Modeling Techniques for Community Development (1975)

Pages
95

Size
8.5 x 10

ISBN
030902420X

U.S. National Committee for CIB; Building Research Advisory Board; Commission on Sociotechnical Systems; National Research Council

Modeling Techniques for Community Development

Summary Proceedings of the
USNCCIB Seminar on Modeling Techniques for Community Development
June 7–9, 1974, Airlie House Conference Center, Warrenton, Virginia

U.S. National Committee for CIB
Building Research Advisory Board
Commission on Sociotechnical Systems
National Research Council

NATIONAL ACADEMY OF SCIENCES
WASHINGTON, D.C. 1975

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This report was prepared under Contract No. NSF-C310, Task Order No. 287, between the National Academy of Sciences and the National Science Foundation.

Library of Congress Catalog Card Number 75-37377

International Standard Book Number 0-309-02420-X

Available from
Printing and Publishing Office, National Academy of Sciences
2101 Constitution Avenue, N.W., Washington, D.C. 20418

Printed in the United States of America

U.S. NATIONAL COMMITTEE FOR THE INTERNATIONAL COUNCIL FOR BUILDING RESEARCH, STUDIES AND DOCUMENTATION

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PREFACE

Individuals responsible for the development of large-scale communities require dependable tools upon which to base their management decisions if they are to respond adequately to the demands placed upon them, and it was in this context that the U.S. National Committee for the International Council for Building Research, Studies and Documentation (USNCCIB) organized the Seminar on Modeling Techniques for Community Development. The seminar was structured both to promote direct communication between those involved in the development process and those building models for use in that process and to establish a framework for further positive efforts in the development and application of modeling techniques. This document is intended to present a summary of the seminar proceedings and to make available to the building and development community the general conclusions of the seminar participants regarding specific areas requiring concentrated effort in the future.

The USNCCIB gratefully acknowledges the financial support for the seminar from the National Science Foundation. It also wishes to express its gratitude to the seminar chairman, speakers, group leaders, and participants for their enthusiastic support in making the seminar a success and in developing and reviewing the material presented in this summary of the proceedings. Finally, the USNCCIB thanks the members of its ad hoc Task Group on Significant Cost Elements in Community Development and Seminar Planning Committee for their efforts in developing the concept and program for the seminar.

BERNARD BREYMANN
Chairman, USNCCIB

INTRODUCTION

BACKGROUND OF THE SEMINAR

The need to assess the state of development of community modeling techniques was first identified as an area for the attention of the U.S. National Committee for the International Council for Building Research, Studies and Documentation (USNCCIB) in 1972 by an ad hoc task group[1] invited by the U.S. National Committee to explore the potential for developing a consensus of U.S. thinking on topics of interest to the International Council for Building Research, Studies and Documentation (CIB)[2] Commission on Building Economics.[3] The task group initially attempted to develop a program for identifying and documenting U.S. knowledge of and experience in dealing with significant cost elements in the

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[1]Invited participants in this task group were Samuel S. Baxter, Consulting Engineer, Philadelphia; Lawrence Bloomberg, Federal Reserve System, Washington, D.C.; John R. Hamburg, Creighton-Hamburg, Inc., Bethesda, Maryland; Joseph L. Intermaggio, Virginia Polytechnic Institute and State University, Blacksburg; John M. King, USNCCIB Vice Chairman (at the time a member of the staff of the NAHB Research Foundation, Inc.); William Loring, U.S. Public Health Service, Rockville, Maryland; Catherine A. Martini, Economist, Silver Spring, Maryland (formerly with the National Association of Realtors); Robinson Newcomb, Consulting Economist, Vienna, Virginia; Frank Piovia, Economic Associates, Inc., Washington, D.C.; William H. Scheick, American Institute of Architects, Washington, D.C.; Glenn Saunders, Gulf Reston, Inc., Reston, Virginia; and Jack Underhill, Department of Housing and Urban Development, Washington, D.C.

[2]See Appendix B for a description of the USNCCIB and the CIB.

[3]The terms of reference for the CIB Commission on Building Economics (W-55) focus on the development of efficiency calculations or techniques for application at various stages in the building process (from project inception to completion) including evaluation of maintenance and operating costs. The objective of the CIB group is to provide tools that will facilitate the comparison of the relative economics of alternative design solutions; thus, it intends to define techniques or methods that will permit an assessment of costs relative to quality and performance for use in decision making. To reflect particular areas of U.S. interest more specifically, the USNCCIB believed it desirable to explore the subject from a slightly different perspective from that of the CIB group.

community development process that could serve as the basis for a charge to a USNCCIB counterpart commission. Subsequently, a select working group reviewed current activities in the field and held discussions with a broad spectrum of individuals directly involved in the economics of new community development and, in particular, with individuals involved in financial feasibility determinations. As a result of these efforts, USNCCIB was encouraged to organize a seminar on modeling techniques for new community development as a first step in formulating such a program.

