Chapter VII

Costing Tools and Techniques

The preceding chapters looked at the relationship of cost information to decision making, examined how to define a service and measure service outputs, discussed costing concepts, and took a look at the allocation of indirect cost.

In this chapter we examine the calculation of direct and indirect cost by use of several examples as well as introduce a variety of techniques useful in practical situations.

presents a costing problem and works through the elements of the solution,
presents a series of cost analysis techniques of wide applicability,
discusses some problems in calculating and using unit costs, and
analyzes the sign)ficance of time in comparing costs.

Cost analysis, like most areas of knowledge, consists of a limited number of central concepts and an associated vocabulary peculilar to those concepts. The case that follows highlights cost analysis techniques that have wide applicability.

A Case in Cost Analysis — Problem Statement

As an example of the application of a number of the cost concepts that will be discussed in this chapter, consider the following problem: what would it cost to provide street sweeping services for a certain section of the jurisdiction? Assume that due to problems with parked cars and the speed with which trash accumulates the sweeping is to be 24 hours per day and that a sweeper vehicle with one driver is to be used. Additional data will be provided as we work through the solution.

Solution Outline

The first choice in solving the problem is the cost concept on which the analysis will be based. Since the proposed service is one that is not already being provided, an appropriate focus of the analysis might be on the marginal cost of providing the new service. After all, if the new service is not provided, no savings will occur and if the new service is provided, only the increase in cost must be financed.

The cost of providing the new service will include the cost of staff — wages and benefits — equipment, and supplies. The development of techniques that generally are useful in estimating these types of costs follows.

Direct Costs: Personnel

Personnel costs include not only wages and salaries but other costs associated with personnel such as health insurance, vacation time, pension contributions or payments, and allowances for uniforms.

Benefits As A Percent of Salary

If a number of possible management options are being considered in a short space of time, it is not practical to do a detailed analysis of the employee benefit costs that are associated

with each option. On the other hand, it is never wise to omit benefit costs from consideration, because they usually are a very large fraction of the total cost. It is useful to have a technique that allows for a quick estimation of these costs without actually examining in detail the personnel records of the individuals performing the service. An approach that works well in practice is to add all annual benefit costs and then divide that amount by the total wages paid to identify benefits as a percentage of wages. This process is illustrated below.

Calculation of Benefits	
Annual Benefits Payments	
Insurance premiums	$ 118,000
Retirement contributions	615,000
Salary during vacations	192,000
Disability payments	73,000
Uniform and other allowances	18 000
Total Benefits	$ 1,016,000
Total Payroll	$ 3,860,000

Thus, benefits as a percent of payroll:

$$\frac{\$1,016,000}{\$3,86O,000} = 26.3\%$$

In this situation, total cost for a new employee is a little over one quarter higher than the cost of the salary alone.

Technique: Averaging

Expressing benefits as a percent of payroll illustrates how averaging techniques are used in cost analysis. All employees may not be entitled to the same amount of annual vacation, and employees at different ages may have somewhat different insurance premiums. But, rather than calculate the benefits costs for each individual, these costs can be totalled together and averaged for all personnel so as to produce a rough and ready guide which, while only an approximation, can be a useful tool.

Of course, the benefits of some groups of employees can exceed the average employee's benefits by a considerable amount. This is frequently the case with police and fire personnel. In this case, it is best to prepare a separate calculation for each of these groups and to omit these groups from the calculations used for the remaining employees.

Not all cost analysis studies use averaging; instead, some studies calculate all the costs applicable to a given service. However, averaging is recommended wherever there is interchangeability. Suppose, for example, that 20 hand radios were bought in January at a cost of $230 each, and 10 identical hand radios were bought in June on sale for $190 each. It would be easier and better to use an average cost of $216.67 than to check to see which of the radios were used in the delivery of any one service. Since one radio is

interchangeable with another, the overall average is more representative of a typical cost than either of the prices actually paid.

