Economics of Community Services – Budgeting Methods

Beth Nelson

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Economics of community services

Budgeting methods

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and
Thomas Dobbs, Extension economist, rural development

Increased public scrutiny of government spending is causing officials at all levels of government to search for better program planning and evaluation procedures. Local governments are becoming particularly cost conscious in the area of community services.

At the same time that they face an increasingly tax conscious public, local officials are finding that their communities are changing, sometimes quite rapidly.

A number of South Dakota communities are participating in a new nationwide growth trend—non-metropolitan areas of the country are expanding at a faster rate than metropolitan areas. Such communities are experiencing the pressure for expanded community services such as health and emergency medical care, fire protection, law enforcement, housing, water and sewer systems, and educational and recreational facilities.

Some other rural South Dakota communities continue to lose population. They face critical decisions on how to maintain adequate services for their remaining residents.

In all these situations, decision making can be improved by sound economic analyses of alternative delivery systems for community services. These analyses entail budgeting.
Formal budgeting procedures can help local governments improve or expand services at the least possible cost. In other cases, budgeting can help reduce costs without significantly decreasing services. Budgeting procedures are beginning to be used in the planning of community services in various other states. South Dakotans can profitably borrow from these approaches.

While budgeting (the estimation of expenditures and revenues associated with various courses of action) is an old and familiar tool in many fields of economics, it has often not been used as systematically as it might have been in public sector decision making about community services. There are a great many opportunities for using budgeting to aid in local choices about what community services should be provided, the level at which they should be provided, and how they should be provided.

This circular illustrates how budgeting can be used to clarify choices about delivery of community services, primarily through an example for one particular service—that of fire protection.

In 1974 the USDA began helping to provide budget information for a number of community services to local decision makers. The effort focused on the economic and social conditions of the Great Plains region, and the pilot area selected was northwestern Oklahoma. Under this pilot effort, budgets were prepared for rural ambulance, fire protection, hospital, rental housing, rural clinic, and law enforcement services. Staff of the USDA and of the Oklahoma State University (OSU) Cooperative Extension Service worked with local communities in developing the budgets and helping the communities plan for cost-effective service delivery.

The following example of fire protection illustrates the use of budgeting procedures in planning community services. Although the example and materials reflect costs in Oklahoma, the approach is relevant to South Dakota for various reasons: (1) Both the pilot
area in Oklahoma and South Dakota are basically rural in character, and (2) the population densities of the two areas are very similar, being 8.58 in the Oklahoma study area and 9.0 in South Dakota. As a consequence, costs found in the Oklahoma example are probably not very dissimilar from costs in South Dakota; they could be adjusted to South Dakota communities and updated for inflation without difficulty by local officials.

Similar budgeting studies have been conducted for various other community services by researchers and extension workers in several other western, Great Plains, and north central states. The budgets from those studies could also be adapted for use in South Dakota communities without difficulty. Selected examples and sources are listed at the end of this publication, along with suggestions on how to obtain publications and individualized assistance.

An Example: Rural Fire Protection

Some community services are "optional." For all practical purposes, fire protection (in whatever form) is not. Urban sprawl, growth of small towns and cities, increased farm investments, and increased cost of fighting equipment increase the need for adequate but cost-effective rural fire protection.

Basic budgeting procedures for rural fire protection include (1) estimation of the number, types, and locations of future fires; (2) calculation of annual capital and operating costs of fire protection; (3) calculation of the cost per fire; and (4) determination of possible funding alternatives.

Estimation of Future Fires

Data on the number, type, location, and seasonality of past fires help to determine the level and type of fire protection a community will need in the future. These data are used in conjunction with population data to estimate Fire Frequency Coefficients
(FFCs) which, in turn, are used in the estimation of probable future fires. Three basic steps are involved in this estimation process:

**Step 1.** Relevant population and fire data are gathered from the State Fire Marshal's Office, fire chiefs, fire department annual reports, and other local records. These data include the number of people, homes, businesses, vehicles, and farms in the study area, as well as the number of fires of various types that have occurred over a specific time period. (For example, the various types of fires could include rural grassland fires, home fires, and business fires, among others).

Data may be selected from one year or based on an average of several years, depending on how representative a given year is expected to be. This example from Oklahoma uses data from only the year 1974. However, the data were compared to an average derived over a 6-year period and found to be accurate enough for use in the study.

**Step 2.** Fire Frequency Coefficients (FFCs) for the study area are calculated. This is done by dividing the number of units in each category by the number of fires occurring in the respective categories during the given time period. For example, a FFC for business establishments in the Oklahoma study was calculated as follows:

\[
\frac{\text{Total number of business places (1961)}}{\text{total number of business fires (54)}} = \text{FFC of 36.}
\]

This means that one fire occurred per 36 business places (in 1974, the base year). FFCs are calculated in this same manner for each of the categories designated in Step 1 (farmland, housing units, etc).

