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A Decision Making Framework for Municipal Services in Rural Areas.

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Municipal officials must make decisions concerning services without the aid of traditional market mechanisms. Suggestions are made on how to overcome these shortcomings through the use of simulation techniques. The framework developed incorporates the influence of social, economic, spatial and political components of the community on municipal service decisions.

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A Decision Making Framework for Municipal Services in Rural Areas

Ron Shaffer and Jeff Stier*

Municipalities in nonmetropolitan areas are far from dormant. They are constantly in the process of growth or decline. Although they have been of concern to researchers for many years, state and federal policy makers are just now becoming cognizant of the problems of smaller municipalities. The vast majority of this research and policy interest has been with the demographic, social and economic changes that have or are expected to occur. (Beale, Fuguitt, Haren) There is an increasing awareness of the implications of these changes for the public services that are desired and delivered in rural areas. (Leadley, Brunn) Changes in the size and characteristics of population influence the type and quality of municipal services desired. Taste and preference changes towards public versus private provision of services are exhibited in the substitution of formalized public institutions for previously informal private arrangements, e.g., care of the elderly. Almost instantaneous mass communication, coupled with a high level of population mobility, is raising expectations of rural residents about the quality of services that they believe they should receive. (Brunn and Jones) Another aspect affecting municipal services in rural areas is the changing economic structure associated with the declining importance of agriculture as a source of employment and income, and the increasing importance of manufacturing, services and recreation. This economic structural change has resulted in differences in terms of the types of services required. (Gessaman, Brunn and Jones) Thus, the heightened

interest in services in rural municipalities can be linked with national changes in population mobility, tastes and preferences, and economic activity.

We are starting to accumulate a body of research knowledge that addresses some of the questions of municipal service delivery and provision, but this is not occurring in any overall systematic fashion. Our purpose is to share with you a conceptual framework that we believe will be fruitful for guiding research on municipal services in rural areas. Our long-run objective is to prepare a simulation model of municipal service "demand" and "supply" for use by municipal officials. In the next section we will review the appropriateness of the theoretical concepts of demand, supply, costs, and production in analyzing municipal services. From this we will distill a model to guide research efforts on municipal services in rural areas.

THEORETIC CONSIDERATIONS

The traditional perspective is that the market system should be the method and manner determining the who, how, what, and where of production and consumption. However, this perspective is more the exception than the rule when discussing public goods and services for which there is no traditional price mechanism to perform the allocative function of the private market system. Other characteristics of pure public goods, including inability to exclude any user, a fixed consumption coefficient, and zero cost of providing the service to the marginal consumer also restrict direct application of conventional forms of economic analysis. (Samuelson) In contrast, pure private goods have polar characteristics. Since most municipal services lie somewhere between these extremes of the spectrum, we have

chosen the terminology "municipal services" in lieu of "public services" for this discussion.

The impetus for this model was to develop a method to assist local governmental officials in making decisions concerning the provision of and need for municipal services. To accomplish this requires determining the objective function of the various actors within this decision-making framework. Brunn and Jones suggest that the actors are politicians, consumers, and taxpayers. Gessaman would add the bureaucrat. Each of these individuals or groups of individuals views the level and quality of services from a different perspective. This is somewhat analogous to private decision making in a partnership with each of the partners desiring to maximize different objectives, e.g., profits, community goodwill, leisure time, or good working relationships with the employees. The politician is probably desirous of continuing his term in office by maximizing the support (votes) he can generate. The consumer is concerned about maximizing the amount of services that he or his family receives. The taxpayer is interested in minimizing his taxes, while the bureaucrat desires to maximize the total budget for his agency's operation. These four sets of actors could conceivably reach an agreement, but it is quite likely that they generally would not be in agreement. For example, the consumer desires to have a service delivered at a time and place and in a form that is most convenient to him. The bureaucrat is desirous of providing the service given his constraints of minimizing administrative problems and maximizing total output. Thus, any model of the municipal service decision-making process must consider resolving the potential conflicts among different sets of objective functions.