In this case we are using a weighted average, since a different number of radios was purchased at each price. The total cost is determined and divided by the total number of items purchased.

Average Cost for Radios		
First Purchase:	20 x $230 =	$ 4,600
Second Purchase:	10 x $190 =	$ 1,900
Total Cost		$ 6,500
Average Cost =	$6,500 / 30 =	$216.67

Similarly, averaging can be used to establish a single cost for all personnel who are used interchangeably, even if they are at different pay grades. For example, there may be three or four pay grades for employees who are performing the same service but on different shifts. For cost analysis purposes, use of the average cost for one of these individuals per shift or per hour will be easier and give a better picture of the cost per unit of service than t.ying to consider the particular individuals assigned to deliver each unit of service.

Care must be taken, however, not to overdo averaging when the components are not interchangeable. An incentive paid to police officers who serve on the tactical squad, for instance, should not be averaged, but charged to the services performed by the tactical squad. Similarly, if heavier and more costly vehicles are purchased for highway duty, services involving use of those vehicles should be assigned those added costs.

Another averaging procedure is necessary when costs which occur once or a few times a year should be averaged over the entire year. Examples of this might include longevity pay — which in some systems is a lump-sum payment based on the number of years of service — or the cost of annual physical examinations administered to all firefighters in a given month. In each case, while the cost is incurred once, it is appropriate to average the cost over the year so that all services provided by the affected personnel will reflect the expense.

In order to facilitate calculation of salaries and benefits, it would also be appropriate to further average the cost of longevity pay given to some employees with the salaries of employees who do not receive it, as long as both groups perform the same service.

Technique: Calculating A Staffing Factor

If a government wishes to provide a service without interruption every day of the week (such as police or fire protection), allowance must be made for the fact that one employee will typically work only 40 hours per week — less than the coverage needed for one position for one week. In addition, allowance will have to be made for holidays, sick days, etc. Thus, a decision to increase police foot patrols by one officer on one shift (an increase of one service unit) costs more than the expense of one of ficer. The staffing factor associated with a service unit is the effective number of positions that are needed to provide one unit of service. Knowing the staffing factors for services, combined with knowledge of the costs of employee benefits, can go a long way toward explaining why government costs what it does.

The basic approach to calculating a staffing factor is to determine the number of available days and divide it into the number of desired service days. As an illustration, calculate the staffing factor for one police of ficer for one shift every day.

First calculate the number of paid days in a year. If a patrol officer works (as many do) on a four-days-on and two-days-off schedule, the number of paid days in a 365-day year is:

$$\left(\frac{\text{365 desired service days}}{\text{(4 on + 2 off)}}\right)\text{(4 days on)} = 243.33 \text{ paid days.}$$

Unworked days such as holidays and vacation must be deducted from the 243.33 paid days. Assume that each officer is entitled to 13 holidays, three personal days, and an average of 17.5 vacation days. In addition, assume that experience indicates that, on the average, each officer will take nine sick days and two days of other leave (death, merit, etc.), for a grand total of 44.5 paid but unworked days each year.

Days actually worked are therefore: 243.33 - 44.5 = 198.83 effective service days.

The staffing factor is the desired service days divided by the effective service days or:

$$\frac{365}{198.83} = 1.835$$

Thus, it will take almost two full-time employees to staff one position for each shift staffed.

The problems of managing staffing under these conditions are actually greater than these numbers indicate. If, for example, management wished to staff 10 of these service units, about 18 officers would be needed; however, on any given day the number of officers reporting for the shift would likely be more or less than the needed 10 — since unplanned leave will usually vary from the average. If the number is greater than 10, the jurisdiction will be paying for unneeded service. If less than 10 of ficers report for duty, staffing will be inadequate unless officers are held over from the previous shift.

The ability to use overtime to alleviate the problem has encouraged some local governments to actually understaff — perhaps hiring to fill only eight of the 10 vacancies — with the intent of using overtime assignments to smooth out staffing. This allows the government to avoid paying for more staff than are needed, although it may not save any money.