**Step 3.** The final step in estimating future fires involves projections of the units expected to exist in each category in the future. The Oklahoma example used 1980 as a projection point. Estimates were made of the total population, number of housing units, num-
ber of businesses, etc, expected to exist in the study area in 1980. Each estimate is then divided by its appropriate FFC to determine the projected number of future fires in the various categories. After making the computations for each category, the results are summed to arrive at the total number of future (1980) fires expected to occur in the study area. This final figure is required not only for determining the level of fire protection needed but also for estimating annual capital and operating expenses.

Table 1 summarizes the procedure to use once the individual FFCs have been calculated. Part B of that table is used if FFCs can be calculated for each of several different categories of fires, as just described. If that kind of detail is not possible, a single FFC based upon population in the study area can be used. This alternative is shown in Part A of Table 1.

Estimation of Annual Costs

The next task involves the estimation of capital and operating costs associated with the fire protection.

**Capital costs**: Capital costs include annual depreciation and interest expenses for items such as fire trucks, communication systems, fire stations, and firefighter suits.

Local officials need to identify the type and condition of firefighting equipment already on hand, as well as whatever additional equipment or improvements are needed. Local geographic conditions and the types of fires that occur must be analyzed to determine the type and expected life of firefighting equipment.

Table 2 is a brief summary of the annual capital costs (based on 1975 prices) found in the Oklahoma study for an average rural, 12-person volunteer firefighting system which involves the use of a small truck, a fire station building, and a communications
Table 1 -- Procedure to estimate number of future fires for a given service area.

The fire frequency coefficients (FFCs) given below were calculated for the Great Plains study example using the procedure in Step 2. Choose Part A or Part B. If data are available, estimates in Part B of this form are more reliable than estimates based on Part A.

A. Estimated future fires based on population only:
   1. Population (1,131) \( \times \) FFC for population (62) = 18.24

B. Estimated future fires based on demographic characteristics:
   1. No. acres (91,250) \( \div \) grass fire FFC (15,007) = 6.10
   2. No. housing units\(^1\) (414) \( \div \) storage and trash fire FFC (85) = 4.87
   3. Population (1,131) \( \div \) "other fires" FFC (418) = 2.71
   4. No. registered vehicles (1,406) \( \div \) vehicle FFC (397) = 3.54
   5. No. business places (10) \( \div \) business place FFC (36) = .28
   6. No. mobile homes registered (10) \( \div \) mobile home FFC (71) = .14
   7. No. town housing units (130) \( \div \) town housing unit FFC (144) = .90
   8. No. rural housing units (274) \( \div \) rural housing unit FFC (299) = .92

Estimated number of future fires (add items B-1 through B-8) = 19.46

\(^1\)Includes town housing units, rural housing units, and mobile homes.

Table 2 -- Summary of annual capital costs in Oklahoma study.

<table>
<thead>
<tr>
<th>Item</th>
<th>Capital Cost</th>
<th>Amortization Rate</th>
<th>Annual Capital Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle</td>
<td>$11,450</td>
<td>.09634</td>
<td>$1,103.12</td>
</tr>
<tr>
<td>Communication System</td>
<td>$ 7,220</td>
<td>.129505</td>
<td>$ 935.03</td>
</tr>
<tr>
<td>Fire Station</td>
<td>$16,000</td>
<td>.058278</td>
<td>$ 932.45</td>
</tr>
<tr>
<td>Firefighter Suits for 12 Volunteers at $100 each</td>
<td>$ 1,200</td>
<td>.129505</td>
<td>$ 155.41</td>
</tr>
</tbody>
</table>

Total Annual Capital Costs $3,126.01
system. Cost data could be adjusted to current levels by using a price index such as the Consumer Price Index (CPI).

This particular example was based on an assumed loan from the Farmers Home Administration (FmHA) for the vehicle and fire station and a conventional loan for the communications system and firefighter suits. Capital costs are put on an annual basis by multiplying the initial cost of each item times the appropriate amortization rate.

Amortization rates are cost factors determined by taking into account annual depreciation and interest charges. Amortization tables can usually be provided by local bankers or by Extension specialists in the Economics Department at SDSU. They are also found in some of the publications coming out of the USDA - OSU budgeting studies. Those publications also contain easy-to-use forms for computing annual capital and operating expenses.

Operating costs: Information for determination of operating costs can be obtained from fire chiefs, fire department annual reports, and equipment dealers. Vehicle operating costs include such items as gasoline, tires, oil, oil filters, grease, tune-ups, antifreeze, insurance, communications system service contracts, and other miscellaneous items.

