Limitations of Computerized Impact Assessment Models for Planning in Small Towns

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LIMITATIONS OF COMPUTERIZED IMPACT ASSESSMENT MODELS
FOR PLANNING IN SMALL TOWNS

by

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Mark Richard Brown
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INTRODUCTION

Background

Western boomtowns have been the focus of intense planning activity since the early 1970's. The goal of this activity has been to manage rapid growth caused by large energy, industrial, and resource developments. Planning assistance has been made available to impacted communities in a variety of forms including financial aid from senior levels of government and from impacting industries, economic and demographic forecasting models, growth-management consulting firms, case studies, and comprehensive handbooks for community action. There has been rapid mobilization of sophisticated administrative and technical expertise to mitigate the problems of impacted communities.

Purpose and Method of Study

The purpose of this study is to evaluate the appropriateness of one form of local planning assistance: computerized impact assessment models. Such models are made available to supplement local planning capacity during rapid growth, principally by forecasting the economic, demographic, and fiscal consequences of growth and growth management decisions. The thesis of this research is that to use computerized impact assessment models without understanding the methods and assumptions on which they are based is to implicitly delegate local decision-making power to those who design and operate the models.
The research is guided by a desire to evaluate impact assessment models from a planning perspective, which appears to have been neglected in the published literature concerning their design, validation, and use.

Two aspects of models' appropriateness for local planning applications are explored: (1) their methodological and operating characteristics, and (2) the role they play in the development of the local planning system. To be methodologically appropriate in the context of boomtowns, impact assessment models must produce information that is useful for growth management. In addition, those who use the information must be able to evaluate this usefulness for local planning applications. Similarly, the role played by models in the planning process must also be understood by local planners and officials so that they may exercise control over community development.

These questions are researched by a conceptual approach, owing to the difficulty of surveying firsthand how impact models are applied in growing communities. The study is based largely on published documentation and other reports on assessment models, and on the literature of rural and small town planning, and of boomtowns.

Several aspects of boomtown planning were excluded to narrow the scope of the study. (1) Land use planning and spatial analysis models, or "geographic information systems," were excluded, principally because they are more familiar to planners, are conceptually simpler, and thus lack the potential for misapplication that is found in more complex economic, demographic, and fiscal forecasting tools. (2) Environmental impacts and modeling systems are not studied. (3) Social impacts of growth, such as whether or not benefits and
costs of growth are equitably distributed according to age or sex, for example, are not investigated, because although some assessment models attempt such forecasts, they have seen very limited use, and are virtually undocumented. (4) Finally, there are many smaller computer models, for budgeting, transportation and engineering analyses, and other planning tasks, which are excluded because they are not specifically tailored to the demands of planning during the rapid growth of boomtowns.

Organization of Document

The first section establishes a background for the research. It describes an historic pattern of some characteristics of boomtowns. The outlook for their continuation in the western states is then assessed.

The second section presents a simple conceptual framework for discussing the effects of rapid growth on the community.

The third section describes rural planning in the context of rapid growth, to identify the unique demands which growth places on the planning system of an impacted community. The planning capacity of the community prior to growth, and the response demanded by changing demand for municipal services are described. The section focuses especially on how the planning system itself, as a distinct municipal service, is impacted, rather than on what specific tasks it must accomplish.

The fifth section describes computerized impact assessment models which are claimed to supplement local planning during rapid growth.
The sixth section compares models' performance in local planning applications with their objectives in this capacity.

Finally, the conclusion summarizes limitations on the uses of models for local planning, as identified by this research, and the study ends by suggesting some implications of the findings.
LITERATURE REVIEW

History and Outlook for Rapid Growth

Introduction

This section highlights the history of American boomtowns and identifies causal forces which make them a persistent form of community development. The pattern that is revealed is confirmed by present-day examples. The section ends with the conclusion that in the western states, many small communities can be expected to experience periods of rapid growth in the future.

History

Many regions of the country have been affected at one time or another by rapid growth or decline in their communities. In the mid-1800's gold and silver mining periodically spurred temporary settlements throughout the mountainous western states. The western landscape abounds with visual reminders of the gold and silver booms—tailings and abandoned mine structures spill down mountainsides, and place names recall the mining heritage: Silverton, Gold Creek, and Eldorado Springs. History books contain numerous accounts of life in these boomtowns. A description of the founding of Central City, Colorado, illustrates the speed with which prospectors flocked to the lure of gold:

In May, 1859, a wandering prospector, John H. Gregory, "struck it rich" on the north fork of Clear Creek. News of pay dirt yielding $2 a pan, proclaimed to the world . . . brought the usual rush of gold seekers
from the whole Pike's Peak region converging on Gregory Gulch to stake out claims. By the middle of June 5,000 people lived there, most of them in a mining camp called Central City, and twenty sluice boxes were in operation. (Billington, 1949, p. 620)

The railroad followed the gold rush west, dictating the location of new settlements, and contributing to the decline of some existing communities that happened to be located beyond its sustaining influence. In November of 1867 Louis Simonin, a Frenchman touring the new frontier, recorded the concise history of one railroad boomtown, Cheyenne:

Such is Cheyenne: it did not exist this last July... already there are two printing shops, two newspapers, book shops, banks, stagecoaches, then the post office and the telegraph, to carry life and movement far away. And how many inhabitants has this city just sprung from the earth? More than 3,000. It has added a thousand inhabitants each month, and the railroad has not yet caught up with it. (Simonin, 1869/1966, p. 63)

In Appalachia the boom and bust cycle has been repeated time and again, triggered by that region's abundance of coal, fluctuating world energy demand, and advances in mining technology. Harry Caudill's Night Comes to the Cumberlands (Caudill, 1962) chronicles the fickle effects of resource economics on the Cumberland Plateau of Kentucky. This particular history shows very clearly how exogenous forces can dictate prosperity or poverty for towns that depend on limited natural resources for their livelihood. Caudill reported some statistics of the first coal boom in the 1920's:

The vast population influx is difficult for us to comprehend. Many counties were, outwardly at least, almost completely transformed. In ten years some of them experienced a population increase of 200 percent. Perry County had a total of 11,255 people in 1910, and 26,042 in 1920. The population of Harlan County rose
even more dramatically in the same period from 10,564 to 31,546, and the pattern was the same elsewhere. (Caudill, 1962, p. 106).

The great depression of the 1930's, however, brought financial ruin to the coal companies, and so to the entire population of the plateau, dependent as it was on the single industry. In Caudill's words, "with a ponderous sigh the Big Boom died. In a few short years the coal-rich plateau had traveled from rags to riches, and back to rags again" (1962, p. 174). The industrial surge of World War II brought a second boom, but by 1950 the region had again commenced a long downhill slide into poverty. Although coal continues to be mined in the Cumberlands, the industry has become increasingly capital intensive, and can no longer support the population of the region.

These, and many other examples of rapid growth, figure prominently in the history of the nation.

**Boomtown Pattern**

Despite the time span and geographic variety of the examples given above, they illustrate a consistent pattern that is characteristic of U.S. boomtowns. Some central features of the pattern are as follows.

**Exogenous forces.** Historically, whatever force has caused local populations to boom and bust has come from outside the community. For example, coal demand in the industrializing Northeast initiated the Appalachian boom; the Rocky Mountain gold rush drew "greenhorns" from the east, and "yondersiders" from the west coast, while the wealth they extracted was, in turn, largely exported from the region.

**Resource exploitation.** The exogenous cause of boomtown growth has almost invariably been the demand for some locally occurring
scarce or otherwise valuable resource. Exogenous demand, and the
technologies required to extract, transport, or otherwise utilize the
resource are not usually under local control, but are determined
regionally, nationally, or internationally by governments, corpora-
tions, and markets for goods.

Unpredictability. Rapid population changes in small communities
are difficult to predict or comprehend beforehand. Questions of
whether or not the boom (or bust) will occur, when, and for how long,
and how large might it be, are difficult to evaluate in advance.

Bust. The image of a ghost town is a familiar one, and many
boomtowns eventually decline, but rapid growth does not necessarily
mean that a bust will follow. Chicago is a prime example of what was
once a small town that grew very rapidly, but never returned to its
small-town beginnings. The key to Chicago's vital longevity, in
contrast to many western boomtowns (or ghost towns) is that its
economy became diversified, owing to a prime geographic location, and
was able to support a large population base. Where rapid growth is
solely the product of resource extraction, however, the depletion of
the resource may have dire consequences for the life of the community.
The concept of a bust is important to understanding the life of a
boomtown. When we describe a place as a boomtown it implies the
likelihood of an eventual bust. Boomtowns are places where rapid
growth is a dominant aspect of everyday life—dominant because the
growth has a large effect on the relative size of the community, and
in some cases even more so because the growth is the result of a
single supporting industry in the local economy. Population growth
may be as rapid in a large town, or in a town with a diversified economy, but the significance of the event to the life of the community is considerably less.

Two additional features of this pattern of boomtown development are important trends, or characteristics that have not remained consistent over time.

Prior population base. The earliest American settlements, including boomtowns, were established in the wilderness, each a veritable "new town." As time passed, more and more regions could claim increasing numbers of small communities. Thus, recent boomtowns were more likely to arise from or near existing population bases. Thus, in a study of coal development in the Northern Great Plains states, Bender et al. (1980) found that today:

The effects of coal development are concentrated in towns and cities near the coal projects rather than being spread out within the major coal reserve counties and the region. These are small towns in sparsely settled parts of the region. (pp. 8-10)

The size of the population base prior to rapid growth is very important in determining how the community will be affected. As Bender states, it is small towns that tend to become boomtowns, because of geographic location and partly as a consequence of how boomtowns are defined. This trend has become more pronounced in recent times, giving rise to such contemporary concepts as socioeconomic impacts of rapid growth, and impact mitigation, which are concerned with the effects of development on local residents.

Service expectations. As American settlements matured into permanent communities, their residents' expectations of municipal
services and amenities expanded. For example, police and fire protection, schools, and public sanitation systems are considered to be essential public services, and so are expected by residents from their communities. Although service levels were, and still are, likely to differ between stable communities and boomtowns, the trend is one of increasing expectations. This trend can be viewed as simply a reflection of the growth of government and the welfare role of government in the United States which have been especially marked since the New Deal of the 1930's.

Contemporary Boomtown Examples

The boomtown pattern is confirmed by a review of contemporary examples. Through much of this century western rural towns contributed to a national trend of declining population in nonmetropolitan places. Since the late 1960's, however, parts of the Rocky Mountain west have seen a vigorous recurrence of boomtown growth. The major source of the activity is, once again, resource extraction, though the nature of resource demand has changed. Some important contemporary causes of rapid growth, and places where it is occurring at present, are:

COAL MINING
- Gilette, Wyoming
- Huntington, Utah
- Beulah, North Dakota
- Sheridan, Wyoming

OIL AND GAS EXTRACTION
- Williston, North Dakota
- Gillette, Wyoming
Demand for these energy and recreation resources comes for the most part from outside the intermountain region, and is almost entirely external to the economies of the individual communities themselves.

Outlook for Continuing Rapid Growth

Despite the difficulty of anticipating specific details of rapid growth events, there is every indication that the current resurgence of boomtowns will continue. A brief investigation of the nation's "energy future" reveals that increasing dependence on domestic energy supplies is all but guaranteed (Kahn, 1976; National Geographic,
1981; Stobaugh and Yergin, 1979). It is an equally safe bet that energy production will continue to cause growth in the western states. Bender et al. (1980) found that during the 1980's "the Northern Great Plains States are scheduled for large increases in coal production" (p. 3), the rate of development and locations of which will depend on "petroleum prices, rates of conversion from petroleum to coal, the future of nuclear power, synfuels development... leasing and transport linkages" (p. 3). Elsewhere in the literature, Cummings and Mehr (1977) expect "an eight-fold increase in coal production between 1976-1985 in northwest New Mexico alone" (p. 224); and Mountain West Research, Inc., in the Construction Worker Profile, predicted that:

Many areas of the Rocky Mountain States are now or will soon be the sites of major construction projects associated with the production of energy. Extraction and conversion of the natural resources necessary to produce this energy portends dramatic changes for many areas that have historically been rural and sparsely settled. (Mountain West Research, Inc., 1975, p. 1)

Although it is not inevitable that energy development will foster rapid growth in small communities, the record to date leads one to anticipate that it will continue to do so.