Conceivably, these conflicts in decision making could be resolved via demand and supply analysis. However, classic demand and supply analysis in

its purest sense is unsuitable for much of the research in municipal services. Brunn and Jones note that the lack of an identifiable price, or close substitutes and the nonexclusionary property frequently make demand analysis inappropriate for municipal services. Economists have devoted considerable effort to estimating demand functions of public goods and services, but the limitation is inadequate empirical testing of the existing theoretic approaches. One approach is based on the premise that individuals are conscious of the cost of public services and their own satisfaction from consuming an additional unit. This essentially is an application of the constructs of private consumption theory to public goods and services. To measure the cost it is necessary to establish a definite link between taxes paid and consumption, a somewhat tenuous assumption in most situations. The consumer does not associate his consumption with a cost (price or taxes paid), and therefore does not undertake the same calculus that he would for private goods. An alternative is to use the proxies of costs associated with use (travel, congestion) and costs of close substitutes.

In a classic article Margolis discusses three approaches to determining public service demand: revealed preference, benefit-cost, and need.

The revealed preference approach to public service demand analysis substitutes political signals (voting behavior) for traditional market signals. One variant is based on the voter's calculus of the relationship between the cost of voting and the cost of the service. A limitation of this approach is the requirement for a plebiscite on every service or an ambiguous ballot on the total municipal levy. At the local level one suggested measure, commonly labeled "voting with one's feet," is postulated on the willingness and ability of consumers to move to communities that have the desired level and combination of services. The problem with this ap-

proach is that the signals received by municipal officials may be too late to be of use or may be clouded by other conditions (employment availability). The third methodological approach to utilizing voter behavior to measure demand is through citizens' collective decision concerning candidates and their associated service-taxation platforms. While no doubt many municipal officials utilize this indirectly in their general service-taxation decisions, it fails to provide adequate information on specific levels of service-taxation for every municipal service. The variations of the political process approach all require the use of an intermediary institution (the ballot box) to determine public service demand, resulting in an analysis of determinants of voting behavior rather than determinants of public service demand per se.

Benefit-cost analysis of public services is the second major approach to measuring demand. However, this also requires measuring units of output and their price. Also, the approach is an all or nothing rather than marginal analysis, e.g., full time vs. volunteer fire department rather than another fire truck. The data problems (price, quantity, quality) are not averted when benefit-cost analysis is utilized.

When the needs approach is utilized, the question becomes by whom and how needs are determined. Usually needs are specified as standards and regulations, but they can also be determined from surveys, consultation with professionals or based on physical and biological factors. We suggest that need analysis be substituted for demand analysis at this stage in the development of the arts.

The other half of the market, supply, faces many of the same problems associated with demand analysis. These problems relate to the frustrations of applying neoclassical theory of the firm to supply decisions by governmental units. Again, there are no prices to provide signals, or quantity

and quality measures of service provided, and the production process that converts inputs into municipal service outputs is largely undefined.

An overriding consideration in any study of municipal services is the quantity-quality question. Implicit in the discussion of municipal services is that quality is a constant and quantity is the characteristic subject to change by municipal officials, i.e., an additional mile of paved street vs. repair of five miles of existing street. However, there appears to be a definite inverse relationship between quantity and quality given a budget constraint. (Hirsch) In addition, the definition of quality assumes different dimensions when the perspective of the agency administrator and consumer are compared, further complicating the measurement of municipal services. There have been attempts to measure quality (Schmandt & Stevens, Ostrum, McGranahan et al., Wilkening) but these approaches may exceed the resources of a small municipality. Until more economical measurement procedures are developed an alternative may be to accept minimum standards of quality and assume additional resources provide an additional quantity of service. These minimum standards of service could be set by various agencies, associations and other sources. This does not mean that we have given up attempting to solve this problem, but rather that we believe this issue is of secondary concern in the present endeavor.

The decision maker not only lacks the traditional price, quality and quantity factors in supply, but the competing, complementary or independent relationships between services are usually unknown. A local unit of government must allocate its resources among different components of a service package, e.g., water, streets, police, health and general administration. The crucial aspect of these relationships is the effect that a change in quantity and/or quality of one service can have on the cost and output of another service, e.g., water and fire protection. Although there have been

attempts to quantify these relationships, e.g., the Fire Insurance Rating Bureau's guidelines, municipal officials are seldom able to incorporate these tradeoff relationships effectively into their calculus. This does not diminish the importance of these relationships in decisions on present and future municipal service delivery.

