each control State as of 1980 follows.

Alabama. The Alabama Alcoholic Beverage Control Board is responsible for sales, licensing, and enforcement within the State. It operates approximately 130 retail stores and a warehouse. Enforcement activities, which require about 100 of the 1,000 State Control Board employees, include drug abuse as well as alcohol control activities.

Idaho. The State Liquor Dispensary operates approximately 90 State stores and one warehouse and oversees the operation of about 45 agency stores. Agency stores are licensed to sell spirits and wine, primarily in locations where sales would not warrant operation of a State store. Licensing and enforcement of liquor laws and regulations are handled by another part of the State government.

Iowa. The Iowa Beverage Control Council operates approximately 215 State retail stores and a warehouse. The stores sell spirits, wine, and beer. The Council also licenses on-premise alcoholic beverage sales. Enforcement is the responsibility of the Department of Public Safety.

Maine. The Bureau of Alcoholic Beverages, part of the Department of Finance and Administration, operates about 70 State stores and oversees the operation of about 50 agency stores. Licensing is part of the State store operation, but enforcement is handled by another part of the State government.

Michigan. The Liquor Control Commission of the Department of Commerce oversees the operation of 76 State stores and about 3,300 agency stores. State stores provide a combination of wholesale and retail services; 99 percent of their operation is wholesale. Licensing and enforcement are also handled by the Commission.

Mississippi. The Alcoholic Beverage Control Commission of the State Tax Commission handles wholesale spirit and wine sales, and alcoholic beverage licensing and enforcement. Private stores handle retail sales.

Montana. The Montana Department of Revenue operates approximately 115 retail stores and oversees the operation of 30 agency stores. The Department also handles alcoholic beverage licensing and enforcement.

New Hampshire. The New Hampshire Liquor Commission operates about 70 retail stores and one

Table 25. Forms and functions of State alcoholic beverage control operations

State	Scope of operations			Type of sales		Type of retail sales		Type of beverage sold		
	Sales	Licensing	Enforcement	Wholesale only	Wholesale and retail	State store	Agency	Spirits	Wine	Beer
Alabama	x	x	x	–	x	x	–	x	x	–
Idaho	x	–	–	–	x	x	x	x	x	–
Iowa	x	x	–	–	x	x	–	x	x	x
Maine	x	x	–	–	x	x	x	x	x	–
Michigan	x	x	x	–	x	x	x	x	x	–
Mississippi	x	x	x	x	–	–	–	x	x	x
Montana	x	x	x	–	x	x	x	x	x	–
New Hampshire	x	x	x	–	x	x	–	x	x	–
Ohio	x	x	x	–	x	x	x	x	–	–
Oregon	x	x	x	–	x	x	x	x	–	–
Pennsylvania	x	x	x	–	x	x	–	x	x	–
Utah	x	x	x	–	x	x	x	x	x	x
Vermont	x	x	x	–	x	x	x	x	x	x
Virginia	x	x	x	–	x	x	–	x	x	–
Washington	x	x	x	–	x	x	x	x	x	x
West Virginia	x	x	x	–	x	x	x	x	x	–
Wyoming	x	x	x	x	–	–	–	x	x	–

SOURCE: Distilled Spirits Council of the United States, ***Summary of State Laws and Regulations Relating to Distilled Spirits,*** 1977; and ***Retail Outlets for the Sale of Distilled Spirits–1978***, 1979; National Alcoholic Beverage Control Association, Inc., ***Yearbook 11th Edition,*** 1978.

warehouse. The Commission is responsible for licensing and enforcement as well as sales. Sale of alcoholic beverages provides about 18 percent of total State revenues.

Ohio. The Department of Liquor Control operates about 290 retail liquor stores and is responsible for another 125 agency stores. The Commission is also responsible for licensing and enforcement.

Oregon. The Oregon Liquor Control Commission relies heavily on agency stores for retail alcoholic beverage sales. There are approximately 175 agency stores and 6 State stores. The Commission is responsible for licensing and enforcement.

Pennsylvania. The Pennsylvania Liquor Control Board is responsible for licensing, enforcement, and sales. Pennsylvania runs the largest State alcoholic beverage control operation in the United States, with approximately 725 State retail stores. The stores sell spirits and wine.

Utah. The Utah Liquor Control Commission handles sales, licensing, and enforcement. There are about 30 State stores and 74 agency stores which sell spirits, wine, and beer.

Vermont. The Department of Liquor Control is responsible for spirit, wine, and beer sales, as well as licensing and enforcement. Both State-operated stores and agency stores are used.

Virginia. The Virginia Alcoholic Beverage Control Commission is responsible for sales, licensing, and enforcement. About 260 State stores sell spirits, or wine and spirits. Wine and beer are also sold through private distributors.

Washington. The Washington Liquor Control Board oversees alcoholic beverage sales, licensing, and enforcement. At one time it operated its own bottling plant. Today, it operates 6 warehouses and about 140 retail stores, and monitors the operation of another 180 agency outlets. These outlets are managed by State employees—1 per outlet—who share in the profit from their sales. Beer, wine, and spirits are sold in State and agency stores.

Wyoming. The Wyoming Liquor Commission administers licensing, enforcement, and wholesale sales. Private vendors handle retail sales.

In addition to these 17 States, four States permit or require local government sales. North Carolina requires local government sales if alcohol beverages are sold for use off-premise. Local governments operate about 225 county stores and 120 city stores in the State.

Maryland, Minnesota, and South Dakota permit local option. Minnesota has a combination of private and municipal liquor stores. As of October 1978, there were 567 private and 113 municipal stores. South Dakota also permits local jurisdictions to operate their own stores.

Research and statistics

Little research or even descriptive writing has been done on alcoholic beverage store operations, either State or private. Academic research has focused almost entirely on tax issues, such as the incidence of the liquor tax and its impact on consumption. The principal references to State store productivity found during this investigation were in State annual reports.

Statistics on alcoholic beverage operations are collected under a variety of definitions. The *Standard Industrial Classification Manual* defines alcoholic beverage stores as:

> "Establishments primarily engaged in the retail sale of packaged alcoholic beverages such as ale, beer, wine and whiskey, for consumption off premises."[28]

The Bureau of the Census uses two slightly different definitions for alcoholic beverage operations. For financial transactions, Census defines a "liquor store" as an alcoholic beverage distribution facility "operated by 17 State governments and by some counties and small municipalities in a few States." "Liquor store" expenditures consist of purchases of "beverages for resale and provision and operation of liquor stores. Excludes expenditure for law enforcement and licensing activities, which are classed under general expenditures."[29]

For employment statistics, Census limits its definition to the "administration and operation of retail liquor stores operated by State governments."[30] Statistics collected under this heading apparently include wholesale as well as retail operations; many control States are unable to separate licensing and enforcement personnel from State store personnel. The Census employment statistics do not include any local government personnel.[31]

The Distilled Spirits Council of the United States (DISCUS) collects and publishes statistics by State on sales of spirits, wine and beer, gallons sold, revenue generated, specific revenue source, and number of retail outlets.[32] Many statistical series date from the end of Prohibition.

The National Alcoholic Beverage Control Association (NABCA), the association of State control officials, collected and published statistics on store operations in its annual *Yearbook* from 1973 and 1977. These includ-

[28] *Standard Industrial Classification Manual*, p. 272.
[29] *Government Finances*, p. 630.
[30] *Public Employment*, p. 462.
[31] Rough calculations suggest that local governments have about 2,500–3,000 employees in alcoholic beverages sales and operations.
[32] See *Public Revenues from Alcohol Beverages, Annual Statistical Review*, and *Retail Outlets for the Sale of Distilled Spirits*, all published annually by the Distilled Spirits Council of the United States.

ed the total number of personnel, enforcement and licensing facts, the number of State stores and store personnel, and revenue raised through State stores. NABCA ceased collecting and publishing these statistics in 1977.

NABCA still collects and summarizes each month statistics on the number of sales by case and by bottle size in control States. DISCUS uses these statistics to compute and publish the number of gallons sold.

In addition, each control State publishes an annual report on its operations, ranging from a few summary pages of financial information to detailed reports on all phases of the State's operations, including the number of employees, gallons and cases sold, and financial information on each store (table 26). Two States, Idaho and Michigan, present labor productivity statistics in their annual reports.

Outputs

This section discusses how State alcoholic beverage store outputs might be measured, and presents several illustrative indexes for wholesale and retail sales. As indicated earlier, many alcoholic beverage control authorities are responsible for enforcement and licensing as well as wholesale and retail sales. Enforcement and licensing, which account for less than 10 percent of beverage commission employees, would require a different set of output measures; they are not considered in this review.

This investigation focuses on sales of spirits and wines. Although several States sell beer, beer sales are such a small part of State sales—less than 0.01 percent—they can be safely ignored in any output calculations.

Sales of alcoholic beverages are commonly measured in one of five ways—dollars, customers, bottles, cases, or gallons. A brief discussion of each measure follows.

Dollar sales. Dollar sales figures measure the final organizational output, and are readily available, easily understood, and repetitive. Every State collects dollar sales data, and many publish them annually. Furthermore, the Census Bureau collects these statistics and has published them annually since 1960, for each State and in total.

The difficulty with using dollar sales as a measure of output is that it is not a good measure of the base-year unit labor required to move and sell the product. This is true for retail trade in general, where manufacturing costs are a large part of the retail cost. It is particularly true for alcoholic beverages, where taxes and mark-ups are a significant part of the sales price. One expert describes the situtation as follows:

> "Control States adopt a variety of postures with regard to earning revenues via taxes or mark-ups, depending on enabling legislation. States are interested in generating a certain amount of revenue per gallon, and can arrive at that amount through any mix of taxes and mark-ups. Some States depend relatively heavily on mark-ups; others on taxes. Since mark-ups usually can be changed administratively whereas tax changes require legislation, there is a tendency to adjust mark-ups rather than taxes. Thus, in concept, mark-ups do not serve the same purpose in control States as they do in the private sector."[33]

An additional problem, common to most revenue indexes, is that price and revenue usually reflect changes in input costs, including labor. If deflated revenue is used as the measure of output, it is necessary to adjust for change in input price.

Prices of alcoholic beverages vary markedly by product, but this variance seems unrelated to labor requirements. Pennsylvania, for example, reported that wine sales accounted for 40 percent of the gallons sold in 1972, but only 17 percent of the revenue generated. Furthermore, sales have shifted from higher priced to lower priced distilled spirits and from distilled spirits to wine over the past several years.[34]

In addition, dollar sales must be adjusted to reflect price changes, which vary according to whether wine or spirits are examined. Between 1967 and 1978, wine prices increased over 75 percent while spirit prices increased less than 25 percent.

In short, dollar sales are a poor measure of State alcoholic beverage operations for calculating labor productivity.

Customers. The main virtue of using the number of customers is that it is a physical measure. Also, it is easily understood and a repetitive unit.

It has two shortcomings, however. First, stores stock and sell bottles or cases; the number of customers is only a proxy for the number of bottles or cases sold. Unit labor requirements more closely correlate to bottles and cases than to the number of customers. Second, data to calculate this measure are not readily available, at least nationally. Only one State report examined during this investigation included data on the number of customers.

Bottles. Probably the best measure of labor effort in retail alcoholic beverage sales is the number of bottles sold. Most retail spirit and wine sales are made by the bottle, and shelves are replenished bottle by bottle. In addition, this measure is easily understood.

Several problems arise in using bottles as the measure of output. First, bottles range from miniatures to 4 liters, and different size bottles require different amounts of effort to stock and sell. The impact of these differences is not known but it could be substantial. Furthermore, the average bottle size has increased over the past several years. Also, bottle statistics are not published nationally, and only two States included the

[33] Personal communication from Steve L. Barsby, dated August 11, 1981.
[34] Ibid.

Table 26. Selected data contained in State alcoholic beverage control annual reports

State	Dollar sales	Gallons sold	Cases sold	Employment	Other
Alabama	x	x	x	x	–
Idaho	x	–	–	x	Bottles sold
Iowa	x	x	–	x	–
Maine	x	x	–	–	Bottles sold and number of customers
Michigan	x	x	x	x	Bottles sold and bottles sold per clerk
Mississippi	x	–	–	–	–
Montana	x	–	x	–	–
New Hampshire	x	–	–	–	–
Ohio	x	x	–	x	–
Oregon	x	–	–	–	–
Pennsylvania	x	–	–	–	–
Utah	x	x	–	–	–
Vermont	x	x	x	x	–
Virginia	x	x	x	x	–
Washington	x	x	x	x	–
West Virginia	x	–	x	–	–
Wyoming	x	–	–	–	–

statistics in their annual reports. However, these data are available in unpublished form nationally.

Cases. Another commonly used measure of output is the number of cases sold. It is also easily understood. For warehouse operations, it is probably better than bottles as a measure of output and unit labor requirements.

About half (8 of 17) of the State annual reports included statistics on the number of cases sold. No published national statistics were found but they are available in unpublished form.

Gallons. Probably the most common physical output measure is gallons. The trade associations calculate it annually and more than half (9 of 17) of the control States carry the statistic in their annual reports. Comparable data are available for a number of years. Although not as good a measure of unit labor requirements as bottles or cases, it is probably an adequate surrogate.

Preferred measure. Experts suggest that the best output measure for computing State alcoholic beverage retail productivity is the number of bottles sold. Probably the best measure of wholesale operations is the number of cases.

The most readily available physical statistic, however, is gallons sold; bottle and case statistics are compiled for spirits although they are not published. Bottles, cases, and gallons are highly correlated, and output trends constructed for these three measures would probably be similar, at least in the short run. Data are not generally separated between retail and wholesale movements.[35]

[35] Statistics for Michigan, which publishes data on all three measures, show a correlation of .91 between cases and bottles, .89 between bottles and gallons, and .99 between cases and gallons for 1978.

Gallonage indexes. Retail gallonage spirit sales are available by State and year from DISCUS; wine gallonage sales are available by State and year from the Wine Institute. Also, as noted, the majority of States publish statistics on gallons sold. These three sources of data have been used to prepare three illustrative output indexes—all States, the five largest States, and wholesale-only States (table 27).

Total State gallonage sales increased about 40 percent between 1967 and 1978, an average annual increase of 3.1 percent. Gallons sold rose every year, but the rate of increase dropped throughout the period: 4.3 percent from 1967 to 1970, 3.3 percent from 1971 to 1974, and 2.0 percent from 1975 to 1976.

Gallon sales of the five largest control States—Pennsylvania, Ohio, Virginia, Washington, and Alabama—increased about 30 percent, an average annual increase of 2.3 percent between 1967 and 1978. Like total sales, the rate of increase decreased throughout the period.

Gallons sold by the three wholesale-only States—Michigan, Mississippi, and Wyoming—increased 52 percent between 1967 and 1978, an annual increase of 3.7 percent.[36] Gallons sold increased every year but again the rate of increase decreased over the period.

Agent sales need to be removed from the retail sales statistics insofar as possible because they create difficulties in productivity calculation. Ten of the 17 control States use agents (non-State employees) to sell alcoholic beverages.

The procedure used to remove agent sales was to calculate the ratio of dollar sales by agents to total dollar sales and to apply that ratio to total gallons sold. In 6 of the 10 States using agents, data were readily available for this computation. In four States—Idaho,

[36] Michigan is primarily a wholesale State; less than 1 percent of its gallonage sales are retail sales.

Table 27. Three gallonage indexes for alcoholic beverage control operations, 1967–78

(1977 = 100)

Year	All States	Five largest States	Wholesale-only States
1967	73.3	97.5	69.1
1968	76.3	82.8	71.8
1969	80.0	86.3	76.4
1970	82.9	87.8	80.9
1971	86.1	90.2	82.7
1972	89.9	93.2	89.5
1973	94.2	97.9	92.4
1974	94.6	97.2	93.9
1975	97.4	99.9	94.8
1976	98.5	99.4	97.7
1977	100.0	100.0	100.0
1978	103.4	102.4	105.0
Average annual percent change	3.1	2.3	3.7

SOURCE: State annual reports, unpublished data provided by individual control States, and published reports of Wine Institute and Distilled Spirits Council of the United States.

Montana, Utah, and West Virginia—agent sales data were not readily available for the period examined and the calculations could not be made. However, these four States accounted for only about 8 percent of total State sales; hence, including agent sales for these four States is unlikely to affect the output index significantly.

Labor inputs and employee costs

The number of employees, number of full-time-equivalent employees, and number of hours are the input measures suggested in the previous chapter to calculate State and local government labor productivity. The three sources of such data for alcoholic beverage control are: (1) The Bureau of the Census, (2) individual State authorities, and (3) the National Alcoholic Beverage Control Association (NABCA). Since NABCA no longer collects and publishes these data, as noted earlier, NABCA statistics are of use only in constructing historical time series.

The Census figures are collected annually as part of the survey of government employment. This survey's overall strengths and weaknesses were discussed earlier. However, the State alcoholic beverage control data have several specific weaknesses. First, agencies apparently report all their personnel, which usually include enforcement and licensing staff as well as store and warehouse staff. One State, as noted earlier, assigns drug control operations to its enforcement staff. To match employment with sales, enforcement and licensing personnel must be separated, which is not possible with Census information. Second, State liquor stores use part-time, intermittent, and seasonal employees extensively. Census statistics, collected each October, miss the peak holiday (November and December) sales and staffing period. If the ratio of October to holiday-period sales remains constant, the October statistics will be satisfactory for trend analysis. A set of ratios is needed to determine this.

The other principal source of employment data is the State alcoholic beverage agencies themselves. As noted earlier, all agencies publish annual reports; about half include statistics on the number of staff by function. Several include statistics on salaries, the number of supervisors, and part-time and full-time employment. However, none provides information on hours worked, although several provide statistics on full-time equivalency.

The primary problems in using State agency reports to calculate a labor index are inconsistency through time and incomplete information on coverage and methods of derivation. Individual State data series will appear in several annual reports, disappear for several years, and then reappear. Sometimes yearend figures are presented; other times full-time equivalency is included.

Employment indexes. Labor indexes were prepared for the total number of employees, total full-time-equivalent employees, and total hours paid. State and Census data were used to make the computations. In each case, State license and enforcement personnel have been removed from the figures.

The total number of employees, part time and full time, was taken from unpublished Census Bureau statistics and adjusted with State data when available and appropriate. For example, the 8-percent jump in the Census figure in 1973 was directly attributable to one State, Pennsylvania. This statistic was at odds with data provided directly by the State as part of this study, and the Census statistics were adjusted accordingly. Census employee counts have been available only since 1970. Statistics for 1967–69 were taken from State data or Census full-time-equivalent data when State statistics were unavailable.

The total number of full-time-equivalent employees was taken from published and unpublished State data, augmented when necessary by Census data.

The third set of data is for hours paid for State alcoholic beverage control employees.[37] These data were provided by the individual States or were calculated from information provided by the State (average hours worked) and the Bureau of the Census (full-time-equivalent employment). Pennsylvania, which employs about 30 percent of all State and alcoholic beverage personnel, provided statistics on hours paid. Ten States (about 40 percent of the employees) provided full-time equivalent data and the average hours paid per employee per year. The remaining six States (about 30 percent of the employees) were unable to provide the requested data so Census data and average workweek hours were used to estimate total paid hours.

[37] No State could supply a time series of actual hours worked or hours at work. Several States had limited recent data.

Table 28. Three employment indexes for alcoholic beverage control operations, 1967–78

(1977 = 100)

Year	Number of employees	Full-time-equivalent employment	Hours paid
1967	93.8	92.7	92.6
1968	96.5	94.9	94.8
1969	99.6	98.3	98.1
1970	100.3	102.0	101.9
1971	100.4	100.4	100.2
1972	100.5	101.6	101.4
1973	99.2	100.2	100.2
1974	98.7	99.6	99.5
1975	100.9	100.8	100.7
1976	101.4	100.9	100.9
1977	100.0	100.0	100.0
1978	100.3	98.5	98.5
Average annual percent change	.4	.4	.4

SOURCE: Number of employees—1967-69, State-provided data or statistics published by Bureau of the Census; 1970-78, Bureau of the Census computer printout. Full-time-equivalent employment—State and Census data. Hours paid—State data or computed from State-provided data augmented by Census data.

The total change and the average annual rate of change for the 1967–78 period were similar for the three indexes (table 28). The number of employees increased 6.5 percent, full-time-equivalent employment increased 5.8 percent, and hours paid increased 5.9 percent. The averge annual change was 0.4 percent for each index.[38]

Full-time-equivalent employment indexes were also calculated for the five largest States and the wholesale-only States for the 1967–78 period (table 29). The index for the five largest States—Pennsylvania, Ohio, Virginia, Washington, and Alabama—increased a total of about 5 percent, or 0.3 percent annually. The three wholesale-only States—Michigan, Mississippi, and Wyoming—decreased about 2 percent, or 0.8 percent annually.

Salaries and wages. The average annual increase in salaries and wages (excluding fringe benefits) was calculated for 1967–78. These statistics, which are collected and published by Census, are for October of each year. They show that during 1967–78 salaries and wages more than doubled, or increased 7.3 percent annually (table 30).

Table 29. Two full-time-equivalent employment indexes for alcoholic beverage control operations, 1967–78

(1977 = 100)

Year	Five largest States	Wholesale-only States
1967	92.3	106.4
1968	95.5	101.5
1969	99.3	106.0
1970	103.9	108.4
1971	102.7	107.2
1972	102.6	105.5
1973	99.7	105.5
1974	99.4	93.7
1975	100.5	94.7
1976	100.1	94.8
1977	100.0	100.0
1978	97.4	104.4
Average annual percent change	.3	−.8

SOURCE: Bureau of the Census and State data.

Table 30. October earnings for alcoholic beverage control personnel, 1967–78

Year	Dollars	Index (1977 = 100)
1967	$ 493	52.0
1968	510	53.7
1969	526	55.4
1970	590	62.2
1971	585	61.6
1972	642	67.7
1973	735	77.5
1974	788	83.0
1975	818	86.2
1976	895	94.3
1977	949	100.0
1978	1,031	108.6
Average annual percent change		7.3

SOURCE: Dollars—*Public Employment*, annual issues; index—computed.

Productivity indexes

This section presents three productivity indexes calculated from data presented and discussed in the preceding sections. All use gallons as the output measure and full-time-equivalent employment as the measure of labor input. Separate indexes are presented for the total, for the five largest States, and for the States which operate wholesale-only operations.

The results of these calculations show that labor productivity for total State alcoholic beverage control operations increased 33 percent between 1967 and 1978, or 2.7 percent annually (table 31). The rise was fairly constant throughout the period.

The figures for the five largest States generally parallel the statistics for all States, which is to be expected since they account for about 70 percent of all employment. From 1967 to 1978, large-State productivity increased 22 percent, or 2.0 percent annually.

Productivity in the three wholesale-only States —Michigan, Mississippi, and Wyoming—increased at a much more rapid rate than in the control States as a whole or in the large States. Labor productivity for the 1967–78 period increased 55 percent for full-time-equivalent employment, or 4.6 percent annually.

None of the three productivity indexes, including the wholesale-only index, grew as rapidly during this period as State employee earnings, which increased 7.3 percent

[38] A comparison was also made between data presented here and data without adjustments for enforcement and licensing personnel and obvious errors. Unadjusted data rose 0.2 percent a year compared with 0.4 percent presented here. The absolute numbers differed by about 8 percent.