Non-energy resources likewise promise growth for the west, based on the occurrence of rare metals and minerals, and the availability of land for recreation, food production, and large institutions such as military bases.

Summary

There is a characteristic pattern of western boomtown growth. The pattern encompasses an exogenous demand for natural resources, which occurs unpredictably with respect to time and location.
Population growth occurs in or near existing small towns, and certain services or amenities will be demanded from these communities as a consequence of that growth. Rapid population growth in boomtowns is usually a temporary phenomenon, of uncertain duration, followed by stability, decline, or bust, or some combination of these demographic effects. There is every likelihood that rapid growth will continue to impact western communities, owing to the occurrence of scarce resources.

Profile of Rapid Growth

Introduction

Although no two boomtowns are exactly alike, there are many studies supporting the formulation of simple descriptive models of boomtown growth. A growing body of literature describes the effects of rapid growth on the structure and character of the community. In particular, Chalmers and Anderson (1977), Davenport and Davenport (1980), Murdock and Leistritz, (1979), and, U.S. Department of Housing and Urban Development (1978), present comprehensive and thorough surveys of rapid growth effects. The intent of this section is to define economic and demographic events of major importance to local planners, as a foundation for the discussions to follow. The models described in this section were selected for their bearing on growth management activities. These models broadly outline the nature and sequence of events during rapid growth caused, for example, by the arrival of a large industry or energy development in or near a small community.
Simple Descriptive Models of Rapid Growth

Figure 1, a simple descriptive model of boomtown growth, is reproduced from Lorna Michael Butler's report "Population Change: Do You Know the Trends in Your Community?" (Butler, 1980).

This simple model consists of four components: a source of impact, which creates economic and demographic changes in the community, which in turn cause a variety of narrower, more specific impacts. The model uses arrows to indicate the flow of time and events. The small arrows between the economic and population components indicate interaction between these two parts of the model—a critical dynamic relationship. Butler stressed that:
Economic changes and population changes are inseparable. They interact to affect virtually everything underlying community well-being—adequate housing, stable businesses, secure jobs, serviceable streets, quality schools, dependable hospitals, adequate protection, responsive government planning and decision-making systems. (Butler 1980, p. 2)

Another description of the same events is that of Ronald Faas and Robert Howell (1979, p. 2). This model, shown in Figure 2, varies from the previous one in several respects: expected impacts are differentiated from actual impacts, and the planner's role is injected between the source of impact and actual impacts. These differences indicate that growth management activities are predicated on uncertain expectations, and that actual impacts may be influenced by these activities.

Figure 2. Faas and Howell's model of rapid growth.

As a final example, the structure of Bruce Weber and Robert Howell's book, Coping with Rapid Growth in Rural Communities (Weber and Howell, 1982), provides a conceptual framework for the same growth
processes. The chapter titles of Coping (paraphrased here for brevity) divide easily into "modules" which roughly correspond in content and order to the previous two models. The first module describes traditional growth trends in western local areas, and the causes of local growth.

CHAPTER:

1. The Demographic Context of Western Growth.

The second module, comprising two chapters, includes the economic and demographic components.

2. Local Economic Changes

3. Local Demographic Changes

In the third module, several chapters address the ways in which these changes are manifest in community impacts.

4. The Impacts on the Provision and Financing of Local Public Services.

5. The Impacts on Local Organizations and Community Services.

6. The Impacts on the Social and Personal Well-Being of Local Community Residents.


Three chapters comprising the final module suggest opportunities for management during the process.


9. Organizing for Local Control in Rapid Growth Communities.

10. Impact Assessment and Rapid Growth Management.
A Generic Model of Rapid Growth

The model shown in Figure 3 summarizes major events during rapid growth, as suggested by the preceding examples. The purpose of the model is to illustrate the most critical elements for growth management. These elements are stated in very general terms, however, to encompass the diverse circumstances of boomtowns.

Figure 3. A generic model of rapid growth.

There are four modules or elements to the model. First is the PRIOR SETTING, or make-up of the local community before any influence of the growth stimulus is felt. Second, the GROWTH EVENT is some intrusion in the life of the community that has the potential to cause rapid growth. Third, ECONOMIC AND DEMOGRAPHIC EFFECTS of the growth event alter the fundamental structure of the community. Finally,
these changes are realized directly by community residents as IMPACTS ON SERVICES.

There is no explicit reference made to growth management in this model, because it describes growth from a broad management perspective. The planner (or local official, citizen board, etc.) may exert an influence on each of the four components. Thus, growth management of one form or another is implicit throughout the model. Most community planning activities seek to mitigate negative impacts and to secure positive impacts of growth either by treating the impacts directly, by influencing the underlying economic and demographic effects, or by making preparations for the growth event. Because attitudes toward growth can vary markedly between communities, and between groups and individuals within any community, the term growth management is used here to mean any activity designed to influence growth and its consequences. In summary, Leistritz et al. (1982a) defined objectives that would be encompassed by this broad definition:

The objectives of an impact management program are to anticipate and alleviate those project effects which are generally perceived as undesirable, and to enhance effects which are deemed beneficial. (p. 12)

Prior setting. The structure of the existing community influences the ways in which it will be affected by growth. This relationship is thoroughly discussed by Chalmers and Anderson (1977), Leistritz and Murdock (1981), and, Weber and Howell (1982). For growth management and impact mitigation, which mediate between the town and the growth event, the prior situation serves as a benchmark against which to measure change, and to gauge the effectiveness of mitigation efforts. The assessment of the prior situation, or the baseline, thus becomes a
starting point for any management activity. Furthermore, many growth management activities are most effective if commenced before the growth event, to prepare the community for anticipated changes.

**Growth event.** Most studies describing rapid growth have concerned energy industries (Champion and Ford, 1980; Leholm, Leistritz, and Hertsgaard, 1976; Stinson and Voelker, 1978). This literature reveals that each type of impacting industry has its own profile of construction timing, temporary and permanent labor requirements, siting demands, tax obligations, and many other characteristics.

Although local residents and officials may have few opportunities to influence corporate planning within the impacting firm, there are strong reasons for investigating the profile of the industry. Business managers concerned with adding inventory and employees, land speculators and builders, school administrators, and those who must plan to expand municipal services and facilities—all find it necessary to anticipate the implications of growth in their communities.

There are also some avenues by which a community may attempt to control aspects of the growth event itself, rather than merely responding to it. The most common of these include land use regulations such as zoning, subdivision regulations, and comprehensive plans, tax incentives or disincentives, required impact assessments, and even litigation to delay or deter development on environmental or aesthetic grounds. These methods may be used, for example, to delay the arrival of development or to spread it over a longer time period, to gain time for the community to prepare for associated impacts.

**Economic and demographic effects.** It is essential to understand
the effects of the growth event as a prerequisite to projecting its impacts on the community. Most impacts actually experienced by local residents can be traced to economic and demographic effects, which in turn are rooted in the changing structure of local employment. The interaction of site-area characteristics with those of the growth event sets the pattern for employment changes in the community, in terms of magnitude, qualities, and timing. There are many articles and books addressing how rapid growth can alter economic and demographic structure; comprehensive surveys of the effects and the corresponding literature have been written by Leistritz and Murdock (1981), Murdock and Leistritz (1979), and, Weber and Howell (1982).

The size of the local population is the most obvious element of demographic change. Equally important, however, is the composition of the residential population, including such characteristics as age, sex, race, marital status, household size, education and income levels, and religious preference. These factors affect structural characteristics of the community such as the demand for municipal services, age and spending patterns, long-time residents' perceptions of change, and political balance. To project probable structural effects resulting from these qualities is a complex undertaking, and has been the subject of numerous demographic studies (Mountain West Research, Inc., 1975; Thomas E. Carroll Associates, 1976).

Economic effects of rapid growth are pervasive—the increase in money in circulation locally, the amount of respending of local money, the economic base, and investment patterns. Although not as well documented as demographic effects, there are numerous studies of
the economic effects of community growth (Denver Research Institute, 1979; Hirsch, 1964; Stenehjem, 1975).

Community impacts. The impacts of rapid growth are the consequences of effects that are experienced directly by community residents. An impact of demographic change might be that housing stock in the community does not meet rising or changing demand, so residents are unable to find housing to suit their needs, and must pay dearly for what they can obtain. If construction of new housing increases dramatically to meet new demand, another impact may be that the local building inspector (if there is one) is incapable of keeping pace with the growth in his or her duties. The concept of impacts can be stretched to include almost any element of dissatisfaction among community residents, such as cost of living, taxes, environmental degradation, traffic congestion, budgetary woes, crime rates, suicides, and a host of others. One dominant cause of impacts felt by residents is overburdened service capacity. Such impacts probably receive the most discussion in the available literature on boomtown growth and management.

Summary

The economic and demographic events that accompany rapid growth can be divided into two groups: First, economic and demographic effects, which are major changes in community structure, and can be traced, substantively, to how the employment profile of the impacting industry interacts with characteristics of the host community. Second are impacts, which are tangible results of economic and demographic effects experienced directly and daily by community residents. The
mitigation of negative impacts is the predominant goal of growth management, which can occur in some form through each of four basic arenas: The preparation of the pre-impact community; the impacting industry itself; the interaction of pre-impact and impact-related population and economic structures; and, as mentioned, the arena in which final impacts evolve, which, for the planner, is the municipal service fabric of the community.

Rural Planning During Rapid Growth

Introduction

Municipal services are a primary responsibility of local governments. The service structure of a rural community is usually impacted strongly by rapid growth--service demands rise dramatically, while residents' satisfaction typically declines. For the planner, changes in municipal services are one of the most significant consequences of rapid growth.

This section first examines how municipal services are impacted by rapid growth. Then, the character of the planning system that must cope with these impacts is described. The system is broken into three elements: (1) decisionmakers and their attitudes toward planning, (2) the administration of the planning system, and (3) specific areas of planning expertise. This section focuses especially on how, and by whom these elements of planning capacity are accomplished in rural towns.

The Affects of Growth on Municipal Services

The service structure of small communities can vary significantly
from larger urban places, owing to social and cultural homogeneity, greater self-reliance, the inherent inability of a small group and limited tax base to support diverse and special services, and other factors. In rural communities this means that only the most basic services are locally provided—sewer and water, ambulance, police and fire protection, parks and recreation, and roads, for example.

To qualify this relationship, however, it should be noted that community service levels do not appear to vary strictly with size, but deviate from the general trend owing to other unique community characteristics. Thus Stinson (1978), identifying this general trend, stated that, "small local governments provide fewer services than those serving larger populations and they make more use of volunteer labor and other donated inputs" (p. 16). Cluett, Mertaugh, and Micklin (1978) injected an element of uncertainty as to how closely individual communities would adhere to the norm:

Although it is clear from casual observation that large populations have larger, more complex social service infrastructures than small populations, it is not necessarily clear how population fluctuations over time are translated through political and fiscal mechanisms into changes in the quantity or quality of services provided. (p. 11)

Service demands may change rapidly and significantly, in quantity as well as in the nature and quality of services demanded, as a result of growth. In the "Summary Report" of the Construction Worker Profile (Mountain West Research, Inc., 1975) it was stated that:

One of the most immediate and visible effects which rapid population growth has on a community is that of greatly increased demands on a community's facilities and services. Unless a town has excess capacity in its facilities prior to growth, severe inadequacies can occur. (p. 17)
Leistritz and Murdock (1981) also found that "many services in rural areas are inadequate" (p. 111), but this does not mean that local residents are necessarily dissatisfied. It may be more useful to describe adequacy in reference to what service levels are expected, rather than judging them by standards imported from a different community context. Longtime rural residents--those who have chosen the small town for permanent residence--place relatively more importance on other dimensions of rural life than on the availability and quality of municipal services than do their urban counterparts. What Leistritz and Murdock probably mean is that when urbanization occurs in rural areas, as during rapid growth, then the former services no longer meet residents' changing overall demands.

