COMPUTERIZED ANALYSIS OF THE ECONOMICS OF COMMUNITY SERVICES FOR LOCAL APPLICATIONS

by

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Introduction

Rural community leaders are frequently called on to make decisions related to the allocation of local public resources to provide community services to residents. The public funds with which these decisions are concerned make up substantial portions of local budgets for rural communities. Consequently, public officials of rural communities have specified the provision of adequate local community services within budget constraints as one of the more important problems with which they must deal. In Oklahoma, such officials have indicated that information on local public service demands and localized costs of such services are high priority needs that should be addressed by research and extension personnel associated with the land grant university system [2, 5].

Such requests for assistance might be interpreted as indicating

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that little research has been done concerning the economics of rural community services. However, such is not the case. The literature abounds with such works. Numerous studies have been conducted related to rural water systems [8, 13], rural sewer systems [12], solid waste management [10, 6, 11], rural ambulance services [4], rural fire services [1, 14], and rural hospitals [3, 7, 9], to name a few.

There are needs for further study of these and other services, but meaningful and useful research results do exist. Professional knowledge about the economics of community services is not as great a limiting factor in assisting rural community decision makers as is the capability to deliver existing information. Several factors hinder information delivery.

Needs for particular types of public services vary greatly among communities. These varying needs along with special social, economic, and demographic characteristics of particular communities cause difficulties in generalizing results of community service research projects to make them fit all or even large groups of rural communities. Such research projects usually yield proven methodologies and information about basic relationships which must be adapted to local circumstances and utilized with local data to analyze the economics of existing or proposed community service systems in specific communities.

The methodologies for analyzing community services tend to be rather complex. While such methodologies may not be recognized as overly sophisticated by professional economists, they can be fraught with difficulty and confusion when applied by community leaders or extension field personnel whose training is oriented more toward interaction

with people than toward analytical techniques.

The application to local community service problems of analysis techniques developed and validated in research situations, can be very time consuming. Yet, local community service decisions must often be made on short notice. The community leader or field extension specialist with numerous other responsibilities may be hard pressed to localize such models, operationalize them and produce results when working with a desk calculator and a pencil under severe time constraints.

Utilization of generally available computer hardware and techniques can minimize these hindrances to community services information delivery. Computer programs can be developed to rapidly estimate specific community service needs and costs for alternative delivery systems in local situations. In many cases, these programs are based on existing research findings. Such programs can be developed for field access on remote computer terminals. Access procedures are usually relatively simple and can be learned by field extension personnel. These professional extension field personnel can then devote more time to working with local decision makers to identify local problems, pull together local information pertinent to these problems and explain results and implications of analyses.

An effort to develop and adapt computerized community service decision making aids from existing research is currently underway at Oklahoma State University. The remainder of this paper is devoted to the discussion of the development, application and acceptance of such a tool.

An Example

A computerized model to analyze the economics of rural fire services has been developed at Oklahoma State University. The model is based on research conducted by Childs, et al. [1] on fire protection in the Great Plains. The program is written in PL/I under the IBM time sharing package TSO, and is accessed by a remote computer terminal. It is an interactive program, constructed such that an operator can enter specific local information as needed to estimate the number of fires in a fire service area, the labor and equipment needed to fight these fires, and the resulting annualized capital and operating costs. An example computer output is shown in Figure 1.

Once a terminal operator has logged on and accessed the program, he is asked to enter the current consumer price index. This index is utilized within the program to adjust the 1975 fire service cost estimates made by Childs, et al. [1] to current dollars. After the consumer price index is entered, the computer then prints out estimates of purchase prices for capital equipment items which may be needed to operate a rural fire department (labeled Table 1 in computer output).

The operator is then asked to enter local service area data on population, number of acres, number of business places, number of registered vehicles, number of rural housing units, number of town housing units and number of mobile homes. The computer then calculates and prints two estimates of the number of fires annually in the service area (labeled Table 2 in computer output). One estimate is based on population only. The other is based on population as well as the other local demographic data entered earlier. This demographic data is

FIGURE 1 -- COMPUTER OUTPUT

R U R A L F I R E S E R V I C E C O S T S

What is the current consumer price index?
:
191.5

TABLE 1.--ESTIMATED CAPITAL COSTS

VEHICLE :	
LARGE TRUCK	37717.87
SMALL TRUCK	13602.19
COMMUNICATIONS EQUIPMENT:	
MOBILE REPEATER BASE	5464.63
REMOTE BASE STATION	439.55
REMOTE BASE STATION TOWER EQUIPMENT	3563.89
MOBILE UNITS	1556.23
BUILDINGS	19007.43
FIREFIGHTING SUITS	118.80