Table 31. Three productivity indexes for alcoholic beverage control operations, 1967–78

(1977 = 100)

Year	Total	Five largest States	Wholesale-only States
1967	79.1	86.1	64.9
1968	80.4	86.7	70.7
1969	81.4	86.9	72.1
1970	81.3	84.5	74.6
1971	85.5	87.8	77.2
1972	88.5	90.8	84.8
1973	94.0	98.2	87.6
1974	95.0	97.8	100.2
1975	96.6	99.4	100.1
1976	97.6	99.3	103.1
1977	100.0	100.0	100.0
1978	105.0	105.1	100.6
Average annual percent change	2.7	2.0	4.6

SOURCE: Computed from data in tables 27, 28, and 29.

annually. The net result was an increase in unit salary and wage cost.

Conclusions and suggested research

Calculation of a national State alcoholic beverage store productivity index should be a straightforward operation. Although no national index exists today, several States calculate their own labor productivity. All States collect data that could be used as the base from which to build a national productivity measure.

The preferred output measure has not been discussed in the literature. Several State officials have suggested that the number of bottles is the preferred retail measure and the number of cases the preferred wholesale measure. The national data which are most readily available are the number of gallons sold, which is a good proxy for bottles and cases. Insofar as inputs are concerned, Census collects and publishes annually full-time-equivalent employment statistics which can be used to calculate labor trends.

Several illustrative productivity indexes were calculated from available data. In general, they track quite well and match intuitive judgment. The summary index, which uses gallons as the output and full-time-equivalent employment as the input, shows labor productivity increasing at an annual rate of 2.7 percent between 1967 and 1978. Gallons sold increased 3.1 percent annually while employment increased 0.4 percent annually.

Topics for further research have been noted and discussed. They include substituting bottles and cases for gallons as the measure of output; separating wholesale from retail operations; more accurately identifying and removing agent sales from the totals; further analyzing the impact of licensing and investigation on productivity; and including local government alcoholic beverage operations in the index.

Unemployment Insurance

The Unemployment Insurance Service (UIS) presents a very different set of productivity measurement issues from those encountered in electric utility operations or alcoholic beverage control sales. The UIS provides a service without a market price, one for which demand fluctuates greatly. It typifies State and local government income maintenance programs in that it covers every State and is jointly administered by the Federal and State governments.

Institutional considerations

Unemployment insurance was established by the Social Security Act of 1935. The intent of the act, insofar as unemployment insurance was concerned, was to provide financial security for the majority of the Nation's workers during times of temporary unemployment.

Coverage. About 97 percent of all workers are covered by unemployment insurance today. The only employees not covered are the self-employed, domestic employees earning less than $1,000 per quarter, and agricultural workers who work on farms with 10 or fewer employees which have a payroll of less than $20,000 per quarter.

The number of beneficiaries fluctuates substantially, depending on economic conditions. In mid-1980, about 4.2 million individuals were drawing unemployment insurance benefits.[39] In 1968, the figure was 1.1 million; in 1976, 3 million. In 1977, total paid unemployment insurance benefits were about $13 billion; in 1980, they were almost $19 billion.

Program description. UIS provides coverage through a series of programs. In 1981, these included the regular State, Federal, and veterans programs which provide up to 26 weeks of benefits. States with high unemployment provide another 13 weeks of benefits through the extended benefit program.

The individual States fund the regular State program. The Federal Government covers the cost of the regular Federal civilian and military programs. The extended benefit program is financed jointly (50–50) by the Federal and State governments. Each State sets its own level of benefits. Each State also sets the waiting period, if any, the qualifying wage, dependent allowances, and other requirements.

In addition to the regular unemployment insurance programs, several special programs provide assistance under unique situations, such as natural disasters, trade dislocations, and deregulation. These programs provide stipends, in addition to normal unemployment benefits,

[39] "Unemployment Insurance Claims" (Employment and Training Administration, July 10, 1980).

for relocation and retraining. They are funded by general Federal tax receipts.

UIS programs are born in response to economic and political conditions of the times. Between 1963 and 1980, 10 different UIS programs were in operation (table 32). Some, such as the regular State program, operated throughout the period. Others, such as the temporary compensation program, operated for only a brief time.

Size and scope. The size and the scope of the programs vary substantially. Some are broad-based and operate in every State. Others, such as the National Redwood Park program, are tailored to a small geographic area or clientele.

The importance of a program can vary considerably, depending on the time period examined (table 33). Trade readjustment allowance, for example, began as a small program in the mid-1970's but expanded rapidly in the latter part of the decade. In 1975, $38 million of benefits were paid; in 1980, $2.1 billion were paid. The program has since been cut substantially.

The regular State program is the backbone of the UIS. It normally accounts for 90–95 percent of all benefit expenditures, although it accounted for only 55 percent in 1976 when a number of temporary programs were in force.

Programs studied. This study focuses on the traditional UIS programs. These include the regular State program, the Federal employee program, the ex-serviceman program, extended benefits, temporary compensation, Federal supplemental benefits, and special unemployment assistance. Excluded from this study are special or nontraditional programs, including disaster unemployment assistance, trade readjustment allowance, and the National Redwood Park program, which each require a unique set of output measures. Also, the railroad unemployment insurance program, which is sometimes included in unemployment insurance statistics and discussions, is not included since it is not financed or administered by UIS or the State governments.

Table 32. Unemployment insurance programs, 1963–80

Program	Period
Regular State program	1935 to present
Unemployment compensation for Federal employees	1955 to present
Unemployment compensation for ex-servicemen	1958 to present
Extended benefits	1970 to present
Temporary compensation	1972–73
Disaster unemployment assistance	1972 to present
Trade readjustment allowance	1972 to present
Federal supplemental benefits	1975–78
Special unemployment assistance	1975–78
National Redwood Park	1978–84

SOURCE: *Unemployment Compensation: Final Report*, (National Commission on Unemployment Compensation, 1980).

Table 33. Unemployment insurance program benefits, selected years, 1965-80

(Millions)

Program	1965	1970	1975	1980
Total	$2,283	$4,158	$19,362	$18,790
Regular programs:				
State	2,166	3,847	13,239	14,486
Federal	50	76	158	129
Veterans	67	199	387	294
Extended benefits:				
State	–	34	2,492	1,697
Federal	–	1	44	14
Veterans	–	1	75	30
Federal supplemental benefits:				
State	–	–	2,133	–
Federal	–	–	59	–
Veterans	–	–	55	–
Special unemployment assistance	–	–	670	–
Trade readjustment allowance	–	–	38	2,138
Disaster unemployment assistance	–	–	3	2

SOURCE: Unpublished data from Unemployment Insurance Service, Sept. 24, 1981.

The regular UIS program has two primary activities: Making payments to unemployed workers, and collecting money from employers. Making payments to unemployed workers includes activities such as registration, establishment of eligibility, issuance of checks, and hearing appeals. Collection of funds from employers includes monitoring and auditing employers' contributions, auditing employers' books, and capturing money due from delinquent accounts.

Financing. UIS programs are financed through three sources—a Federal payroll tax, a State payroll tax, and general Federal revenue. The Federal payroll tax, which is set at 0.7 percent on the first $6,000 of annual wages paid to each employee, is levied on the employer. These funds are used to administer the program, finance extended benefits, and maintain a reserve from which States may borrow if their reserves are inadequate to pay beneficiaries.

A State payroll tax is also assessed against each employer. These assessments are used to pay regular benefits. Each State establishes the tax level and the base against which it is levied. Taxes currently range up to 7.5 percent on the first $6,000–$10,000 of annual wages paid to each employee.

The third source of financial support is general taxes. These are used to finance Federal and veterans unemployment insurance and special programs, such as

trade readjustment and disaster assistance.

Most UIS funds are used to pay beneficiaries. Administrative or operating expenditures account for only 5–10 percent of total expenditures, depending on the year. About 80 percent of the administrative funds are for wages, salaries, and fringe benefits.[40] The remaining 20 percent are for items such as mail, computer lease and purchase, and building rental and operation.

Definitions. "Unemployment insurance" is the term most commonly used when discussing the program. "Unemployment compensation" and "unemployment assistance" are also used, although in a strict technical sense the terms are quite different. The three terms are used interchangeably here.

Neither the Census of Governments nor the Standard Industrial Classification (SIC) system separately identifies the UIS program. Thus, it is impossible to rely on either of the two systems most often used to collect and categorize State and local government statistics. Alternative sources of data will be discussed later.

The Census of Governments includes the UIS program under the general category of Income Security. The SIC Manual assigns the program to Industry 9441, "Administration of Social, Manpower, and Income Maintenance Programs."[41] The program is lumped with equal employment opportunity offices, public welfare administration, and workers' compensation offices. The major group title is, "Administration of Human Resources Programs." Local employment service offices are assigned to Industry 7361, Employment Agencies, which are part of Business Services, Major Group 73.

Research and statistics

Surprisingly little formal research has been published on unemployment insurance operations in view of the size of the program and the massive amounts of data collected and published. Most published research has focused on actuarial issues, such as financial solvency, and program issues, such as the impact of benefit levels on the willingness to work.

The cost model. UIS has funded some research on administrative issues. Most notable is the development of a cost model to establish budget needs, allocate money to the States, undertake cost comparisons, and identify cost-effective procedures.

The cost model divides the UI process into six activities: Initial claims, weeks claimed, nonmonetary determinations, appeals, wage records, and tax functions (table 34). The labor required for each activity varies, sometimes significantly, by workload mix. For example, in 1981 an average of 53 minutes was required to process an initial State claim (UC). An initial Federal claim (UCFE) took twice as long, or 105 minutes. The overall weighted average was about 60 minutes since the majority of claims are State claims.

The time per unit also varies by State. One State processed its initial claims on the average in 38 minutes. Another State required 67 minutes.

UIS uses such statistics, updated annually, to set State UI budgets and allocate funds.

For the purposes of this study, cost-model dollar and time expenditures are grouped into three basic functions: Beneficiary payments, finance operations, and support (table 35). Beneficiary payments, which account for about 75 percent of the labor time input, include activities such as initial claims, weeks claimed, and appeals. Finance or tax functions account for about 17 percent. Support or overhead accounts for about 26 percent of the labor input.

Other studies. The cost-model work has spawned a number of internal UIS studies which have particular relevance for productivity computation.[42] Some of the more important findings include:

1. The time to process a claim varied significantly, depending on the workload mix. A veteran or Federal claim took significantly longer to process than did a regular intrastate claim.

2. Internal office procedures substantially influenced unit processing time.

3. Larger States required less unit labor.

4. The more heavily urbanized a State, the more efficient its UIS operations.

5. The greater the percent of employers (not employees) added to and subtracted from the rolls, the greater the unit labor requirements.

6. Unit labor requirements differed greatly from State to State for the same functions. For initial claims, unit labor requirements varied by 368 percent.

7. A number of procedural changes would improve UIS productivity, including more extensive use of computers and paying recipients biweekly.

Statistics. The Federal Government, as the primary funding and coordinating agency, requires dozens of

[40] *Unemployment Compensation: Final Report* (National Commission on Unemployment Compensation, 1980), p. 128.

[41] *Standard Industrial Classification Manual*, 1972, p. 340.

[42] "Development and Utilization of the Cost Model Management System in the Unemployment Insurance Program" (Unemployment Insurance Service, May 1979), pp. 40, 76–87; "Report on the Analysis of Initial Claims and Wage Record Activities by the Operational Improvement and Cost Equalization Project" (Unemployment Insurance Service, 1979), p. 4; and *Millions Can be Saved by Improving the Productivity of State and Local Governments Administering Federal Income Maintenance Assistance Programs* (General Accounting Office, June 5, 1981).

Table 34. Synopsis of unemployment insurance activities

Activity	Synopsis
Initial claims	The process whereby individuals file applications for unemployment insurance. Initial claim activities include completion and review of the application, monetary determinations, and monetary redeterminations. The number of initial claims directly reflects UIS coverage and the rate of unemployment. Between 1963 and 1979, the number of initial claims filed ranged from 10 million (1969) to 30 million (1975 and 1976).
Weeks claimed	The number of weeks for which unemployment insurance payment is requested by those filing claims. The tasks under this heading include certification of eligibility, periodic client interviews to verify job search, and the processing and paying of benefits (i.e., writing checks). The number of weeks claimed is somewhat larger than the weeks compensated (or checks written) since about 20 percent of the claims are disallowed. Between 1963 and 1979, the number of weeks claimed ranged from 55 million (1969) to 292 million (1976).
Nonmonetary determinations	Examinations, determinations, and redeterminations of whether an individual is eligible to draw benefits. Determinations result from a protest by an interested party, such as a former employer or employee, or from new information such as a new Federal or State statute or court ruling. Common reasons for determinations include refusal to accept an offer of work and nonavailability for work. There were about 10 million nonmonetary determinations and redeterminations in 1979.
Appeals	Processes that give the former employee or employer the right to challenge a claim ruling. All States have hearing officers or referees to hear appeals, investigate the circumstances, and hand down written decisions. In fiscal 1979, there were about one million appeals—lower, higher, intrastate, and interstate.
Wage records	Processes required to maintain and update employee earnings files. Computerized records are maintained by 38 States and the District of Columbia. Normally, UIS updates wage records quarterly. UIS measures the workload by the number of updated wage records.
Tax functions	All activities involved in collecting money from employers to support UIS beneficiary payments. Activities include new account registry and discovery, accounting, auditing, and delinquent account follow-up. The work in this area has grown steadily since 1963.

routine reports from the States and, in turn, prepares a number of summary reports. State governments, as operating agencies, collect statistics from their own offices and contributing employers, many of which they summarize, analyze, and publish.

The basis for most of these data is the State Employment Security Agency (SESA) accounting system. Over 40 SESA reports are prepared routinely in five general categories—time distribution, property, appropriation, general ledger, and activity expenses.[43] In addition to the accounting information and reports, there are about two dozen program reports and one dozen financial reports.[44]

Specific output and input statistics are discussed in the following two sections.

Outputs

Selection of the preferred UIS output measure is not as straightforward as it might first appear. No research on the question was uncovered during this investigation.

[43] "SESA Accounting System Accounting Manual—Report Utilization Guide" (Employment and Training Administration, October 1978).

[44] *Summary of Employment Security Statistical Reports–August 1977* (Employment and Training Administration, 1977).

The following discussion briefly reviews seven possible output measures:

Number of employees covered
Number of employers covered
Number of beneficiaries
Number of compensation weeks
Composite benefit/finance index
Composite program index
Composite functional index.

Number of employees covered. The number of employees covered is simply a count of the people who have earned wages in jobs covered by unemployment insurance. This type of measure is often used by the private insurance industry; their measure of output is the number of policies sold. The arguments for using the number of employees covered as the output measure for UIS include the following: (1) It is measurable, (2) it has been calculated for a number of years, (3) it is a physical measure, (4) it is easily understood, and (5) it is supported by good data.

The primary argument against using this measure is that it is not a measure of the final product of the UIS. There is apparently little correlation between the

Table 35. Distribution of time expended by Unemployment Insurance Service function, fiscal year 1979

Function	Percent
Total	100
Benefits	57
Initial claims	17
Weeks claimed	19
Nonmonetary	11
Appeals	8
Wage records	2
Finance	17
Support	26

SOURCE: Unpublished data from Unemployment Insurance Service.

number of persons covered and the resources required to operate the UIS.

Number of employers covered. The number of employers covered is simply a count of the businesses, firms, and organizations which have one or more individuals who are covered by unemployment insurance. It could be divided by size of firm, type of firm, or other characteristics. General Motors, New York City, and the State of California are examples of covered employers. Arguments for and against using the number of employers as the UIS output measure are essentially the same as those noted in the preceding discussion.

In the finance function of UIS, the number of employers and unit labor requirements should be closely related. This avenue will be explored further in a later section.

Number of beneficiaries. The number of beneficiaries is the number of individuals who draw unemployment benefits during a given period. The basic measure has several variations: The number of different *persons* (one person may draw unemployment benefits several times during a year); the number of different *times* a person is assisted during a year; and the number of claims. Claims and beneficiaries, though closely related, are not synonymous; individuals can file claims but do not become beneficiaries until the claim is approved and a check is written.

All these outputs are related to work performed, are measurable, repetitive, and easily understood. Also, data are available to calculate an index.

A criticism of this measure is its failure to take into account the length of time an individual draws unemployment insurance, and this time does vary. During periods of high unemployment, the average time increases as tasks associated with the maintenance of a person on unemployment compensation (check writing, recertifications, and appeals) increase. This measure of output does not consider these additional labor requirements.

Number of compensation weeks. A measure which takes into account the length of time unemployment insurance is drawn, as well as the number of people drawing insurance, is the number of compensation or beneficiary weeks. This measure is the number of people drawing unemployment insurance each week during a given period, such as a month or a year.

Variations of the number of compensation weeks which would produce time series that parallel the basic measure are: (1) Average weekly number of beneficiaries for a year, or the total divided by 52; and (2) the average weekly insured unemployed, which includes all persons reporting at least 1 week of unemployment during the reporting period. A person may report being unemployed but be refused unemployment insurance or drop out of the program before receiving a check.

The number of compensation weeks is sometimes suggested as the output measure for unemployment insurance. It is measurable, repetitive, accurate, comparable through time, and is not affected by different State unemployment insurance levels. Also, it is an easily understood, unitary measure, and data exist to calculate an output index for a number of years. The primary argument against this measure is that compensation is only part of UIS operations; the other part, financing the program, is not covered by this measure.

Despite its faults, the number of compensation weeks has been used to calculate an output index. These computations show that in 1963 UIS paid about 86 million weeks of compensation to the unemployed. The figure dropped to 49 million in 1969, jumped to 260 million in 1976, and declined to 109 million by 1979. The average annual change between 1963 and 1979 was 7.1 percent.

Benefit/finance index. A good case can be made for dividing UIS outputs into two distinct parts. One would focus on service to the unemployed, that is, those applying for and drawing benefits. The other would focus on finance operations.

Service to the unemployed is a function of the number applying for and drawing UI. One measure of beneficiary output is the number of compensation weeks paid, already discussed. A better measure would take into account the different unit labor requirements needed to process those applying for and those drawing UI. Separate indexes have been calculated for each. Between 1963 and 1979 the average annual percent change in compensation weeks was 7.1 percent, as already noted, and for initial claims, 4.6 percent.

Finance operations, the second part, have the objective of ensuring the integrity of employer tax payments. These operations are a function of the number of employers, not the number unemployed. If UIS benefits and operations were funded from general revenue, the tax collection function and the supporting State staff would not exist.

The output measure suggested for finance operations is the number of employers. It is tangible and straightforward, and accurate data exist to make the calculations. The measure is not subdivided by size and type of business, since base-year labor requirements are not readily available for such a division.

Finance output has increased fairly constantly since 1963. The average annual increase between 1963 and 1979 was 4.8 percent.

The three indexes that make up the benefit/finance index have been combined using annual labor weights. This index shows an average annual growth of 5.4 percent between 1963 and 1979.

Program index. An even better measure of UIS output would be one that maintained the separation between benefit and finance but took into account the differences in program unit labor requirements in the base year for initial claims, the area where unit labor requirements vary by program. As indicated earlier, in 1981, the time required to process the basic State initial claim was 53 minutes; the unemployed Federal worker, 105 minutes; and the unemployed veteran, 70 minutes.

An index weighted by program was calculated. Other than for the initial claim output, the index is the same as the benefit/finance index presented earlier. That is, the index has three outputs—initial claims weighted by program unit labor requirements, weeks compensated (unweighted), and tax (unweighted). These three output indexes are combined by using labor weights to arrive at a single output index. The average annual increase in the program index between 1963 and 1979 was 5.3 percent.

Function (activity) index. Another approach to measuring UIS output is to focus on activities or functions. The six basic functions were described at some length earlier in this paper. Separate indexes were calculated for each function, which have, in turn, been combined by labor weights to form a single index. The functions were not weighted by program.

The primary arguments in favor of using a functional index are its familiarity and the ready availability of the data. The data should be reasonably accurate and comparable through time. The primary argument against the functional index is that it measures functions and activities in several instances, not final outputs.

The functional index shows an average annual rate of change of 6.2 percent between 1963 and 1979.

Comparison of output indexes. Seven measures of UI output have been discussed in this section. Indexes have been calculated for four measures: Compensation weeks, functions (activities), benefit/finance, and program.

Comparison of trends for the four indexes for 1963–79 shows that the compensation week index grew most rapidly (7.1 percent per year), followed by the function index (6.2 percent), the benefit/finance index (5.4 percent), and the program index (5.3 percent) (table 36). In other words, there is very little difference between the program index and the benefit/finance index, and not a great deal of difference between these two and the function (activity) index. The compensation week index grew at a higher rate than the other three; because finance activities are not explicitly considered and no provision is made for separating intake and continuing payments, it is not considered further.

Table 36. Four output indexes for the Unemployment Insurance Service, fiscal years 1963–79

(1977 = 100)

Year	Compensation weeks	Function (activity)	Benefit/finance	Program
1963	45.3	48.1	53.2	54.3
1964	42.2	46.7	50.5	51.6
1965	35.5	42.6	46.6	47.5
1966	28.0	38.6	42.4	43.2
1967	27.4	38.8	43.7	44.5
1968	28.2	38.6	43.2	44.0
1969	26.0	37.8	42.0	42.7
1970	33.9	42.5	48.9	49.8
1971	58.0	57.5	62.3	63.0
1972	61.7	59.1	64.7	65.5
1973	46.7	56.9	60.2	60.9
1974	48.9	60.5	64.9	65.7
1975	102.0	90.5	105.6	106.2
1976	137.4	108.7	121.2	119.6
1977	100.0	100.0	100.0	100.0
1978	68.0	84.9	79.4	80.2
1979	57.8	80.6	76.1	77.4
Average annual percent change:				
1963–79	7.1	6.2	5.4	5.3
1966–78	13.3	9.7	8.8	8.6
1966–79	10.9	8.7	7.5	7.4
1969–79	10.3	9.4	7.7	7.6
1973–79	4.7	6.7	3.8	3.9

SOURCE: Computed from unpublished data provided by the Unemployment Insurance Service.

The rate of growth of the program, benefit/finance, and function indexes varies depending on the period examined. Rates of growth have been calculated for five different periods. They are:

1. 1963–79—the entire period,
2. 1966–78—the period covered by the productivity index presented later in this study,
3. 1966–79—three UIS cycles,
4. 1969–79—two UIS cycles, and
5. 1973–79—one UIS cycle.

Four points stand out in examining the rates of change in these different periods. First, the period can dramatically affect the rate of growth of the three indexes. In fact, the rate of change depends more on the

period chosen than the index chosen.

Second, there is very little difference between the rate of change of the benefit/finance and program indexes, regardless of the period.

Third, the benefit/finance and program indexes generally move in concert with the function index. The function index generally increases at a more rapid rate.

Fourth, the cyclical highs and lows generally fall in the same years for each of the three indexes.

To summarize, the benefit/finance, program, and function indexes move in much the same manner, and there is virtually no difference between the first two. The program index is preferable from the conceptual standpoint.

Output data. Although there is no lack of data for computing output indexes, several potential problems exist in using the data. First, because of the cyclical nature of UIS operations, the period covered by outputs must match that covered by inputs. The output information is for the calendar year or the fiscal year, or both, depending on the source. Because the labor information in this study is summarized by fiscal year, output information and indexes are by fiscal year.

A special problem with federally collected fiscal year data is how to handle the shift in the beginning of the fiscal year in 1976 from July 1 to October 1. The indexes presented here simply delete that period from both outputs and inputs.

Another potential problem is inconsistent coverage of the statistics. Some output series include only State programs, others include State and Federal UIS programs, and some include State, Federal UIS, and railroad unemployment insurance.

Third, most UI statistics, including those presented here, include the trust territories. An index of "State only" UIS output could be computed with some additional effort. The trust territory statistics have not been removed from the statistical series presented here since they account for only about 0.05 percent of UIS resources and are unlikely to have much effect on productivity calculations.