Increasing numbers of Americans are trading urban service levels for rural lifestyles, as evidenced by the reversal of non-metropolitan population loss that has occurred during the last decade, but movement from urban areas, where service levels tend to be higher, to rural areas has the effect of raising service expectations in small towns. In a study of rural development assistance by Cooperative Extension personnel, Nelson and Doeksen (1981a) found that:

Many of the new rural residents in Eastern Oklahoma and elsewhere in the West and Southwest have migrated from large towns or urban areas. They generally bring to their new homes demands for the sort of highly developed community services they learned to expect in the cities. So, community service problems are important to decisionmakers in such areas. (p. 2)

However, even if the expectations of newcomers are equal, on average, to those of the longtime residents of a place, they will not be identical in all respects, and the effect on the local population will
be to increase the range and level of services expected and demanded. Lorna Michael Butler (1980), in her article "Population Change: Do You Know the Trends in Your Community?", thus found that:

Newcomers almost always press for improved services such as police and fire protection, medical care, garbage pick-up, snow removal, improved roads, larger schools. More people may generate added community income; however, these consumers may also require special services. (p. 1)

Furthermore, even without growth or inmigration, service demands of rural residents are likely to rise. Thus, Nelson and Doeksan (1981a) also found that "the residents of such [rural] areas are becoming more sophisticated due to their exposure to the prerequisites of urban America through travel and the media," and that "long term rural residents are also increasingly desireous of the same types of public services enjoyed by urban residents" (pp. 2-3).

The migration of temporary workers to energy projects represents a special case of this overall trend. Cluett et al. (1978) explored this theme, and stated that:

The actual demand for services involves a balancing of local expectations with potentially higher expectations on the part of the inmigrants ... It is plausible that in-migrants will expect a higher level of service provision than is likely to obtain in the relatively rural reference sites. This is likely since most of these construction and operations workers will be coming from nearby urban areas where more adequate services are available. (p. 12)

To state it somewhat differently, one might characterize small towns as diverse groups of people: that is, small, homogenous, and somewhat isolated groups. Cities, on the other hand, are large groups of diverse people. The affect of communication and migration between small towns, and from large to small towns, is to make them less
homogenous by the addition of newcomers from locations with different social service (and other) dimensions or standards. Using similar logic, Gerald Hodge (1981) found that "it is possible for small towns to become citified without becoming cities," and that "citification has occurred without any grand policy design (p. 46). This is the impact of rapid growth on the overall planning and service structure of the small town--to force "citification" at an accelerated rate, and for an uncertain period of time.

To fail to increase service capacity may be costly: to the industry, which suffers productivity decline, and to the community, if the potential tax base of new residents and industries is lost as a result. On the other hand, growth may serve to stabilize some services if historical population decline has left them overbuilt. The dominant pattern under rapid growth, however, is for demand to exceed the capacity of the local service structure during the construction phase.

Cummings and Mehr (1977) found that:

Given the threat to the general "quality of life" in a community posed by an anticipated development project, the local government, taken here to be a municipality, faces a wide range of planning problems, among which are investment plans for the provision of urban infrastructure. (pp. 224-225).

Stenehjem (1975) discussed how costs may arise if the community fails to maintain adequate public services:

As population increases, demand for public services grows correspondingly. . . if local capacities to provide these services fail to grow at an adequate rate, the per-capita decrease in service leads to a lower quality of life in the area. (p. 7)

It is clear, then, that expansion of municipal services is mandated by rapid growth.
Local Planning Function and Capacity

The provision of municipal services to local residents is a primary concern of planners and administrators, and the quality of life of a community is partially equated with the quality of municipal services. According to James Nelson (1979):

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. (p. 125)

Thus, planning, at the local level implies planning for the service needs of the community.

The maintenance of satisfactory service levels is the subject of innumerable tests and reports. Whatever the details of the process, though, it is essentially a continual cycle of monitoring conditions in the community, complemented by adjustment of service levels when necessary. The monitoring function is accomplished in various ways: citizen input to officials through elections and other public forums, through informal channels, by surveys of residents' needs and attitudes, and by the daily observations of administrators, for example. Service adjustment may be more complex, perhaps involving a political dimension, and often necessitating a review of budgets. Nelson and Doeksen (1981b) presented an adaptation of a community services "decision taxonomy" developed by Powers (1979), which identified: 1) Monitoring questions, including "the degree of need for a particular service and how to determine that need, and its relationship to other needs;"
and, 2) questions as to service provision, including "economic feasibility of providing various services... distribution of service costs and benefits... impacts of decisions" (p. 5). In general terms, these questions and process of monitoring and adjustment are a "planning function" of local government.

From the process just described, three functional elements can be identified: (1) decisionmaking, which is ultimately the responsibility of elected officials, (2) the adequacy of the underlying planning process as a whole to support decisions, which depends on the administrative and design skills of a planning director, and (3) the specific expertise necessary to actualize the planning process. These three elements or roles comprise the planning capacity of a community, and the adequacy of the municipal planning function is its capability to perform them.

The U.S. Department of Housing and Urban Development (1978) studied 131 communities impacted by energy projects, to ascertain how they were prepared to plan for growth. Of these communities, 116 (89 percent) had fewer than 5,000 residents. The study found that:

- Impacted communities typically have no professional staffs.
- Of these communities:
  - 12 (9%) have professional planners
  - 8 (6%) have full-time city engineers
  - 4 (3%) have city managers
  - 4 (3%) have other administrators


Usually this indicates that administrative and technical planning...
capacity—the ability to effectively carry on the monitoring and adjustment of services at the local level—is also minimal, although the nature of rural communities is such that little planning is necessary under normal conditions. Within limits, however, local planning is probably adequate (with regard to providing services) if the supply of services is in balance with demand for them.

Given the increasing service demands of new residents, as described above, it follows that planning function must also expand in order to maintain adequate service levels. The purpose of municipal services such as community infrastructure is to satisfy basic needs of residents. Growth forces services to expand. Similarly, the purpose of local government planning is to maintain these services adequately. When services expand, therefore, so must the capacity of the community to plan for them. This is the response that rapid growth demands of the planning function of local government. In his paper "The Dynamics of the Adjustment Period in Rapid Growth Communities," Thomas Stinson (1978) addressed the trend in service expansion, and noted the connection to planning in small-town settings, stating that "as the community grows new services are added and a shift from volunteer to paid labor occurs" (p. 16).

Hans Bleiker (1980), extending the logic to boomtowns, noted that while "community planning in general is rather ineffective,"

To do community planning in a boom town—more specifically: to do it successfully—is very difficult. The reasons for this are several and rather obvious; they can best be understood by looking at four major factors:

1. Our efforts in protecting and/or enhancing people's quality of life through community planning even in
our typical (not booming) communities, are embarrassingly ineffective.

2. The rapidity of growth and change that a boom town experiences, and which is at the heart of the concept of a "boom town", results in a continuous, relentless, unabated assault on many residents' quality of life.

3. Boom town residents' attitudes towards solving problems after they occur versus preventing problems before they occur naturally favors a certain amount of shortsightedness.

4. In spite of the fact that boomtown planning is about the most difficult kind of community planning that we ever attempt, we attempt to do it with totally inadequate planning resources—both in terms of quantity and quality. (Bleiker, 1980, p. 146)

Bleiker goes on to identify the same three roles that contribute to planning capacity—the political decision makers' sophistication, the planning director's expertise, and technical expertise. He concluded that each of these roles must be developed if community planning is to be successful in a boomtown, but that this is the most difficult setting in which to plan.

The following three sections address, in turn, each of the three elements of planning capacity, in order to more thoroughly identify changes that are demanded by rapid growth.

Planning Attitude: The Decision-Making Role

The decision-making role is perhaps the most fundamental, as it necessarily precedes the others in the development of planning capacity. In order for planning capacity to expand at all, there must be a favorable attitude among community leaders.

A pervasive quality of rural planning, however, that is
represented most clearly in the attitudes of decisionmakers, is a reluctance to plan. This attitude is no doubt reinforced by community homogeneity, and the minor service demands made by rural people. Alan Hahn (1970) explained that until a jurisdiction becomes somewhat urban, "planning will be ignored or resisted as inconsistent with traditional informal, personal ways of doing things, unnecessary, and too costly" (p. 45). Lee Nellis (1980) identified four reasons for rural resistance to land use planning:

(a) A strong emphasis on private property rights, coupled with (b) distrust of outside priorities for land use, aggravated by (c) the inappropriateness of traditional urban planning tools and attitudes, all resulting in (d) a feeling that planners have little empathy with rural values and needs. (Nellis, 1980, p. 68)

Resistance to planning presents an obstacle to be overcome when planning needs grow too pressing to be ignored--when rapid growth impacts a small rural community, for example. One of four problems identified by Gilmore and Duff (1974), in a study of the Sweetwater County boom in Wyoming, was:

General skepticism about planning at both the local and state levels which delayed inception of community development planning, and which apparently still contributes to underestimation of the resources needed for planning in such a varied and fast growing community. (Gilmore and Duff, 1974, p. 26)

Planning for growth may therefore be attendant on overcoming the inertia of the existing system, which traditionally resists planning. When newcomers such as migrant construction workers arrive with different attitudes toward municipal government, pressure on decision makers to actively plan for future growth will increase. Early impacts of growth felt by residents will expose inadequacies in existing
services through the various means of monitoring service satisfaction, decision makers will be apprised of the need to adjust the supply of services. Implicit in the activity of changing service levels is some amount of formal planning--new services do not materialize automatically. The growing demand for services therefore requires consonant growth of the planning process itself. The success of decision makers in providing the necessary planning capacity within the municipal government is a dominant factor in the ability to maintain services and service satisfaction.

Murdock and Schriner (1979) presented a brief survey of researches in community service satisfaction in developing communities, concluding that there is:

The need for early planning in many service areas prior to the initiation of developments and to point out several long-term effects of developments in communities, especially small rural communities... development specialists might do well to advise community leaders in communities soon to be impacted to begin planning early for housing, medical, and recreational services and to anticipate high levels of service dissatisfaction among all citizens during the developments. At the same time, however, they might advise such leaders that levels of dissatisfaction will tend to decrease over time. (Murdock and Schriner, 1979, p. 122)

Failure to acknowledge this need to plan can lead to loss of power or position for reluctant decision makers. The desire to maintain adequate service levels, and to avert potential personal and community losses is the impetus to increase local planning capacity.

Planning Process: The Role of Planning Director

The qualitative and quantitative changes brought by the growth
event will require significant changes in the community planning process. It is usually the role of a planning director to design and implement such changes. Of Bleiker's three roles or functions, the planning director most clearly represents the overall role and importance of planning in community development during rapid growth.

Local planning administration, if it exists at all prior to the growth event, may not be the responsibility of a planner as such, and even less likely a local planner, but rather is accomplished by a combination of local elected officials who probably are without specific planning skills, and outside agents with expertise in areas such as health, economic development, law enforcement, transportation, and engineering. Alan J. Hahn, in his article "Working with Local Elected Officials," (Hahn, 1978), likewise found that "local elected officials are forced to rely on various specialists for information and recommendations" (p. 31).