Vehicle expenses are calculated by estimating and combining information on the number of future fires for the area, the average number of miles per call, miles per gallon of gasoline and per tire, costs per gallon of gasoline and per tire, and so forth. Other operating expenses include replacement of minor equipment, labor (which is dependent on the type — such as volunteer, part-paid, or full-paid), and fire station operation and maintenance expense. Annual operating expenses (representing 1975 prices) for the Oklahoma example are summarized in Table 3.
### Table 3 -- Summary of annual operating expenses in Oklahoma study.

<table>
<thead>
<tr>
<th>Item</th>
<th>No. of Fires</th>
<th>Ave. Distance Per Call</th>
<th>Per Unit Adjustments</th>
<th>= Annual Operating Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Vehicle</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Gasoline</td>
<td>(19 x 38)</td>
<td></td>
<td>8 mpg x $.54/gal.</td>
<td>48.74</td>
</tr>
<tr>
<td>2. Tires (use a or b, whichever result is larger)</td>
<td>(19 x 38)</td>
<td>10,000 mi. x $80/tire x 4 tires</td>
<td>= 64.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.2 (for a max. of 5 yrs.) x $80/tire x 4 tires</td>
<td></td>
</tr>
<tr>
<td>3. Oil</td>
<td>(19 x 38)</td>
<td></td>
<td>500 mi. per oil change (or 2 times a year, whichever is greater) x 5 qt. x $.75/qt.</td>
<td>7.50</td>
</tr>
<tr>
<td>4. Oil filter</td>
<td>(19 x 38)</td>
<td></td>
<td>500 mi. per oil filter change (or 2 times a year, whichever is greater) x $4/filter</td>
<td>8.00</td>
</tr>
<tr>
<td>5. Grease</td>
<td>(19 x 38)</td>
<td></td>
<td>500 mi. per grease job (or 2 times a year, whichever is greater) x $2</td>
<td>4.00</td>
</tr>
<tr>
<td>6. Tune-up</td>
<td>(19 x 38)</td>
<td></td>
<td>1,000 mi. per tune-up x $60</td>
<td>43.32</td>
</tr>
<tr>
<td>7. Antifreeze/yr.</td>
<td></td>
<td></td>
<td></td>
<td>10.00</td>
</tr>
<tr>
<td>8. Miscellaneous</td>
<td>(19 x 38)</td>
<td></td>
<td>500 mi. per misc. exp. x $10</td>
<td>14.40</td>
</tr>
<tr>
<td>9. Insurance</td>
<td></td>
<td></td>
<td>$14 per $1,000 worth</td>
<td>154.00</td>
</tr>
<tr>
<td>10. Communication system service contract</td>
<td></td>
<td></td>
<td></td>
<td>50.00</td>
</tr>
</tbody>
</table>

**Vehicle subtotal**

$403.96
Table 3 -- Continued

<table>
<thead>
<tr>
<th>Item</th>
<th>No. of Units</th>
<th>Per Unit Adjustments</th>
<th>= Annual Operating Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other Operating Expenses</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B. Fire Equipment Equipment</strong></td>
<td>19 fires x $3 (ave. replacement per call)</td>
<td>= 57.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equipment subtotal</td>
<td>= 57.00</td>
<td></td>
</tr>
<tr>
<td><strong>C. Labor</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. No. of paid personnel (1) x 12 months x amount per month ($50)</td>
<td>= 600.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Ave. no. of firefighters at monthly meeting (12) x 12 months x amount paid/meeting ($2)</td>
<td>= 288.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Fires (19) x ave. no. of firefighters responding (4) x amount paid/fire to each firefighter ($3)</td>
<td>= 288.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor subtotal</td>
<td>= $1,116.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>D. Fire Station</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Monthly electricity: 12 months x $20/month</td>
<td>= 240.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Monthly water and sewer: 12 months x $12/month</td>
<td>= 144.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Insurance per year</td>
<td>= 240.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Maintenance and miscellaneous</td>
<td>= 160.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire station subtotal</td>
<td>= $784.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Annual Operating Expenses</strong></td>
<td></td>
<td></td>
<td>$2,360.96</td>
</tr>
</tbody>
</table>
Calculation of Cost Per Fire

Cost per fire can be calculated on the basis of information generated above. This is done by adding the annual capital and operating expenses and dividing by the estimated number of future fires annually, as follows:

\[
\frac{\text{Annual capital} + \text{Annual operating expense}}{\text{Estimated future fires annually}} = \text{Cost per fire}
\]

In this example from Oklahoma, the cost per fire was estimated to be \[\frac{($3,126.01 + $2,360.96)}{19}\] = $289. This implies that an average of $289 per fire would need to be charged if all fire protection costs were to be covered by users of the service in that area.