Quality of service. The issue of quality of UIS service is important, complex, and often discussed. The UIS has collected statistics on quality for decades and today collects statistics on 35 different quality variables, which it summarizes and reports annually.

The question for this study is: How does quality affect productivity measurement and, particularly, how does quality change affect productivity trends? To affect productivity trends, two conditions must exist: (1) The quality attribute must affect base-year unit labor weights and (2) quality must be changing. Some quality characteristics, such as courtesy and helpfulness of UIS staff, are important to UIS managers but probably do not affect unit labor requirements and thus do not directly concern this investigation. Other characteristics, such as the error rate, could affect unit labor requirements through time and thus need to be examined. Assessment of the impact of quality change on productivity trends requires two kinds of information—a time series on quality and the relationship between the quality characteristic and unit base-year labor requirements.

Since 1975, the UIS has measured quality in ten areas, and has established minimum standards (desired levels of achievement) for 9 of the 10 (table 37). Data are collected, tabulated, and published by State for 35 different measures. States conduct self-appraisals for two consecutive years. Every third year, staff from the Federal Government and other States conduct appraisals. With this information it is possible to trace (since fiscal 1977) how UIS quality is changing by State.[45]

This study examined trends for 7 of the 35 quality measures: Timeliness of higher and lower appeals, promptness of intrastate and interstate payments, promptness of status determinations, percent delinquent employers, and percent employers audited. Data on appeals are available since the 1930's; data on the remaining areas, since the mid-1970's.

These seven time series show the following trends: Two series—timeliness of high-level appeals and of intrastate payments—show little change; three series—timeliness of lower level appeals, promptness of intrastate payments, and promptness of status determinations—show quality improvement; and two series—percent deliquent employers and percent employers audited—show quality deterioration.

Although these statistics suggest no general shift in UIS quality, the data are too incomplete to draw hard and fast conclusions.

The four time series that include the 1974–75 recession do suggest that, during that period of increased workload and increased production, the quality of service may have dropped temporarily. Both the timeliness of appeals (lower and higher) and promptness of payments (intrastate and interstate) deteriorated during the recession. After the recession, quality returned to its previous level. These brief dips in quality evidently did not affect long-term productivity trends.

UIS has examined the relationship between quality and workload on several occasions but has been unable to associate shifts in quality with changes in unit labor requirements and productivity. This may be due to insufficient change in quality variables, insufficient data, inadequate analytic techniques, or simply the absence of such relationships. The impact on productivity of quality of UIS service remains an area for future discussion and analysis, particularly as additional time series data

[45] "Unemployment Insurance Quality Appraisal Results for FY 1981" (Employment and Training Administration, May 1981).

Table 37. Selected quality appraisal measures of the Unemployment Insurance Service

Area	Quality characteristic	Typical measure	Federal standard
Initial claims	Performance (interstate, intrastate)	Number of undetected issues per 100 cases	Yes
	Promptness (interstate, intrastate)	Percent payments within "x" days	Yes
Weeks claimed	Performance (interstate, intrastate)	Percent weeks claimed affected by undetected issues	Yes
Nonmonetary determinations	Performance	Percent acceptable errors	Yes
	Promptness	Percent issues resolved within "x" days	Yes
Combined wage claims	Promptness	Percent forms processed within "x" days	No
Appeals	Performance	Percent appeals scoring 80 or above	Yes
	Promptness	Percent discussions issued within "x" days	Yes
Status determinations	Performance	Percent acceptable cases	Yes
	Promptness	Percent determinations within 180 days	Yes
Employer accounts	Promptness	Percent of monies deposited within "x" days	Yes
Field audits	Penetration	Percent employers audited	Yes
Report delinquency	Promptness	Percent reports delinquent	Yes
Collections	Performance/promptness	Percent delinquent employers with payments within 150 days	Yes

SOURCE: Adapted from data in "Unemployment Insurance Quality Appraisal Results for FY 1980" (Employment and Training Administration, May 1980).

are collected and national indexes are calculated.

Indexes in this paper have not been adjusted to account for quality shifts. However, future adjustments may be needed, particularly in fraud identification and control, for which the UIS has created separate administrative units. Two quality measures—initial claims performance and weeks claimed performance—should reflect the increased emphasis that the UIS is giving to this area.

Labor inputs

The UIS program is extremely labor intensive. About 80 percent of all administrative funds go to pay employee salaries and benefits. All operating personnel are State employees; no local employees are involved. About 200 UIS Federal employees oversee and coordinate State activities, but they are not included in this study. In any case, they constitute less than 0.05 percent of all UIS employment.

Three labor measures are recommended for calculating State and local government labor productivity—all employees, all employee hours, and number of full-time-equivalent employees (see chapter III).

The only nationwide UIS employee statistic routinely collected is the number of positions—analogous to the number of full-time-equivalent employees. The Federal Government uses these statistics, which are available by activity (e.g., initial claims, appeals, and tax) by State, to budget for UIS programs, allocate funds to the States, and account for funds allocated. Statistics on hours worked are collected by State but not for the Nation. No counts are made of the total number of employees.

The employee figures used here are the number of UIS positions reported by State labor officials to the U.S. Department of Labor. The statistics relate to positions used, not positions budgeted. The trend computed from the number of State positions should approximate an hours trend if it were possible to compute that index. However, it probably would differ from the trend of the total number of employees since States use many intermittent employees.

Data on positions are available by State, by function, and for the total UIS since 1963. They show that the total number of positions increased from about 35,000 in 1963 to 45,000 in 1979, or 27 percent (table 38). The numbers fluctuate considerably, ranging from 26,567 in 1967 to 57,321 in 1976. The average annual rate of change between 1963 and 1979 was 3.7 percent.

The next section of this study examines three time periods: 1963–79, 1966–78, and 1972–79. The average annual rate of growth of positions in these three periods was 3.7, 6.6, and 5.6 percent, respectively.

These statistics cover the basic unemployment insurance program, including the regular State program, Federal and veterans programs, extended benefits, supplemental benefits, special unemployment assistance, and temporary compensation. Positions for trade readjustment allowance and disaster unemployment assistance have been removed from the totals since these two programs are not included in the outputs. The number of positions dealing with disaster is extremely

Table 38. Positions in the State Unemployment Insurance Service, fiscal years 1963–79

Year	Number	Index (1977 = 100)
1963	35,146	63.7
1964	32,946	59.7
1965	30,921	56.1
1966	28,484	51.6
1967	26,567	48.2
1968	27,483	49.8
1969	27,065	49.1
1970	28,489	51.7
1971	32,720	59.3
1972	37,799	68.5
1973	35,137	63.7
1974	32,711	59.3
1975	44,528	80.7
1976	57,321	103.9
1977	55,152	100.0
1978	48,205	87.4
1979	44,546	80.8
Average annual percent change:		
1963–79	–	3.7
1966–78	–	6.6
1972–79	–	5.6

NOTE: Excludes disaster and trade readjustment personnel.

SOURCE: Unpublished data from Unemployment Insurance Service except for fiscal 1975, which was taken from the fiscal 1977 Federal Budget, Appendix, p. 517.

small, usually two or three per year, and would not make any marked difference in productivity calculations. However, the positions supporting trade readjustment could have a significant effect if included. In the mid-1970's, there were fewer than 100 such positions; in 1980, the figure had climbed to almost 2,000. With 1981 Federal legislation, the number has dropped dramatically.

Productivity indexes

This section presents national UIS productivity trends drawing on the output and input indexes from preceding sections. Productivity trends for six States are compared with the national index. (All average annual rates of change are based on the linear least squares trend of the logarithms of the index numbers.)

National index. The preferred measure of output, at least from the conceptual standpoint, is the program-based index. Between 1963 and 1979, program output increased at an average annual rate of 5.3 percent. During the same period, employee positions increased at an annual rate of 3.7 percent and output per employee, or productivity, increased at a rate of 1.5 percent (table 39).

The average annual rate of change is extremely sensitive to the period examined, as has been noted earlier. For example, productivity increased at an annual average rate of 7.2 percent between 1972 and 1976 but decreased at a rate of 0.7 percent between 1972 and 1979.

In selecting time periods, it is preferable to focus on complete cycles, that is, from trough to trough or peak to peak or midpoint to midpoint. The 1963–79 troughs were 1966, 1969, 1972, and 1978; the peaks were 1964, 1967, 1971, and 1975. The period examined here is 1966–78, which includes three cycles.

Between 1966 and 1978, outputs increased at an average annual rate of 8.6 percent; inputs increased at a rate of 6.6 percent; and output per employee at 1.9 percent.

Output per employee (productivity) increases rapidly during periods of increasing work for UIS (higher unemployment) and falls during periods of decreasing work (falling unemployment). For example, during the 1974–75 recession, output per employee increased 34 percent. In the subsequent two years it fell 26 percent. Apparently it is difficult to add staff as rapidly as the work increases. Conversely, management is reluctant to reduce staffing as rapidly as the work diminishes. This pattern is like that found in the private sector.

Two other points should be noted: For each of the three cycles, the relative increase in output was larger than the relative increase in employees—hence the increase in productivity. In addition, the longer the period examined, the more stable the index and the less important the individual cyclical fluctuations. As additional years are added to the index, the results should become more and more stable; however, results will be influenced by the magnitude of the fluctuations.

Table 39. Indexes of output, employee positions, and output per employee position, Unemployment Insurance Service, fiscal years 1963–79

(1977 = 100)

Year	Output	Employee positions	Output per employee position
1963	54.3	63.7	85.2
1964	51.6	59.7	86.4
1965	47.5	56.1	84.7
1966	43.2	51.6	83.7
1967	44.5	48.2	92.3
1968	44.0	49.8	88.4
1969	42.7	49.1	87.0
1970	49.8	51.7	96.3
1971	63.0	59.3	106.2
1972	65.5	68.5	95.6
1973	60.9	63.7	95.6
1974	65.7	59.3	110.8
1975	106.2	80.7	131.6
1976	119.6	103.9	115.1
1977	100.0	100.0	100.0
1978	80.2	87.4	91.8
1979	77.4	80.8	95.8
Average annual percent change:			
1963-79	5.3	3.7	1.5
1966-78	8.6	6.6	1.9

SOURCE: Tables 36 and 38.

State trends. Additional insights can be gleaned by examining individual State trends, which often move quite differently from national trends. Some differences are due to economic conditions and institutional situations, but many reflect management processes and procedures. Management processes probably account for the greatest differences in UIS productivity.

Productivity trends have been computed for six States selected to display a range of institutional arrangements and productivity trends—Alabama, Illinois, Kentucky, Pennsylvania, Texas, and Virginia. They are illustrative, not representative, of the States.

The State indexes differ from the national index in several respects. First, labor data to compute the program index were not readily available, so the benefit/finance measure, which parallels the program index quite closely, was used for output. Second, the base index year was shifted to 1972 for ease of comparison. Third, and most important, the time period covered was restricted to 1972–79. State data were not readily available before fiscal 1972.

The results of these computations show that the average annual change in output per employee ranged from 4.7 percent for Virginia to -3.1 percent for Texas, as follows:

	Annual percent change, 1972–79
Virginia	+4.7
Kentucky	+2.6
Illinois	+1.9
Alabama	+1.2
Pennsylvania	- 1.7
Texas	- 3.1

These trends generally support the conclusions drawn from the national UIS productivity data. First, those States with the most rapid growth in output have the highest rate of productivity growth. Second, the increase in employee input generally follows the increase in output. And third, the employee growth peak does not generally reach the peak in output. The exception in this case was Texas.

Comparison of State and national indexes. A national productivity index can be useful as a norm or benchmark for assessing State productivity progress. To make the comparison, it was necessary to recompute the national index presented earlier by the same procedures used to compute the six State indexes. That is, the new or truncated national index uses the shortened time period (1972–79), the benefit/finance output measure, and the 1972 base year.

The new national index does mirror the national index presented earlier: The average annual trend in output per employee is exactly the same for the two indexes (–0.7 percent) for the 1972–79 period even though individual years do not match precisely.

In four States—Virginia, Kentucky, Illinois, and Alabama—productivity grew faster than in the total UIS. In two States—Pennsylvania and Texas—productivity declined. Both outputs and employees increased in the total UIS and in each of the six States. Outputs increased 4.9 percent and employees 5.6 percent. Employee growth was smaller for the Nation than in any of the six States examined, and output was smaller than in five of the six States.

These statistics are presented for illustrative purposes only. The truncated national index is not representative of long-term trends. Also, it is doubtful that the State trends presented here are representative of long-term State trends.

Suggested research

A number of extensions to the work presented here are possible and desirable. Probably the most useful extension would be to compute trends for each State by methods similar to those presented for the six States. This would provide each State a means with which to compare its progress. The UIS routinely collects data which could be used to make such calculations.

Other potentially useful extensions would be the preparation of an index of the number of UIS employees and comparisons of the index of positions with an index of hours paid. Additional research is needed into quality factors and their possible impact on unit labor requirements, particularly as additional quality data become available. Also, it should be possible with little additional effort to separate trust territory statistics from State statistics. Finally, the UIS is a service which lends itself to the computation of absolute levels of productivity in contrast to the productivity trends examined here. The feasibility and implications of making such calculations should be addressed.

Chapter V. Thinking About the Unmeasured: Four Case Studies

This chapter examines the possibility of calculating productivity indexes for four services—solid waste collection and disposal, drinking water supply, mass transit, and the Employment Service. Each service presents a different set of issues and problems. Some are simple problems of data availability, some are conceptual problems, and some combine conceptual and data problems. In no case has a productivity index been calculated.

These four services were selected because of past conceptual and analytical work in the area. Each illustrates some of the problems encountered in measuring State and local government productivity, but should not be construed as being representative of all the problems that might be encountered.

The investigative approach for each service is similar to that used in the preceding chapter: Institutional considerations and past research are reviewed; possible measures of service output are examined, the preferred measure is selected, and data needed to compute the measure are reviewed; labor input issues and data are discussed; and recommendations for future research and data collection are presented.

Solid Waste Collection and Disposal

Sanitation service, particularly solid waste collection, is the government service which is used most often to illustrate productivity measurement issues. Its straightforward nature, tangible outputs, private sector counterparts, and past research make it a useful example for analysis and examination. Even though the analytic and institutional base of knowledge underlying the service is fairly large, no productivity index, or even time series data with which to build one, has been produced.

NOTE: This chapter has profited from the comments of Charles Ardolini, Gary Burdette, Richard Carnes, and Arthur Young of the Bureau of Labor Statistics: Robert Clark of the Environmental Protection Agency; George Craft of the American Water Works Association; John Greiner and Harry Hatry of The Urban Institute; Norman Paulhus of the Department of Transportation; and Allan Stevens of the Bureau of the Census.

Institutional considerations

Although the Federal Government and the States set standards, local government is responsible for day-to-day operations of solid waste collection and disposal. Most local governments are deeply involved as service providers or as regulators. Private firms and voluntary organizations are also active in the solid waste field. Few cities are served by a single provider. One investigation identified 12 different types of solid waste collection, ranging from total private to total public operations.[1] A combination of providers is the norm for most jurisdictions; for example, private service for commercial establishments, government service for private residences, and recycling by voluntary associations.

Local governments collect solid waste from about two-thirds of the Nation's residents. They serve the residents of most medium- and large-size cities.

Private firms serve the other one-third of the Nation's residents, but two-thirds of the Nation's cities; private companies serve most small cities.[2] According to a 1966 survey, private firms collected about 36 percent of the Nation's residential solid waste.[3]

Voluntary associations, such as the Boy Scouts and neighborhood recycling centers, are primarily concerned with resale items, such as newspapers, bottles, and aluminum cans. These organizations, which play a relatively minor role in this field, are not considered further.

Expenditures. This discussion focuses on local government, which spent $2.3 billion on solid waste collection and disposal operations or about 1 percent of all State and local government expenditures in 1977 (table 40). Approximately 133,000 local workers or 1 percent of all State and local government employees were in this field. For the average city, solid waste collection and disposal constitute about 9 percent of its budget.[4]

[1] E. S. Savas, *The Organization and Efficiency of Solid Waste Collection* (Lexington, Mass.: Lexington Books, 1977), p. 29.

[2] Ibid., pp. 63-64.

[3] R. J. Black and others, *1968 National Survey of Community Solid Waste Practices: An Interim Report* (Cincinnati: U.S. Bureau of Solid Waste Management, 1968).

[4] E. S. Savas and Barbara J. Stevens, "Solid Waste Collection," in George J. Washnis, ed., *Productivity Improvement Handbook* (New York: John Wiley, 1981), p. 592.

Solid waste services, as a group, are fairly labor intensive. Salaries and wages account for about 52 percent of all sanitation expenditures and 58 percent of current operating expenditures (table 40). Inclusion of fringe benefits would raise the latter figure to about 65 percent. A 1970 study found that labor-related costs accounted for 88 percent of all solid waste expenditures.[5] A 1975 study of Connecticut cities found that 73 percent of collection costs were for labor.[6] A more recent study estimated salaries, wages, and fringe benefits at 69 percent.[7]

Solid waste operations are commonly divided between collection and disposal. One 1968 study estimated that 85 percent of funding supported collection, 15 percent supported disposal. Another study, at about the same time, estimated the ratio at 80–20.[8] A breakdown of Detroit's solid waste expenditures in 1969 showed that 69 percent went for residential collection, 6 percent for street cleaning, 4 percent for snow removal, and 22 percent for disposal operations.

For most governments, solid waste collection is residential collection. Collection may also encompass street sweeping, dead animal pickup, abandoned vehicle removal, leaf collection, snow removal, and bulky waste pickup (e.g., stoves and refrigerators). Some governments also collect commercial and industrial waste. At one time most jurisdictions collected garbage and trash separately; today they are usually combined.

Solid waste disposal is primarily disposal at a sanitary landfill or a dump. A 1966 survey found that cities with a population of over 25,000 used landfill mostly (79 percent), incineration some of the time (20 percent), and composting infrequently (1 percent). A 1967 survey found that 92 percent of the solid waste was disposed of at landfills and 8 percent was burned at incinerators.[9] A 1974 survey found that landfills accounted for 85 percent of the disposal operations.[10] Resource recovery and recycling are much discussed but apparently play a small role in municipal disposal operations.

Definitions. A variety of terms are used to describe sanitary services, including solid waste, refuse, trash, rubbish, and garbage. Solid waste is used most often today. This report uses them interchangeably. Definitions which are used by others include the following:

Table 40. Local government solid waste collection and disposal expenditures, fiscal year 1977

Type of expenditure	Dollars (millions)
Total	$2,374
Current operation	2,126
Salaries and wages	1,239
Other	888
Capital outlay	247
Construction	129
Other	119

NOTE: Because of rounding, detail does not add to totals.

SOURCE: *1977 Census of Governments—Compendium of Government Finances* (Bureau of the Census, 1979), p. 30.

The Bureau of the Census uses the term "sanitation services," which it defines as follows:

> "Refuse collection and disposal, operation of sanitary landfills and street cleaning activities."[11]

Snow and ice removal are not included.

The Standard Industrial Classification Manual assigns solid waste systems to one of two codes, depending on whether disposal is part of the process. Code 4212 is used for collection without storage; code 4953 is for refuse with disposal. The precise definitions are the following:[12]

Code 4212 Local trucking without storage:

> "Establishments primarily engaged in furnishing trucking or transfer services without storage, in a single municipality, contiguous municipalities, or a municipality and its suburban areas."

Code 4953 Refuse systems:

> "Establishments primarily engaged in the collection and disposal of refuse by processing or destruction. Includes:
>
> Acid waste, collection and disposal
> Ashes, collection and disposal
> Dead animal disposal
> Dumps, operation of
> Garbage: collecting, destroying, and processing
> Incinerator operation
> Radioactive waste materials, disposal
> Refuse systems
> Rubbish collection and disposal
> Street refuse systems
> Waste materials, disposal at sea."

The American Public Works Association (APWA) defines solid waste as garbage, rubbish, ashes, bulky wastes, street refuse, dead animals, abandoned vehicles,

[5] National Center for Resource Recovery, *Municipal Solid Waste Collection* (Lexington, Mass.: Lexington Books, 1973), p. 42.

[6] Peter Kemper and John M. Quigley, *The Economics of Refuse Collection* (Cambridge, Mass.: Ballinger Publishing Company, 1976), p. 109.

[7] Columbia University Graduate School of Business, *Evaluating Residential Refuse Collection Costs: A Framework for Local Government* (Washington: Public Technology, Inc., 1978), p. 18.

[8] Black, *1968 National Survey.*

[9] Fred N. Rubel, *Incineration of Solid Wastes* (Park Ridge, N.J.: Noyes Data Corporation, 1974).

[10] Eileen Berenyi, "Solid Waste Disposal," In George J. Washnis, ed., *Productivity Improvement Handbook* (New York: John Wiley, 1981), p. 629.

[11] *1977 Census of Governments—Compendium of Public Employment* (Bureau of the Census, 1979), p. 461.

[12] *Standard Industrial Classification Manual* (Office of Management and Budget, 1972), pp. 224 and 238.

Table 41. Refuse materials by kind, composition, and source

Kind of refuse	Composition	Source
Garbage	Wastes from preparation, cooking, and serving of food; market wastes from handling, storage, and sale of produce	Households, restaurants, institutions, stores, markets
Rubbish	Combustible: Paper, cartons, boxes, barrels, wood, excelsior, tree branches, yard trimmings, wood furniture, bedding, dunnage	
	Noncombustible: Metal cans, metal furniture, dirt, glass, crockery, materials	
Ashes	Residue from fires used for cooking and heating and from on-site incineration	
Street refuse	Sweepings, dirt, leaves, catch basin dirt, contents of litter receptacles	Streets, sidewalks, alleys, vacant lots
Dead animals	Cats, dogs, horses, cows	
Abandoned vehicles	Unwanted cars and trucks left on public property	
Industrial wastes	Food processing wastes, boiler house cinders, lumber scraps, metal scraps, shavings	Factories, power plants
Demolition wastes	Lumber, pipes, brick masonry, and other construction materials from razed buildings and other structures	Demolition sites to be used for new buildings, renewal projects, expressways
Construction wastes	Scrap lumber, pipe, other construction materials	New construction, remodeling
Special wastes	Hazardous solids and liquids: Explosives, pathological wastes, radioactive materials	Households, hotels, hospitals, institutions, stores, industry
Sewage treatment	Solids from coarse screening and from grit chambers; septic tank sludge	Sewage treatment plants; septic tanks

SOURCE: American Public Works Association, *Municipal Refuse Disposal* (Chicago: Public Administration Service, 1970), p. 13.

construction and demolition wastes, industrial refuse, special wastes, animal and agricultural wastes, and sewage treatment residues (table 41.)

The following discussion includes all solid waste collection activities—whether identified as trash or garbage, residential or commercial, street sweeping, dead animal removal, or leaf pickup—and all government disposal operations. The crucial factor for this study is that local government personnel provide the service.

Research and conceptual issues

Considerable research has been done on sanitation services, particularly solid waste collection. Much of it focuses on technical issues such as crew size, truck routing, work rules, vector control, and equipment-labor mix. Also, a modest amount of research has been done on broad technical and economic issues such as cost functions, quality, effectiveness, and economies of scale.[13]

By contrast, little research has been done on the economics of disposal. Most disposal research has focused on environmental concerns, with a modest amount of analysis of recycling and resource recovery issues.

Research on collection falls into three general categories—technical, geographic, and policy. Many studies have dealt with technical issues such as routing procedures, truck size, crew size, aging of equipment, use of transfer stations, and crew incentive systems and their relationship to unit costs and productivity. These factors are not the concern of this study although they obviously affect labor productivity.