Ideally, it is the planning director, or some person adopting the role, who assumes the administrative element of local planning capacity, in order to coordinate and expand the planning processes and programs of the community. In discussing the "viability of local government," Gilmore and Duff (1974) concluded that "one conspicuous need for added local government effort appears to be in the field of planning" (p. 44). Bleiker (1980) described the role of planning director as "an effective and constructive inter-face between the technical analysts and the political decision-makers" (p. 151), and said that the planning director must have:
The expertise to get the community's decisionmakers to make good use of the most rigorous available technical analysis in making decisions that affect the quality of life in the community; he/she helps the decisionmakers develop informed consent among all the various potentially affected interests. (Bleiker, 1980, p. 152)

Failure to incorporate or expand the administrative expertise or planning function of a growing community, or any community, leads to mis-matched and inefficient services, wasteful duplication, missed opportunities to provide or improve services, over- or under-provision of desired services, and other undesirable consequences. Without this coordinating function, the negative impacts of rapid growth will be compounded. For example, if services are provided without thoroughly understanding the long-term growth profile, then there is the risk that in meeting present demand, considerable overcapacity and burdensome debt obligations may be established which will remain long after the population peak and primary sources of revenues have passed.

As examples of the need for a planning director to coordinate community development, Monts and Bareiss (1979) cited a number of "local impacts from recent Texas energy developments:"

Rising crime rates accompanied power plant construction near Mount Pleasant. From 1970 to 1975 robberies, burglaries, and thefts rose 759 percent (Burke, 1976). One wastewater treatment plant received twice the daily wastewater it was designed to treat. During petroleum development near Carrizo Springs, eight of the ten wells that tap the Carrizo Aquifer and supply Carrizo Springs with domestic water went dry because of a drop in the water table brought about by increased demand (Stinson, 1977). With construction of the South Texas Nuclear Project in Matagorda County during 1977, roads and bridges fell into disrepair because of use by heavy construction vehicles (Houston Post, 1977). (Monts and Bareiss, 1979, p. 3).
Technical Role

Finally, to actualize the opportunities and necessities of planning in a growing community, there must be sufficient technical expertise. Stinson (1978), discussed some aspects of technical expertise relevant to municipal services, and concluded that:

For local planning to be successful, it must be based on realistic estimates of future population and revenues. Without such estimates officials are reduced to reacting to what has occurred and guessing about the future. (Stinson, 1978, p. 16-17).

The difficult task of making such estimates, in order to match supply and demand in an efficient and affordable manner is an essential form of planning expertise for growing communities.

Small communities are not likely to possess professional planning expertise of their own prior to rapid growth. Usually, any duties for which a larger town would employ an expert planner are performed by a private engineering consultant retained by the small town on a part-time basis. In the absence of either of these local approaches to planning, many tasks are deferred to broader jurisdictions altogether, such as regional associations of governments, university extension agents, or state and federal agencies.

To meet increasing service demand requires growth of technical capacity—the ability to both plan and operate physical facilities and infrastructure. Service quality characteristically declines during the construction phase of energy development as existing services are overburdened by newcomers. On top of this, many new residents will expect services of higher quality than existed prior to the boom. To maintain service adequacy it is imperative to perform adequately
the monitoring function of the planning process. To do so in the rapidly changing and uncertain boomtown environment requires increasingly sophisticated methods, such as forecasting the impacts of growth. Typically, impact assessment models are used to plan the expansion of municipal services. Finally, services that have no precedent in the impacted town will be demanded, such as mental health counseling and indoor recreation facilities. This requires not only the expansion of existing skills, but also the addition of new kinds of planning expertise. Murdock and Leistritz (1979) presented a comprehensive review of these changes, noting that:

The levels of service demands accompanying an energy development are not simply a function of baseline service levels or of the number of new persons entering as a result of a development. Such demands are also a function of the levels, quality, and availability of services desired by in-migrating groups. In many cases, in-migrating groups may have significantly higher service expectations than indigenous groups. (Murdock and Leistritz, 1979, p. 211)

Summary

This section described several attributes of rural planning. (1) Rural governments typically provide only minimal essential public services to residents. (2) Service quality is likely to be marginal by the standards of larger communities, but this does not necessarily mean that residents are dissatisfied with the services they ordinarily receive. (3) Rural communities lack full-time professional planners and administrators, owing to the low importance of planning in local government and low service requirements. Such planning as necessarily occurs is performed by elected officials or is deferred to organizations that are outside of the community. (4) Planning is often resisted
in rural areas. These attributes of rural town planning capacity comprise a system that is marginally adequate under stable conditions.

Rapid growth requires the expansion of local planning capacity in order to maintain service adequacy and satisfaction. Three elements of the local planning system must necessarily grow to meet this goal: (1) decisionmakers must acknowledge the need to expand planning capacity, (2) the administration of the planning process must grow in correspondence with service demand, and (3) local planning expertise must gain the sophistication to monitor and adjust changing service structures.

Planning Assistance: Impact Assessment Models

Introduction

Computerized impact assessment models have become a major supplement to the planning capacity of communities experiencing rapid growth. Other forms of assistance are available, such as the Action Handbook published by the U.S. Environmental Protection Agency (1978), which is designed to be "a detailed 'how to manage' manual for small communities undergoing or facing the prospect of accelerated growth" (p. v). As suggested by the title, the primary thrust of the handbook is to encourage and organize local public participation in the growth management process. Another form of assistance, directed somewhat more toward supplementing local technical skills relevant to growth management is the excellent series of bulletins in the Coping With Growth series (Butler, 1980; Faas and Howell, 1979; and, Lewis et al., 1979), published by the Western Rural Development Center, in Corvallis,

Finally, many University Cooperative Extension programs offer technical assistance to local decisionmakers. The Agricultural Experiment Station at Oklahoma State University has developed a comprehensive and promising set of computer programs and procedural guides to aid extension personnel who assist in local service budgeting processes. They have developed programs to budget for specific municipal needs including emergency medical services, hospitals, sewer, and water systems. These programs, however, do not appear to be tailored to the special economic and demographic conditions of boomtowns. There are also programs available for small computer systems such as microcomputers, designed to perform other municipal planning tasks such as mapping and land use planning, transportation planning, route selection, and civil engineering and surveying.

Gauged by the volume of literature addressing these forms of assistance, however, it is computerized impact assessment models that are the most extensively developed and applied planning tools designed explicitly for boomtown applications. This section will explain how such models are designed to, or at least claimed to augment planning capacity.

Models

Monarchi and Taylor (1977) stated that "the purpose of constructing a model is to analyze and/or predict some real-world situation" (p. 8). A model that can do this has obvious applications in the
municipal planning process. If a model can predict changes in service adequacy then it will enhance the monitoring tasks of planning. Leistritz et al. (1980) indicated the magnitude of the role for models in monitoring or predicting the impacts of rapid growth:

If public officials and private sector managers are to plan effectively to mitigate the undesirable consequences and enhance the beneficial effects of such [large scale industrial and resource] developments, they obviously require mechanisms for assessing the likely magnitude, timing, and location of economic, demographic, fiscal and other impacts of new development projects. (Leistritz, et al., 1980, p. 1)

Similarly, if a model reveals avenues by which to reconcile differences between supply and demand, then the maintenance of adequate service levels will also be made more efficient, economical, and easier. It is by performing these functions, ordinarily the duties of technical experts, that computerized simulation models are intended to increase planning capacity.

Examples of Impact Assessment Models

The following are descriptions of two models currently used in impact assessment. The descriptions are brief, intended only to provide a general background for the discussion. Impact assessment models have been reviewed quite thoroughly elsewhere by a number of authors, including Leistritz et al. (1980), Leistritz and Murdock (1981), and, Sanderson and O'Hare (1976).

Each example covers at least five points: objectives; "use characteristics"; the apparent "transparency" of methods, structure, and assumptions used; data requirements; and, the identity of the organization which designed or created the model.
Each model's objectives are cited in order to illustrate the capabilities and intended audiences that are claimed.

The use characteristics of a model describe the ease with which local planners or officials may obtain results from it. One fundamental distinction is whether or not the planner actually operates the computer during the simulation (an interactive model), entering data, and responding to the requests of the computer, for example. If this is the case, then the "user friendliness" of the modeling system is a key to user access.

Transparency is the degree to which the internal structure, methods and assumptions of the model are made clear to users. These examples indicate only the transparency that is apparent from reading published users' guides or technical manuals.

Data requirements are addressed, where available, to indicate the types of basic data on which a model depends. Most models, and both of these examples, rely on data of two principle types: Background data—usually economic and demographic statistics—that is built-into the model in order to simulate the environment within which a specific policy or project event is studied. The second type of data is transient in the model, serving to describe the particular event of interest to the user.

Finally, the organization that designed or created the model is provided, which may explain objectives and any biases that are found.

The material of these examples, as noted, comes almost entirely from users' guides and technical manuals published by sponsoring organizations.
Example: NEDAM. The North Dakota Economic-Demographic Assessment Model (NEDAM) is the most recent in a long series of impact assessment models. Its immediate predecessors were the programs RED-1 and RED-2, created by:

Researchers from North Dakota State University, the University of North Dakota, and Arthur D. Little, Inc. under the auspices of the North Dakota Regional Environmental Assessment Program, a state-funded program created to aid planning efforts and to inform policy making at the local and state levels. (Leistritz and Murdock, 1981, p. 217)

NEDAM is the implementation of enhancements suggested by extensive testing performed to validate the RED-2 model.

The objectives of the model are stated in its "Technical Description":

NEDAM provides baseline and single or multiple-project impact projections for all eight state planning regions in North Dakota... The model can take account of nonenergy- and energy-related development projects and allows for evaluation of expansion (as well as decline) in a region's economic base... Outputs are then available as selected by the individual user at the regional, county, and municipal levels and include such variables as type of employment, population, population by age and gender, school enrollments by age, housing requirements by type, public sector costs and revenues by type, and net fiscal balance... The model provides annual projections of these indicators over a 25-year planning horizon. (Leistritz et al., 1982b, pp. 8-10)

A simple profile of users of RED-1 was presented in the NEDAM "Technical Description:"

It [RED-1] provided projections of the economic, demographic, and fiscal effects of energy development at the regional, county, and municipal levels for a 15-county area in western North Dakota where energy impacts were expected to be most significant. During the period January 1 to October 31, 1977, 45 different entities used the model for various aspects of planning and policy development. User groups included state legislative committees, state agencies, local governments, federal agencies, and private development firms. (Leistritz et al, 1982b, p. 6)
NEDAM is actually a compilation of six lesser models: an economic model, a demographic model, a module to integrate the economic and demographic models, a model to estimate where in-migrants will reside, a service-requirements model, and, finally, a fiscal impact model. This structural organization of the model is clearly explained, as is the purpose of each sub-model. To understand the technical operation of each sub-model requires considerably more effort, and presumes more than a passing familiarity with specific economic, demographic, and fiscal forecasting methodologies. Casual users would not find it easy to understand the detailed workings of the model, nor its underlying assumptions.

For example, the economic sub-model is based on a technique called input-output analysis. The "Technical Description" explains quite clearly that input-output analysis is, "A technique for tabulating and describing the linkages or interdependencies between various industrial groups within an economy" (Leistritz et al., 1982, p. 13), and that its purpose is to "estimate the gross business volume by economic sector for a specified level of final demands for the area's products" (Leistritz, et al., 1982b, p. 14). Although some further technical characteristics of the model are presented, they are oriented to knowledgeable economists. There is no suggestion or discussion of the limits of input-output analysis when applied to small jurisdictions, nor of general limiting assumptions that underlie this technique.

The "Technical Description" states that "NEDAM is a complex model that performs a myriad of internal calculations in a specialized
computer environment" (Leistritz et al., 1982b,p.119), and, in addressing use characteristics, recommends that "it is advantageous to become familiar with operating and response procedures necessary in specifying the scenario and reporting options of interest in the most efficient manner" (Leistritz et al., 1982b, p.119). The model is described as user interactive, and it is apparent that with a moderate amount of training the user could use the model to perform impact assessments.