More on Direct Costs

Other direct costs include all direct nonpersonnel expenses, including the expenses of vehicles and other equipment used to provide a service and any consumable materials such as fuel, electricity, the cost of equipment used, supplies consumed, and the cost of the use of capital facilities.

For the same reasons of convenience that were discussed earlier with regard to estimating employee benefits as a percentage of salary, it is advisable to calculate, whenever possible, rates for the use of equipment, such as the cost per vehicle mile, the cost per vehicle hour, or the average annual cost of one vehicle. As before, such information can be useful, particularly when a number of possibilities are under consideration.

Calculating Depreciation

If a major piece of equipment is purchased in one year but used over a period of several years, a problem exists with respect to the proper way to reflect incurred costs. If the purchase was financed from a general fund appropriation, standard accounting practice would require that the full amount of the expenditure be charged in the year of the purchase and that no charges for the item appear thereafter. On the other hand, if the focus is on the consumption of resources (expenses) rather than on the disbursement of cash (expenditures), then a more appropriate form of allocating the purchase price would be to charge to a given year only that portion of the asset consumed in that year. This allocation process is the conversion of an expenditure to a series of expenses. The annual decline in the value of the asset is its annual depreciation.

Whenever an asset has a life that exceeds one year, depreciation should be used to determine the cost of using that asset during a given year. This technique provides for the calculation of the cost of a vehicle as it is used rather than when it is purchased.

Exhibit 14 illustrates the method for calculating depreciation. Based on this example, $19,000 of depreciation expense would have to be included when calculating the annual cost of a service which included the use of one of these vehicles.

Assumptions for Exhibit 14: Suppose a group of 10 public works vehicles was purchased in 1980 at a cost of $800,000, and that communications and other equipment was then installed in each vehicle for a total cost of $20,000. Based on experience, it is estimated that each vehicle will average four years of service before it has to be replaced; some will have a longer useful life, and some less, but the average will be four years. After four years, the average salvage value per vehicle is estimated to be $6,000, including the installed equipment. The cost per vehicle per year would be calculated as follows:

Exhibit 14 "Calculating Depreciation"

10 vehicles	$ 800,000
Equipment	20,000
Total initial cost	$ 820,000
Less salvage	60,000
Total net cost	$ 760,000
Divided by 10 to get cost per vehicle	76,000
Divided by 4 to get cost per vehicle per year	$ 19,000

Operating Costs

Of course, depreciation is only one cost of using a vehicle; to this cost must be added the cost of insurance, maintenance, tires, gasoline, and so forth. These costs are all related to how much the vehicle is used. This can be calculated by hours of service or miles of service, depending on which system is appropriate. If miles of service is the standard measure used and if it is known that:

the average vehicle is-driven 20,000 miles a year;
the average cost per vehicle for maintenance and repairs is $370 per year;
the average cost per mile for gasoline and oil is 14.5 cents;
the cost of liability insurance is $221 per year;
the average cost of four tires is $256, and the vehicles average 32,000 miles per set; then the total cost per mile can be calculated as follows.

Sample Vehicle Operating Costs		
Vehicle: $19,000 / 20,000 miles	=	95.0 cents
Maintenance: $370 / 20,000 miles	=	1.9 cents
Gasoline and oil:$ 0.145 / mile	=	14.5 cents
Insurance: $221 / 20,000 miles	=	1.1 cents
Tires: $256 / 32,000 miles	=	0.8 cents
Total cost per mile	=	113.3 cents

To arrive at an exact cost per mile, the costs of other kinds of supplies must be included. These are usually small costs, but they can add up. The figure of $1.13 per mile, however, is probably a very good estimate of the total cost per mile of operating the vehicles in question.