Geographic and community considerations, such as precipitation, topography, collection density, and composition of solid waste also affect collection productivity. For example, studies show that costs for cities which have hilly terrain average about 15 percent more than costs for cities which are relatively flat.[14] Management has little or no control over geographic factors, which are not considered further here.

[13] Savas, *Organization and Efficiency,* pp. 107-110.

[14] Johns Hopkins University, *Mathematical Modeling of Solid Waste Collection Policies,* Public Health Publication 2030 (U.S. Public Health Service, 1970); Ronald A. Perkins, "Satellite Vehicle Systems for Solid Waste Collection, Evaluation and Application" (Cincinnati: U.S. Environmental Protection Agency, 1971); and University of California, *An Analysis of Refuse Collection and Sanitary Landfill Disposal* (Berkeley: University of California, 1952).

Local government officials control policy issues, such as the level of service, which are subject to modification, vary from jurisdiction to jurisdiction, and affect unit labor requirements. The point and frequency of pickup are two important policy issues which affect output and need to be considered in calculating productivity. Shifts from curb or alley to backyard pickup can increase collection costs from 25 to 100 percent, according to studies (table 42). Shifting pickup of residential solid waste from once to twice a week will increase costs from 19 percent to 74 percent.

Economies of scale of operations can be important in constructing a productivity index. Evidence is conflicting for solid waste. Several studies have not found any economies of scale[15]; others have found some.[16] One of the most recent studies found increasing economies (decreasing unit costs) in cities with a population of under 20,000; cities with a population of 20,000-50,000 probably had decreasing costs, although the evidence was not conclusive; and cities with a population of more than 50,000 showed no evidence of changing unit cost.[17] A review of six different studies in this area concluded that economies occur in the smaller cities but not in medium-size or larger jurisdictions.[18]

There is general agreement that major economies of scale exist in landfill operations, although few studies have specifically addressed the issue. One found large decreases in unit costs until the 100,000 tons per year figure was reached (residential population of about 100,000).[19] Beyond this point, the costs continued to decrease but at a lesser rate.

The amount of economic research on solid waste has declined rapidly since the mid-1970's; today, little is being done outside environmental concerns. However, the analytic groundwork has been well laid for productivity calculations.

Several points stand out in the research:

1. The measures of output used most frequently are tons, cubic yards, and residents served.
2. The input measures most often used are labor hours or number of employees.
3. Almost all quantitative research has been cross sectional.
4. Calculation of a solid waste productivity index needs to take into account level-of-service issues, such as frequency of service and point of collection. These areas have experienced major shifts over the past two decades, and such shifts are likely to continue.

Table 42. Studies of effect of location and frequency of collection on solid waste collection costs

Investigator or author	Basis of comparison	Change in cost (percent)
Location: Shift from curb/alley to backdoor or backdoor to curb/alley		
Hirsch	Statistical	100
University of California	Statistical and time/motion study	65
Citizens Budget (NYC)	?	60
Rawn	?	26–48
Ralph Stone	Statistical	37
Flintoff/Millard	?	30–45
Clark/Gillean	Statistical	100
Kemper/Quigley	Statistical	40
Savas	Statistical	25–38
Frequency: Shift from once to twice weekly or twice to once weekly		
University of California	Statistical	67
Los Angeles County	?	50
Perkins (dollars)	Statistical and simulation	50
(hours)		74
Rogers/Bellenger	Time/motion	50
Kemper/Quigley	Statistical	50
Savas	Statistical	19–25

SOURCE: Compiled from references listed in bibliography.

Outputs

Productivity measures should reflect an organization's physical output. The measure most often used to compute solid waste output is tons collected and disposed. Other measures frequently used are cubic yards collected and disposed and residential or household units served. Private collectors often base their charges on the number of containers emptied. The relative strengths and weaknesses of the different measures are seldom discussed. The following examines these issues, quality considerations, and the data which could be used to calculate a national index.

Solid waste collection. Tonnage is the measure most often used to track and analyze solid waste collection output. This is a good measure of work performed, particularly in residential and commercial collection, and it is familiar to the industry. Also, it is a physical unit not affected by price level changes. Most large governments keep tonnage statistics.

Two reasons sometimes given for not using tonnage as the measure of output are: 1) It is not a particularly good measure of work performed for some of the secondary sanitary services such as street sweeping, snow removal, leaf collection, and dead animal pickup. These services, however, account for a small portion of sanitation resources in most cities. 2) Tonnage statistics

[15] Werner Z. Hirsch, "Cost Functions of an Urban Government Service: Refuse Collection," *Review of Economics and Statistics,* February 1965, pp. 87-92.

[16] Dennis Young, *How Shall We Collect the Garbage?* (Washington: The Urban Institute, 1972).

[17] Columbia University, *Evaluating Collection Costs,* p. 58.

[18] William F. Fox, *Size Economies in Local Government Services: A Review* (U.S. Department of Agriculture, 1980), p. 24.

[19] Thomas J. Sorg and H. Lanier Hickman, *Sanitary Landfill Facts* (U.S. Department of Health, Education, and Welfare, 1970).

are not collected by all governments, particularly smaller ones.

Cubic yards is often used to measure output in jurisdictions which do not weigh their refuse. Like tonnage, cubic yards is not affected by price change.

The major argument against using cubic yards as an output measure is its instability or variability. That is, most trash is compacted as it is collected, and the rates of compaction differ markedly from jurisdiction to jurisdiction, and even from truck to truck. Uncompacted household wastes usually weigh 200-250 pounds per cubic yard. Wastes compacted in a collection vehicle usually weigh 550-750 pounds per cubic yard, and landfill wastes are usually compacted at a density of 750-1,000 pounds per cubic yard.[20] Compaction rates directly affect resource requirements—fewer trips are made to the landfill and thus fewer labor hours and other resources are required. Furthermore, compaction rates have improved over time, which would bias output trends. The problem is further compounded by secondary services such as street sweeping and dead animal pickup. In short, solid waste collection experts feel that cubic yards is not a very good measure of output for productivity calculations.

The *number of residential units served* is used by many jurisdictions as a measure of output. It is a physical unit unaffected by price change, and data to support this measure are normally available and should be quite accurate. However, it is not a very good measure of the work performed since volume and weight differences are not reflected. Refuse generation varies considerably by household, and the underlying variables are not stable through time. That is, the number of individuals per residential unit has decreased while the amount of refuse generated per person has increased. Also, some sanitation departments serve commercial and industrial businesses as well as residential units. Nor can the measure be used to track secondary sanitation services such as street cleaning, leaf removal, and dead animal pickup.

Finally, the *number of containers emptied* is sometimes used as a measure of output, particularly by private collectors. However, it is not a very good measure for local government. Containers vary in size and weight, and average container size and weight have changed through time. Also, most jurisdictions lack statistics on the number of containers.

Level of service. Level-of-service factors, such as point of residential collection pickup and frequency of pickup, can markedly affect unit costs and unit labor requirements (table 42). If levels remain constant through time, the point becomes moot for productivity trends. If the levels are changing, they must be considered.

[20] John Reindi, "Interrelationships Within the Solid Wastes System" *Solid Waste Management,* April 1977, p. 23.

Evidence is skimpy on the level and rate of change of solid waste collection. Cross-sectional studies conducted over the past two decades suggest that the frequency of service has remained fairly stable but pickup has shifted from yard to alley or street. Calculations of productivity trends need to take such shifts into consideration.

Two ways to handle a shift from backyard to curbside collection are: 1) To include total resource inputs, not just those provided by government. The time residents take in setting out the solid waste and carrying back the cans would need to be included in the computations. 2) To differentiate the services, in this example backyard and curbside pickup, by using labor weights or by partitioning the data. This approach is recommended here.

Quality factors. Quality factors, such as missed collections, spillage, collector noise, and damage to residential property, are sometimes considered in productivity discussions. As noted earlier, this study includes only attributes which affect unit labor requirements. Since solid waste collection quality factors probably would have little impact, no adjustment is suggested here.

Secondary services. In addition to traditional residential service, some sanitation departments remove abandoned automobiles, empty city park refuse cans, pick up dead animals, collect leaves, and sweep streets. To measure output, these services may be handled in several ways.

One approach is to remove secondary service outputs and inputs from productivity calculations. That is, the tons of refuse from parks and tons of sweepings from streets would not be included in outputs, and individuals who performed these services would not be included in inputs. However, data are rarely available to make such calculations.

Another way to handle secondary services is simply to include them as part of the primary service. That is, no distinction would be made between tons collected from the park, on the street, or from residential units, and no distinction would be made in labor requirements. The rationale behind this approach is that most secondary services account for only a small proportion of sanitation department resources and are unlikely to affect overall productivity irrespective of how they are handled. The argument against this approach is that some secondary services, such as street cleaning, are important in some cities and their productivity may change at a different rate from that of residential collection. Also, tonnage and cubic yards are not very good measures of many secondary service outputs.

The preferred approach in measuring secondary service productivity is to develop separate output and input measures for each service, and to combine them with proper weights to calculate the solid waste collection in-

dex. Examples of secondary services and suggested outputs are:

Abandoned cars	- number of cars towed
Dead animals	- number of carcasses collected
Leaves	- number of cubic yards removed
Refuse cans	- number of cans emptied
Street cleaning	- number of curb miles swept

The primary problem with this approach is data availability.

Finally, some jurisdictions use sanitation equipment and personnel for services normally assigned to other areas. An example is snow removal, often included as part of street operations. In computing a sanitation productivity index, these services, both outputs and inputs, should be removed from the calculations. If they constitute a small part of total sanitation resources, they can be ignored.

Solid waste disposal. The factors that are most often used to measure disposal outputs are weight (tonnage) and volume (cubic yards). The arguments advanced for and against these measures are essentially the same as those discussed earlier. The measure that is suggested for use is weight (tonnage). To quote one expert:

> "In many respects weight data are of limited value; after all, when we design a landfill we are concerned about volume, not weight. However, weight is an easier measurement to take since volume measures will depend upon how much the wastes have been compressed, and whether or not it is a dense material, such as foundry sand, or a very light material, such as waste foam rubber."[21]

Most solid waste is buried. Although precise figures are lacking, about 80 percent of municipal solid waste is disposed of in landfills. The remaining 20 percent goes to resource recovery operations such as composting, materials recovery, and energy recovery, or is dumped into the ocean. Because unit labor requirements vary by disposal process, and the mix between the various processes may be changing, separation of different processes is important in computing productivity trends.

Because disposal tonnage does not often equal collection tonnage, the two should be measured separately. In most communities, the private collector dumps at the community disposal site. In others, the sanitation department may dump at private sites or at sites operated by other governments. Regional disposal sites are quite common.

Recommended measures. Two sets of output measures are presented here, one an idealized set and one a minimally acceptable set. Both use tonnage as the basic recommended measure of output. The idealized set of measures is presented first. Tasks as well as measures are listed.

Collection
- Residential—tons collected (small container collection)
  - Once-a-week pickup
    - Backdoor
    - Curbside/alley
  - Two or more pickups per week
    - Backdoor
    - Curbside/alley
- Commercial and school—tons collected (large container pickup)
  - Once-a-week pickup
  - Two or more pickups per week
- Secondary services
  - Abandoned car removal—cars removed
  - Bulk collection—tons collected
  - Dead animal removal—carcasses removed
  - Leaf removal—cubic yards removed
  - Street cleaning—curb miles cleaned

Disposal
- Landfill—tons buried
- Resource recovery—tons recovered
- Other—tons disposed

Data are not always collected and maintained by local government in the detail needed to compute the idealized measures. Furthermore, for reasons discussed earlier, idealized measures may not yield a more accurate productivity index than a less comprehensive set of measures and data. Therefore, a set of minimum measures is presented below for which data should be readily available in most local governments. All services are included, but without the detailed product division presented in the idealized measures.

Collection
- Pickup—tons collected
  - Once-a-week pickup
    - Backdoor
    - Curbside/alley
  - Two or more pickups per week
    - Backdoor
    - Curbside/alley
- Secondary services—tons collected

Disposal
- Landfill—tons buried
- All other—tons disposed

For most jurisdictions, government collection tonnage and government disposal tonnage will differ because of the use of multiple collectors—private and nonprofit as well as government—and multiple disposal

[21] Reindi, "Interrelationships," p. 23.

site operators—private and government. Rarely does a government collect all the solid waste that is dumped at its disposal site. Some governments do not even operate disposal sites, and some that operate disposal sites do not collect any solid waste with their own employees. Because of the use of multiple suppliers, tonnage must be separated between collection and disposal. Also, statistics should indicate the point of pickup, frequency of collection, and type of secondary service.

Availability of data. As noted earlier, data needed to calculate a national index are not routinely collected. A number of special studies have collected cross-sectional data, some of which have focused on a small geographic area; others have sampled jurisdictions throughout the United States.

At least 11 surveys have been made of community solid waste collection practices since 1900 (table 43). The largest of these, at least in number of communities contacted, was the 1968 Public Health Service survey. This survey collected data from over 6,000 communities located in 38 States and covered about 46 percent of the U.S. population. Data were collected on many aspects of solid waste activities including total tonnage or cubic yards collected and disposed, number of abandoned automobiles removed, and type of disposal activity. Three States were asked to assess the quality of the information collected. They gave good marks to institutional information but poor marks to tonnage and yardage statistics.

Probably the most comprehensive solid waste collection survey was one in 1975 by Columbia University, which was a stratified random sample of over 1,300 jurisdictions. The sample was carefully chosen and the survey rigorously administered. Data were collected from each government on institutional arrangements; type of financing; contractual forms; outputs, including tons and cubic yards; and inputs, including costs, labor, and type of equipment.

Most of the surveys leave much to be desired. The response rates are poor, and definitions and cut-off levels are unclear.[22] None of the surveys, including the Columbia study, collected time series data.

While national time series data are lacking to compute a solid waste output index, most large and medium-size jurisdictions do collect and record tonnage data.[23] Some communities, particularly the smaller communities, do not weigh their solid waste, but many keep statistics on the estimated number of cubic yards or the number of trucks unloaded, statistics which can be used to estimate tonnage. Although the percentage of local governments that weigh solid waste is not known, the consensus among experts is that most large governments weight their waste, and hence that the major portion of local government waste is weighted.

[22] Savas, *Organization and Efficiency,* p. 36.

[23] Harry P. Hatry and Donald M. Fisk, *The Challenge of Productivity Diversity; Measuring Solid Waste Collection Productivity,* Part II (Washington: The Urban Institute, 1972), pp. 11-12.

Table 43. Community surveys of solid waste collection

Survey	Date	Number of communities responding	Response rate (percent)
Massachusetts Institute of Technology	1902	161	?
Municipal Index	1929	667	?
American Public Works Association (APWA)	1939	190	?
APWA	1955	908	38
APWA	1964	995	32
Public Health Service	1968	6,259	?
Ralph Stone	1969	234	?
Public Works	1973	1,630	31
APWA	1973	661	51
International City Management Association	1974	1,092	48
Columbia University	1975	1,377	100

SOURCE: E.S. Savas, *The Organization and Efficiency of Solid Waste Collection* (Lexington, Mass.: Lexington Books, 1977), p. 36.

Labor inputs

Three labor measuures are suggested for calculating local government labor productivity: Number of employees, number of full-time-equivalent employees, and employee hours. For sanitation, these data should be available by function and subfunction—collection, disposal, abandoned car removal, and so forth.

Only two sources of time series data exist on local government sanitation employees: (1) The Bureau of the Census and (2) the individual municipalities.

The Census Bureau is the only organization that routinely collects and publishes national time series data on sanitation employment (table 44). These data show 128,000 local government employees in 1980, of whom 119,000 worked full time and 9,000 part time. Full-time-equivalent employees numbered 121,000. The peak employment year was 1977.

A number of problems, in addition to those noted in chapter III, result from using Census data. First, the data are not separated by function or subfunction or between primary and secondary tasks. Labor data need to be divided at least between collection and disposal; separation by frequency of collection and point of pickup, and between landfill and other techniques of disposal, also would be helpful.

Nor are Census data available for hours worked, hours at work, or hours paid. Hours worked is important for solid waste collection because some governments permit employees to go home as soon as they have completed their assigned task. The task system enables many workers to receive pay for 8 hours but to work less time. If program operations remain constant through time, then the task system would have no effect on productivity trends—that is, the relationship between the time paid and the time worked would remain

Table 44. Local government sanitation employment, 1967-80
(Thousands)

Year	Total employment	Full-time-equivalent employment
1967	125	118
1968	125	118
1969	127	120
1970	133	125
1971	128	121
1972	125	120
1973	130	124
1974	130	124
1975	128	121
1976	127	121
1977	133	127
1978	131	124
1979	132	123
1980	128	121

SOURCE: *Public Employment*, annual issues (Bureau of the Census).

constant from year to year. Such information is not available.

Another problem with Census statistics is that they are collected only for October of each year. Seasonal help may be an important factor in sanitation services. The seasonal variance in labor employed is not known but one study estimated a 20-percent average variance in tonnage collected.[24] A variance of this magnitude would suggest the need for additional labor input during increased tonnage periods. If the October/seasonal proportion remains constant, the October statistics would be satisfactory for the determination of the trends. A set of October/seasonal statistics is needed to determine whether there is constancy.

The only other regular source of local government sanitation employment statistics is local government itself. Some sanitation agencies publish annual reports which include employment statistics, and most governments include employment statistics in their annual budgets, usually divided between collection and disposal and often between primary and secondary collection services.

Suggested research

Data collection is the next step in computing a sanitation productivity index. Two separate approaches are possible: 1) A census of all jurisdictions, and 2) a stratified, random sample which might include all large governments and a sample of medium-size and small governments. The latter approach would be less expensive and would still produce satisfactory information for a national index. It would not permit examination of small geographic areas (depending on the sample size). Also, a procedure would have to be developed to collect the data regularly if the index was to be kept current.

Analysis of productivity levels, as contrasted with trends, can provide an important additional dimension to productivity measurement. With a unitary measure of output, such as tons, computation of productivity levels should be possible, and would be helpful for individual government managers.

[24] National Center for Resource Recovery, *Municipal Solid Waste Collection*, p. 13.

Drinking Water Supply

Water supply, like solid waste collection and disposal, is a service with a tangible set of outputs and a well-defined set of inputs. The research community has examined this service in some depth and, unlike solid waste services, some time series data have been collected.

Institutional setting

Of the several hundred thousand public water systems in the United States,[25] about 60,000 are community systems which serve 25 or more year-round residents or which have 15 or more connections serving permanent residents.[26] Community water systems serve most of the American public, an estimated 192 million in 1976.[27]

Most water utilities (76 percent) serve fewer than 1,000 people (table 45). However, the large systems provide most of the drinking water in the United States. Eight percent of the systems serve about 80 percent of the population; at the other end of the scale, 80 percent of the systems serve 8 percent of the population.[28]

More systems are publicly owned than privately owned (56 percent vs. 44 percent). Publicly operated systems serve more than four-fifths of the population (84 percent vs. 16 percent).[29] Publicly owned systems tend to be located in large metropolitan areas; privately owned systems in rural areas. Public systems tend to provide more extensive water treatment than private systems, which often provide no treatment.

Water utilities operated by local governments in every State and the District of Columbia have over 120,000 employees. The average number of public employees per State is about 2,200. California leads the list with almost 15,000 employees and revenue of $766 million (fiscal 1977). Vermont is last with 139 employees and $6 million in revenue.

In fiscal 1977, government water utilities spent about $6.4 billion, or 2 percent of all State and local government expenditures.[30] Salaries and wages of water utility

[25] *Small System Water Treatment Symposium (U.S.* Environmental Protection Agency, September 1979), p. 2.

[26] The number of community water systems is open to debate. In 1975, the figure was estimated at 40,000; in 1976, at 35,000; in 1979 at 58,000; and in 1980 at 61,000. EPA staff suggest that the most recent figures may have some double counting.

[27] Temple, Barker, and Sloane, Inc., *Survey of Operating and Financial Characteristics of Community Water Systems* (U.S. Environmental Protection Agency, April 1977), p. II-4.

[28] Ibid.

[29] Ibid., p. II-5.

[30] *1977 Census of Goverments—Compendium of Government Finances* (Bureau of the Census, 1979).

Table 45. Community water systems by size of population, 1979

Population	Number of systems	Percent of total
Total	58,379	100
Less than 100	21,468	37
100–999	22,907	39
1,000–4,999	9,221	16
5,000–9,999	1,915	3
10,000–100,000	2,599	4
More than 100,000	269	1

SOURCE: *Small System Water Treatment Symposium*, (U.S. Environmental Protection Agency, Sept. 1979), p. 1.

workers accounted for about 1 percent of all State and local government salary and wage expenditures; capital expenditures accounted for about 4.5 percent of all State and local government capital expenditures.

The primary factor input into water systems operated by State and local governments is capital, which accounts for 32 percent of all water supply expenditures (fiscal 1977). Salaries and wages (without fringe benefits) account for 22 percent (39 percent of current operating expenditures).[31] Interest on debt, materials and supplies, energy, and purchased water account for the remaining 46 percent (table 46).

Utility operations are frequently broken into four functions—acquisition, treatment, distribution, and overhead. Acquisition, normally a small part of the cost of water, includes all operations before treatment, such as storage and transport to the treatment facility. Treatment, as the word implies, includes any purification of water before distribution, a relatively small part of utility operations. Distribution includes all operations after treatment such as storage and transmission of water to the ultimate customer. Overhead includes all administrative and customer services required to manage a utility. Overhead and distribution account for the largest portion of utility expenditures.

Until 1980, Census public employment statistics defined water supply as "local government activities associated with the production or acquisition and distribution of water to the public."[32] In other words, employment statistics included only local government employees. The Census finance statistics, on the other hand, included State as well as local government expenditures.[33] Exclusion of State employees before 1980 is probably not important since they accounted for less than 0.05 percent of total State and local government salaries and wages for water supply workers (table 46). Only three States—Massachusetts, Nevada, and New Hampshire—operate utilities supplying drinking water.

[31] An EPA study of 12 large water utilities found that labor costs accounted for 42 percent of the utilities' operating cost. See James I. Gillean and others, *The Cost of Water Supply and Water Utility Management,* Contract Report 68-03-2071 (Cincinnati: (U.S. Environmental Protection Agency, 1977), p. 9.

[32] *Public Employment,* p. 462.

[33] *Government Finances,* p. 10.

The *Standard Industrial Classification Manual* assigns water supply to Industry Group 494 and Industry 4941. The definition presented in the *Manual* for 4941 is the following:

> "Establishments primarily engaged in distributing water for sale for domestic, commercial, and industrial use. Systems distributing water primarily for irrigation service are classified in Industry 4971."[34]

Agencies that administer water quality, including regulation, research, and planning, are assigned to code 9511.

Research

Considerable research has been done on drinking water supply. Although most of this research has dealt with the environment and public health, economic issues also have been investigated. Economic research helps answer questions important for productivity calculation, such as relationships among the factors of production, the relationship between costs of production and pricing, the role of size in production costs, the proper measure of output, and the effect of quality change on costs.

Several investigators have done research on production and cost functions, but the results have not been entirely satisfactory. In the 1960's, Ford and Warford attemped to derive a total cost function for the water supply industry of England and Wales.[35] Hines attempted a similar analysis with data from Wisconsin, and Goddard did likewise with data from Cincinnati.[36] Although the industry product was relatively homogeneous, Ford and Warford noted that production conditions were quite dissimilar. They concluded that either the differences in technology or sources swamped the independent variables or production costs had to be broken down further.