The model relies heavily on built-in historical data. For example, the input-output analysis uses data "obtained in 1965 from a survey of expenditure patterns of a sample of firms, households, and local units of government in a seven-county area in southwestern North Dakota" (Leistritz et al., 1982b, p.15). The user-supplied data may include:

- Projection Period Length
- Project-Specific Identifiers
- Project Site Distances
- Area Specification (Jurisdiction)
- Community Attraction Index
- Surplus Labor Pool Rates
- Workforce Participation Rates
- Workforce Distribution Allocator

Project Sites
Starting Dates
Gravity Powers
Birthrate
Inflation Rate
Major Tax Rates
Family Size

Although there are default values supplied for some of these user-alterable parameters, this is clearly a model for knowledgeable users.

Leistritz, Ransom-Nelson, and Rathge (1982) stated that "the NEDAM Model has been used by more than 50 groups in North Dakota, including state legislative committees, state and federal agencies,
county and city planning authorities, and private firms" (Leistritz, Ransom-Nelson, and Rathge, 1982b, p.119., Leistritz et al. (1980) cited one example of the use of RED-1 by a small community in planning for capital facilities expansion during rapid growth. The Commission of the City of Beulah, population 1,344 in 1970, requested:

A series of [14] population projections incorporating several alternative assumptions regarding the extent and timing of development coupled with alternative assumptions concerning Beulah's capture rate for the in-migrating population. (Leistritz et al., 1980, p. 25)

At the other end of the spectrum, RED-1 was used by the North Dakota Legislature as "the principal framework for analyzing the implications of various tax rates and distribution formulas during the 1977 Legislative Session" (Liestritz et al., 1980, p. 18).

Example: CLIPS. The Community-Level Impacts Projection System (CLIPS) was developed by the Social Systems Analysis Division of the Center for Energy Studies at the University of Texas at Austin. Funding for CLIPS was provided by the Texas Legislature through the Texas Energy Development Fund.

The objective of CLIPS, as stated by Monts and Bareiss (1979), who authored the CLIPS descriptive manual, is to provide, "in advance, the detailed information required for rational planning" (p. ii). Although the authors "do not presume to dictate how CLIPS will be used, nor at what level of organization, nor for what purpose" (Monts and Bareiss, 1979, p. 7), they stated that:

Anticipated uses of CLIPS include:

--Site-specific regional and local planning
Statewide programmatic assessment of socioeconomic impacts resulting from resource development.

Estimation and disbursement of impact assistance funds (Monts and Bareiss, 1979, p. iii)

Two potential applications for CLIPS were suggested:

We anticipate that CLIPS will prove to be most immediately useful on two levels: ... Community-level baseline and impact population projections should prove most useful at the local planning level (councils of governments, school superintendents, wastewater superintendents, police chiefs, fire chiefs, etc.) ... Socioeconomic reports might serve as guides for local planners ... but likely will prove more useful to state planners. (Monts and Bareiss, 1979, p. 7)

Structurally, CLIPS proceeds from a "Community Baseline Socioeconomic Projection," to a "Community Impact Socioeconomic Projection," by the addition of various elements of population change caused by the impacting project. CLIPS places more emphasis, outwardly, at least, on population as the change agent in the community, than does NDEAM. It appears that CLIPS begins by modeling the effects of population change on the local economy, whereas NEDAM allows population growth to be controlled more directly by regional economic conditions, and thereby to effect local economic changes.

The CLIPS documentation describes with considerable clarity and depth the methods that are used, and goes so far as to describe, individually, some 200 equations used in the model. Like NEDAM, though, it is assumed that the reader has a basic understanding of economic, demographic, and fiscal forecasting methods. Unlike NEDAM, the authors of the CLIPS documentation have clearly identified many limits to the model. The output of the model is acknowledged, fairly early on in the manual, to be "fraught with limitations," and later
on, "several serious caveats are in order with respect to the use of the output from the CLIPS socioeconomic assessment submodel" (Monts and Bareiss, 1979, p. 92). The caveats are presented in two ways: First, the selection of particular methods or sub-models are compared against possible alternatives, as a means of justifying their selection. Second, the authors are careful to identify technical limits that make selected methods inappropriate for either state or local planning purposes.

For example, a simple, average-costing fiscal impact sub-model was selected owing to the absence of data bases to support other, more sophisticated methods, and because of the costs of collecting and maintaining the requisite data base. The method chosen is then qualified as to certain applications:

The output from these simpler [average costing] models can be valuable as long as its use is restricted appropriately. Such an appropriate use will likely fall into two areas: (1) to avail local planners' initial "guesstimates" of the municipal facilities/services and budgets likely to be hardest hit by specific developments; and, (2) to enable higher-level government officials to conduct programmatic socioeconomic assessments when they must have such information in order to execute impact-aid disbursements. (Monts and Bareiss, 1979, p. 93)

The underlying assumptions and limits of CLIPS have been much more clearly identified than those of NEDAM, and the descriptions of the equations may be useful to some knowledgeable users. At the structural level, though, CLIPS is marginally less transparent.

CLIPS is designed to interact with the user in a "friendly" manner, requiring the input of: projection period, starting date, project duration, and manpower requirements by year for both construction and operation phases of the impacting project.
Because CLIPS is less complex than NEDAM, its data requirements are lower for both user-supplied and built-in data. This suggests that CLIPS does a poorer job of simulating reality, which might tend to explain the greater care taken to define its limitations. It does not, however, necessarily mean that one model is better than the other when it comes to making forecasts, and is especially inconclusive considering the variety of applications of model results.

Other Models. There are many other models of similar caliber operated in the western states which would demonstrate similar characteristics to NEDAM and CLIPS. These models include:

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Summary

The purpose of this section has been to familiarize the reader with examples of typical computerized impact assessment models. Two examples were described, the North Dakota Economic-Demographic Assessment Model (NEDAM), and the Community Level Impact Projection System (CLIPS). The examples focused on five characteristics: Objectives, sponsors, transparency, use characteristics, and data requirements.

Limitations of Models for Local Planning Purposes

Introduction

Despite the benefits and widespread application of comprehensive impact assessment models, they are not without limitations which cause them to fail to perform as claimed for local planning purposes. This section compares the promises made by models for local planning applications with their actual performance. First, models' objectives are described in reference to local planning tasks. Then several critical, but little-understood limitations of models for small-town planning purposes are discussed.

Objectives: The Promise

Typical objective statements of impact assessment models contain such claims as: "A comprehensive model that identifies and estimates the magnitude of the economic impacts of anticipated energy resource development in site-specific areas" (Stenehjem, 1975, p. 5); "a set of techniques for providing, in advance, the detailed information required for rational planning... site-specific regional and local planning" (Monts and Bareiss, 1979, p. ii); and "the model's outputs
include projections of business activity, personal income, employment, population... intended for use by local and state public and private decisionmakers and planners" (Murdock et al., 1979, p. i).

For models to fulfill these objectives for local planning depends on their ability to produce information that is useful in the local planning process; that is reliable and actionable in the planning process. Decisionmakers, who hold ultimate responsibility for growth management, are concerned with the potential results of policy decisions. Therefore, they require specific planning skills—the skills identified earlier as comprising the planning function of local government—and the administrative ability to bring these skills to bear on local planning problems. In communities possessing well-developed planning functions, these tasks are the domain of expert planners and the planning administrator. Ideally, a planning director is able to draw on the skills of experts—planners, demographers, economists, and other specialists—to predict the consequences of growth, to devise and present corresponding management strategies, and to evaluate potential impacts of what is proposed. The final objective is to produce information that is useful to decision makers for policy formation. According to their objectives, models are able to assume these roles, and to supply such useful information.

For example, Elizabeth Moen suggested that for local planning purposes, useful population projections would ideally provide:

Estimates of the numbers and characteristics of inmigrants and outmigrants detailed enough to plan for community needs (housing, classrooms, services, etc.) and to predict subsequent growth (age-gender distributions, age-specific birth and death rates). (Moen, n.d., p. 5)
Another example comes from the article "Models in Theory and Practice: Some examples, problems, and prospects," by Larkey and Sproull (1981) who presented similar criteria in a more general sense:

The primary purpose of models here is to make policy more intentional through a more accurate grasp of what the consequences of our policy decisions will be. The most useful models are those that can accurately answer many "what if...?" questions. The ability of models to answer such questions is largely a function of their success in capturing why the world works as it does. (Larkey and Sproull, 1981, p. 236)

These functions of models should sound similar to points raised in prior sections. Essentially, the usefulness of models exists in their ability to assume or enhance the planning functions of maintaining municipal services. Furthermore, Moen, and Larkey and Sproull raised two vital qualifications to the information role of models: explicitness (or detail), and accuracy. Computerized impact assessment models promise not only to perform these functions, but to do so within the uncertain boomtown planning environment.

This is a principle source of attractiveness of computerized simulation models to local officials and planners: they claim to be expedient and inexpensive supplements to planning capacity. They purport to overcome many of the difficulties of boomtown planning, including the rapidity with which planning capacity must grow to keep abreast of impacts, uncertainty over the magnitude, timing, and occurrence of the event, and the lack of indigenous planning expertise to draw on in coping with it. In their article entitled "Coping with Rapid Growth: A Community Perspective," Fass and Howell (1979) addressed the issue, stating that:
Given the pressure of making decisions on many diverse and complex issues, few public officials have the incentive to devote their time and analytical resources to becoming fully informed on any particular issue. (Faas and Howell, 1979, p. 4)

In rural towns, the analytical resources themselves must first be developed to a level at which they can supply useful information to public officials. This function is the promise of computerized impact assessment models, and is thus their principle source of attractiveness to local decisionmakers.

Performance Limitations: Overstated Objectives

Considering the expense and difficulty of implementing large simulation models, it is only to be expected that the sponsoring agency will attempt to maximize the return on its investment by serving as many user groups as possible. This gives rise to the formulation of very broad objectives for impact models, as illustrated by the examples cited above—objectives encompassing the needs of state legislatures, planning regions, counties, and small municipalities. Unfortunately, smaller users' objectives are compromised because the ultimate power to influence model design lies with those who control the funding and expertise—larger organizations such as state agencies and universities—and it is their interests which prevail. Appropriate applications for local area planning are severely limited as a result.

In his article "Requiem for Large-Scale Models," Douglas Lee (1973) suggested that broad objectives and multiple user groups are typical failings inherent in large models:
The overly comprehensive structure of existing large-scale models has two aspects: (1) the models were designed to replicate too complex a system in a single shot, and (2) they were expected to serve too many purposes at the same time. Too broad a scope usually means too many variables and too much detail are included in the model structure. Including more components in a model generates the illusion that refinements are being added and uncertainty eliminated, but, in practice, every additional component introduces less that is known than is not known. (Lee, 1973, p. 164)

Although primarily concerned with land-use models, Lee's article ranges over models of all sorts, and contains a useful discussion of their limits. This problem of overstated objectives is perhaps the most fundamental limitation of current impact assessment models for local planning uses. Many other limitations result from compromises made to meet the objectives of both small and larger users. By attempting to meet conflicting objectives in one model, there is a tendency for no single objective to be addressed in an optimal fashion, and owing to political and financial considerations, small users' objectives are most neglected.

Performance Limitations: Forecasting Methods

In designing an impact assessment model for Argonne National Laboratory, Erik Stenehjem (1975) found that forecasting methodologies are critical determinants of the accuracy of models:

A critical review of the limitations of past models and empirical impact studies, with respect to their applicability to more than one technology or more than one region, underscored the importance of the technical components of a comprehensive impact assessment methodology and suggested criteria for developing such a model. Choices of analytical techniques and the extent of informational content must be very carefully considered because they influence the accuracy with which impacts can be measured. (Stenehjem, 1975, p. 6)
A model may be of limited use to local planners if the forecasting methods that are used do not produce accurate, explicit predictions, especially if they were selected to forecast accurately only at the regional or state level, for example. The critical distinction for local planning purposes is that a method which forecasts adequately for regional and state policy evaluation is often much less adequate for local, community-specific planning.