Intertwined with the concepts of need and provision is the idea that production functions, cost functions, and revenue functions are determinate and available to decision makers. We lack a production function for public services. We just do not have the necessary evidence to indicate that 25 man hours of foot patrol, 3 hours of vehicle patrol, a high intensity street light, and a silent burglar alarm will or will not prevent a burglary. Related to this is knowledge concerning utilization levels of facilities and their capacity to provide service. The existance of a 6 million gallon per day sewage treatment plant is only part of the answer. Can or will lines be extended to an industrial park or subdivision? Likewise, is there sufficient surplus capacity to handle the addition? This type of information is being collected, but more is necessary.

Another characteristic that Hirsch mentions in his discussion of public service production functions is that of technology. Implicitly the research on municipal services assumes a specified level of technology, usually the latest. However, for a given municipality the level of technology frequently is a function of past decisions concerning that or other services. City fathers are not always able to adopt all the latest technology because of the costs involved, and the implications for other services. The end result is an additional constraint placed on the decisions concerning present service provision.

Cost functions have traditionally been estimated by two methods: the ex post statistical method, and engineering cost method. Both of these approaches have their advantages and disadvantages as enumerated by Hirsch. We believe that engineering data offers the most potential for a simulation study because it avoids some of the biases in record keeping or accounting procedures, management practices, and other uncontrolled factors. (Blaase, et. al.) A bias in present municipal accounting practices is the under-counting of the economic costs of the service. This bias is predominate in the volunteer nature of many municipal services in rural areas, e.g. fire departments. Furthermore, the private provision of services, e.g. septic tanks, water wells etc. is not measured. Another pervasive but hidden problem in the utilization of municipal accounts is the implicit shifting of some services to another jurisdiction, e.g. county sheriff vs. local constable.

An issue that needs to be considered in production and cost functions is distinguishing between the cost of production and cost of delivery of the service. (Dajani, Gessaman) These two components are influenced by different characteristics. The cost of production probably is largely independent of community characteristics, but the cost of delivery is likely to be strongly influenced by community characteristics, e.g., a sparse vs. dense population settlement pattern.

Implicit in any discussion of providing municipal services in rural communities is a premise that there are sufficient resources to provide the service. Rural areas, because of low income, heavy dependence upon property as a tax source, and a conservative political philosophy, often do not have the financial resources to provide the municipal services desired. Some would suggest that the solution to this problem is to consolidate services and gain whatever economies are possible. While this offers

some potential, Gessaman's arguments for the division of production and delivery of services and agency versus consumer perspectives provide new insight to this question. The multitude of agency advantages from consolidation means little to the consumer if the service is less accessible. This accessibility not only refers to the point of consumption, but also the accessibility to decision makers as evidenced by the growing concern of citizens with appointed boards governing special districts and regional commissions.

Attempts to determine a revenue function must consider questions of existing and potential revenue sources, legal taxing constraints and community growth implications. The existing and potential local revenue sources are conditioned by five forces: equity, flexibility, sufficiency, efficiency and externally imposed legal restraints. The local tax sources of most municipalities are limited to property, sales, fees, fines, and permits. Municipalities can supplement their local financial resources via grants-in-aid, debt financing (short-run solution) or by growth promoting municipal services. (Blaase, Maki) For most municipal services there are no direct linkages between service use and revenues, excepting such services as sewer and water. The mounting evidence that the fees do not cover the full cost of production weakens even the existing linkage. The end result is that decisions on municipal services are made with little consideration of how much revenue will be generated or the equity of taxing some item that may only be tangentially related to the service provided.

The decision maker is faced with a budget constraint and must attempt to allocate resources among different services to satisfy the needs expressed by citizens, regulations and standards. The model in the subsequent section explicitly recognized these components of the decision making framework.

A PROPOSED MUNICIPAL SERVICE PLANNING MODEL

The municipal service planning model to be presented falls within the rationalistic approach to planning theory. (Friedman and Hudson) It is designed to integrate the economic and political influences affecting the decision making authority, and to determine the consequences such decisions have for the provision of services and for various aspects of the community's identity.