Please enter the following information
for your fire service area :

Population : 1131
Number of Acres: 91520
Number of Business Places: 10
Number of registered vehicles, not including
trailers and mobile homes : 1406
Number of non-mobile home rural Housing Units: 274
Number of non-mobile home town Housing Units: 130
Number of Mobile Homes: 10

TABLE 2.--ESTIMATED ANNUAL FIRES

BASED ON POPULATION ONLY	18.2419
BASED ON DEMOGRAPIC CHARACTERISTICS	19.3427

FIRE TYPE	TOWN	RURAL
GRASS FIRES	0.0000	6.0985
STORAGE FIRES	2.3507	2.4022
VEHICLE FIRES	1.7516	1.7900
BUSINESS FIRES	0.2778	0.0000
HOUSE & MOBILE HOME FIRES	0.9724	0.9937
OTHER FIRES	1.3382	1.3675
TOTAL	6.6907	12.6520

TABLE 3.--ESTIMATED ANNUAL FIRE LOSSES

FIRE TYPE	TOWN	RURAL
GRASS FIRES	0.00	2108.23
STORAGE FIRES	5451.09	7690.83
VEHICLE FIRES	461.94	4393.18
BUSINESS FIRES	4503.70	0.00
HOUSE & MOBILE HOME FIRES	2375.13	3841.45
OTHER FIRES	376.77	5177.53
TOTAL	13168.63	23211.27

TOTAL ESTIMATED ANNUAL FIRE LOSSES 35394.54

What is your best estimate of the annual number of fires ?
:
19

What is your best estimate of the average
(round trip)distance traveled for each fire?
:
38

TABLE 4.--INFORMATION ON VEHICLE OPERATION

	LARGE TRUCK	SMALL TRUCK
GAS COST	0.64	0.64
GAS MPG	4.00	8.00
NUMBER OF TIRES	6.00	4.00
COST PER TIRE	118.80	95.04
TIRE REPLACEMENT (MILES)	10000.00	10000.00
TIRE REPLACEMENT (YEARS)	5.00	5.00
OIL CAPACITY (QUARTS)	5.00	5.00
OIL CHANGE (MILES)	500.00	500.00
OIL CHANGE (MONTHS)	6.00	6.00
OIL COST	0.89	0.89
OIL FILTER COST	4.75	4.75
GREASE COST PER LUBE JOB	2.38	2.38
TUNE UP (MILES)	1000.00	1000.00
TUNE UP COST	71.28	71.28
ANTIFREEZE COST PER YEAR	11.88	11.88
INSURANCE COST PER $1000	16.63	16.63
MISC COST PER 1000 MILES	23.76	23.76
COMMUN. SYST. MAINT.COST/YEAR	59.40	59.40

Would you like to change any of this
vehicle operation information ?(Yes or No)
:
NO

TABLE 5.--OTHER OPERATING COSTS

MONTHLY ELECTRICITY	23.76
MONTHLY WATER AND SEWER	14.26
ANNUAL BUILDING INSURANCE	285.11
ANNUAL BUILDING MAINTENANCE	190.07
VOLUNTEER PAY PER FIRE	3.56
VOLUNTEER PAY PER MEETING	2.38
PAID CHIEF PAY PER MONTH	674.76
PAID ASST. CHIEF PAY PER MONTH	636.75
PAID FIREMEN PAY PER MONTH	532.21
SUPPLIES PER CALL	3.56

Do you wish to change any of these
operating costs ?(YES or NO)
:
NO
How many firemen work in your fire department?
:
13

What is the total monthly waste bill for your
department ?
:
693

TABLE 6.--REPLACEMENT PERIOD(IN YEARS) FOR CAPITAL EQUIPMENT

TRUCK	15
COMMUNICATIONS EQUIPMENT	10
FIRE STATION	40
FIREFIGHTING SUITS	10

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Do you wish to change any of the
 replacement period information?(YES or NO)
:
NO
Do you wish to consider a large truck(code 1)
or a small truck(code 2) in this analysis ?     CODE: 1


Enter costs and appropriate interest rates for capital items.
TABLE 1 may be used to help in your estimate
of capital costs.
                INTEREST
     COST       RATE
TRUCK
:
  37720          5

COMMUNICATIONS EQUIPMENT
:
   7020          9

FIRE STATION
:
19000            5

FIREFIGHTING SUITS
(PER SUIT)
:
    118          9
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ESTIMATED ANNUAL FIRE SERVICE COSTS

NNUAL CAPITAL COSTS :

VEHICLE		3634.07	
COMMUNICATIONS SYSTEM		1093.86	
BUILDING		1107.29	
FIREFIGHTING SUITS		239.03	
TOTAL ANNUAL CAPITAL COSTS			6074.24