This principle failure of what is promised for local planning is an inherent drawback of forecasting methods that rely on statistical averages, or regional or national standards. Such methods predict with decreasing accuracy as the size of the study area diminishes. Yet because the needs of decisionmakers with broader policy concerns are adequately served by less costly methods that are only accurate in the aggregate, these are almost invariably selected for use in large models, and appropriate local planning applications are limited as a result. For example, Table 1 shows measures of forecasting errors for the NEDAM model when tested for its ability to reproduce historic population changes. The results in Table 1 illustrate very clearly the distinction between accuracy in aggregate and disaggregated geographic forecasts. For all municipalities, which included 319 towns and cities with populations of 50 persons or greater, the model appears to be very accurate when measured by mean percentage difference, or the average variation of all forecasts from the actual historic population change. The Mean Absolute Percentage Difference, however, indicates that the average variation of any forecast for a single municipality could be expected to be, on average, 33.3 percent above or below the mean.
### Table 1
Comparison of Estimated and Reported Personal Income and Population, North Dakota Regions, Counties, and Municipalities\(^a\)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean Percentage Difference</th>
<th>Mean Absolute Percentage Difference</th>
</tr>
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<tbody>
<tr>
<td><strong>Population:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Dakota counties, 1980</td>
<td>5.7</td>
<td>8.2</td>
</tr>
<tr>
<td>North Dakota counties, 1970</td>
<td>-2.2</td>
<td>6.4</td>
</tr>
<tr>
<td>North Dakota municipalities, 1980(^c)</td>
<td>2.3</td>
<td>33.6</td>
</tr>
<tr>
<td>North Dakota municipalities, 1970</td>
<td>-6.8</td>
<td>36.6</td>
</tr>
<tr>
<td>North Dakota municipalities with populations greater than 2,000, 1980</td>
<td>+6.3</td>
<td>11.7</td>
</tr>
<tr>
<td><strong>School Enrollment:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Dakota Regions, 1980</td>
<td>+10.9</td>
<td>12.1</td>
</tr>
<tr>
<td>North Dakota Regions, 1970</td>
<td>-2.0</td>
<td>6.1</td>
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\(^b\)Computed to taking a simple average of individual differences (for years, counties, or cities) without respect to sign.

\(^c\)For 319 North Dakota municipalities.

**Source:** North Dakota Economic-Demographic Assessment Model (NEDAM): Technical Description. Leistritz et al., 1982(b).
Data Limits. It is very difficult to accurately project specific impacts for small communities, and it is very expensive to attempt to do so using large models, owing to the expense of data acquisition, maintenance and processing. Yet local planners are concerned most with impacts that are specific to their communities. Leistritz et al. (1980) discussed the trade-off between cost and accuracy in making local projections:

Detailed projection techniques may impose greater costs for model development and also may lead to greater requirements for computer capacity and to higher costs for each model execution. Similarly, techniques which utilize substantial amounts of local data may be more reliable in projecting local level conditions that depart markedly from state or national patterns, but may also imply substantial costs for data collection. (Leistritz et al., 1980, p. 8)

In his book *Models in Planning*, Colin Lee (1973) summarized the unavoidable data limitations encountered when a model must make realistic projections, such as those desired by local planners to enhance growth management activities:

One of the major practical problems involved in the use of models is the limitations imposed by the availability of data. Even the simplest model can have a vast appetite for data, and the more realistic a model becomes, the more the appetite increases. Many planning studies in the United States have foundered because of the problems of data availability and collection. This again is not an argument for abandoning models. It is, however, a warning that frequently the information required by models is not readily available from published sources, and elaborate, time-consuming and costly data-collection exercises are required. (Lee, 1973, p. 16)

Sponsoring organization must therefore be willing to bear increasing costs if more accurate and explicit predictions are to be achieved for small places. For very small communities, detailed demographic,
economic and fiscal data such as recorded statistics or prior forecasts which are necessary for accurate local projections may be unavailable, inaccurate, or incomplete. To gather them firsthand could be prohibitively expensive or time consuming. Even if available, the cost of maintaining and processing detailed data for a great number of separate communities would likewise be costly.

Aggregated forecasting limits. To reduce these data costs, models substitute statistical averages or standards for primary data, but explicitness is traded off in return for the savings. The needs of decision makers representing larger jurisdictions, however, as discussed above, are adequately served by less detailed, aggregate forecasting methods. Because these methods are also less expensive to implement, they are the usual choice of model builders.

For example, the use of an impact assessment model to evaluate the fiscal consequences of raising severance taxes on energy or mineral resources is a broad policy application, for which decision makers have little or no need to predict community-specific impacts. Rather, their concerns are political in nature, and thus are governed by compromise. It would be naive to expect that their interests are identical with those of rural communities. For purposes of broad policy analysis such as this, to attempt to evaluate the unique impacts on individual communities would frustrate the policy-making process merely because of the logistics of producing accurate and politically acceptable forecasts.

By trading explicit, accurate forecasts for expediency, those who implement impact assessment models severely limit the usefulness of
projections for specific, small communities. In a review of over
thirty impact assessment models Sanderson and O'Hare (1976) discussed
shortcomings of using averaging methods to forecast local impacts:

The majority of models predict service demands by
multiplying population estimates by per capita "adequacy"
standards like "hospital beds per 1000 population" or
"policemen per person". The models' different sources
of standards... reflect different definitions of
"adequate"; but the studies present little evidence to
support one definition over the others. Projecting
future service levels from these standards risks
inaccuracy, since variation in population behavior
and attitudes threaten the validity of the standards'
underlying assumptions. (Sanderson and O'Hare, 1976,
p. II-12)

In discussing the fiscal impacts of growing service demands, Stinson
(1981) identified the same basic flaw of applying adequacy standards
of this sort to specific communities. He concluded that "because
existing service capacity is different in each community, localities
must project expenditures that reflect their situation. Arbitrary
use of statewide averages will seldom be appropriate" (Stinson, 1981,
p. 12). Douglas Lee (1973) also criticized the use of statistical
averages, emphasizing points that seem particularly relevant to
rapid growth in small towns:

A model constructed of empirical regularities [statistical
averages or trends] might be very useful for interpolation
between data points or for minor marginal changes, but it
is dangerous to use it for prediction under as-yet-
unobserved conditions. (Lee, 1973, p. 169)

Projecting future impacts of as-yet-unobserved energy development is
precisely what large simulation models claim to do, yet they rely
heavily on historic empirical regularities, and in boom town applica-
tions that really have remarkably little to do with minor, marginal
changes.
Example. As a more specific example, consider the economic module of the NEDAM model. The data on which the economic sub-model is based "were obtained from a survey of expenditure patterns of a sample of firms, households, and local units of government in a seven-county area in southwestern North Dakota" (Leistritz et al., 1982, p. 15). This sample is deemed sufficiently representative (the decision is not explained) to serve as the basis for estimates of:

The gross business volumes and employment in each sector [of the economy] for the period 1981-2005. . . based on the assumption that the interdependence coefficients will not change significantly during the period. . . that trends that existed during the period 1960-1979 will continue to 2005. (Leistritz et al., 1982, p. 32)

Thus, a fifteen-year-old estimate of economic activity in seven counties, serving as a standard for over fifty counties, is incorporated into a twenty-five year projection. Input-output analysis was judged to be adequate for forecasting baseline economic conditions. This may be a valid judgment where broad policy analysis is concerned, because the selected standard of economic activity in North Dakota--the seven-county sample--may indeed to a good indicator of average regional activity. A brief (unscientific) look at some literature on the application of input/output analysis raises serious questions as to its use for smaller jurisdictions, and points especially to limitations of data and of aggregate forecasting methods. Chalmers and Anderson (1977) stated that:

At the county level of analysis required for the local impact area, an input-output model based on primary data is not likely to be an alternative. It is expensive and suffers from the limitation of representing the structure of the economy at the time of the survey. This is a serious problem since a major
consequence of the proposed action may be to change the structure of the local economy and render the interindustry transactions data irrelevant, especially in the case of relatively large proposed actions in sparsely populated areas. (Chalmers and Anderson, 1977, p. 77)

In their report *A Framework for Projecting Employment and Population Changes Accompanying Energy Development, Phase I*, Stenehjem and Metzger (1976) found that "the usefulness of input-output models as the cornerstone of a general methodological approach to the assessment of the fiscal impacts of industrialization must be seriously questioned" (p. 203). Finally, Monts and Bareiss (1979), the CLIPS modelers, rejected the use of input-output analysis, finding that "the potential limitations of an I/O approach were particularly striking," and explained:

> It is extremely unlikely that an I/O analysis would produce an accurate projection of economic activity in the area between 1970 and 1990 (unless, of course, its technical coefficients were updated annually, a feat that is virtually impossible). . . I/O analysis and highly aggregated continuous-growth econometric models will produce reliable results only for larger areas with many firms in each industry group. (Monts and Bareiss, 1979, p. 52)

The CLIPS reasoning seems to rebut NEDAM's use of input-output analysis on two important accounts: accuracy depends on current data, and results are only reliable for larger regions, measured across diversified industrial groupings.

This discussion of input-output analysis is intended only as an illustration of how local planning applications of models can be considerably limited by inappropriate forecasting methods. More specifically it demonstrates the illegitimacy of using aggregating methods of analysis for purposes of predicting impacts in specific, highly
disaggregated locations. Whereas input-output analysis may meet the needs of regional and statewide policy analysis, it is highly suspect for local planning purposes because it takes no account of local variations from aggregate descriptions of economic activity, and depends on detailed, current, primary data even to produce accurate descriptions of average activity.

Various other projection methods commonly used in impact assessment models share limitations of averaging or aggregation. These include the use of standard municipal service levels (averaged from a cross-section of towns of equal size) to predict how service demands will change as a community grows, and second, the use of average birth and migration rates to project population change in small areas when site specific statistics are unavailable.

**Performance Limitations:**

**Lack of Transparency**

The methodological drawbacks of large models would be less limiting for local applications if they were more easily understood by users. At present it is difficult to determine just how well forecasts are understood by local planners, officials, and citizens who use them, because this aspect of model validation has rarely been studied by modelers. It is, however, certain that the lack of transparency in most large impact assessment models encourages inappropriate applications.

Lack of transparency in models has two fundamental limitations for small-town planners or decisionmakers. First, if the forecasting methods of the model are invisible to users, then their ability to
evaluate its appropriateness (methodologically, and as to the proper role of the model in the planning process) for desired local planning applications is severely limited. Second, if the model is formulated elsewhere, and lacks transparency to local users, then they may be unable to identify assumptions or biases that are built into it, and may even be subject to intentional bias from parties with vested interests or hidden agendas opposing those of the community.

**Definition.** Transparency is the degree to which the internal structure, methodologies, and assumptions of a model are made clear to users. A useful measure of transparency would be that the transparency of a model is sufficient if it enables each intended user to evaluate the appropriateness of the model for the desired application, without making an inordinate investment in special training or technical expertise beyond that ordinarily demanded by his or her occupation.