The technique proposed is a simulation model of the community "system". The system is established as the basic unit of analysis. The system itself may be a subset of a much larger system but all elements falling outside the particular community are considered to form the environment surrounding the system. This conceptualization does not preclude interaction in either direction across the boundary between the community and its environment; it merely relegates such interaction to a secondary level of interest. The primary focus is upon the relationships which describe the functioning of the community both internally and in relation to its environment.

In economic planning, the systems approach can perhaps best be exemplified by the framework and taxonomy, developed by Tinbergen. Tinbergen recognized five basic elements of the planning model: (1) uncontrolled exogenous variables--the data for the model, (2) controlled exogenous variables--the policy variables under the control of the planning or decision making authority, (3) target variables--goals which the decision making authority desires to reach, (4) irrelevant side effects generated by attempts to meet the target variables--effects which are felt outside the system, and (5) the structural relationships defining the model or system. To this classification might be added a sixth element; that of the planning or decision making authority which controls the policy variables.

The framework of the municipal service planning model is presented as a flow diagram in Figure I. The model depicts the relationships which are believed to be significant in the determination of the need for municipal services, as well as the interactions between the level of service provided and the various economic and social aspects of the community. The model also includes temporal and spatial elements so that the dynamic and spatial dimensions of service level decisions can also be explored by simulation analysis. This ability of the model to include the cumulative effects of decisions over time should be of considerable benefit to decision makers in evaluating the long-term implications of their current decisions.

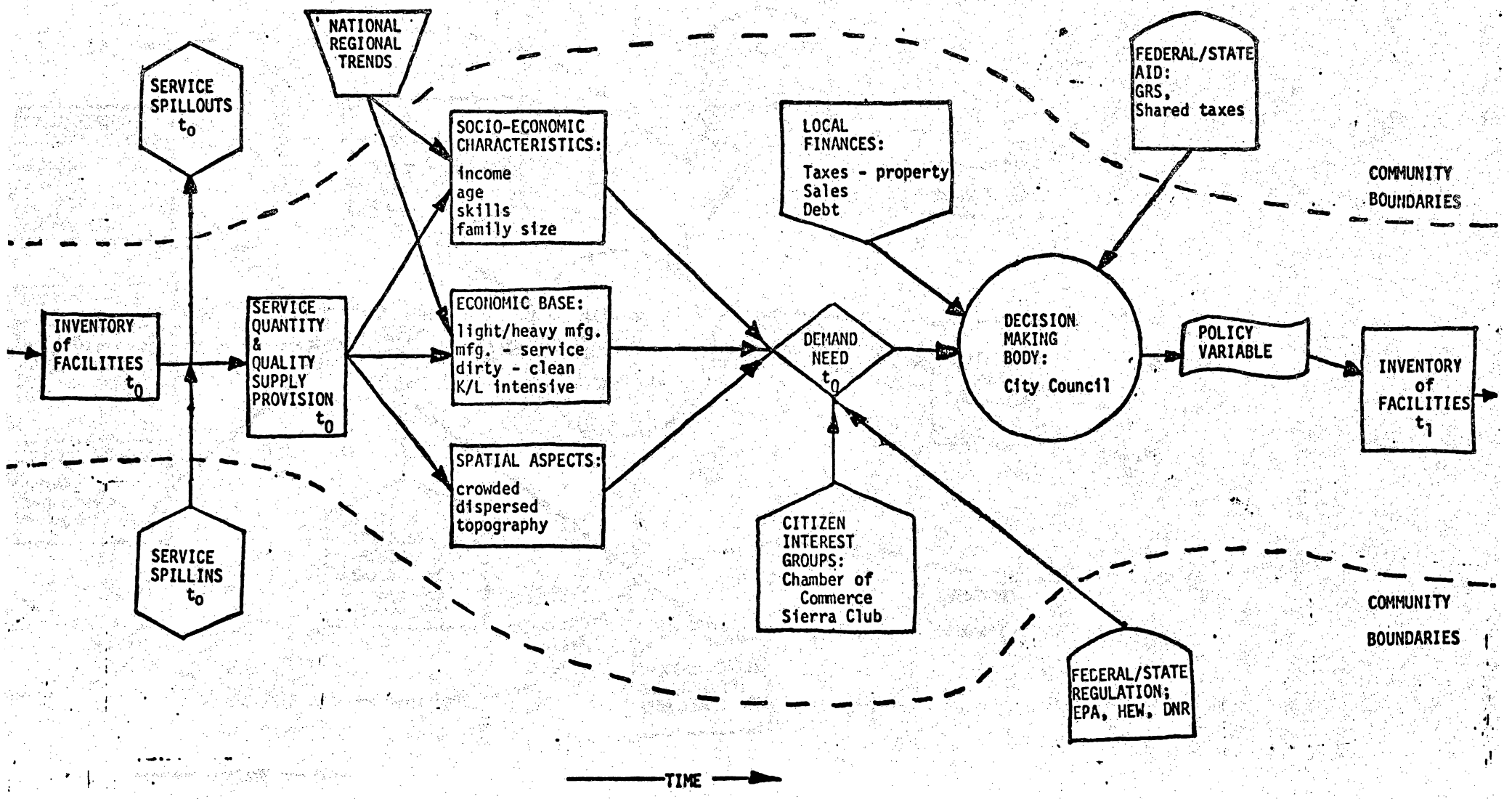
The model represents a partial equilibrium analysis with respect to the more general supersystem. But it is also possible to view the model as representing a general equilibrium analysis for the given community with respect to the provision of municipal services and still conduct a partial equilibrium analysis for one service within the community. In such a case it is merely necessary that the decision making authority make assumptions about the level of provision of the remaining services, i.e., the assumed service levels are ceteris paribus conditions of the partial analysis.