Determination of Funding Alternatives

Since rural fire services may not always charge user fees adequate to cover costs as determined above, other funding alternatives may need to be considered.

In addition to user charges (if any), some combination of the following alternatives may be called for: (1) public donations and fund raising events, (2) tax revenues of some sort, and (3) special grants, such as from the federal government.

It is not our purpose here to identify or describe all funding alternatives. Rather, the point is that budgeting procedures can be used to arrive at the costs of providing rural fire service. Those costs can then serve as a basis for examining funding alternatives and the financial viability of the service.

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1 In South Dakota, information concerning FmHA loans and other funding may be obtained from the State Fire Marshal's Office, which is part of the Division of Fire Safety, Department of Public Safety in Pierre.
Additional Uses of the Budget Information

This same type of budget information also can be used in more complicated analyses if sufficient planning capability exists. For example, an analysis was made of optimum location points for fire trucks in one Oklahoma county.

A technique known as linear programming was used to determine which combination of possible fire truck locations in the county would best serve various planning objectives, including (1) minimizing the time required to reach fires, (2) minimizing the mileage required to reach fires, and (3) maximizing fire protection in terms of the value of burnable property. Alternative locations for trucks were considered, assuming a total of one, two, or three trucks.

The linear programming approach facilitated a clear understanding of the trade-offs among various objectives when it came down to locating fire trucks within the county.

Budgeting for Other Community Services

Budgeting procedures can be useful in examining the economic and financial feasibility of virtually any type of community service. While the concepts used in each of the studies are similar to those in the fire protection example, the particular applications vary somewhat in detail. Just a few of the applications to other services are mentioned here to further illustrate the relevance of budgeting to community decision making.

Transportation Services for the Elderly

Economists at the University of Minnesota recently used budgeting procedures to compare alternative methods of providing transportation services for elderly persons in a rural county.
Capital and operating costs were computed for alternatives, including (1) various sizes of vehicles, (2) owned and rented vehicles, and (3) hired and volunteer drivers. Least-cost alternatives were determined for three different levels of assumed passenger usage.

The steps used in this study are clearly spelled out in a University of Minnesota publication, and could be copied by communities in South Dakota or elsewhere with similar transportation concerns.

**Ambulance and Law Enforcement Services**

Included in the budgeting studies conducted as part of the USDA-OSU project were ones focused on alternative delivery systems for ambulance and law enforcement services.

Capital and operating costs were computed and compared for different types of ambulance systems, including (1) a fully staffed system, (2) a volunteer system, and (3) a hospital-based system. In the law enforcement study, costs (for a single community) were compared for (1) a police department operated by the community itself, (2) a police department shared by two or more communities located close together, and (3) a system of one community contracting with another entity for police services.

In both of these studies, as in other USDA-OSU budgeting studies, forms were developed and presented which could be used in estimating costs in other communities.

**Rural Rental Housing**

The USDA-OSU project also included a budgeting analysis of rural rental housing. Such an analysis highlights the need for reasonable estimates of local demand for housing.

Various occupancy and rental rates can be assumed in estimating rental revenues and comparing those rev-
enues to total capital and operating costs. If reasonable estimates of housing demand -- as reflected in the assumed occupancy and rental rates -- result in estimated rental revenues that fall short of total costs, the housing unit may be financially impractical.

Additional Information and Assistance

The budgeting approach also works in other service areas, such as solid waste disposal and rural water systems. It could be used in additional areas, such as whether and how to provide additional day care services in areas being affected by increased participation of young mothers in the work force.

Extension economists at SDSU can provide information on these budgeting procedures through the "Community Services Extension Project." Under this project, an annotated bibliography which lists and briefly describes various community services budgeting studies is available. Ask for EMC 806 at your county Extension office or write to the Economics Department at SDSU.

A number of the publications which are most pertinent to South Dakota conditions are available for examination in each county Extension office. Individual copies of publications can be obtained either from the Economics Department or from sources listed in EMC 806.

Advice on applying these budgeting procedures to particular community services problems can be obtained from SDSU Extension economists specializing in rural development. Community leaders and officials can inquire about such assistance by contacting county Extension personnel or by writing to:

Community Services Extension Project
Economics Department
Scobey Hall
South Dakota State University
Brookings, SD 57007 (Phone: 688-4141)
Sources

The sources listed below were drawn on in various sections of this circular. Most heavily used were those publications by the USDA which resulted from a pilot study in Oklahoma dealing with the application of budgeting procedures to community services decision making. The fire protection publication listed below (number 1) was drawn on the most heavily.


EC 732
ECONOMICS OF COMMUNITY SERVICES: BUDGETING METHODS

October 1979