Problem Solution

Assembling the work done so far indicates that the personnel costs for the street sweeping service will be the number of shifts (three) times the staffing factor (for convenience use the calculated 1.835) times the average salary of a driver (assume it to be $18,000 per year) times the benefits percent or:

3 x 1.835 x $18,000 x 1.263 = $125,150.67peryear.

The cost of approximately $ 125,000 is for personnel only. The cost the equipment and supplies must also be included.

If it is assumed that Exhibit 14 reflects the depreciation on the vehicles and that the above table correctly reflects the additional nonpersonnel costs of operating the sweeper, then the nonpersonnel cost of providing the service is:

20,000 miles x $ 1.133 per mile = $22,660.

Thus, the total direct cost of the service (assuming new personnel are to be hired) is:

Personnel Cost	$ 125 151
Non-personnel Cost	22 660
Total	$ 147 811

The specific numbers used are not intended to reflect the actual costs of street sweeping for a given jurisdiction. What is intended is a presentation of an application of cost analysis techniques to a common situation in local government: costing a new service. An analysis like the one above can be useful in a wide range of situations in local government where new services frequently are considered. By providing information that assembles all relevant cost components into a total bill for the service, a cost analysis can result in such a striking cost figure that program leaders, management, council members, and the public might pause and reflect on the real need for the proposed service and on whether the desired results can be achieved through some less costly method.

Other Considerations

The remainder of this chapter discusses a variety of considerations, techniques, and analytical concepts that are useful to a wide range of cost analyses of local government services. The following material does not exhaust the range of useful ideas but it does cover the ones most frequently used.

Anomalies of Unit Costs

The most difficult steps in a cost analysis are deciding what components are to be included in the cost calculation and how the cost of each component is to be established. The first step is the art of cost analysis; the second is the science of cost analysis. Every science has its anomalies, and cost analysis is no exception.

Note that some individual unit costs used in the preceding example would not change if the vehicles were driven fewer miles (tires and gasoline would cost as much per mile driven, for instance). If a route realignment resulted in the vehicles being driven fewer miles to deliver the same sewice (a productivity improvement), the consequence would be an increase in the cost per mile driven. This is because many of the costs of the vehicle are fixed. For example, insurance costs would likely remain the same, and if only 19,000 miles were driven the per mile cost for this item would increase. While this may appear undesirable, it is not; total cost for the delivery of the service, all other things being equal, will decrease because less gasoline and oil would be consumed and maintenance would be needed less frequently.

Many unit costs will exhibit the same anomalous behavior when productivity is improved. It is important that this be understood so that the total picture can be kept in mind at all times. An increase in unit cost for a service need not indicate a problem — it may even indicate a solution. The key is understanding why the unit cost has changed. Is less service being provided? Is a service being provided more efficiently? Watching fluctuations in unit costs alone will never answer these questions, but such fluctuations can flag situations that merit investigation.

Another example of the anomalous behavior of unit costs is the case of a purchasing division whose unit cost for producing one purchase order went from $4.50 to $9.50 in three years. These numbers seemed to suggest spending with wild abandon, while the truth could hardly have been more different. By combining the purchase orders (POs) issued for repeated purchases of the same goods and issuing a blanket PO, paper work was reduced, efficiency was improved, and money was saved on the goods that were purchased.

In this case, the problem arose because only the unit cost was presented. In general, it is best to display the direct and total data on cost and output along with the unit cost. Such presentations facilitate discussions of productivity — one of the principal uses of unit costs as a management tool.

Technique: Sampling

Very often, being able to calculate the cost of providing a service will depend upon the availability of data not generally maintained in governmental or departmental records. Such data might include the number of flares used for a typical accident, the number of minutes of a health inspector's time used for travel to the site of an inspection, or the amount of time spent in searching records to determine if a protested tax bill has actually been paid.