**Determinants.** Transparency is a product of several factors. The complexity of a model and its technical sophistication are clearly important. Transparency depends, too, on the relative difference between the technical sophistication of the model and the corresponding expert knowledge of users, and is greatly determined by the care taken to bridge this gap. This discrepancy may be increased when modelers pursue objectives that bear little or no relation to the practical applications of the model. For example, Leistritz et al. (1980) found that:

> With the development of numerous socioeconomic systems models and the increased use of these models in impact assessment, there is a tendency for analysts to become engrossed in the technical task of developing ever more simple modeling
systems and to thus lose sight of the pragmatic considerations related to model use. (Leistritz et al., 1980, p. 4)

Speaking of his experience in developing large land-use models, Voelker (1975) stated that designers are interested primarily in:

Specifying a model structure that will allow the model to mimic a given conceptualization of real-world processes. Their concern is with model behavior, and their experience and interests are generally far removed from the pragmatic world of the planners and decision makers. For example, a researcher may use a model as a mechanism to test hypotheses explaining land-use processes. The model best suited to this purpose is simple and stripped of detail. This is in direct contrast to the detail-rich model generally sought by planners. . . A gap will always exist between the modeler's intended application of the model, the planner's ability to use it, and the decision maker's expectation of it. (Voelker, 1975, pp. 9-10)

The mis-matched skills and knowledge of modelers and users often is compounded by the computer environment in which models reside. The computer itself is not part of the model, but acts as a shell around it which may be an additional obstacle to transparency, especially to users unfamiliar with the operating or use characteristics of computers.

To increase the transparency of models requires the reduction of either or both of these potential difficulties. Sponsoring organizations issue some form of technical description or instructional manual to enhance users' knowledge of the model, and to improve use characteristics, models are often made interactive or "user friendly." The CLIPS modelers, for example, desired user interaction because "if a modeling system is difficult to use, the planner is much more likely to 'leave it to the experts' and attempt no understanding for himself" (Monts and Bareiss, 1979, p. 7). Often, however, the interaction
which such goals produce may simply substitute ease of use for understanding the model itself, in which case users' confidence in the model's forecasts may be strengthened for the wrong reasons. Actual understanding of methods and assumptions, in order to assess the model's appropriateness is a more rational criterion for confidence.

Documentation is a more direct approach to transparency, but typically suffers from incompleteness: there is a tendency to assume that users are familiar with various forecasting methods. Through its "Technical Description," the organizational structure of NEDAM is made quite clear, for example, and enables users to easily comprehend what basic processes are being simulated by the model. It fails, however, to identify methodological limits and assumptions, and, though interactive, demands some prior experience or training of the operator. CLIPS, on the other hand, is more friendly toward users, and is far less complex than NEDAM, which made it feasible for its designers to explain in detail the forecasting methods used. The CLIPS documentation is somewhat less clear in matters of model structure.

Underlying assumptions. Douglas Lee (1973), in "Requiem for Large-Scale Models," made the following assertion:

Probably the most important attribute any model should have is transparency. It should be readily understandable to any potential user with a reasonable investment of effort. "Black-box" models will never have an impact on policy other than possibly through mystique, and this will be short lived and self-defeating. A transparent model is still about as likely to be wrong, but at least concerned persons can investigate the points at which they disagree. (Lee, 1973, p. 175)

Lee's statement stresses the importance of transparency to planners who use models: To enable users to directly evaluate their
appropriateness for potential forecasting tasks, or to illuminate the qualifications of the model if it is indeed used. First, there may be political implications underlying the model's methodology, data, and structure. Second, transparency clarifies the role of the model in decision making processes, and may shed light on the impact process as a whole, including economic, demographic, fiscal, and possibly social processes causing change in the community.

To use impact forecasts supplied by others without understanding the assumptions on which they are based is to implicitly delegate decision-making power or authority to those who design or operate the model. Without transparency, the possibility exists for the model to assume a political or moral role otherwise reserved for local elected officials. Faas and Howell (1979), citing the work of Bartlett (1977), placed local planning decisions into a broad political context, relevant to this discussion:

When faced with uncertainty due to the high cost of acquiring information about complex issues, the decision maker will generally be receptive to information provided by others. Persons having a stake in the outcome of the decision have an incentive to generate and supply more information than the decision makers can obtain without such assistance. It should be recognized, however, that some interest groups have greater incentives than others for providing information. (Faas and Howell, 1979, p. 4)

These conclusions are easily restated in the terms of this discussion:
(1) they identify the attractiveness of models in supplementing the planning capacity of the community facing rapid growth; the "information provided by others" would be forecasts received by local planners or officials from state agencies, private consultants, or the impacting industry. (2) These groups all clearly have superior technical,
informational, and financial capabilities relative to the small community. (3) Each could conceivably have vested interests in the development of the community which might be furthered by exploiting their advantages. (4) Lack of transparency in a model disguises how impacts are forecast, making it easier to incorporate assumptions that are insensitive to the needs and interests of the small community. This final point is probably the most pervasive limitation—the difficulty of modelers, who are not trained as rural planners, to be sensitive to the uses for their models.

Example. In a more explicit example, Lewis et al. (1979) similarly cautioned against implicit political assumptions in their article "Economic Multipliers: Can a rural community use them?" A multiplier, described by the authors as "a single number that summarizes the total direct and indirect respending effects of a given change," is equally useful for predicting the total effects of growth (or decline) on business volume, income levels, employment, in-migration and so on. As such, multipliers are valuable and often used elements of impact assessment models. The same authors discussed a number of criteria by which to evaluate the accuracy of multipliers. They advised "anyone who uses multipliers" to ask: "who calculated the multiplier—and did the person or agency doing the calculation have a vested interest in the result" (Lewis et al., 1979, p. 4) and explained that:

Multipliers are calculated by people using statistics, and as such, there is always the opportunity to adjust the size of the multiplier intentionally. Before accepting the results of a given multiplier take time to assess the origin of the data. Studies conducted
by individuals or firms having a vested interest in the study's results deserve careful examination. (Lewis, et al., 1979, p. 4)

As an hypothetical example of the importance of a multiplier to various vested interests, consider the disbursement of energy impact assistance funds of which the amount paid to a community is based in part on the projected size of the impact population. In the forecasting model, a multiplier is used to predict the total population gain caused by the development itself. Two groups in particular would have opposing interests in the population multiplier: the impacting firm, and the impacted community. A low multiplier might benefit the industry by downplaying the costs and negative impacts associated with rapid growth. Moen (n.d.) listed several reasons for industry to influence population forecasts, including:

- to intimidate the competition, to draw a larger labor force to the area, to change forecasts being done by others, to obtain federal funds, (e.g., from the Synthetic Fuels Board), to encourage investment in the company and in the area to be affected, and... to 'snow the locals.' (Moen, n.d., p. 18)

Conversely, the impacted community would be favored fiscally if the multiplier systematically overestimates population effects. "It may be especially tempting to local governments to inflate projections when millions of dollars in energy impact mitigation funds are available" (Moen, n.d., p. 20).

One author, John Friedmann, has taken the argument even further, concluding that to relinquish control of decision-making power is tantamount to abandoning a moral obligation of decision makers: their responsibility to the overall interests of the public they represent. In his book Retracking America, Friedmann (1973) stated that:
Because the relationships among elements composing a scenario [forecast] are at best plausible, incapable of being verified, the construction of scenarios is not a scientific enterprise at all, as it is sometimes claimed to be, but essentially a moral one. The attractiveness of future scenarios for planning lies not in the accuracy of their prescriptions for specific actions, but rather, as it were, in their ability to import values from the future into the present, providing political actions with a moral foundation.

In most societies, several images of the desired future compete with one another, clashing whenever one group tries to impose its particular vision to the exclusion of some or all of the others. (Friedmann, 1973, p. 125)

Models, by their very nature, make it easy to disguise political decisions. "Even for technological forecasting, seemingly far removed from political developments, a major source of uncertainty stems from doubt about the political context" (Ascher, 1981, p. 260).

Visibility of local growth processes. In his article entitled "Tools for Community Managed Impact Assessment," Dean Runyan (1977) echoed Friedmann's concern for the values that may be imparted to an impact assessment. Runyan's concern, though, is more particular to local participation in decision making and to the opportunity for increasing the descriptive abilities of impact assessments by the introduction of intimate local knowledge:

Impact assessments serve as vehicles for understanding why impacts may occur as well as for anticipating what they will be. This understanding is critical for those, including local groups, who want to alleviate potential problems. . . . the importance of locally derived impact assessments stems from the values, perspectives, and experience they introduce to decision making that are not reflected elsewhere. Such forecasts may or may not be more accurate than those from other sources. But since no one knows what the future will bring, we need to concentrate on including multiple perspectives and increasing the quality of all such input. (Runyan, 1977, p. 127)
The importance of Runyan's statement is its contention that the value of an assessment or forecast is not only a function of the accuracy with which it predicts future events. He indicated fairly explicitly that personal, local knowledge is valuable to community planners beyond its ability to improve the accuracy of forecasts: Assessments can be useful tools for alleviating local problems by helping to understand how impacts occur, but the value of the assessment depends in part on the quality of the input, or the degree to which it reflects local, personal knowledge.

The point seems obvious, and is, in fact, one that was discussed in an earlier section, although from a methodological perspective. This relationship between personal (local) knowledge and processed (technical) knowledge, to use Friedmann's labels, is a critical link between the transparency of models and their appropriateness for local decision making. The crux of models' transparency limitations is that there is no methodological equivalent to Runyan's statement, at least not as large simulation models are implemented at present. This point deserves further explanation.

Runyan placed equal emphasis on both the results (forecasts) of an assessment, and its ability to clarify the underlying processes by which impacts occur. In computerized simulation models, to pursue one of these goals tends to defeat the other, largely because of limitations of transparency. The dilemma is as follows: In a model, the data base is a proxy for the local experience emphasized by Runyan. To improve the accuracy of community-specific forecasts requires the input of large amounts of data particular to the
community; this point was discussed earlier. The second element of assessment--explanation of how impacts occur--has its equivalent in the structure and methodology of the model, which are made only as clear to users as allowed by its transparency. To implement a model capable of integrating a sufficiently broad data base for community-specific forecasts appears to be inimical to transparency. In fact, the tendency is for transparency to be sacrificed for reasons of expediency and economy even in models that do not predict accurately at the community level. This does not mean that large models, capable of forecasting accurately at the community level are necessarily "opaque" to users. To achieve both, however, would be costly, and, as has been discussed, small communities have not had the power or else have not understood the trade-off well enough to force the additional investment.

Summary

The central purpose of this section has been to identify limitations of existing, computerized, impact assessment models in small-town planning applications. Two fundamental limitations of models were identified and discussed.

First, the forecasting methods used by these models have significant limitations when used to predict explicit impacts at local levels. Forecasts tend to be accurate only in the aggregate because to implement models that predict with community-specific accuracy invoke methodological complexity and data limitations. The resulting models are very expensive to design, operate, and maintain, and are logistically intractable.
Second, models are limited by lack of transparency into methods and structure, caused by inadequate documentation and unfamiliar computer environments. Without transparency unsophisticated users are unable to evaluate potential uses for a model. As a consequence, local applications may be based on invisible, underlying assumptions which bias forecasts against the best interests of the community.

In summary, then, computerized impact assessment models fail to fulfill their stated objectives for local planning purposes owing to the limitations identified in this section. This quote from Thomas Stinson's article "Overcoming Impacts of Growth on Local Government Finance" states concisely the central arguments of this section:

Smaller cities have an especially difficult time making accurate and useful estimates of local impacts of growth. A major obstacle is that most estimation methods are designed for larger cities. Because the particular problems affecting small local governments are often ignored, the estimated impacts are often of limited value. Sometimes, they are even misleading. Forecasts made for an average community and a typical plant are not likely to reflect what will happen when a particular firm moves to a specific locality. (Stinson, 1981, p. 12)

The accuracy of explicit forecasts made by models must be questioned on methodological grounds. Furthermore, to base policy decisions on models containing these limitations is to delegate power over local decisions to un-identified parties external to local concerns, and quite likely insensitive to the values and needs of small rural communities.
CONCLUSION

Synopsis

The purpose of this research has been to investigate whether computerized impact assessment models are appropriate tools with which to augment small rural towns' ability to plan for rapid growth. The question was asked: How well do models supplement planning expertise and administration? The method of investigation was, through a review of literature, to assess planning needs of rapidly growing communities, and then to appraise the performance of models that claim to fill these needs. The following is a synopsis of the research.