In Figure I the boundary of the system has been defined and this would be the city limits in most rural areas. For heuristic purposes, since the model is presented as a flow diagram, it may be instructive to examine the components of the model along the direction of flow. Before initiating the description of the model, it should be emphasized that the central element is the decision making body (city council, village board, etc.) which reacts to external and internal stimuli.

The assumed beginning point in the model is the inventory of service facilities in time period t_0. This inventory of facilities is a matrix of

FIGURE 1

Representation of Municipal Service Decision Making Framework



physical and human resources defining the physical "plant" the community has available in t_0 to produce municipal services. Examples of the types of resources appearing in the inventory of facilities matrix might be number of snow plows, number of road graders, miles of sewer lines and number of police and fire personnel. The inventory matrix defines only the productive capacity of the municipal service facilities. The actual quantity and quality of services provided does not maintain a one-to-one functional relationship with the capacity of the municipal service plant. Hence both the quantity and quality level of municipal services being supplied must be specified. At this point the research question is the form (structure and elements) of the production function.

To the actual services produced by the municipality must be added the external service spillins received by the community, less the local service spillouts. The decision making implications of spillins and spillouts of services may be illustrated by means of an example. Suppose that the particular community is reaping the benefit of relatively clean stream water as a result of a high quality waste water treatment by a community upstream, thereby reducing the need for expensive water purification. A spillout may take the form of leaching in our municipality's land fill site affecting the water quality elsewhere. Spillins and spillouts are to a large extent exogenous variables in Tinbergen's classification, and while beyond the control of our local decision maker, their presence should at least be recognized.

The level and quality of municipal services in a community generates some influence on the community's demographic, economic, and spatial base as well as having the potential to please or displease local interest groups. Tracing through the effect of the level and quality of a municipal service upon various elements within the community and then suggesting that these same elements generate demand or requirements for municipal services is not

an exercise in circuitious reasoning. Rather it demonstrates the inherent interrelationships between elements in the model and the necessity for considering the system as a whole. This interrelatedness is again best illustrated by means of an example. A community may have an ordinance regarding the maintenance of buildings rented as residences, but if the enforcement of that code is weak or ignored (a low level of service quality), one spatial and commercial base may result. If that community now begins to enforce the ordinance, thereby increasing the quality of that service, landlords might not invest in residential structures. The end result might be a changed spatial inventory of commercial housing property and the creation of new demands by citizens, e.g., for low cost rental housing. This example also illustrates the potential workings of yet another component of the model, the local interest groups. The demand for low cost housing might be identified by the decision making authority through analysis of the economic, demographic and spatial factors. It is also quite possible that the demand would be articulated directly to the decision making authority by a coalition. Indeed the initial decision to enforce the building code would probably have been stimulated by a coalition of renters while an interest group of landlords no doubt would also provide input to the decision process. The local interest group's dissatisfaction with the supply of municipal services may even lead to replacing members of the decision making authority through the political process. In less severe instances citizens may band together in informal associations to provide services, e.g., crime patrols in urban neighborhoods.