Studies of individual parts of the production process have explained somewhat more successfully cost variations among systems. Studies by Orlob and Lindorf, Koenig, and Hinomoto were all reasonably successful in explaining the differences in treatment costs.[37] Orlob and Lindorf studied cost of operation as a function of average daily treatment (in millions of gallons) for 32 treatment facilities. Koenig expanded the methodology of Orlob and Lindorf to examine specific treatment costs. His correlation coefficient for the average cost relationship was .77. Hinomoto, using Koenig's data,

[34] *Standard Industrial Classification Manual,* p. 238.

[35] J.L. Ford and J.J. Warford, "Cost Functions for the Water Industry," *Journal of Industrial Economics,* November 1969, pp. 53-63.

[36] Lawrence G. Hines, "The Long Run Cost Function of Water Production for Selected Wisconsin Communities" *Land Economics,* Vol. 45, February 1969, pp. 133-40; Haynes G. Goddard and others, *Planning Water Supply: Cost-Rate Differentials and Plumbing Permits* (Cincinnati: U.S. Environmental Protection Agency, 1978).

[37] See Goddard, *Planning Water Supply,* pp. 20-27, for a description of these studies.

Table 46. Finances of government-operated water utilities by type of government, fiscal year 1977
(Millions)

Government	Revenue	Expenditures					
		Total	Capital	Interest on debt	Current operations		
					Total	Salaries and wages	Other
Total	$4,995	$6,381	$2,047	$786	$3,547	$1,395	$2,152
States	6	21	3	6	13	8	5
Municipalities	3,823	4,306	1,261	475	2,570	1,085	1,485
Special districts	772	1,413	518	206	688	194	494
Townships	139	187	44	20	124	47	77
Counties	256	453	221	79	153	63	90

NOTE: Because of rounding, detail may not add to totals.

SOURCE: *Government Finances*, p.33.

estimated unit and total costs for a plant of a given capacity operating at a given rate. His estimating equations used seven resource inputs: Capital, chemicals, pumping energy, heating energy, labor, maintenance and repair, and miscellaneous. None of these three studies explicitly considered economies of scale which were evident in the derived equations.

A number of studies have been done on economies of scale in drinking water supply. A study by Clark of water treatment costs notes that the unit cost water treatment curve changes dramatically between the ranges of 0 - 2.5 million gallons per day (MGD), 2.5 - 20 MGD, and more than 20 MGD.[38] Another study by Clark found that in 42 municipal utilities large-system unit costs were about half those of small systems. Although statistics were not presented for the relationship between labor and output, he noted that they would parallel the decreasing cost relationship.[39]

An EPA study of 70 investor-owned utilities showed economies of scale as measured by unit costs and the number of employees for the small and medium-size, but not large systems.[40]

William Fox examined five studies of economies of scale in water utilities.[41] Each showed increasing economies. Two studies used the quantity of water sold as the measure of output. Another used the number of users. The other two studies used both quantity and customers/population.

The water supply industry is extremely capital intensive as measured by the investment per dollar of revenue. According to one study, water utilities require $6-10 of capital investment for each dollar of revenue. Comparable figures for airlines, railroads, telephone companies, and electric utilities are $1, $2, $3, and $4 respectively.[42]

Although there is no national index of water supply productivity, Clark has calculated labor efficiency measures for a sample of 12 utilities.[43] Using revenue gallons as the output measure, he found that over a 10-year period labor hours per million gallons decreased (an increase in labor efficiency) but not sufficiently to offset increasing labor costs. The net result was that dollar cost per million gallons increased.

Water quality has long been an important issue, and the amount of capital investment is partly a function of the treatment required to ensure a safe water supply. Operating cost, including labor input, is also a function of the amount of treatment required. The exact relationships depend on a number of factors such as the type and amount of pollutants in the influent, difficulty in removing the pollutants, alternative sources of supply, and available technologies to remove the pollutants. One analysis found that removing five different types of pollutants increased unit operating costs from 1 to 700 percent depending on the process used.[44] The importance of labor was not specifically considered. In another study, examination of an exchange process to remove nitrates from a utility's water supply showed that labor cost accounted for about half the increase in annual operating cost.[45] A study of 67 water utilities in the Cincinnati area showed that increasing the quality of water to a "good" level could substantially affect the costs of production for many utilities, particularly smaller ones.[46]

[38] Robert M. Clark, "Small Water Systems: Role of Technology," *Journal of the Environmental Engineering Division,* American Society of Civil Engineers, February 1980, pp. 19-35.

[39] Robert M. Clark, "The Safe Drinking Water Act: Its Implications for Planning," in David Holz and Scott Sebastian eds., *Municipal Water Systems: A Challenge for Urban Resource Management* (Bloomington: Indiana University Press, 1978), pp. 117-37.

[40] "Comparisons of Cost, Manpower Utilization, and Flow in Operation and Maintenance of Investor Owned Water Companies and Municipal Waste Water Systems" (U.S. Environmental Protection Agency, June 5, 1979), unpublished report.

[41] Fox, *Size Economies,* pp. 26-30.

[42] Temple, Barker, and Sloane, *Community Water Systems,* p. II-8.

[43] Robert M. Clark, "Labor Wage Rates, Productivity, and the Cost of Water Supply" *Journal of the American Water Works Association,* July 1979, pp. 364-68.

[44] Clark, "Small Water Systems," pp. 26-27.

[45] Robert M. Clark, "Water Supply Regionalization: A Critical Evaluation," *Journal of the Water Resources Planning and Management Division,* American Society of Civil Engineers, September 1979, p. 286.

[46] Robert M. Clark and Haynes G. Goddard, "Cost and Quality of Water Supply" *Journal of the American Water Works Association,* January 1977, pp. 13-15.

Several important conclusions for productivity measurement emerge from the research:

1. Production conditions are dissimilar.
2. There are marked economies of scale in the production process, particularly in treatment.
3. The industry is capital intensive, but labor plays an important role.
4. The function has a relatively homogeneous product, although water quality factors differentiate the product.

Outputs

Four common measures of water utility output, one monetary and three physical, are: Sales adjusted for price changes, number of customers, number of connections, and number of gallons. The strengths and weaknesses of each measure are briefly enumerated below.

Dollar sales. The primary virtue of dollar sales is its ready availability. It is the only output measure for which national data are available for a number of years (table 47). The Bureau of the Census collects and reports these data as part of its annual survey of government finances.

A primary problem in using dollar sales as a measure of output is adjusting for price level changes. The price deflator most often used is the joint water-sewerage deflator of the Consumer Price Index, which is not entirely satisfactory for adjusting drinking water sales. First, the CPI reflects changes in sewerage as well as water supply and it is not known whether water and sewerage price changes move at the same rate. Second, governments turn to price increases to discourage the use of water and to increase utility profits. Whether deflated revenue any longer adequately reflects changes in physical output is debatable. Third, no adjustments are made for quality changes for either water or sewerage, and both have improved greatly since the Safe Drinking Water Act was passed in 1974. In short, physical outputs are preferred for productivity calculations.

Table 47. Revenue of State and local government-owned water utilities, fiscal years 1967-80

(Millions)

Year	Unadjusted	Deflated[1]
1967	$2,187	$4,575
1968	2,313	4,617
1969	2,464	4,606
1970	2,687	4,665
1971	2,980	4,671
1972	3,165	4,781
1973	3,463	4,954
1974	3,712	5,016
1975	4,142	5,095
1976	4,463	4,948
1977	4,995	4,995
1978	5,512	4,952
1979	6,250	5,365
1980	6,766	5,426

[1] Water/sewerage index of the Consumer Price Index used to deflate revenue dollars; 1977 = base year.

SOURCE: *Statistical Abstract of the United States*, selected years (Bureau of the Census).

Population served. This measure simply counts the number of people served and assumes that the average quantity of water used per person remains constant. Research shows a good correlation between the water used and the number of people served. Population figures are often used to plan the amount of water a community will need. This statistic is kept or can readily be produced by most water utilities (number of residential connections times average household population). Most national surveys of water utilities collect these data.

There are two arguments against using this as a measure of output. First, most water utilities serve commercial and industrial users as well as residential customers. If the community has a large number of nonresidential users, or a few that consume a large quantity of water, population is not a particularly good measure of output. A recent study estimated that residential units made up 90 percent of the billings of U.S. water systems but accounted for only 60 percent of the water delivered. If the proportion of residential to nonresidential units remained constant through time, the measure would be satisfactory for trend determinations, but the ratio is not known. Considerable pressure has been exerted in recent years for industrial and commercial users to restrict their use of water through recycling.

The second argument against this measure of output is that sometimes population does not correlate well, particularly over the short run, with the quantity of water used. Variations in temperature and rainfall will affect water usage, and a population measure will not reflect these changes.

Connections. The number of connections is the number of residential, industrial, and commercial hookups. It is a surrogate measure for the water produced and delivered to users. This measure of output, which has many of the same strengths and weaknesses as the population measure, has one distinct advantage: Almost every water system should have accurate data readily available on the number of connections. This information is certainly more accurate than a population count, although population is probably a better estimator of water use.

Revenue gallons. This measure is the number of gallons purchased by consumers. Revenue gallons are similar but not identical to gallons treated, gallons pumped, or gallons produced, which are sometimes used as output measures. Revenue gallons do not include water pumped but lost through leaky water mains and open hydrants. Revenue water reflects actual sales.

Another reason for focusing on sales to final customers is interutility water sales. The magnitude of resales is not known, but focusing on sales to ultimate users minimizes the problem of double counting in a national index. This approach is similar to that used in electric utilities as discussed in the previous chapter.

The primary argument against using this measure is data availability. There are no comprehensive national statistics and, in some cases, no individual utility statistics on revenue gallons. Furthermore, some water systems do not collect statistics on the quantity of revenue water sold. New York City, for example, which does not meter most of its sales, has no record of the number of gallons purchased by its customers. Even those cities which have a policy of metering, such as Boston, New Orleans, and Washington, D.C., do not meter all sales.[47] However, most large and medium-size water systems do meter most sales.

The use of gallons as the output measure also implies that production input requirements (unit labor requirements) vary by gallon when, in fact, they do not. Water treatment has economies of scale, particularly for small and medium-size utilities. Most water systems set graduated rates based upon the amount of water used—the greater the amount of water purchased, the cheaper the unit price.

An analogous situation exists in electric power production and sales—the greater the amount of power used, the cheaper the unit price. Electric power productivity calculations often take into account decreasing production costs (unit labor requirements) by separating users into classes and weighting output accordingly.

Quality considerations. Drinking water quality concerns every water utility. Of the dozens of water quality attributes, some affect consumer utility, some affect production costs. This discussion deals with water pressure and with health.

Adequate water pressure is an important consideration in drinking water supply. Inadequate pressure can result in minor inconveniences, such as improperly working washing machines and dishwashers, or major effects, such as backsiphonage, contamination of the water supply, and reduced firefighting capability. A number of factors affect water pressure. Most important are the design and construction of the system. Operation and maintenance of the system are less important and less significant for labor productivity and are not considered further here.

The health issue is often raised in discussions of drinking water supply. Dozens of pollutants can affect water quality and community health, and their removal can increase production costs, as noted above.

[47] *Additional Federal Aid for Urban Water Distribution Systems Should Wait Until Needs are Clearly Established* (General Accounting Office, November 24, 1980), p. 30.

Most jurisdictions, particularly medium-and large-size ones, carefully monitor and control water quality. Most State governments, with the assistance of the Environmental Protection Agency, collect and tabulate statistics on how well drinking water quality standards are met. This information is available by system, by State, and nationally since 1978. EPA estimates that 13,600 water systems, private and public, do not meet one or more drinking water quality standards.[48] Small systems account for the majority of the problems.

The important issue insofar as productivity indexes are concerned is how quality has changed through time. Additional research is needed into the area, particularly the effect on unit labor requirements. As a first step, utilities should be divided into two groups: Those meeting and those not meeting EPA standards. Labor weights could be used to combine the indexes for a national index.

Recommended measure. The recommended output measure to compute a national water supply productivity index is revenue gallons, the measure used by most economic analysts and water utility managers. The output should be weighted by type of customer— residential, commercial, and industrial—since unit labor requirements vary by type. Unit labor requirements are the preferred weight, but price may be a satisfactory surrogate. Data and outputs should be separated between those which meet EPA standards and those which do not. If sample data are used, outputs should be weighted by size of utility—e.g., small (less than 2.5 million gallons per day), medium (2.5 - 20.0 million gallons per day), and large (more than 20 million gallons per day).

Availability of data. No comprehensive set of statistics is available to compute a revenue gallon output index for State and local government water utilities at this time. Some data may be obtained from several ad hoc surveys and two ongoing data collection activities.

EPA's Federal Regional Data System, the largest ongoing data collection system, collects data annually. This system, which was initiated in fiscal 1978, monitors compliance with Federal drinking water standards. However, data are also collected on operations, including gallonage, population served, number of meters, and type of customers served. Whether the gallonage data are revenue water, treated water, pumped water, or some other gallonage measure is not known. Most likely they are a combination of these. Possibly there is some double counting. As EPA works with the States to improve data and reporting, this system should be more useful in calculating water supply output. EPA does not collect input data, unfortunately.

[48] *States' Compliance Lacking in Meeting Safe Drinking Water Standards* (General Accounting Office, March 3,1982), p. 11.

Probably the most accurate data on community water supply operations are available from those EPA collects from 78 utilities for research purposes. The data are collected in the field, and the time period covered ranges from 6 to 15 years, depending on the utility. The data, which reflect fiscal years, include revenue gallons, labor hours, costs of operation, population served, and population density. These sample data, however, may not be representative of U.S. community drinking water systems. For example, all 78 utilities meet EPA quality standards. Data from the EPA 78-system series can be useful, but they are not sufficient for computing a productivity index.

EPA also collected data on operations from 1,000 utilities in 1976. This Community Water System data base includes statistics on population served, connections by type, sources of water, treatment, gallons delivered, and revenue for one year. Although the data are useful for cross-sectional analysis, they are of no use in computing a revenue gallons output index.

Revenue gallonage statistics are available from several of the American Water Works Association (AWWA) surveys. However, AWWA statistics cover only selected years, they are a sample of the large water supply utilities, and the number of utilities varies from sample to sample. Although the AWWA statistics can help in preparing an output index, they are not sufficient.

Labor inputs

Chapter III discussed three labor measures for calculating State and local government productivity: Number of employees, number of full-time-equivalent employees, and number of employee hours.

The four sources of data on local government water system employment are: (1) The Bureau of the Census, (2) the American Water Works Association, (3) EPA, and (4) the individual utilities.

The Bureau of the Census is the only organization that regularly collects and publishes a comprehensive set of time series data on employment in local water utilities. The data show that these utilities had about 134,000 employees in 1980, a 17-percent increase since 1967 (table 48). About 11 percent were part-time employees in 1980. Census statistics do not include State employees until 1980, which is probably not a limitation for calculating a national index because of the small number of State employees—fewer than 1,000. A more serious problem with the Census statistics is that only aggregates are collected and presented.

No information is collected on force account (construction) employees. The number of such workers, and the extent to which the number has changed during the past decade, is not known. This would be an important issue for measuring labor productivity trends if the ratio between construction and operating employees had changed substantially. Also, Census statistics are not divided by type or size of utility, which is useful in developing and applying unit labor weights.

Table 48. Local government water utility employment, 1967-80

(Thousands)

Year	Total employment	Full-time-equivalent employment
1967	115	108
1968	114	107
1969	116	108
1970	117	110
1971	116	108
1972	114	108
1973	121	113
1974	129	115
1975	129	115
1976	129	115
1977	131	118
1978	134	121
1979	132	120
1980	134	122

SOURCE: *Public Employment*, annual issues.

Finally, the assignment of government personnel to water supply operations when they work in other areas—e.g., sewerage, gas, and/or electric power—is a potential problem. The Bureau of the Census suggests that governments allocate personnel among functions using revenue figures. Statistics from larger electric power utilities, as discussed in the preceding chapter, suggest that this may not be a problem, particularly for trend calculations.

The only other time series on employment is EPA's 78-utility sample. It includes detailed statistics for each utility on the number of personnel and hours paid, and includes output as well as employment. The primary deficiency of the information, insofar as this study is concerned, is that it may not be representative of the universe. Also, data collection is not timely; some data are collected 4 or 5 years after the fact. However, this information, collected through field visits, is probably the most accurate available.

The American Water Works Association also periodically collects statistics on employment, wages, salaries, and fringe benefits. The problem with the AWWA statistics is their sporadic nature and inconsistent sample. Although these statistics may help in analyzing employment data, they are not sufficient to compute a labor index.

The only other sources of personnel statistics are the individual utilities.

Suggested research

An accurate, representative set of output and input data is the first requirement for calculating an index of productivity for State and local water supply. Analysis and research should also be conducted in other areas. Quality of service, particularly water quality and its effect on unit labor requirements, warrants further in-

vestigation. There is some research in the area but much remains to be done.

Another area for research is multifactor productivity. The Bureau of the Census estimates that salaries and wages (without fringe benefits) accounted for only 22 percent of State and local government water supply utility expenditures in fiscal 1977. Capital accounted for 32 percent, and interest on debt, materials and supplies, energy, and purchased water the remaining 46 percent. To better analyze shifts in productivity, all major factor inputs and their interrelationships need to be examined.

Analysis of levels of productivity, as opposed to trend analysis presented here, can provide an important additional dimension. With a unitary measure of output, such as revenue gallons, computation of productivity levels should be possible. Comparisons among jurisdictions that take into account differences in law, geography, topography, hydrology, weather, population size and density, location of water, and water quality will be more difficult to prepare.

Mass Transit

Although mass transit, like sanitation and drinking water services, has been the subject of considerable research and analysis, no national productivity index is currently calculated. Unlike the other two services, data are routinely collected on outputs and inputs, and computation of a productivity index should be relatively straightforward. The problem, as with so many State and local government services, is to know what measure of output to use.

Institutional setting

Interest in measuring State and local government transit productivity is a fairly recent phenomenon. Until World War II, most transit systems were privately owned. In 1950, only 26 systems or less than 2 percent of all transit systems in the United States were publicly owned. By 1980, 55 percent of the systems were public. More importantly, public systems carried the vast majority of passengers. The private systems were mostly small operations. State and local government systems delivered 94 percent of the industry's passenger trips, operated 93 percent of the vehicle miles, and owned or leased 90 percent of the vehicles.[49]

The shift from private to public systems has been particularly rapid since the mid-1960's. In 1968, 65 percent of the industry's passenger trips were public; in 1978, 93 percent. In 1968, 56 percent of all vehicle miles were public; in 1980, 93 percent. In 1968, 55 percent of all vehicles were publicly owned; in 1980, 90 percent. This shift from private to public systems continues, although obviously not at the same rate of speed.

Even today, institutional arrangements are mixed, varying from total private to total public, including:

1. Private ownership and operation, such as the South Carolina Electric and Gas Company, which operates the buses in Charleston, South Carolina.
2. Private ownership and operation with a government subsidy, such as the Southern Pacific commuter operation to and from San Francisco.
3. Joint ownership with private operation. An example of this type is the Massachusetts Bay Transportation Authority, which owns the commuter cars while the Boston and Maine Corporation, a private corporation, provides the tracks and service.
4. Public ownership with private operation, such as the commuter railroads in and around Chicago.
5. Public ownership, private management with government employees. An example is the ATE Management and Service Company of Cincinnati, which manages 49 municipal bus systems throughout the United States. Approximately 125 systems of this type operate in the United States today.
6. Public ownership and management, as in Washington, D.C.

The following discussion focuses on types (5) and (6), those in which government employees operate the system.

State and local government transit systems operate in 44 States. New York, with over 39,000 State and local government employees and almost $2 billion in expenditures (fiscal 1977), is the most deeply involved. The large systems are heavily concentrated in urban areas, particularly in the Northeast. The large systems dominate production; the 13 largest systems, for example, account for about 65 percent of all transit employment.

In fiscal 1977, State and local transit systems spent approximately $5.6 billion, or 1.7 percent of all State and local government expenditures.[50] Their expenditures for salaries and wages accounted for about 2 percent of all State and local salary and wage expenditures; their capital expenditures, for about 3.7 percent of State and local capital expenditures.

Passenger fares cover about one-third of all transit expenditures. Transfer payments and gasoline, sales, and property taxes support the other two-thirds. In fiscal 1977, the Federal Government provided $1.9 billion in transfer payments for mass transit, 24 percent of all State and local government expenditures in this area.

The primary factor input into transit operations is labor. Salaries and wages account for 43 percent of all expenditures (65 percent of current operating expen-

[49] American Public Transit Association, *Transit Fact Book—1981* (APTA, 1981), p, 43.

[50] *Government Finances,* pp. 29 and 33.

Table 49. Finances of government-operated mass transit systems by type of government, fiscal year 1977
(Millions)

Government	Revenue	Expenditures					
		Total	Capital	Interest on debt	Current operations		
					Total	Salaries and wages	Other
Total	$1,991	$5,598	$1,681	$250	$3,668	$2,391	$1,277
States	308	628	109	–	520	290	230
Municipalities	941	1,811	433	89	1,288	966	322
Special districts	703	3,052	1,124	157	1,770	1,074	696
Townships	1	–	–	–	–	–	–
Counties	38	107	15	2	89	51	38

Dash = zero or rounds to zero.

SOURCE: *Government Finances*, p. 33.

NOTE: Because of rounding, detail may not add to totals.

ditures) (table 49). Inclusion of fringe benefits would further increase this percentage. Capital expenditures account for 30 percent, and interest, fuel, materials, supplies, and the like account for the remaining 27 percent.

The Bureau of the Census reported 87,000 public transit employees in 1968. By 1978, the figure had increased to 125,000 and by 1980 to 172,000, or about 1 percent of all State and local government employees. Although some of this increase reflects redefinition of terms and new data collection procedures, employment growth has been real and rapid. The vast majority of the 172,000 State and local government employees work for local government (92 percent), and most are full-time employees (97 percent).[51]

Public transit can be divided into nine different types (modes): Bus, heavy rail such as subways, commuter rail, light rail such as streetcars, trolley coach, urban ferry boat, cable car, inclined plane, and paratransit. The first two modes account for about 95 percent of all passenger trips.

The *motor bus* was the most important mode in 1980 in the number of passenger trips (67 percent), operating revenue (60 percent), and vehicle miles (74 percent) (table 50). About 60,000 urban buses and vans were in use in the United States in 1980. These vehicles logged over 5.7 billion passenger trips and approximately 23 billion passenger miles. Over 85 percent of the fleet of urban buses were either owned or leased by government.

Heavy rail or subway is the next most important mode of public transit. In 1980, 11 heavy rail systems, all publicly owned and operated, logged 2.3 billion passenger trips for an estimated 10.6 billion passenger miles (table 51).

Eighteen *commuter railroads* logged about 285 million passenger trips and 5.9 billion passenger miles in 1980. All were government owned or received government subsidies. Amtrak, for example, provided service for Los Angeles, San Diego, and Washington, D.C., and the Baltimore and Ohio provided service to Baltimore and Washington, with State of Maryland subsidies. Since these were not operated by government employees, they are not included in this study.

Only nine *streetcar* systems were still operating in the United States in December 1980. These systems operated about 1,000 cars which traveled about 380 million passenger miles.

Five *trolley coaches* using 825 cars traveled almost 200 million passenger miles during 1980.

Sixteen *ferry boat* establishments which operated 68 boats traveled almost 340 billion passenger miles in 1980. Eight of the 16 systems were publicly owned and operated.

During 1980, one publicly owned and operated *cable car* system and five *inclined planes* were in operation. None are sufficiently important to warrant special investigation in national productivity calculations.

Paratransit includes services such as dial-a-ride, subscription bus service, airport limousines, and jitneys. They provide variable-route or demand response service. The latter type of service and costs of production are very different from the fixed route and time operations. Paratransit operations are not included in this discussion.