In most cases, it is far easier to determine these amounts through sampling studies than by requiring all personnel to keep detailed records. Virtually everyone regards detailed

recording of time to be an inconvenience, if not an absolute obstacle to proper job performance. If employees regard the recording chores that are required of them as onerous, the data supplied by them will be of an indifferent character, if not completely untrue. Accurate information cannot be collected without the cooperation of the people directly involved in supplying it. Thus, even if detailed records are available, their accuracy should be verified periodically. Statistical sampling is also an effective tool for such verification.

It is not within the scope of this book to discuss statistical sampling in detail. Instructions on how to use sampling are readily available in a number of texts devoted to the topic. The point here is that sampling is a useful technique that can be applied in many local government situations.

In situations where data are not maintained and there is too little time for sampling, an educated estimate will do if the results of the cost analysis do not have to be precise. As always, it is important to indicate clearly where and why such estimates are used.

Gaining Confidence With Sampling

When conducting a sampling study, data should be obtained from employees actually performing the service. The number of employees and the number of service units on which they report should be large enough to provide results that reflect the overall situation. The actual number of samples needed can be determined by someone familiar with statistical sampling. As a rough guide, however, time reports should be collected from at least 20 persons, and each person should be asked to report on 10 or more different instances.

Instruction should be provided to those who will contribute data. It is important that they fully understand what they are to do and what should be included in or excluded from their reports. Also, it is important that they understand that they should not vary their performance because of the study.For these reasons, the study should be supervised by someone outside of the usual line of authority — perhaps an analyst from the budget office. Otherwise, the reports will reflect what is expected rather than what actually happens.

One alternative to sampling is to use a full record-keeping system, such as detailed time cards. Such systems are cumbersome, however, and may not include the necessary level of detail, since time use is generally recorded in hour or half-hour segments. Estimates may also be used, but they can be faulty and/ or misleading.

Indirect Costs

Indirect costs are costs that cannot be assigned to any particular service but which are necessary for the functioning of the organization as a whole. Most indirect costs are either administrative or facility. It is sometimes advisable to separate administrative and facility costs when determining indirect costs.

Administrative indirect costs can be further categorized as municipal and departmental. Municipal administrative costs include the expenses of both policy — city council — and management — city manager's or mayor's office — leadership, and a variety of support services, such as the city treasury, and the central accounting function. Departments also have their own overhead for internal leadership and support services.

Departmental indirect costs are the costs of administering and managing the services to be delivered by the department. They include the salaries and benefits of senior staff and their

support personnel such as clerks, the costs of vehicles used by senior staff, the costs of hiring and training personnel, and the cost of doing cost analysis studies, among others. It is useful to calculate both levels of administrative costs — departmental and municipal.

Departmental Administrative Costs

Departmental administrative costs should be divided among services in a way that reflects the benefit that these administrative activities provide to the various service efforts. In a public works department, for example, the expense of salary, benefits, vehicle, and space for the chief sanitation engineer should be assigned to services provided by the sanitation division and should not be charged to services provided by the street maintenance unit. The cost of the public works director, on the other hand, should be divided among all services provided by the department, since they all benefit in one way or another from this leadership function.

The usual method for prorating supervisory and administrative costs is to add them as sort of a tax on direct costs. The way this is done depends on the department, but since the cardinal rule is benefit, it is usually best to allocate supervisory and most administrative costs to labor hours, because this most accurately reflects how these costs are incurred. If the jurisdiction happens to contract out most of its public works functions, the contract amount might be an appropriate allocation basis.

Municipal Administrative Costs

The other type of administrative costs are those incurred by the municipality in providing basic management functions. Depending on the way the local government operates, these may include payroll processing, health examinations, and/or other senices. For many reasons, municipalities differ sign)ficantly from one another in terms of which costs appear in the departmental budgets and which appear in the overall city budget. Some jurisdictions allocate every cost they can, while others will lump several major expenses into one pot.

Just as local governments often fail to recover the total costs for the services that they provide to their enterprise funds, municipal departments often are not charged for water, sewage, or refuse collection because the costs are picked up by other city departments or funds. In addition, vehicles used by city executives may be serviced by a police garage and get gas from the public works supply, with those departments footing the bill.