In addition to the lobbying of citizen interest groups, demand for services is generated by the needs or requirements of the community socioeconomic and spatial base. Studies of the determinants of demand for munici-

pal services use a variety of socio-economic characteristics in their argument lists, e.g., education, family size, per capita income. (Bahl) In addition, Schriener and Jones have utilized input-output analysis to incorporate economic activity in planning for some services. Likewise, a crude spatial component previously utilized is land area or population density. (Bollens, Ohls and Wales, Pattie)

These demands may be tempered by regional and national trends such as population growth, redistribution of commercial activity and external provision of municipal services, e.g., county and special purpose districts. The combination of the spatial, socio-economic and political characteristics of the community are translated into a felt need for services. But the economic variables of sales, income and real wealth affect the local tax base used to finance these services. The combination of intergovernmental aid and local tax base define the revenues available to the community, exclusive of debt financing. These variables influence the financial resources of the community and act as a supply constraint. An additional supply constraint is the state and federal regulations with which communities must comply. A recent example of such a regulation causing severe reallocations in municipal budgets in many communities is the 1972 amendments to the Federal Water Pollution Control Act. In Wisconsin, the most recent and proposed biennial state budgets limited the percentage increase of local property tax levies, a significant supply constraint.

In choosing whether or not to respond to the service demands generated within the community, the decision making authority has at its disposal various policy variables, such as the reallocation of manpower, capital investment in additional service facilities, greater use of existing facilities, etc. These policy variables will differ between services but will essentially

relate to changes in one or any combination of three aspects: capacity of service facility, service quality or service quantity from a given facility. The decisions taken will generate a new service level and quality and inventory of service facilities for time period t_1, which will begin the process anew in the next time period.

Today municipal officials are facing questions pertaining to the type of and need for municipal services in response to changing conditions in their community. The dynamics of the situation create uncertainty not only regarding decisions on current services but also on the future structure of the community. How many school officials realized the implications of following or leading the exodus of citizens to suburbia with new school buildings? We think very few. This example emphasizes the need to anticipate the implications of current municipal service decisions as stated by Eddleman (p. 959):

> The development of a rural community can be influenced by local public decision makers mainly through programs relating to the planning, financing, and physical production of public services ... there is a need to evaluate alternative courses of action in providing public services in rural communities.

Hopefully, the type of analysis that we believe is possible within the framework suggested may permit examining those alternatives prior to making final commitments of resources.

SUMMARY AND CONCLUSION

What we have attempted to present in this paper is a conceptual framework that we believe is lacking in most applied research on municipal services. The purpose was to encourage others to continue their research efforts on specific municipal services, but not to lose sight of the total municipality and its multi-product service package.

At Wisconsin, we are just completing studies on rural ambulance services and rural fire protection districts. Other colleagues are working on other services and a local revenue model. The research by Blaas et. al. appears to be in the direction we are suggesting. It also renews our enthusiasm that the effort may be feasible.

The structural form of the model may vary between communities or there may be sufficiently small variation to permit the basic model to suffice with only minor changes in the parameters for each community. It is the latter possibility which would render the utilization of the simulation model very useful since it could be used over a broad range of communities. The primary concern of the decision maker, for whom the simulation model could be used as a planning aid, is the choice of the target variables and the consequences of particular policies employed in achieving those targets. While the model is not designed to suggest what the appropriate target variables for a community should be, i.e., the determination of a community welfare function, it can be useful in depicting the results of various target choices. The decision-making authority would then have the benefit of the simulated results to aid in its decision as to whether the policy achieves expected and desired effects.

Footnote

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