The focus here is on regularly scheduled transit operations. No distinction is made between "transit" and "mass transit."

The *Standard Industrial Classification Manual* defines transit (SIC 4111) as follows:[52]

> "Establishments primarily engaged in furnishing local and suburban mass passenger transportation over regular routes and on regular schedules. Such transportation may involve use of one or more modes of transportation. Establishments primarily engaged in furnishing passenger transportation by automobile or bus to, from or between airports or rail terminals over regular routes are included in this industry."

The Bureau of the Census and the American Public Transit Association use analogous definitions.[53]

[51] *Public Employment in 1980* (Bureau of the Census, 1981).

[52] *Standard Industrial Classification Manual*, p. 221.

[53] *Public Employment*, p. 462.

Table 50. Transit modes (private and public) ranked by passenger trips, revenue, and miles, 1980

(Percent)

Mode	Passenger trips	Operating revenue	Vehicle miles
Total	100	100	100
Motor bus	67	60	74
Heavy rail (subway)	27	23	17
Commuter rail	3	14	7
Light rail (streetcar)	1	1	1
Trolley coach	1	1	1
Ferry boat	1	1	–
Cable car	–	–	–
Inclined plane	–	–	–
Paratransit	–	–	–

Dash = not reported.

SOURCE: *Transit Fact Book—1981*, (American Public Transit Association), pp. 40–41.

Table 51. Heavy rail operations in the United States, 1980

Authority	Location
Chicago Transit Authority	Chicago
Greater Cleveland Regional Transit Authority	Cleveland
Massachusetts Bay Transportation Authority	Boston
Metropolitan Atlanta Rapid Transit Authority	Atlanta
Municipality of Metropolitan Seattle	Seattle
New York City Transit Authority	Brooklyn
Port Authority Trans-Hudson Corporation	New York
Port Authority Transit Corporation of Pennsylvania and New Jersey	Camden
San Francisco Bay Area Rapid Transit District	Oakland
Southeastern Pennsylvania Transportation Authority	Philadelphia
Washington Metropolitan Area Transit Authority	Washington

SOURCE: *Transit Fact Book—1981*, p. 16.

Research and conceptual issues

The measurement of transportation productivity has a long history. The Bureau of Labor Statistics has calculated private-sector indexes for railroads, intercity trucking, intercity buses, air transportation, and petroleum pipelines for a number of years.[54] These measure final output by revenue traffic units. Two output measures are used for railroads (SIC 401). One, revenue traffic units, the preferred measure, is a weighted composite of freight ton-miles and passenger miles. Freight ton-miles are adjusted for changes in commodity mix. Freight and passenger miles are combined using unit revenues. The second measure, car-mile productivity, is an aggregate of loaded and empty car miles for both freight and passenger service. For intercity trucking (SIC 213), the output measure is ton-miles for six classes of service weighted by the number of employees. As for railroads, outputs are adjusted for changes in commodity mix. The ouput measures for intercity buses (SIC 4111, 4131, 414) are passenger miles and deflated freight revenue. The air transport industry (SIC 4511) output is measured by revenue passenger miles, freight ton-miles, express ton-miles and mail ton-miles. They are combined using unit revenue weights. Lastly, petroleum pipeline (SIC 4612 and 4613) output reflects barrel miles (a barrel mile is one barrel of petroleum moved one mile).

A number of studies have been made of private sector transportation productivity. John W. Kendrick completed a detailed study of U.S. air, pipeline, waterway, intercity bus, intercity motor trucking, and local passenger transit productivity in 1966.[55] He developed indexes for outputs, inputs, and partial and total factor productivity from 1948 to 1964. The measure for passenger output was either the number of passengers or passenger miles. The measure for employee input was hours worked, estimated from data on the number of employees and average hours worked per employee.

Deakin and Seward completed a study of United Kingdom bus, railway, truck, boat, airport, and port productivity in 1969. Indexes were calculated for outputs, labor and capital inputs, and productivity change. Outputs were measured in either ton-miles or passenger miles. For each mode, outputs were separated by type of transport and weighted. The labor input measure was adjusted for age and sex to account for composition changes.[56]

Scheppach and Woehlcke published a study in 1975 which demonstrated how productivity measures might be used in transportation regulation. Three modes—rail, air, and trucking—were reviewed. The output measures were traditional ones. For rail passenger service they used the number of passengers, passenger miles, and passenger revuenue.[57]

The shift from private to public mass transit has been accompanied by a number of studies of public transit productivity, efficiency, effectiveness, and impact. One study by Anthony R. Tomazinis addressed performance measurement from the perspective of four different potential actors—operator, user, society, and government.[58] Dozens of measures were examined. Important

[54] See, for example, *Productivity Measures for Selected Industries, 1954-81,* Bulletin 2155 (Bureau of Labor Statistics, 1982).

[55] John W. Kendrick, "Productivity Trends in U.S. Transportation Industries," unpublished paper, 1966, as cited in Scheppach and Woehlcke, *Transportation Productivity* (Lexington, Mass.: Lexington Books, 1975).

[56] B.M. Deakin and T. Seward, *Productivity in Transportation* (Cambridge, England: Cambridge University Press, 1969).

[57] Raymond C. Scheppach, Jr., and L. Carl Woehlcke, *Transportation Productivity* (Lexington, Mass.: Lexington Books, 1975).

[58] Anthony R. Tomazinis, *Productivity, Efficiency, and Quality in Urban Transportation Systems* (Lexington, Mass.: D.C. Heath and Company, 1975).

conclusions were that performance should be divided between efficiency and effectiveness, and that productivity should be measured by efficiency. Efficiency is concerned with what is provided, and effectiveness is concerned with what is consumed. Services provided include vehicle hours, vehicle miles, and seat miles; services consumed include the number of passengers and passenger miles.

Gordon Fielding, among others, used the efficiency and effectiveness concept to measure transit system productivity.[59] Fielding defined efficiency as "doing things right" and effectiveness as "doing the right things." He examined a series of measures, collected data from a number of transit systems, and compared the systems. His efficiency measures were divided into three types— capital utilization, operating expense per produced output, and labor productivity. The labor productivity measure recommended by Fielding was revenue vehicle hours per employee.

A study of the performance of urban bus systems by Sinha and Jukins examined five labor productivity measures: Vehicle miles per employee, vehicle miles per driver, vehicle miles per driver hour, vehicle hours per employee, and vehicle hours per driver.[60] Vehicle miles per employee was their recommended measure.

Another study, of bus operations in different systems in 1960-74, found that the number of buses and employees remained relatively constant over the time period while patronage decreased. Almost every productivity index examined showed a decline.[61]

These are only a few of the many studies of public sector transit productivity, some of which are analytic, some conceptual, and some simply descriptive. Government officials have generally followed the recommendations of these studies and separated efficiency and effectiveness measurement.[62] Consequently, a real dichotomy has developed between private and public sector transit productivity measurement over the past decade. Private sector measurement has focused on final outputs, such as passenger miles, while public sector measurement has focused on capacity measures, such as vehicle hours or vehicle miles. Capacity measures are thought to capture, at least partially, social objectives reflected in numerous administrative and legal requirements.

[59] See, for example, Gordon J. Fielding, Roy E. Glauthier, and Charles A Love, *Development of Performance Indicators for Transit* (Irvine: University of Califorina, Institute of Transportation Studies, 1977); and G.J. Fielding and Roy E. Glauthier, *Distribution and Allocation of Transit Subsidies in California* (Irvine: University of California, September 1976).

[60] Kumares C. Sinha and David P. Jukins, *Definition and Measurement of Urban Transit Performance* (West Lafayette, Ind.: Purdue University, December 1978).

[61] Wells Research Company, *Trends in Bus Transit Operations, 1960-74* (U.S. Department of Transportation, 1977).

[62] *Transit System Productivity* (Washington: Urban Consortium, 1976, revised 1978); *Proceedings of the First National Conference on Transit Performance,* (Washington: Public Technology, Inc., 1978); and Eckart Bennewitz, "Mass Transit," in George J. Washnis, ed., *Productivity Improvement Handbook,* pp. 771-72.

Outputs

Physical quantities are the preferred measure of output for government productivity calculations. Dozens of such measures exist for public transit, and, as noted earlier, there is considerable debate over which measure best describes transit output. The measures most often recommended include:

1. Revenue vehicle hours
2. Vehicle miles
3. Seat miles
4. Number of passengers
5. Passenger miles
6. Passenger revenue.

Analysts of *private* sector transit productivity tend to focus on the last three measures in assessing outputs. Public sector transit analysts and managers use all measures but tend to focus on the first three for productivity calculations. Strengths and weaknesses of each of these measures are analyzed at length in the literature.[63] Each measure is briefly reviewed here.

Revenue vehicle hours. Revenue vehicle hours (RVH) is the single output measure that most transit managers prefer for productivity analysis. Revenue refers to the hours a vehicle is in service and capable of generating revenue rather than the amount of revenue actually generated. RVH does *not* include the hours spent traveling to and from storage facilities, other deadhead travel, and layover time. Revenue vehicle hours is a measure of transit availability for a community. A bus could travel a route for 8 hours without any passengers but still generate 8 revenue hours.

Arguments in favor of this measure are:

1. It is a good measure of the costs of production. A recent study showed that 54 percent of the variation in operating costs among transit systems was explained by this factor.[64]
2. It is a good surrogate measure for the service provided to a community. If the hours of service are extended, revenue vehicle hours increase. If service is cut, they decrease.
3. It is a measure over which managers have good control.
4. It encourages reduction of nonproductive use of vehicles such as deadhead and layover time.
5. Most transit systems have information to calculate this measure, although it has not been collected nationally until recently.

The principal argument against using revenue vehicle hour is that it is a measure of capacity rather than use. An increase in revenue vehicle hours does not necessarily lead to an increase in the number of passengers car-

[63] For example, see Fielding, *Performance Indicators.*

[64] Ibid., p. 12.

ried or revenue collected. It is not a measure of final output.

Vehicle miles. This is a measure of total distance traveled by revenue vehicles. Some vehicle mile measures include deadhead and revenue miles; others focus only on revenue vehicle miles. The arguments for and against using vehicle miles as an output measure are similar to those already discussed under revenue vehicle hours. In addition, revenue vehicle hours explained 54 percent of the variation in operating cost; vehicle miles explained only 28 percent.[65]

Seat miles. A measure closely related to vehicle miles is the number of seat miles, which are the total vehicle miles on passenger-carrying routes multiplied by the seating capacity. Seat miles is a better measure of transit capacity than vehicle miles, although it ignores standee capacity, which is important in many communities with heavy rush hour traffic. Like revenue vehicle hours, data should be readily available in most transit systems to calculate this measure. However, no national time series data are available.

Number of passengers. A measure of transit use, in contrast to capacity provided, is the number of passengers. The basic measure is a simple count of all passengers using a transit system. The measure is sometimes divided by type of passenger—paying, nonpaying, school child, reduced fare, elderly, and so forth. A special issue is how to count passenger transfers. Some systems count transfers as additional passengers; others do not.

The basic strength of the measure is its focus on usage, or final output. As Fielding noted, "for the typical transit system, increased patronage from one year to the next is much more significant than any other financial or operating statistic."[66] Another study noted that "service performance must ultimately be measured by the number of riders attracted."[67] Most transit systems keep statistics on the number of passengers. The American Public Transit Association has national statistics on total passengers, and revenue passengers for private and public systems.

Two basic arguments are advanced against using total passengers as the measure of transit output. First, it does not consider the numerous legal and administrative mandates such as assisting the handicapped, serving low-income riders, reducing air pollution, and conserving energy, a point often raised by transit officials and academicians.[68] This argument applies equally to all consumption-based measures of transit output. Second, this measure provides no information about the length of the ride.

Passenger miles. Passenger miles is probably the most widely used physical output measure of *private* sector passenger transportation productivity. This measure is better than a simple count of the number of passengers since it takes into account the length of the ride. Passenger miles are normally defined as the number of miles traveled by all paying passengers in a set time period. One passenger traveling one mile is one passenger mile. The private sector studies of BLS, Kendrick, Deakin and Seward, and Scheppach and Woehlcke cited earlier all use passenger miles in one form or another.

Three arguments are normally advanced against passenger miles as the measure of output:

1. As with the "number of passengers" measure, it does not reflect many mandated operations.
2. Studies show that passenger miles are not closely correlated with the costs of production or unit labor hour requirements.
3. Data to calculate passenger miles are not generally available, are difficult to collect, and are not very accurate when available. A primary problem is estimating how far passengers ride in fixed-fare systems. If the length of the average passenger trip remains constant through time, which is probably a reasonable assumption in the short run, then passenger miles and number of passengers would result in the same index.

Passenger revenue. This measure is the total revenue collected from passengers. Passenger revenue is sometimes known as "farebox revenue." This measure is available in every system that collects fares, and it is available nationally. For those systems that cover costs through fares, it reflects transit usage.

For several reasons, passenger revenue is not a particularly good measure of output for productivity measurement. First, passenger revenue makes up only about one-third of total national transit revenue (subsidies make up the difference). Second, it has been decreasing as a percent of total revenue for a number of years. Furthermore, nonpaying passengers are often an important user group. Every system has some, and some systems have many. A few systems charge no fares whatsoever. Also, farebox revenue is a function of administered fares, which may not relate directly to the cost of providing the service and to unit labor requirements.

Preferred measures. The line has been drawn over the past decade between measuring public and private service output. Private output is measured by the traditional "passenger mile." Public sector transit service

[65] Ibid.
[66] Ibid., p. 32.
[67] Massachusetts Bay Transportation Authority and Tidewater Transportation District Commission, *Bus Service Evaluation Procedures: A Review,* 1979, p. 23.
[68] John R. Meyer and Jose A. Gomez-Ibanez, *Measurement and Analysis of Productivity in Transportation Industries* (Cambridge, Mass.: Harvard University, 1975).

has focused on multiple measures. Transit managers and many researchers prefer capacity measures such as revenue vehicle hours for calculating productivity. The strengths and weaknesses of the two approaches are well documented.

Output and productivity trends vary depending on which approach is used.[69] Actually, the two approaches are complementary—one focuses on use, the other on availability. Both approaches should be used as part of future research in this area.

The preferred measures are passenger miles and revenue vehicle hours. The two measures should be calculated and weighted by transit mode. Nine modal divisions, noted earlier, are preferable but two divisions (bus and rapid rail) should be adequate for national output indexes.

Quality and level of service. Quality and level of service are important considerations in every transit operation. Travel time, reliability, comfort, and frequency of operation are all important dimensions of transit output. Chapter III suggested that such factors need to be explicitly considered and adjustments made whenever they affect base-year unit labor requirements. Unit labor requirements will be affected by three factors: (1) The relationship of quality and level of service to total labor requirements; (2) the unit output measure; and (3) the magnitude of the shifts.

Quality and level of service must be taken into account when a change markedly affects labor requirements. This is not to say that the attribute is unimportant when it does not affect labor requirements, only that it need not be considered in productivity calculations. For example, employee courtesy is an important quality attribute, to which the public and transit authorities alike are sensitive. To improve employee courtesy, transit managers sponsor "Driver of the Month" awards and courtesy training, and, when all else fails, disciplinary action. Important as these programs might be to a transit manager, they are relatively unimportant for unit labor requirements and need not be considered in transit productivity calculations.

The second factor to be considered is the output measure used to calculate productivity. The quality and level of service attribute can affect unit labor requirements for some measures but not others. For example, frequency of service plays a major role in unit labor requirements. Systems which provide 24-hour service usually have very different unit labor requirements from those which provide only rush hour service. Changing the level of service will likely have a major effect on unit labor requirements for output measures such as passenger miles, but will have little effect on the revenue vehicle hour measure.

The third point is that, for trend computation, adjustments are not needed as long as quality and level of service remain constant or approximately constant. These attributes need to be followed through time.

Six quality and level of service attributes are often cited in the literature. Table 52 presents examples of how they might change and their likely impact on total and unit labor requirements for two output measures.

Frequency of service seems to affect unit labor requirements the most. At the very least, it needs to be tracked through time. Three levels are suggested: (1) Rush hour only, (2) rush hour and limited service up to 12 hours per day, and (3) 12 hours or more of service per day.

Availability of data. Until recently, the only regular source of national transit statistics has been the American Public Transit Association (APTA). APTA has regularly collected a wealth of statistics from transit operators. It publishes the *Transit Fact Book* and the *Operating Statistics Report* annually. Some of the data series go back to the turn of the century.

The APTA statistics cover the entire transit field, private and public. They include outputs, as noted earlier, including revenue and passenger miles, and information is available on individual systems and for the total industry for the major transit modes.

The primary problem with the APTA statistics for calculating government output is the difficulty in separating private from public operations and the impossibility of assessing the error associated with the statistics. APTA statistics are provided by APTA members and reporting is strictly voluntary. Less than half the transit operators are APTA members and some of these do not report. The statistical bias associated with the data is not known.

The availability of transit data has improved greatly with the implementation of Project FARE (Uniform Financial Accounting and Reporting Elements), commonly known as Section 15.[70] Section 15 reports provide detailed statistics on all transit systems, private and public, that receive Federal financial support, which includes most systems in the United States. The initial reports were submitted in 1979, and annual reporting is required. Statistical reports are available on outputs, inputs, operations, community characteristics, personnel, finances, and so forth, by mode, by system, and by geographic area. Statistics are available on revenue vehicle hours and passenger miles, the two measures recommended in this report for further examination. The primary problem with Section 15 data is its newness.

In addition to these national data bases, every transit system collects and maintains output statistics, and many also publish them. Some States, including California and Michigan, collect data from individual

[69] Ibid., p. 24.

[70] "Urban Mass Transportation Industry Uniform System of Accounts and Records and Reporting System" (U.S. Department of Transportation, Urban Mass Transit Administration, 1977).

Table 52. Examples of relationship of quality and level of service to program change, labor requirements, and two output measures

Attribute	Illustrative program change	Impact on total labor requirements	Impact on unit labor requirements of two output measures	
			Revenue vehicle hours	Passenger miles
Employee courtesy (such as operator demeanor)	Increased employee training	Small	Small	Small
	Increased monitoring of complaints	Small	Small	Small
	Driver-of-the-month awards	Small	Small	Small
Safety (such as number of accidents)	Increased safety training	Small	Small	Small
	Increased maintenance	Small	Small	Small
	Increased monitoring and discipline	Small	Small	Small
Reliability (such as percent runs completed)	Increased maintenance	Small	Small	Small
	Increased monitoring of routes	Small	Small	Small
	Replace old equipment	Small	Small (probably reduce)	Small (probably reduce)
Travel time (such as average commuting time)	Cut number of stops	Small	Small	Small
	Add express buses/trains	Large	Small	Unknown
Comfort (such as adequacy of heat)	Increased repair of equipment	Small	Small	Small
Frequency of service (such as rush hour and non-rush hour)	Shift equipment	Small	Small	Unknown (probably small)
	Add equipment	Large	Unknown (probably small)	Unknown (probably large)
	Add service hours	Large	Small	Unknown (probably large)

operators and prepare regular transit operating reports.

Although no single source of statistics is available to calculate a mass transit output index, Section 15, APTA, and individual system data should provide sufficient data to build a national index, and Section 15 data should be adequate to update the index once calculated.

Labor inputs

Transit operations are labor intensive. Salaries and wages made up 43 percent of all transit expenditures in fiscal 1977 and 65 percent of current operating expenditures.[71] When fringe benefits are added, the figures rise substantially. One study calculated that salaries, wages, and benefits accounted for 82-87 percent of operating expenditures.[72] Another study found that they accounted for 73 percent of operating expenditures.[73] In 1980, according to the Bureau of the Census, 159,000 local and 13,000 State employees, a total of 172,000, worked in transit systems. The number of full-time-equivalent employees was 169,000.

Chapter III listed three labor measures to be used in calculating State and local government productivity—all employees, all employee hours, and the number of full-time-equivalent employees. The three sources of yearly time series data on the total number of public transit employees are the Bureau of the Census, the American Public Transit Association, and the U.S. Department of Transportation (Section 15 reports).

The Bureau of the Census reports total employment, full time and part time, and full-time-equivalent employment. Census statistics have several problems for calculating a labor index. First, Census included only local government employment until 1980, when State figures were added. Second, data are not separated by mode of transportation. Information by mode is necessary because of the apparent differences in productivity and the shift in employment among modes—e.g., fewer buses and more subways.

Like the Bureau of the Census, the American Public Transit Association has collected and published statistics on transit employment for years. The Census

[71] *Government Finances,* p. 33.

[72] U.S. Urban Mass Transit Administration, "Transit Operating Performance and the Impact of the Section 5 Program," November 1976, p. 23.

[73] American Public Transit Association, *Transit Fact Book—1981,* p. 48.

and APTA statistics vary dramatically, particularly in the early years. Several reasons account for the differences. First, APTA figures include both public and private employment; Census figures, only public employment. Second, APTA figures reflect estimated employment for six transit modes—bus, subway, trolley, streetcar, inclined plane, and cable car (commuter rail, ferry boat, and automated guideway are excluded). Census statistics, on the other hand, reflect employment in transit agencies as defined by the responding government. Third, APTA figures include Puerto Rico; Census does not. Neither Census nor APTA separates employment by mode.

The Section 15 reporting system provides some data not available from the other two systems. It provides information on the number of full-time-equivalent employees by mode and by system. It also separates employees by class (maintenance, transport, and general administration) and collects information on salaries, wages, and benefits by mode.

Section 15 reports have five problems for productivity calculations. First, the few years of data available are useful for benchmarking but are not sufficient to compute a labor index. Second, statistics are not collected on the number of employees or employee hours. However, an index of employee hours should parallel the full-time-equivalent index. Third, Section 15 reports do not include all public transit systems, but they do cover about 95 percent. Fourth, the reports include private as well as government-owned systems. Fifth, no distinction is made between government and private employees.

None of the three sources collects employee hours. Because of overtime, these could be important in calculating transit productivity. Split shifts and overtime are common among transit employees and the problems they create for transit operations and staffing are widely discussed. Although hourly figures are not available, full-time-equivalent employment statistics of Section 15 reports should be good surrogate measures.

So far as is known, none of the three sources includes employment on commuter rail systems. However, this information is reported to the Interstate Commerce Commission and also to the Department of Transportation, which plans to publish it in the future.

Table 53 summarizes the availability of employment data.

Suggested research

The next step should be to attempt to calculate a series of productivity indexes using the available summary data, augmented, where necessary, with individual system data. Initial calculations should focus on the two recommended measures, passenger miles and revenue vehicle hours, for bus and rapid rail. Level of service and quality need to be addressed. In addition to national trends, it should be possible to construct trends by geographic area, by size of system, and by mode.

Statistics on the level of productivity would provide important additional information, and with a unitary

Table 53. Availability of employment data by transit mode

Mode	Labor coverage		
	Number of employees (full time, part time, seasonal)	Full-time-equivalent	Hours
Multimode	Full time and part time available from Census for October each year. No statistics available on seasonal workers.	Available from Census for October each year. Section 15 provides information; see form 404.	Information not currently available. Some operator statistics collected by American Public Transit Association (APTA). No plans to collect data.
Bus	Information not currently available by mode.	Section 15 provides information; see form 404.	Some operator statistics collected by APTA. No plans to collect additional data.
Heavy rail	Information not currently available by mode.	Section 15 provides information; see form 404.	Operator statistics collected by APATA. No plans to collect additional data.
Commuter rail	Information reported to Interstate Commerce Commission (ICC) and Department of Transportation (DOT).	Can be computed from information reported to ICC and DOT.	Information reported to ICC and DOT.
Other: Light rail Trolley Ferry boat Cable car Inclined plane	Information not currently available by mode.	Section 15 provides information; see form 404.	Information not currently available. No plans to collect data.

output measure, such as revenue hours, it should be possible to compute productivity levels with little additional work. Meaningful comparisons among jurisdictions will be much more difficult because of differences in laws, topography, weather, population density, road networks, and congestion.