STIMATED ANNUAL OPERATING COSTS :

VEHICLE			
GAS	115.79		
TIRES	142.56		
OIL	8.91		
GREASE	4.75		
TUNE UPS	51.46		
ANTIFREEZE	11.88		
INSURANCE	627.00		
COMMUNICATIONS SYSTEM	59.40		
MISCELLANEOUS	17.00		
TOTAL		1038.75	
SUPPLIES		22.56	
LABOR		8316.00	
FIRE STATION			
ELECTRICITY	285.11		
WATER & SEWAGE	171.07		
INSURANCE	285.11		
MISCELLANEOUS	190.07		
TOTAL		1100.18	
TOTAL ESTIMATED ANNUAL OPERATING COSTS			10477.48

TOTAL ESTIMATED ANNUAL FIRE SERVICE COSTS 16551.73

utilized along with the rural fire frequency coefficients estimated by Childs, et al. [1] to estimate number of fires. The computer also calculates estimated annual fire losses for the service area based on the estimates of numbers of fires by types and inflated loss coefficients from Childs, et al. [1] (Table 3 in computer output).

At this point it is necessary for the terminal operator or those decision makers working with him to make assumptions about the number of fires actually expected in the service area. The calculated estimates of number of fires are usually heavily relied upon for this purpose, but if local decision makers feel these estimates are unrealistic they can make their own assumptions. Estimated average round trip distance traveled per fire must also be entered into the program. Local decision makers can usually utilize the estimates of town and rural fires coupled with their personal knowledge of the service area to reasonably estimate this figure.

The computer then calculates and prints estimates of costs and other information related to rural fire service operations (Table 4 and 5 in computer output). The operator is given the option of changing any of these estimates. If he indicates that a change is desired, the computer prints appropriate instructions. After any desired operating information changes are made, it is necessary to enter the total number of firemen who will be working in the department and the expected total monthly wage bill for the department. Total monthly wages are not calculated internally because systems of wage payment vary so much among rural fire departments as to make such calculations very difficult to generalize. If the analysis is being conducted for a new department, however, for

which wages have not been determined, decision makers can use some of the information printed in Table 5 of the computer output as wage guidelines.

The computer prints typical replacement periods for capital items, (Table 6 in computer output) and once again gives the user an opportunity to make any changes thought to be appropriate for the particular fire service being analyzed. The user is then asked to identify the type of truck (large or small) to be considered in the analysis. He is also requested to make cost and interest rate assumptions for fire service capital items. He is referred to Table 1 of the computer output for guidance in making capital items cost assumptions. The computer utilizes the information discussed above to estimate annual capital costs (including interest and depreciation), annual operating costs and total annual costs for the rural fire service system under consideration. These costs are printed by the terminal.

This computerized rural fire service model has been quite useful in working with rural fire departments in Oklahoma. It facilitates rapid analyses of alternative situations, comparisons among which can lead to much more well informed decision making by community leaders. It has been used to help new departments organize and plan equipment purchases and financial needs, and to assist existing departments in identifying their actual costs. It has also been used in developing areas to predict future needs for service and costs of such future service.

The packaging of the model in an interactive, remote terminal accessible computer program minimizes the amount of specialists' time needed to respond to requests relating to the economics of rural fire services. The computerized packaging of the model also serves to impress

clientele with the sophistication of assistance available to them from their land grant university. Most clientele quickly see the advantages of being able to rapidly evaluate numerous alternatives in light of available funds and community needs.

Summary and Conclusions

Public officials of rural communities identify the provision of adequate local community services within budget constraints as one of the more important problems with which they must deal. Numerous research studies have been conducted concerning the economics of such services. However, several factors hinder the delivery of the results of such research to community decision makers.

To be useful to individual communities, generalized research results must be localized. Methodologies for localizing and applying such results are often too sophisticated to be well understood by extension field personnel. In addition, the application to local community service problems of analysis techniques developed in research situations can be very time consuming.

Utilization of generally available computer hardware and techniques can minimize these hindrances. For many community services, the analysis techniques which have been developed by researchers lend themselves well to computerization for remote terminal access in the field. Such a computerized model has been developed at Oklahoma State University for analysis of the economics of rural fire services. The model, presented herein, facilitates estimation for a designated area, of fire service needs and costs of alternative systems to serve these needs. The model

has been utilized in numerous field applications in Oklahoma. Results have been well accepted and useful to many community decision makers.

An adequate research base exists for the development of other such remote accessible community service analysis tools. Indications are that such models would be well accepted and extensively utilized by community decision makers and extension field personnel.

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