On the other hand, many municipalities keep careful track of these kinds of costs and can supply information on what share of these costs is attributable to individual programs or functions. Knowing these costs is important, since they can be a significant part of the total cost of providing a service.

Estimating Pension Costs: A Problem

One of the most difficult areas with which to deal is pension costs. Since pension costs are incurred now but paid later, there is a feeling that they are somehow not real costs. The situation is compounded by the fact that the time span between incurrence of the expense and its payment can be decades. It thus offers an opportunity to pass the accounting buck to someone else — frequently another generation.

If an ideal pension system was to be initiated, as soon as one person gained the right to a pension (became “vested”), a sum of money would be set aside so that the principal plus accrued interest would be equal to the liability due when the payout date arrived. Unfortunately, perhaps nowhere else in government is the separation of the real from the ideal greater than in the establishment of reserves for future pension payments.

When pension systems were first established there was a general tendency to avoid making the politically difficult decision to put aside money in the present for future pension payments — even though the obligation to pay had been incurred. The result was that as more and more employees reached retirement, governments increasingly were obliged to pay their pension costs out of current funds, since reserves from past years were inadequate.

The implication for a cost analysis is that current pension payments being made by a jurisdiction — depending on the degree to which the government is actually funding its future pension obligations — may have little or nothing to do with costs actually being incurred.

Current pension payments for past services should not be considered when calculating the cost of services since they represent the cost of services previously delivered. It is important to determine what the current or normal cost of the pension system is. This may be different from the amount that is currently being paid out.

Determining the current cost of a pension system is extremely difficult, partly because of the number of complex issues on which assumptions must be made. Major issues that affect estimates of pension costs include:

- the character of the benefit plan, (minimum retirement age and formula for benefit calculation),
- average rate of return on investments,
- mortality tables used, and
- wage growth trends.

Typically, each of the assumptions listed above will vary sign)ficantly from one pension plan to another, making it impossible to give general guidelines. The best advice is to try to locate a recent actuarial valuation and to use its current cost figures. Alternatively, some states provide information to their local governments on current costs of a jurisdiction's pension systems.

Pension costs for current personnel should be projected and calculated as an employee benefit even if no actual expenditure is involved. It is not possible to provide widely applicable guidelines with respect to appropriate percent of payroll, but a report published by The Urban Institute in 1980 gives data on eight governments.[1] The best estimate of current service costs as a percent of payroll (using the “entry age normal” method) ranges from nine percent to 17 percent for general personnel, and from 19 percent to 43 percent for police.

This does not represent the full cost of a pension, but rather the amount that would have to be set aside and invested, with the interest compounded, to meet future obligations presently being incurred. An allowance must be made for the fraction of the required percent of salary that is paid by the employee. If the employee is contributing five percent of salary to the pension system, the municipality is responsible only for the difference between the five percent and the total percent of payroll.

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[1] The Urban Institute, et al., *The Future of State and Local Pensions: Final Report* (Washington, DC: The Urban Institute, November, 1980), p. 19-10.

Facilities Costs

Facilities costs include the cost of depreciation on facilities and the cost of operating and maintaining them. The costs of facilities require special attention because of a general tendency to ignore these costs, which are generally taken for granted. Very often even the operations and maintenance costs of municipal structures are not contained in a department's budget. Capital costs usually are budgeted elsewhere.

Operations and Maintenance Costs

Typical operations and maintenance costs include items such as janitorial services, security services, utility expenses, and machine operation. Specialized areas, such as parks and playgrounds or swimming pools, will have O & M costs unique to their function.

Determining all of the O & M costs and where they are actually budgeted can be quite difficult. Generally, the public works function picks up a significant portion of these costs. In addition, municipal utilities often do not bill government departments for their services. Police may provide security services for public buildings without billing for these services. If a privately owned facility is rented, some or all O & M costs may be included in the rent.