Data are available to permit examination of multifactor productivity. However, this will require considerable additional work, and probably is not warranted given the importance of labor.

The Employment Service

Federal and State governments have been concerned for a long time about measuring Employment Service (ES) productivity. Like sanitation, drinking water, and mass transit, considerable research has been conducted and much information has been collected. Unlike the other service areas, "productivity" has been routinely calculated for the ES. However, there is considerable unhappiness with this work and the resulting productivity measurements.

Institutional considerations

ES was first established during World War I to recruit defense workers.[74] The Service languished during the 1920's but was given new life by the Wagner-Peyser Act of 1933 and the Social Security Act of 1935. The Social Security Act, which established the unemployment insurance program, called for a work test as a condition for receiving unemployment payments, and ES was assigned responsibility for administering that test. ES was also deeply involved in operating referral service for work relief programs. In the 1940's and 1950's, ES first recruited and referred workers to the defense program, and later helped veterans and defense workers return to civilian employment. The emphasis of ES shifted in the 1960's to assisting the disadvantaged and administering registration required of welfare recipients. The 1970's saw a return to more traditional labor exchange operations, although the registration function (work tests) remained.

ES is a joint Federal-State operation; local government is not involved. The Federal Government is responsible for setting procedures, standards, and guidelines to operate the system. The States operate the service. In 1980, about 2,600 ES offices and 30,000 State employees worked on traditional ES activities authorized by the Wagner-Peyser Act. An additional 14,000 State employees worked on ES responsibilities under AFDC and food stamp programs, and 6,000 other State employees worked under other Federal labor contracts.[75] More recently, these numbers have been reduced as programs have been terminated.

[74] *Employment and Training Report of the President, 1977*, p. 71.
[75] Ibid., p. 73.

This study focuses on traditional services, which include:

1. Interviewing jobseekers
2. Identifying job openings
3. Matching job applications with openings and referring qualified applicants to employers
4. Counseling applicants
5. Testing applicants
6. Preparing and distributing labor market information.

An interview, the first step for a client entering the ES process, sheds light on a client's job skills, knowledge, and interests. In fiscal 1979, there were over 15.5 million new and renewal applications.

Identification of job openings or job development, the next step, is an employer-focused function. The primary ES activity is contacting employers to obtain job listings. These contacts consist of personal visits, telephone calls, mail, and promotional activities. Job listings are entered into computerized job banks daily. In fiscal 1979, more than 1.8 million employers were contacted and 9.0 million job openings were listed.

The next step in the process is job matching and referral to employers. In fiscal 1979, ES made 8.2 million referrals which resulted in 4.5 million placements. ES centers are installing computers throughout the country to assist in this process.

Counseling is available to those who need assistance in choosing a field of work, who wish to change their occupation, or who have difficulty in holding a job. In fiscal 1979, over 1 million applicants received job counseling.

Applicants who do not have a trade or occupation, or who wish to change occupations, may take general aptitude, specific aptitude, or general interest tests. ES, which tested about 800,000 applicants in fiscal 1979, has an active program to develop and revalidate tests.

Labor market information is needed to support many ES activities. Information is routinely developed on the number of job openings and the characteristics and number of workers seeking jobs. The national ES office develops and maintains aids such as the *Dictionary of Occupational Titles, Handbook of Occupational Keywords*, and special handbooks such as the *Health Careers Guidebook*.

A 1974 study estimated the ES staff time spent on each of four functions—intake, counseling, referral, and labor market information—as follows:[76]

[76] Neil S. Weiner, John H. Powel, and C. Michael Rahm, *The United States Employment Service: A Conceptual Model of Outputs, Values and Illustrative Estimations*, Vol. II, (Arlington: Boeing Computer Services, 1976), p. B-9-13.

Function	*Percent of staff time*
Total	100
Referral	61
Intake	25
Counseling	8
Labor market information	6

An analysis which followed a sample of applicants through the various activities in fiscal 1974 showed that, for every 100 applicants,

44 dropped out after intake;
4 dropped out after counseling/testing;
2 entered training;
21 dropped out after job referral; and
29 found jobs.[77]

In other words, about 29 percent of the referrals led to jobs. The stability of these proportions through time is not known but fiscal 1979 showed exactly the same placement rate.[78]

In addition to the traditional labor market activities, ES is responsible for enforcement of work test requirements and three compliance activities. Enforcement activities are the reqistration and monitoring of unemployment insurance and food stamp and welfare recipient activities. The three compliance activities are immigration service certification, farm worker and wage standards certification, and worker complaint referral.[79] Immigration certification requires that ES attest that immigrants do not take jobs which unemployed Americans could fill and that they are paid the prevailing wage for that job. ES local offices take the applications; regional offices determine employability. Less than 2 percent of the ES budget is allocated to this activity.

The ES also certifies that the employer provides adequate housing and pays prevailing local wages to foreign and migrant workers. These activities are now a "relatively insignificant proportion of the ES budget."[80]

The third activity—worker complaints—involves forwarding complaints that arise in the workplace, such as working conditions, pay, and discrimination, to other government agencies. This is a minor activity of ES.

Funding for the traditional ES program comes from a tax on employers (Federal Unemployment Tax Act—FUTA). Funding for nontraditional ES programs, such as compliance and enforcement, comes from general tax revenue.

The Department of Labor allocates funds to individual States to support ES program staff; administrative, supervisory, and technical (AS&T) staff; labor market information; special projects; and nonpersonnel services such as space, utilities, computers, and travel. In fiscal 1980, about $742 million went to support about 25,000 basic program staff; $44 million went to support about 2,400 individuals in the AS&T function; and about $127 million went for nonpersonnel services. Labor market information services received about $32 million from several sources; special projects, enforcement, and worker protection received $26 million.[81] Labor, the primary factor input into ES programs, consumes about 85 percent of the budget.[82]

For several years, ES has routinely calculated placements per staff year, a measure of productivity. Recently, these statistics have been included in the President's annual budget (table 54). The basis for these calculations is not known but it certainly varies from year to year. The figure for fiscal year 1978, for example, is 201, 238, or 265 depending on whether the figure is taken from the 1979, 1980, or 1981 budget.

ES uses two basic data systems to track its operations today: One collects program information; the other collects resource and cost accounting information. The Employment Security Automated Reporting System (ESARS) has collected basic program information since the early 1970's. The State Employment Security Agency (SESA) Accounting System has collected resource data since 1970. Both systems collect data from local ES offices. Both program and resource data have been available since the late 1930's but not in the depth of coverage that is available from the ESARS and SESA Accounting Systems.

The Bureau of the Census does not separately identify ES operations in its statistics. ES operations are included under the general heading of Employment Security, which includes all State labor activities.

The *SIC Manual* assigns ES operations to Industry 7361, Employment Agencies. This category includes:

> "Establishments primarily engaged in providing employment services except theatrical employment agencies (Industry 7922) and motion picture casting bureaus (Industry 7819). Establishments classified here may assist either employers or those seeking employment."[83]

State administrative offices apparently are assigned to Industry 9441, Administration of Social, Manpower, and Income Maintenance programs.

Most States and the Federal Government currently refer to local ES operations as the Job Service.

Research and conceptual issues

Considerable research has been done on ES operations and management, including productivity measurement. A recent study reviewed 27 different papers which

[77] Ibid., p. 32.
[78] *Report of the President, 1980,* p. 58.
[79] Weiner and others, *A Model of Outputs,* pp. 62-64.
[80] Ibid., p. 64.
[81] Charles K. Fairchild, *A Performance and Needs Based Methodology for Allocating Employment Service Grants,* (Cambridge, Mass.: Abt Associates, 1980), pp. 12-13.
[82] Ibid., p. 39.
[83] *Standard Industrial Classification Manual,* p. 304.

Table 54. Placements per staff year as shown in the President's budget, fiscal years 1974–82

Fiscal year measured	Fiscal year of President's budget					
	1977	1978	1979	1980	1981	1982
1974	225	–	–	–	–	–
1975	211	–	–	–	–	–
1976	208	217	–	–	–	–
1977	224	225	225	–	–	–
1978	–	–	238	265	201	–
1979	–	–	241	[1]229	[1]207	207
1980	–	–	–	[1]238	[1]190	[1]186
1981	–	–	–	–	[1]297	[1]177
1982	–	–	–	–	–	[1]212

[1] Estimate.

SOURCE: Appendix to President's budget, selected years.

examined and discussed ES productivity.[84] Most were published between 1975 and 1978. The authors assigned the 27 papers to one of four categories—organizational productivity, service category productivity, client effectiveness, and labor market effectiveness. In other words, two categories dealt with efficiency and two with effectiveness. Although this report focuses on efficiency (productivity), the papers dealing with effectiveness are briefly noted first.

Labor market effectiveness. Labor market effectiveness is defined as the impact of ES on the economy as a whole, such as its effect on the gross national product and the unemployment rate. Basil Moore of the U.S. Bureau of the Budget examined this issue in 1966.[85] Although his purpose was to develop an analytical framework, he examined data and made simple calculations. His basic output measure was the difference between the length of unemployment of those registered with ES and the length for all unemployed persons.

Ten years later, Donald Frey completed a conceptual examination of the same general issue.[86] Factors investigated were the duration of unemployment, job turnover, and deterrent effects of ES operations. Potential data sources were reviewed but no attempt was made to calculate the effect of ES.

Client effectiveness. Client effectiveness, the second category of studies examined in the 27 papers, focused on how clients themselves, rather than the Nation as a whole, benefited from ES operations.

A study by Arnold Katz examined the impact of ES labor exchange programs on applicant unemployment

[84] David W. Stevens and others, "Specification and Measurement of Productivity in the USES," draft report (Employment Service, December 1980).

[85] Basil Moore, "A Benefit-Cost Analysis of the United States Employment Service" (Bureau of the Budget, November 1966).

[86] Donald E. Frey, *A Methodology for Measuring the Impact of the United States Employment Service* (Winston-Salem: Wake Forest University, 1976).

[87] Arnold Katz, *Exploratory Measures of Labor Market Influences of the Employment Service* (University of Pittsburgh, 1978).

Jacob Benus, focused on the duration of unemployment and on earnings.[88] His initial conceptual study was followed by a pilot study.

Service category productivity. Service category productivity focuses on the efficiency with which specific ES services, such as counseling, testing, and job development, are handled.

Fred Englander undertook three studies for the New Jersey ES to identify the net influence of ES on job placements. One studied the factors affecting the number of job openings.[89] Another looked at the impact of external, internal, and demographic considerations on placements. The third examined the method ES used to allocate funds to State employment services.

A study by Neil Weiner used the general productivity function to estimate the social return of ES.[90] Weiner divided ES direct outputs between the labor market and compliance requirements. Time accounting statistics were used to estimate the resource flows.

Mark Chadwin and his associates used an institutional approach to examine service category productivity.[91] They studied the organizational characteristics which produced good performance in State ES agencies. Their productivity measure was individuals placed (not transactions) per staff year.

Charles K. Fairchild examined the development of performance standards, both for placement and placement-support functions.[92] He developed suggested standards and procedures for evaluating output and allocating funds to the States and within the States to ES offices. Four output measures were considered: Individuals placed per staff year, placements per staff year, percent of openings filled, and percent of applicants placed. Fairchild concluded that placements per staff year was the preferred output measure for productivity calculations.

Organizational productivity. Three organizational or composite productivity studies were identified and reviewed in the 27-study review. One was a General Accounting Office review of ES operations in 1978 which

[88] Jacob Benus and others, *Use of an Experimental Design in Assessing the Impact of the United States Employment Service* (Menlo Park, Calif.: Stanford Research Institute, September 1976).

[89] Fred Englander, "Factors Affecting the Receipt of Job Openings by the State Employment Service Agencies and by Local Employment Service Offices in New Jersey;" "The Impact of Demographic, Internal and External Factors on the Placement Performance and Staffing of the Local Offices of the New Jersey Employment Service;" and "The Impact of Demographic, Internal and External Factors on the Placement Performance of State Employment Service Agencies" (Trenton, N.J.: Department of Labor and Industry, May 1977).

[90] Weiner and others, *A Model of Outputs.*

[91] Mark L. Chadwin and others, *The Employment Service: An Institutional Analysis* (Employment and Training Administration, 1977).

[92] Charles K. Fairchild, *Development of Performance Standards for Job Placement and Support Services of the Public Employment Service* (New York: E.F. Shelley and Company, August 1975).

examined both placement and job development functions.[93] The primary performance statistics were placements made and jobs filled. The accuracy of placement statistics also was considered. The findings will be discussed later.

Another study, by C. Meike, focused on productivity of individual State ES agencies.[94] It identified outputs, developed quantification procedures, and combined the answers into an overall measure of productivity. The report used four categories of outputs: Applicant process, employer process, placement process, and mandated outputs. A value-added approach was proposed.

The third study, by H. Kaitz, examined relationships among internal factors, external factors, and output.[95] Placements per staff year was his preferred measure of productivity.

Two other research reports not covered in the Stevens draft report bear mentioning. One is a 1979 investigation of ES productivity by Thorpe and Toikka which used a production function approach.[96] Three slightly different measures of output were examined: Placements of 3 to 150 days, called permanent placements; total placements less subsidized (CETA) placements; and total placements (agricultural and nonagricultural). The last measure was dropped because the regression results were so "poor."

Thorpe and Toikka tested a number of independent variables. Significant variables were the number of ES staff years, the size of the civilian labor force, the percent of workers unionized in nonagricultural industries, the percent of applicants who were unemployment insurance claimants, and the percent of applicants who were economically disadvantaged. Coefficients of all the independent variables had the expected sign. The unadjusted coefficient of determination for the Thorpe/Toikka equations ranged from .93 to .96. The coefficients ranged from .92 to .94 for two variables—staff years and civilian labor force. The data used by Thorpe and Toikka were Title III grants for 1977 only.

A Fairchild study examined the feasibility of restructuring the ES grants mechanism using performance and needs as the criteria for distributing funds to the States.[97] His investigation is of interest for this study for two reasons. First, he separated ES goals into five missions or parts—basic labor exchange, supplemental services, employer technical services, labor market information, and compliance/enforcement—and assigned measures of performance for four of the missions. Second, he examined two production functions for the basic labor exchange mission. Both used total individuals placed as the output measure. Staff years was the primary factor input.

External and internal factors were examined. The significant independent variables in the first production function were: Staff years, civilian labor force, population density, number of new and renewal applicants, youth as a percent of all applicants, claimants as a percent of all applicants, the year, and the ES region. Fairchild analyzed 5 years of ES data, State by State. His equations explained 97.5 percent of the variance of "individuals placed," the dependent variable. An estimating equation was also developed from 1979 data. This equation dropped three variables: Number of new and renewal applicants, the year, and the ES region.

The research on ES productivity is extensive, as this brief review indicates, but several basic conclusions emerge:

1. Most productivity research has used placements as the preferred measure of output. However, there are a number of variations on the basic theme.
2. Production function research, using the number of placements as the output, has been fairly successful in explaining variance about the dependent variable.
3. Externalities play an important role in exploring placement variation.

Outputs

Satisfactory measurement of output is the fundamental issue in calculating ES productivity. Two basic outputs—placements and services—are examined here.

In many respects, the issues and concerns that surround the measurement of ES outputs are similar to those that are found in private sector employment measurement: Both government and private firms counsel, test, and assist individuals in obtaining employment (placements). There is one important difference, however. Although a bundle of services may translate into dollar output for private firms, ES output requires a physical measure.[98]

Placements. The number of placements is the measure almost always used today for ES outputs. ES has collected statistics on the number of placements since 1938; it tracks the number of placements monthly; and it includes the number of placements as part of its annual budget justification.

For ES records, a placement occurs each time an

[93] *The Employment Service—Problems and Opportunities for Improvement* (General Accounting Office, 1977).

[94] C. Meike and others, *SESA Productivity Measurement System* (Vienna, Va.: Analytic Systems, September 24, 1976).

[95] *Employment Service Performance Handbook for Local Offices* (Rockville, Md.: WESTAT, Inc., 1979).

[96] Charles O. Thorpe, Jr. and Richard S. Toikka, *Determinants of State Employment Service Productivity* (Washington: The Urban Institute, March 1979).

[97] Fairchild, *Methodology for Allocating Employment Service Grants.*

[98] Employment services in the private sector generally are priced in two ways: (1) Payment is contingent on the individual being placed in a job; without placement there is no payment. (2) Payment is made for a bundle of services such as testing, counseling, referrals, resume preparation, and the like. The price in this case is for a bundle of services and is not contingent on job placement.

employer hires an applicant who is referred. For a placement to be recorded, five steps must take place:

1. A job order form must be prepared before referral;
2. Arrangements must be made with the employer for the referral of an individual or individuals;
3. The individual must not have been specifically requested by the employer;
4. A reliable source, preferably the employer, must verify that the individual entered on the job; and
5. The placement must be recorded on appropriate ES forms.[99]

The basic argument in favor of using placements to measure output is that placing individuals in jobs is the role of ES. Counseling, operation of the job bank, registering workers, and preparing labor market analyses all support the basic service of getting jobs for people.

Furthermore, placements are measurable, repetitive, and easily understood. They are physical measures, and data to make the measurements are readily available.

The three principal arguments against the use of placements are: (1) ES has responsibilities in addition to its labor market mission; (2) externalities have a major effect on placements; and (3) much of the placement data are questionable. This last point will be discussed later in this section.

Regarding the first point, ES has been assigned additional missions from time to time. In 1977, it was involved in administering 21 laws, 11 Executive Orders, and 14 agreements with Federal agencies.[100] These responsibilities ran the gamut from certifying aliens for work in the United States to checking the adequacy of housing for migrant workers.

Fairchild, as noted, identified five separate ES missions or functions. Although Fairchild did not estimate ES resources for each mission, labor exchange is clearly the largest.

A more troublesome issue than multiple ES missions in using placements as the output measure is the externality issue, or the problem of separating placements from other considerations. When the economy is booming and employment is high, placing individuals in jobs is relatively easy, but in a declining economy with high unemployment, placing individuals is difficult. Other considerations, such as the skills requested, availability of a skilled work force, and size of the labor market, also influence the placement rate. ES placements are probably influenced more by factors external to ES operations, particularly the state of the economy, than by internal considerations. For this reason, placements are not a very good measure of organizational outputs.

According to John P. Campbell:

> "The State's unemployment rate consistently yields the highest correlation (negative) with placements. Adding a measure of new hires and a measure of the percentage of the work force in lower level jobs boosts the total variance accounted for to 40 to 45 percent of the total variance in placements. Adding certain additional independent variables to the equation consistently increases the variance accounted for to 60 to 70 percent of the total."[101]

Studies by Thorpe/Toikka and Fairchild, discussed earlier, found external variables to be crucially important in explaining placement variance. The only ES input that was statistically significant was the amount of labor input.

Variations on the theme. Part of the controversy surrounding the use of placements as the ES output measure stems from the different ways in which the term is used. ES makes three important distinctions: Transactions vs. individuals; agricultural vs. nonagricultural; and length of time the placement lasts—3 days or less, more than 3 but less than 150 days, and 150 days or more. Each is briefly reviewed below.

Transactions vs. individuals. Simply stated, a placement transaction takes place when an applicant is hired. The placement may last from 1 hour to many years; one individual can be placed several times each year.

Researchers and some ES administrators feel that the number of individuals placed is a better measure than the number of transactions for two reasons: First, the time required to place an individual is more stable than the time required to complete a transaction. That is, a new applicant requires considerable time; a registered applicant taking an intermittent job requires little time. The primary effort is initial registration, counseling, and testing. No research has been found during this study which shed light on the time required for an individual placement vis-a-vis a transaction placement.

Second, focusing on individuals encourages longer term placements and benefits the client. This thesis, though valid, is not a productivity argument and will not be pursued further.

ES believes that both individual and transaction placements are important, and both should be calculated and used. Comparison of the two statistics, which ES has published since 1975, suggests that they move together (table 55). Between 1975 and 1980, individual placements rose by 15.7 percent while transaction placements increased by 15.1 percent. The ratio of individual to transaction placements varied between 67 and 71 percent between 1975 and 1980. Thus, in calculating productivity trends, it may not make a great deal of difference which measure is used.

[99] *Glossary of Program Terms and Definitions* (Employment and Training Administration, 1978).

[100] General Accounting Office, *The Employment Service,* p. 2.

[101] John P. Campbell, "Comments," in Stevens, "Specification and Measurement of Productivity in the USES," p. 188.

Table 55. Comparison of Employment Service transactions and individual placements, fiscal years 1975–80

Year	Transactions	Individual placements	Individual placments as a percent of transactions
1975	4,670,610	3,137,542	67
1976	4,936,222	3,367,007	68
1977	5,283,715	3,732,152	71
1978	6,015,728	4,213,423	70
1979	6,206,674	4,180,635	67
1980	[1]5,376,871	[1]3,630,930	68

[1] Excludes New Jersey and Puerto Rico.
SOURCE: Employment Service staff.

Agricultural vs. nonagricultural. ES has traditionally divided its transaction placements between agricultural and nonagricultural; at one time the ES budgeted for these separately. In 1960, agricultural placements accounted for 62 percent of total ES placements. By 1970, placements were evenly divided, but by 1979, agricultural placements made up only 6 percent of the total (table 56).

When agricultural placements were an important part of its work, ES divided them into four types—crew, pool, individual, and other. Crew placements resulted from interview and selection of a crew leader to recruit individual workers. Pool placements were made from applicants who gathered at an assembly point each day. No interviews were conducted and the work period was 1 day. Individual placements were those which placed a single individual in a farm job, a process that was similar to nonagricultural placement. Other placements were primarily family groups hired for no longer than 1 day. Most agricultural placements were of the crew and pool types.

Several factors were responsible for the decline in agricultural placements. First, demand lessened as mechanization increased. Second, the Bracero Program was terminated; this program brought Mexican labor to American farms. Third, the Judge Richey decision in 1974 required that agricultural workers be provided with the same services as other workers. Fourth, the Farm Service Bureau was merged into the ES in the 1960's.

Today no distinction is made and no productivity calculated for the different types of agricultural placement. However, anyone preparing a productivity index that covers the period when agricultural placements were an important part of ES's work clearly needs to consider the issue of agricultural placements.

The 1968 Senate budget hearings noted that agricultural placements per staff year for three States were in the thousands; nonagricultural placements were in the hundreds. Mississippi reported 7,896 agricultural placements per ES employee.[102] Clearly a "pool" or "crew" placement requires less labor input than an individual placement.

Number of days per placement. Since the mid-1970's, ES has collected and published placement statistics by job duration—less than 3 days, 3 to 150 days, and more than 150 days. This division is one attempt to identify the quality of placement, the rationale being the longer the placement, the better off the client. In other words, this is a client effectiveness issue.

The question for productivity measurement is whether unit labor requirements vary significantly by placement duration. If they do, some type of division or weighting is needed. No research was uncovered which shed light on this subject. The issue is not considered further here although the subject needs further research.[103]

Placement data. Transaction placement data are available from 1938 on and can be found in a number of places. The data series do not always agree, particularly in recent years, but these differences are usually explainable, as discussed later. Five series were identified during this investigation: Selected Department of Labor annual reports before 1979, the Department of Labor annual report for 1979, *Historical Statistics,* budget data, and Employment Security Automatic Reporting System statistics (table 57).