Rapid growth is a persistent form of community development in small rural towns. There are many historic and contemporary examples of boomtowns. An analysis of their origins leads to the conclusion that boomtowns will continue to occur throughout the western United States.

Rapid growth transforms the social, economic, and demographic structure of the boomtown, primarily as a consequence of new local employment opportunities. The impacts of growth are those changes that are experienced directly by residents, and the mitigation of negative impacts is the chief purpose of growth-management planning activities.

One planning function of small-town government is to maintain satisfactory municipal services for residents. Three basic elements
of planning capacity must be available to accomplish this function: decision-making ability, planning administration, and technical expertise. Rural residents demand few services, however, and local decision makers tend to rely on private consultants and public agencies at state and regional levels when planning skills are required. In addition, rural people often resist planning as unnecessary, inappropriate, and costly. As a consequence, planning is a marginally developed municipal service in rural towns.

Small-town planning capacity typically is ill-equipped to respond to the demands of rapid growth. Planning capacity must expand, however, if changing service demands are to be met efficiently and economically. First, the sophistication of decision makers must be sufficient to overcome the inertia of the existing planning system, and to initiate improvements in planning capacity. Second, administrative expertise is necessary to coordinate the planning process. Finally, technical expertise must be available to assess service needs, and to plan and manage service expansion when it is called for.

Computerized impact assessment models are claimed to be expedient means of increasing technical and administrative planning expertise during rapid growth. Typically, such models are designed and operated by state agencies, universities, and national laboratories, to be made available to local planners. They attempt to simulate economic, demographic and, occasionally, social effects of anticipated development at local, regional, and state levels, for purposes of policy analysis and growth management.

Large models, however, fail to fulfill the promises they make
for many local planning purposes, owing to the near-impossibility of accurately forecasting explicit local impacts, and because the assumptions on which forecasts are based may not reflect the best interests of small, rural towns. Finally, complex methods, unfamiliar computer environments, and inadequate documentation make it very difficult for unsophisticated users to identify and evaluate these limitations.

Findings

The principle finding of this research is that the use of economic, demographic, and fiscal projections without understanding the methods and assumptions of the models which produce them delegates local decision making power to those who design and operate the models. Therefore, many applications of computerized impact assessment models are inappropriate supplements to the planning capacity of small towns during rapid growth.

This conclusion may be divided into two areas of concern. First, the ability of models to produce useful forecasts for local planning purposes must be questioned. Second, the use of models designed and operated beyond local control may contradict local interests.

A secondary finding that emerged from the literature review is that the development of planning itself, as a municipal service impacted by growth, seems to be retarded by the availability of assistance from outside sources. Each of these three findings will be addressed below.

Local Planning Applications

To successfully manage local growth demands an understanding of
the interaction of local conditions and the growth event, in addition to knowledge of growth impacts and planning methods in general. According to their objectives, models claim to supply accurate and explicit forecasts for these local planning purposes. The present research has shown, however, that in practice, existing models are quite limited in performing this planning function.

It was noted that impacts of growth will be realized in each community according to its unique setting and characteristics. The appropriate development of local planning capacity is that which enables planners, decision makers and citizens to distinguish these unique local variations from generic patterns of growth. This ability is vital if municipal services are to be matched efficiently to residents' demands.

In discussing community impact assessments, Dean Runyan (1977) concluded that "the importance of locally derived impact assessments stems from the values, perspectives, and experience they introduce to decision making that are not reflected elsewhere" (p. 127). This degree of understanding requires a familiarity with explicit local conditions which is not possible from large models as they exist today. The specific limitations identified in this paper were: 1) Insufficient and expensive data, 2) insufficiency of simulation methods, and, 3) the failure to respond to small users' needs during model design or specification.

The appropriate expansion of local expertise, then, is that which enables generic planning principles to be interpreted and applied in light of specialized local knowledge. By achieving a marriage between the local and theoretical, the planner relieves to a certain extent the need to go outside of the community for expertise, and at the same time overcomes disadvantages faced by outside experts who are
handicapped by an imperfect understanding of client communities.

Planning in Accordance with Local Interests

To rely on assistance from outside the community may subject local planning efforts to vested interests that run counter to those of the community. This research has shown that large models have the potential for inappropriate applications of this nature. Models enable political and moral decisions to be disguised by methodological complexity, and by lack of transparency into their structure, methods, and assumptions. When models are used locally without understanding this limitation, local decision-making autonomy is lost to outside interests.

In this context, the appropriate development of local planning capacity is that which protects local interests and decision-making power. Where models are concerned, this means that underlying assumptions are made clear to local users, though models often discriminate against them in two ways. The first is the deliberate use of models to further specific vested interests of extra-local organizations. The second, and probably the most ubiquitous, is the innate bias of planning toward urban values, attitudes, and problem-solving methods.

This research has shown that simulation models may contain implicit methodological decisions which have political implications. The example given was that the specification of a population multiplier could alternatively exaggerate or under-predict local effects of industrial development. Because models are methodologically sophisticated and lack transparency to casual users, forecasts may be accepted without understanding implicit underlying assumptions. When forecasts are
thus used as a basis for policy decisions, there is an implicit delegation of authority from elected officials to the sponsors of the model.

The second contradiction of local interests is more general in nature, occurring when external planning assistance is not consistent with rural values, attitudes, and problem-solving styles. Impact assessment models, and other forms of assistance, are essentially the products of urban planners. To incorporate them into rural planning may precondition planning, and through it, community development, to urban standards. If residents desire to maintain unique elements of rural lifestyles, then planning must develop accordingly. Urban planning methods, such as large-scale models, are inappropriate in this sense, as demonstrated by the traditional resistance of rural people to urban planning approaches.

Failure to Develop Planning Locally

The local planning system is one of many municipal services that are impacted by rapid growth. The development of this particular municipal service seems to be inhibited by the availability of planning assistance from outside the community—by impact assessment models, for example. This conclusion was suggested by the neglect of capacity-building approaches to in the boomtown planning literature. In this context external planning assistance is inappropriate because it conceals the long-term planning needs of the community.

It appears that the inadequacy of local planning capacity is obscured during rapid growth by the availability of planning assistance from outside the community. For example, Leistritz et al.
(1982a) acknowledged that "sound physical and financial planning during the period of rapid growth is necessary in order to avoid a legacy of future service problems and fiscal difficulties" (p. 6). They have not, however, recognized impacts on the planning system itself, nor that it too must be developed in order to remain viable during the "legacy" period. This dominance of boomtown planning literature by municipal services other than planning is almost exclusive. To foster local planning capacity is critical, though, because the impacts rapid growth will persist long after the peak activity of industrial development.

To rely on models is to make planning capacity contingent on their continued availability. The uncertainty of boomtown development, however, does not warrant this presumption. Because external sources of assistance, such as models, are not under local control, they are inappropriate in this sense. This research leads to the conclusion that the impacts of growth on local planning capacity have been overlooked in the literature and obscured by the abundance of assistance from outside the community.

Implications: Institutional Hegemony

If impacted communities continue to plan without attention to issues of appropriateness, then two important opportunities will be lost: First, the development of distinctly rural styles of planning will be frustrated by small towns' dependence on external planning
assistance. As a consequence, future planning activities will continue to be stigmatized by the inappropriateness of historic rural planning efforts. Second, growth management will be unable to take advantage of local planners' sensitivity to unique conditions within the community. This section suggests that there are pathological consequences to rural and boomtown planning if the conclusions of this research are ignored.

Pathological effects of inappropriate planning assistance may be best illustrated by analagous arguments dealing with other aspects of boomtown life. Garth Massey (1980) described the "cultural hegemony" of boomtown life. He contended that "the institutional arrangements [between energy industry and boomtowns] dominate the material choices and value structures of people, to the benefit of interests far removed from their everyday lives" (Massey, 1980, p. 187). Massey concluded that the personal development of energy workers and their families is subordinate to the requirements of the workplace. The damage takes the form of alienation in the lives of workers, which the author describes as:

Loss of control over significant domains of life. The destruction of family relations and the absorption of alienation by the family structure, and loss of power over place, time, pace and length of work by the employee. (Massey, 1980, p. 191)

Massey actually drew a parallel to community development: "There is also the alienation of the community itself... the rural town loses its communal character and becomes the impersonal supplier to corporate workers" (Massey, 1980, p. 191). The repression of workers' personal development is analagous to the loss of important, unique
rural values which may occur if inappropriate planning styles and methods prevail.

Much like the workers' dilemma, the emerging planning system seems susceptible to the hegemony of the boomtown. It is an "institutional hegemony", that is, a pathological dependence on expertise from institutions outside of the community. The dependence arises from the urgency of boomtown problems and is compounded by limited indigenous planning capacity. It is pathological because the dependence frustrates the development of more appropriate and acceptable rural planning capacity.

In an article entitled "The Politics of Planning," Pierre Clavel (1970) seemed to address institutional hegemony as a consequence of boomtown development:

The introduction of large organizations in rural areas results in great inequalities between them and existing organizations, particularly with respect to specialized knowledge. The supply of local persons with the time, training, or experience to deal with large organizations or specialists is limited. This inequality whenever contacts occur may well be a pathological situation in the further development of local institutions. (Clavel, 1970, p. 194)

Bender et al. (1980) did not use the word hegemony, but found that a "sudden presence of large profits motivates rent-seekers" to exert "a subtle yet pervasive pressure to change the institutions that define access to, use of, and returns from resources" (p. 21). The five institutions identified by the authors are taxation, which "alters land use policy and land use patterns," water rights, environmental regulations, facility siting, and Indian rights.

Finally, Faas and Howell (1979) questioned the influence exerted
in the community by powerful outside interests:

Concentrated interests (such as industrialists and developers) who directly benefit from large capital improvement projects have strong incentives and thus generally attempt to influence public decisions by promoting information favorable to project approval. . . . Who is likely to challenge and critique the concentrated interests' presentation, which primarily emphasizes project benefits? . . . Are there any individuals, firms, or groups with sufficient incentive to mount and sustain an effective counterargument? . . . one consequence of the passive growth management option would be the de facto transfer of control from within the community, to a source of impact whose representatives are well prepared and strongly motivated to influence decisions being made by local officials. (Faas and Howell, 1979, p. 5)

These authors, then, do not hesitate to attribute great power to the energy industries in influencing day-to-day decisions at the local level. To conclude, Clavel's statement that "nationally linked organizations, public or private, tend to serve objectives set elsewhere rather than those of the local community" (Clavel, 1970, p. 194), summarizes the danger to rural planning of failing to develop appropriate local planning capacity.

Closing Remarks

The critique presented in this paper questions the appropriateness of large, computerized, impact assessment models for certain local planning applications. The discussion has disclosed that misapplications of models and their results may arise from both the nature of models and the uses to which they are put. The arguments developed herein do not, however, mean that such models are without uses in local planning, but that considerable opportunity exists for misuse. The intent of the paper has been to criticize models for the
constructive purpose of improving future model designs, documentation, and applications.

Furthermore, there are innumerable models in use that were not included in this research, which as a group, demonstrate similar general failings to those identified above, but which also, include examples of how they may be overcome. Computer modeling is a new field of expertise, and it is clear that improvements are constantly occurring. In particular, increasing attention is paid to documentation, to the needs of users, and to validation. In addition, new technologies, such as microcomputers, are more appropriate to small planning jurisdictions, and so promise to foster models and applications that are more sensitive to local needs.

This paper has suggested further areas of research. It would seem to be of benefit to modelers and model sponsors to investigate the literature on capacity building in local government, to improve the correspondence between outside assistance and local needs, attitudes, and values. Similarly, research into rural planning approaches in general would lead to better model design and application. Finally, research into the capabilities of assessment technologies that are more appropriate to local uses--microcomputer systems under the direct control of local planners, for example--would appear to be warranted.
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