Depreciation of Buildings

Buildings, like equipment, are used over time, so calculating depreciation is an appropriate technique for estimating the cost of using facilities. Numerically, the process of calculating depreciation is similar the example given in Exhibit 14.

The most commonly used method for depreciating buildings involves dividing the historical cost of the structure by an estimate of the length of the structure's useful life. If a major renovation occurs which extends the useful life of the building, the renovation cost would be added to the remaining (undepreciated) value of the building and that total would be depreciated over the new estimate of the structure's useful life.

If a building (or a portion of one) is leased, depreciation cost is presumably included in the charge for rent. Thus, when there is inadequate information on the original cost of a building, getting an estimate of the cost of renting the same amount of space in a similar structure can be useful in estimating the cost of using the building. The jurisdiction's property assessor is usually very knowledgeable about rental rates and should be of considerable help. If there is no assessor, realty agents can provide useful “guesstimates” based on their knowledge of existing rates. It is possible sometimes to use an estimate of rent as a substitute for costs of depreciation and operation and maintenance.

Another source of information for estimating the cost of using city-owned structures may be an outstanding bond issue for the structure in question. It may be appropriate to assume the annual principal payments are equivalent to depreciation.

Allocating Facilities Costs

When a facility is used to support the provision of more than one service, the costs of depreciation and O & M must be allocated to the various benefiting services. One frequently used technique is to allocate the total facilities cost based on the square footage of space used by each program housed in the building.

In this approach, the areas devoted to hallways, entryways and other common facilities such as restrooms are treated as overhead and are allocated based on percentage of the total

area. Numerically, the procedure is the same as the overhead allocations discussed in Chapters 4 and 6.

Special Issues

Some problems that occur in determining the costs of services, including the use of average rather than actual costs and the calculation of depreciation, have already been examined. Another fairly common problem is how to handle the allocation of general supplies.

Many cost items such as general, office, and cleaning supplies can be pooled. If detailed records are maintained, these cost items can be calculated as direct costs for the services for which they are used; however, it is usually simpler to allocate the costs on some pro rata basis such as the number of of fice employees or square feet to be cleaned rather than to calculate the cost of supplies used separately by each service.

Care must be taken when calculating the cost of items like gasoline or tires bought in bulk. It may seem to be a bargain to buy 1,200 tires at $38 each instead of paying $40 each to buy them 100 at a time. But other costs, such as storage and insurance costs on the tires held in reserve, and the cost of interest, must be considered. The city may either have to borrow money to pay for the tires or, if it has the cash on hand, give up the interest it would earn if this cash was put in a bank. When these costs are calculated, the bargain may be no bargain at all. Exhibit 15 demonstrates that when all costs are taken into account it can be cheaper to purchase some items in smaller lots.

It is important to note that this example provides an appropriate cost analysis only if all of the costs are out-of-pocket expenses. If the storage space is in a city facility and would not be used for another purpose, the expense for storage is an unavoidable cost and would be inappropriate for inclusion here. The cost per tire under this assumption would be $39.75, as compared with the alternative of $40.00. Thus, with this change in assumption, it would be desirable to purchase in bulk.

Exhibit 15 Some Cost Considerations

	Annual Purchase (1,200 tires/year)	Monthly Purchase (1,200 tires/year)
Cost of tires	$45,300	$48,000
Interest costs	2,100	
Storage costs	1,500	
Insurance costs	300	
Total	$49,200	$48,000
Cost Per Tire	$41	$40

Calculating Unit Cost

To cost government services accurately it is important to be sure that only one service is being performed at a time. Police services provide a cla,ssic illustration of problems that can arise in costing when more than one service is involved. Many times, an officer can be described as performing more than one service. This makes it difficult to cost any particular service.

Suppose that an officer assigned to traffic patrol writes an average of 12 traffic citations over each eight-hour shift. Each citation takes 15 minutes of the officer's time. Suppose the cost of that officer's time, vehicle, supervision, and so forth is $180 per shift. How should the unit cost of one citation be calculated?