A more serious concern is the accuracy of the placement data. The General Accounting Office (GAO) in 1975 conducted the best known of the various studies on the issue. This study examined statistics collected in the field and also reported on 1974 and 1975 studies of the same issue by the Department of Labor. The 1974 Labor study found in a sample or four States that 15 percent of the claimed placements did not take place. The 1975 Labor study found in a sample of five States that between 14 and 20 percent of the claimed placements in seven ES offices did not take place. The GAO found in its own sample that 44 percent of those recorded as placed in a job claimed that they did not get a job or obtained it through some mechanisn other than the ES referral.[104] Although the Department of Labor disagreed with GAO methodology and the magnitude of the error identified, it did not dispute the fact that claimed placements often did not take place.

Four interrelated types of error occur in the data series: Coverage errors, definitional errors, data collection errors, and fraud. Probably the largest error comes from definitional issues, although no study has examined the relative importance of each type of error.

[102] *Labor-Health, Education, Welfare Appropriation for Fiscal Year 1968* (U.S. Senate, Subcommittee of the Committee on Appropriations, 90th Congress, 1st session, 1967, Government Printing Office) p. 121.

[103] Job duration statistics as reported by the ES are "expected duration" of the job as reported by the employer, not actual duration on the job. Research shows expected duration statistics to be extremely inaccurate. See "Michigan Placement Follow-up Demonstration Project" (Silver Spring, Md.: Macro Systems, Inc., March 17, 1981).

[104] General Accounting Office, *The Employment Service,* p.11.

Table 56. Agricultural and nonagricultural placement transactions, Employment Service, fiscal years 1955–79[1]

(Thousands)

Year	Agricultural	Nonagricultural
1955	8,992	5,536
1956	9,249	6,174
1957	9,002	5,976
1958	8,710	5,236
1959	9,615	5,704
1960	9,747	6,083
1961	9,004	5,591
1962	9,029	6,506
1963	7,924	6,632
1964	7,125	6,454
1965	6,047	6,330
1966	4,339	6,587
1967	4,113	6,142
1968	4,573	5,760
1969	4,865	5,524
1970	4,550	4,604
1971	3,264	3,597
1972	2,715	3,610
1973	2,105	4,517
1974	1,758	4,913
1975	1,498	4,274
1976	594	4,641
1977	314	4,970
1978	340	5,675
1979	363	5,844

[1] Includes Puerto Rico.

SOURCE: 1955–76, selected annual reports of Department of Labor; 1977–79, Employment Service staff.

Table 57. Five placement transaction time series, Employment Service, fiscal years 1955–79

(Thousands)

Year	Department of Labor annual reports (selected issues)	Department of Labor annual report for 1979	Historical Statistics of Employment Security Activities, 1938–66	President's budget and appendixes, selected issues	Employment Security Automated Reporting System
1955	14,528	–	14,528	–	–
1956	15,422	–	15,422	–	–
1957	14,978	–	14,960	–	–
1958	13,946	–	13,946	–	–
1959	15,319	–	15,319	–	–
1960	15,830	–	15,830	–	–
1961	14,595	–	14,595	–	–
1962	15,534	–	15,534	–	–
1963	14,556	–	14,556	–	–
1964	13,579	–	13,579	–	–
1965	12,377	–	12,377	–	–
1966	10,926	10,892	10,926	–	–
1967	10,255	10,255	–	10,476	–
1968	10,332	10,332	–	10,323	–
1969	10,389	10,389	–	10,337	–
1970	9,154	9,154	–	9,144	–
1971	6,860	6,860	–	6,128	–
1972	6,325	6,325	–	6,325	–
1973	6,622	6,622	–	6,738	–
1974	6,672	6,672	–	6,127	5,159
1975	5,772	5,772	–	5,662	4,671
1976	5,234	6,918	–	4,645	4,936
1977	3,808	5,932	–	5,250	5,284
1978	6,015	6,632	–	6,015	6,016
1979	–	6,755	–	6,207	6,207

Some types of coverage error already have been discussed. Program coverage is probably the most important. Traditional and nontraditional program placements are sometimes commingled. For example, placement data series include placements of food stamp and AFDC recipients as well as traditional placements before 1971. Any productivity series covering these earlier years needs to make allowance for this change.[105]

The time period covered is another potential source of error. Placement data are reported and published monthly and summarized by calendar and fiscal year. At times the period being examined is not made clear. Geographic coverage also may be inconsistent in some data series.

The second reason for data error, probably the largest single reason and major issue for this study, is the definitional issue: What constitutes a placement? As noted earlier, ES has very explicit rules, but they are not always followed despite the validation routines.

The third type of error is in data collection. Problems do occur in keypunch, clerical, and computer operations. For example, the State of Washington was not included in national statistics in 1973 because the data were lost. The magnitude of this type of error is not known but probably is not large. Where such error exists, it probably does not bias transaction statistics.

The fourth reason for error is outright fraud. Because of the pressure to produce placements, some individuals have falsified records, the most well-known case occuring in West Virginia. Although newsworthy, fraud is probably not an important source of error in placement statistics, according to ES staff.

The relevant issue for productivity analysis is not placement error or even bias, but how the statistics vary through time. A constant bias—30 percent underreporting, for example—would have no major effect on output trends. However, if the magnitude of the bias changed, the output trend would be affected.

The ability to identify and correct error varies by type of error. Coverage error is probably the easiest to treat. Elimination of this error requires, first and foremost, a good understanding of ES programs and data series.

Definitional error is probably the most difficult one to deal with. Studies show that it can be significant, although discussions with ES staff suggest that the data are becoming more accurate and less biased. If so, the change in placements and productivity will be understated, but whether the error and bias are changing and, if changing, by how much, is not known.

Data collection errors are probably not large and probably do not produce bias. The fourth type of error, fraud, is probably not important, as noted.

ES has recently embarked on a major program to validate placement and other ESARS data. One of the

[105] U.S. Congress, House of Representatives, Committee on Government Operations, *Operation of the U.S. Employment Service,* (Government Printing Office, 1976), p. 305.

tasks is validation of placement statistics in selected States. Although the study is not complete, results thus far suggest major errors (overstatements of the number of placements) similar to those noted here.[106]

Services and activities. Another type of measure which has been used to measure ES performance is the service unit or activity measure. This includes factors such as counseling, testing, employer visits, referrals, and the like. During the 1950's and early 1960's, ES budgeted and accounted for funds based on the services to applicants and employers.

ES service or activity measures have several attractive attributes. They are physical, measurable, repetitive, and, for many, data are available since 1936. Most important, they are measures of work performed which are largely unaffected by external forces such as the strength of the economy and the labor market.

Although activity data are readily available, their completeness and accuracy are not known. Many data problems noted earlier for placements may apply equally here.

However, the principal argument against using service counts is that they are measures of work performed, not outputs. Knowing the number of people interviewed, number of follow-ups, and number of file checks does not tell much about the basic output of the ES—placing people in jobs. This reasoning, of course, led to the use of placements as the measure of output.

Mission-based outputs. Neither services provided nor placements made are entirely satisfactory measures of ES output. Placements are outcomes; services are work performed or activities.

Fairchild recently examined ES missions (goals) and suggested a series of measures for four missions (table 58). For compliance and enforcement, the number of registered recipients; for employer technical services, the number of employers assisted and visited; for supplemental services, applicants registered and number served; for basic labor exchange, placements. Except for the basic labor exchange, his recommendations are measures of output. Futhermore, they are physical, measurable, and repetitive, and data should be readily available. They could be combined into a single index by using labor weights.

The problem remains of how to measure basic labor exchange outputs. The basic ES role in the labor exchange is to refer individuals. Statistics are available on the number of referrals but this type of output measure opens the door to numerous types of statistical mischief. Additional investigation is needed; the concluding section of this discussion suggests a four-pronged approach.

Quality and level of service. All parts of ES operations, and all measurements of productivity, are heavily entwined in quality and level of service considerations. As noted in other parts of this report, the focus here is on how quality and level of service issues affect unit labor requirements and productivity. Many, such as the helpfulness of employees, are important from the citizen's standpoint but have little or no impact on unit labor requirements.

Many of the quality and level of service factors which could affect unit labor requirements and productivity already have been identified. These include the distinction between agricultural and nonagricultural placements, the four types of agricultural placements used in the 1960's, and the difference between short-term or intermittent and long-term placements. On the other hand, services (counseling and testing, for example) and the process used to produce these services vary by jurisdiction.

Table 58. Missions and measures of performance of the Employment Service as suggested by C.K. Fairchild

Mission	Measure of performance
Basic labor exchange	Individuals placed Total From target groups Type of job placements Nonagriculture High wage Long term By occupation Placement transactions Openings filled by type of job Performance increase on measures listed above
Supplemental services	Applicants registered Total Target group Number served Any service Counseling, testing Referral to job Referral to other service
Employment technical services	Number of employers assisted Number of employer visits
Compliance and enforcement	Number of UI, food stamp, and welfare recipients registered with Employment Service
Labor market information	None proposed

SOURCE: Charles K. Fairchild, *A Performance and Needs Based Methodology for Allocating Employment Service Grants: Final Report* (Cambridge, Mass.: ABT Associates, 1980), p. 9.

[106] In a recent survey, The Urban Institute, using intensive telephone follow-ups of employers and employees, found the overstatement to be only 2-5 percent, a dramatic improvement over the figures noted here (Personal correspondence from John Greiner, September 30, 1982.)

Output indexes need to take into account level and quality of service when they affect unit labor requirements. However, the information is relatively sparse. No quality rating system exists such as for the Unemployment Insurance Service. Nor has research been done at the national level. Calculation of an ES productivity index requires a systematic examination of the effect on unit labor requirements of changes in quality and level of service.

Labor inputs

Labor dominates ES resource inputs. As noted earlier, about 85 percent of the ES budget goes for labor. Although Federal employees provide oversight, State government employees manage and operate the programs. No local government employees are involved.

This discussion is restricted to those State employees who work in the traditional ES program; other sources fund ES-related operations, such as food stamp and AFDC certification. Thirty thousand State positions were funded from 1960 to 1980 to support the traditional program.

The three labor measures recommended for consideration in calculating State and local government productivity in chapter III were all employees, all employee hours, and number of full-time-equivalent employees.

The best source of ES labor data is the State Employment Security Agency (SESA) accounting system, the system used for internal office operations as well as State and Federal management. This system was automated in 1978 and reports are currently generated daily, weekly, monthly, quarterly, and yearly, according to the need.

Insofar as labor statistics are concerned, data are collected on the hours worked, number of persons, and the number of positions (full-time-equivalent employment). However, the only statistics available nationally are the number of positions.

Statistics on the number of hours are summarized by each State and could probably be obtained from each State. But since the number of positions is computed from the number of hours, any position index would be identical to the hours index.

Data on the total number of employees are more difficult to generate; no national or State count is available. Each State has a master file of employees from which these data could probably be summarized; the effort required to make such a count is not known. However, such a count would not be very meaningful since ES personnel often work part of a day on one program, such as food stamps or unemployment insurance, and another part of the day on another program.

Position data are readily available by State and for the total ES. They are of sufficient detail for use in computing labor requirements for any of the three output measures—placements, service and activity, or mission—discussed in the preceding section.

A potentially confounding issue is the use of volunteer and "free" staff. Some ES offices evidently use many retired aides, Public Service employees (in past years), work experience interns, and others not charged under the SESA accounting system.[107] Their overall importance to ES and to ES productivity calculations is not known. This area needs investigation if an ES productivity index is to be calculated.

Suggested research

The primary problem in measuring ES productivity is specification of output. The research strategy suggested is a detailed examination and comparison of four different approaches. One would focus on placements to measure output with adjustment for changes in the level and quality of service. The second approach, which has been thoroughly investigated, would focus on placements with adjustments for externalities. The third approach would attempt to compute a weighted activity index. Finally, research should pursue the mission output measures along the lines suggested by Fairchild. In each case, accuracy and data verification need to be considered carefully to avoid problems noted earlier.

Suggesting additional research for an area that has already been examined on numerous occasions may seem peculiar. However, as a recent review of the research noted, most research has been narrowly focused.[108] Several approaches should be compared to resolve the problems.

If the output issue can be solved, or at least resolved, then computing a national ES productivity index and individual State indexes should be relatively straightforward. Also, computation of absolute levels of productivity, as contrasted with productivity trends, may be feasible. Such computations can provide additional insight into how productivity varies and how it can be improved. Finally, this discussion has focused primarily on traditional labor programs, which in the past have employed about two-thirds of the ES staff. Other ES programs, such as welfare certification, warrant investigation too.

[107] Personal correspondence from John Greiner, September 30, 1982.

[108] Stevens and others, "Specification and Measurement of Productivity in the USES."

Appendix A. Number of State and Local Governments and Number of Employees

One difficulty in collecting data from State and local governments is the number of governments that must be contacted. Tables in this appendix show, for each level of government, the number of governments and the number of employees. Data are presented separately for States, municipalities, school districts, counties, special districts, and townships. The class sizes in each table reflect the way the data are presented by the Bureau of the Census, the source of the data.

Often, a few large jurisdictions account for a sizable proportion of the total employment for that level of government. Ten States, for example, account for almost half of all State government employment.

Table A-1. State governments and State government employment, 1979
(Cumulative)

States	Employees	Percent of total employment
10	1,860,239	48
20	2,735,609	71
30	3,338,541	86
40	3,668,875	95
Total, 50	3,869,282	100

SOURCE: Computed from data in *Public Employment in 1979* (Bureau of the Census, 1980), table 8, p. 14.

Table A-2. Municipal governments and municipal government employment, 1977
(Cumulative)

Municipalities	Employees	Percent of total employment
6	522,088	20
24	820,905	31
46	988,173	38
64	1,089,363	42
163	1,516,887	58
908	2,024,355	77
Total, 18,878	2,623,271	100

SOURCE: Computed from data in *1977 Census of Governments—Compendium of Public Employment* (Bureau of the Census, 1979), table 18. p. 343.

Table A-3. School systems and school employment, 1977
(Cumulative)

Districts and systems	Employees	Percent of total employment
10	622,046	12
20	886,520	17
40	1,199,377	23
618	2,302,840	44
1,639	3,178,251	61
3,533	4,004,456	76
Total, 16,489	5,242,028	100

SOURCE: Computed from data in *Public Employment*, table 21, p. 405.

Table A-4. County governments and county government employment, 1977
(Cumulative)

Counties	Employees	Percent of total employment
10	198,063	11
20	303,325	17
40	449,189	26
181	866,167	49
343	1,043,746	59
679	1,285,601	73
1,274	1,500,970	85
Total, 3,040	1,761,242	100

SOURCE: Computed from data in *Public Employment*, table 17, p. 318.

Table A-5. Special districts and special district employment, 1977
(Cumulative)

Districts	Employees	Percent of total employment
10	98,555	25
20	138,274	34
40	182,831	46
499	274,257	68
910	309,746	77
1,724	343,797	86
2,550	359,309	89
Total, 26,010	401,880	100

SOURCE: Computed from data in *Public Employment*, table 22, p. 423.

Table A-6. Township governments and township employment, 1975
(Cumulative)

Townships	Employees	Percent of total employment
961	213,260	59
1,831	262,187	73
Total, 16,827	360,763	100

SOURCE: Computed from data in *Public Employment,* table 19, p. 344.

Appendix B. Comparison of Bureau of the Census Classification of Government Functions with Standard Industrial Classification

Government function (Bureau of the Census)	Description	SIC industry	
Airports	Operation and support of publicly operated airport facilities.	4582 4583	Airports and flying fields Airport terminal services
Corrections	Activities pertaining to the confinement and correction of adults and minors convicted of criminal offenses. Pardon, probation, and parole activities are also included.	8361 8399 9223	Juvenile correctional homes Social services—parole, probation Correctional institutions
Electric power	Local government activities associated with the production or acquisition and distribution of electric power to individual consumers.	4911	Generation, transmission, or distribution
Financial administration	Activities concerned with tax assessment and collection, custody and disbursement of funds, debt management, administration of trust funds, budgeting, and other governmentwide financial management activities. This function is not applied to school district or special district government.	9311	Tax assessors, budget agencies
Fire protection	Local government fire protection and prevention activities plus any ambulance, rescue, or other auxiliary services provided by the fire protection agency.	9224	Fire departments, fire prevention offices
Gas supply	Local government activities associated with the acquisition and distribution of gas supplies to individual consumers.	4924	Natural gas distribution
General control	Judicial, legislative, and governmentwide administrative agencies of governments. Includes planning and zoning activities, central personnel, and administrative services, the office of chief executive, legislative activities, and court and court-related activities. This function is not applied to school district or special district government.	7374 9111 9121 9131 9199 9211 9222 9229 9532	Data processing Executive offices Legislative assemblies Executive and legislative offices combined Personnel agencies and personnel boards Courts Legal counsel and prosecution Public safety not elsewhere classified Zoning boards

Appendix B. Comparison of Bureau of the Census Classification of Government Functions with Standard Industrial Classification—Continued

Government function (Bureau of the Census)	Description	SIC industry	
Health	Administration of public health programs, community and visiting nurse services, immunization programs, drug abuse rehabilitation programs, health and food inspection activities, operation of outpatient clinics, and environmental pollution control activities.	8081 9431 9641	Outpatient care facilities Public health agencies, environmental health and immunization programs Food inspection
Higher education	State and local government degree-granting institutions which provide academic training above grade 12.	8221 8222	Colleges Juinor colleges
Highways	Activities associated with the maintenance and operation of streets, roads, sidewalks, bridges, tunnels, toll roads, and ferries. Also includes snow activities.	1611 1622 4452 4784	Highways and street construcruction Bridge, tunnel, and elevated highway construction Ferries Operation of toll roads and bridges
Hospitals	Government-operated medical care facilities which provide inpatient care.	8062 8063	General medical hospitals Mental hospitals
Housing and urban renewal	The operation of housing and redevelopment projects and other activities to promote or aid housing and community revewal.	6513 9531 9532	Operators of apartment buildings Housing agencies Community development agencies
Libraries	Libraries operated by local governments for use by the general public. School and law libraries are excluded; they are included in the "local schools" or "higher education" and "general control" categories, respectively.	8231	Libraries
Liquor stores	Administration and operation of retail liquor stores operated by State governments.	5182 5921	Liquor—wholesale Liquor and beer—retail
Local schools	All activities associated with the operation of public elementary and secondary schools and locally operated vocational-technical schools. Special education programs operated by elementary and secondary school systems are also included, as are all ancillary services associated with the operation of schools, such as pupil transportation and food service.	8211 4151	Elementary schools, secondary schools, and vocational high schools School buses
Natural resources	Activities primarily concerned with the conservation and development of natural resources —forest fire prevention and control, irrigation, drainage, land and forest reclamation, fish and game preservation and control, soil conservation, forestry, agricultural aids and research, agriculture development and inspection, and mineral resources activities.	0851 0921 0971 1629 4971 9512 9631 9641	Forest management and services Fish hatcheries Operation of game preserves Flood control projects Irrigation system operations Soil conservation Irrigation districts Agriculture extension services
Other education	State government activities relating to the supervision and regulation of public and private elementary and secondary schools; programs and institutions for the training of blind, deaf, and other handicapped persons; and vocational rehabilitation programs.	8249 9411	Vocational schools other than high schools Administration of educational programs

Appendix B. Comparison of Bureau of the Census Classification of Government Functions with Standard Industrial Classification—Continued

Government function (Bureau of the Census)	Description	SIC industry	
Parks and recreation	Local government activities which include the operation and maintenance of parks, playgrounds, swimming pools, public beaches, auditoriums, public golf courses, museums, marinas, botanical gardens, and zoological parks. State government park and recreation activities are included in the "natural resources" function.	0782 4469 7992 7999 8411 8421 9512	Lawn and garden services Marinas Golf courses Swimming pools and beaches Museums, noncommercial Botanical gardens and zoological gardens Recreational program administration
Police protection	All activities concerned with the enforcement of law and order, including coroners' offices, police training academies, investigation bureaus, and local jails, "lockups," or other detention facilities not intended to serve as correctional facilities.	9221 9223	Police departments Jails
Sanitation other than sewerage	Refuse collection and disposal, operation of sanitary landfills, and street cleaning activities.	4212 4953 4959 9511 9631	Garbage and refuse collection Refuse systems Sanitary services not elsewhere classified Sanitary engineering agencies Sanitary districts
Sewerage	Provision, maintenance, and operation of sanitary and storm sewer systems and sewage disposal and treatment facilities.	1623 1629 4952 7699 9511	Sewerage collection and disposal line construction Sewage treatment plant construction Sewerage systems Sewer cleaning and rodding Sanitary engineering agencies
Social insurance	Administration and conduct of social insurance programs. For State governments and the government of the District of Columbia, these activities include unemployment compensation and worker compensation programs, and work/study programs.	7361 8331 9441	Employment agencies Job training Unemployment insurance offices
Transit	Activities relating to the operation and maintenance of public mass transit systems (e.g., bus, subway, surface rail, and street railroad systems). Elementary and secondary school transportation systems are included in the "local schools" function.	4111 4119	Busline operation and subway operation Local passenger transportation not elsewhere classified
Water supply	Local government activities associated with the production or acquisition of water and distribution to the public.	4941	Water supply
Water transportation	The provision, operation, and support of canals and other waterways, harbors, docks, wharves, and other related marine terminal facilities.	4463 4464	Docks, terminal operation Canal operation
Welfare	Activities such as the administration of various public assistance programs for the needy, operation of homes for the elderly, indigent care institutions, and programs which provide payments for medical care and other services for the needy. Health care and hospital services provided directly by a government, however, are included in the "health" and "hospitals" functions rather than here.	8321 8351 8361 8399 9441	Public welfare services Day care services Residential care Social service information exchanges Public welfare administration

SOURCE: *1977 Census of Governments—Compendium of Public Employment* (Bureau of the Census, 1979), pp. 459–62, and *Standard Industrial Classification Manual, 1972* (Office of Management and Budget, 1972).

Appendix C. Large Electric Utilities

Data for the following State and local government utilities were combined to compute the productivity index for "large utilities" in chapter IV. Utilities are ranked in order of size (kilowatt hour sales to ultimate customers).

1. Los Angeles Water and Power Department, Calif.
2. New York Power Authority, N.Y.
3. Memphis Light, Gas, and Water, Tenn.
4. Salt River Power, Ariz.
5. Nashville Electric Service, Tenn.
6. Seattle City Light, Wash.
7. San Antonio City Public Service, Tex.
8. Jacksonville Electric Authority, Fla.
9. Sacramento Municipal District, Calif.
10. Chattanooga Electric Power, Tenn.
11. Omaha Public Power District, Nebr.
12. Snohomich County Public Utility District, Wash.
13. Tacoma City Light, Wash.
14. Austin Electric Department, Tex.
15. Cowlitz County Public Utility District, Wash.
16. South Carolina Public Service Authority, S.C.
17. Clark County Public Utility District, Wash.
18. Eugene Water and Electric Board, Oreg.
19. Orlando Utilities Commission, Fla.
20. Nebraska Public Power District, Nebr.
21. Lansing Board of Water and Light, Mich.
22. City of Colorado Springs, Colo.
23. Lincoln Electric System, Nebr.
24. Santa Clara Municipal Electric Department, Calif.
25. Imperial Irrigation District, Calif.
26. Grays Harbor County, Wash.
27. Garland Power and Light Department, Tex.
28. Grant County Public Utility District, Wash.
29. Benton County Public Utility District, Wash.
30. Modesto Irrigation District, Calif.
31. Central Lincoln Public Utility District, Oreg.
32. Tallahassee Electric Department, Fla.
33. Lakeland Electric Department, Fla.

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