There are two possible ways to calculate a unit cost for a citation. The first method is to divide cost by the number of citations as if the officer did nothing else during the shift:

$$\frac{\$180}{12 \text{ citations}} = \$15 \text{ per citation.}$$

The second method is to determine the cost of one minute of an officer's time and to set the cost of a citation equal to the cost of 15 minutes of time:

$$\frac{\$180}{(8 \text{ hours x } 60 \text{ minutes})} = 37.5 \text{ cents per minute}$$

$$37.5 \text{ cents x } 15 \text{ minutes} = \$5.62 \text{ per citation.}$$

The five hours of noncitation time is on-patrol time and would be costed at $22.50 per hour. Which method is correct?

The discussion of services in Chapter 3 indicates that a service should be observable, exclusive, and homogeneous. When an officer is issuing citations, he or she is still on patrol. If a more serious situation arose, the officer would immediately respond to it. Thus, the citation service is not exclusive. The second method of calculating cost is therefore superior to the first, since it implicitly recognizes that other services will be performed as needed during the shift.

There are additional reasons for preferring the second method. Seasonal, timeof-day, and other causes of fluctuations in the number of service units will not distort the cost per citation when this method is used. If traffic was low in the winter and an average of only six citations per day was written, the first method would indicate that the cost per citation had doubled. However, the officer still would spend only 15 minutes on each one.

Training As a “Depreciable” Asset

Decisions about changing staffing levels frequently are based on very shortterm considerations, without adequate thought given to probable future costs or actual past investments. Nowhere is this more true than with respect to police services.
The seriousness of the decision to hire a new police officer is underscored when the total cost, over an average career span, of a police officer is calculated. While analyses of the cost of police services generally gather together many relevant current costs, they often omit major and very real sunk costs such as the costs for recruitment and training. These costs may include advertising, testing, development and administration, recruitment staff, physical exams, background checks, operation of training facilities, field service training, performance reviews, and salary during training.[2]

In determining the total typical annual cost of putting one of ficer on the street, such sunk costs should be prorated — like depreciation — over the average career span of an officer

[2] The author is indebted to Louis Mayo of the National Institute of Justice who provided this perspective on police costs.

for that department, since the benefit of training is returned gradually over the officer's time in service. Such an approach is especially important when a police department is experiencing unusually high turnover, since new police officers require significant investments in training.

Inflation-Adjusted Expenditures

"Municipal Budget Up" is a headline that is seen frequently. But how true is it? Many local government budgets have suffered from the fact that, while the absolute dollars are up, the purchasing power that those dollars represent is actually down. While everyone will say they know that things cost more, few have an effective grasp of what this really means. One technique that local government officials can use to put the facts in a better light is to provide inflationadjusted figures to the press and the public. As the old adage goes, a picture is worth a thousand words; in this case, a graph can be a very effective technique for presenting the facts.

Exhibit 16 is a page from the Downers Grove, Illinois budget for fiscal year 1982. It shows one way of presenting inflation-adjusted figures. In this case the regional Consumer Price Index (CPI) is presented as the top line, with the percent increases in the local budget over a four-year period as the middle line. The graphic message is that the budget may be up in dollars but it is up much less than general prices. To drive the point home, the bottom line shows the percent decrease of what the budget can actually buy.

[Exhibit 15, Downers Grove here]

Overall, the presentation is quite compelling, especially because of the wide divergence between the top and bottom lines. Such displays can help the press and the public to appreciate the problems of controlling expenditures in inflationary times. They go a long way to explain why government costs what it does, by pointing out that governments do not exist in a vacuum — they are subject to many of the forces that affect the rest of the economy.

The material presented in this chapter completes the basics of cost analysis and the most widely used techniques to manipulate cost data. Subsequent chapters present various applications of the concepts and techniques that were developed in Chapters 4 and 5.