USNCCIB accepted the recommendation of its task group and in mid-1973 initiated planning for the seminar. It was determined that the format for the seminar should provide the opportunity for assessment of existing models and modeling techniques by both developers and modelers so that both the practical and theoretical aspects of modeling and model application could be debated. Further, the seminar was designed to bring together individuals from abroad as well as from within the United States. It thus ensured that the discussion of the state of the art and the problems involved in the development and application of modeling techniques for use during the planning, implementing, and monitoring stages of the community development process would include the knowledge and experience of other countries and would be relevant to the primary USNCCIB mission of making a constructive input to international cooperation.

Specifically, the seminar was structured to permit an assessment of selected aspects of community modeling--that is, to (a) examine the overall effectiveness of modeling techniques employed to date, (b) identify and examine the point or points at which existing models begin to lose their credibility, (c) define the elements and realistic input data needed to make models more useful, and (d) generate a deeper understanding of the various techniques for gathering and handling input/output data to arrive at the soundest possible determination of economic and financial feasibility. In addition, it was determined that the seminar should include an exploration of potential roles for public and private organizations in the continuing process of evaluating the effectiveness of community development programs.

A Seminar Planning Committee[4] was selected to develop the seminar program in detail and to assist in the identification of potential participants. The Committee developed a plan for the seminar that included

1. Framework presentations on and discussions of community planning and development to provide participants with a set of selected criteria for use in assessing specific topics
2. Three concurrent working sessions--one on economic/market/financial analysis and modeling, a second on land use/site engineering/physical design and modeling, and a third on social/community services planning and modeling--to provide for concentrated exchange of ideas on each of the topics
3. A plenary session for the presentation of working session summaries and the development of general seminar conclusions.

[4]Members of the Seminar Planning Committee were Mahlon Apgar, James Dykes, Mark Freeman, John King, and Robinson Newcomb, who also participated in the seminar, and Robert Huff, Essential Systems Associates, Inc., Columbia, Maryland; William Scheick, American Institute of Architects, Washington, D.C.; and David Stahl, Urban Land Institute, Washington, D.C.

Invited to the seminar were individuals, from both the United States and abroad, possessing competence in community development *per se* as well as knowledge and experience in such specialized fields as economics, market and financial analysis, architecture, banking, urban planning, and social science research. (Brief biographies of the seminar participants are included as Appendix A.)

ORGANIZATION OF THE SUMMARY

To present the information developed for and during the seminar in as concise and usable a form as possible, these seminar proceedings have been summarized in three major parts: Part I, Synthesis of Seminar Results, which presents the general conclusions of the seminar participants and a preliminary identification of areas in need of further attention; Part II, Working Session Synopses, which includes the presentations used to stimulate the discussions and the session leaders' or rapporteurs' summaries of their groups' findings and conclusions; and Part III, Framework Presentations, which includes the general papers presented at the seminar.[5]

[5]The author of one paper, Richard S. Bower, was unable to attend the seminar; however, his paper was distributed to the participants at the beginning of the seminar and is included in these summary proceedings.

Part I

SYNTHESIS OF SEMINAR RESULTS

The conclusions of the seminar participants, based on the consensus of the three working group sessions (on the economic, the physical, and the social aspects of community development planning), are presented and discussed below as a guide to further USNCCIB efforts to establish a program related to the work of the CIB commission on building economics. These conclusions are summarized as follows:

1. There are significant gaps in current understanding of the factors that contribute to achievement of economically, physically, and socially successful community development.
2. Modeling techniques developed to date have contributed little to the knowledge base needed for performance prediction because each model has generally been oriented toward a special situation and thus is unique in its construction and application; the result has been that experience gained with one modeling technique is not easily compared or transferred to new or different situations.
3. Substantial progress could be made in improving performance prediction through modeling by mounting an organized effort to stimulate (a) further research on the community development process *per se*, (b) further direct communication between developers and modelers, and (c) the exchange and dissemination of resulting knowledge and experience.

Each of these major conclusions, various aspects of which are highlighted in the summaries of the working group sessions presented in Part II, is discussed briefly below.

GAPS IN THE COMMUNITY DEVELOPMENT PROCESS KNOWLEDGE BASE

The most consistently echoed sentiment and the subject that received the most attention during the working group discussions was the elementary level of understanding of the community development process itself. Since modeling efforts depend on inputs from a wide spectrum of professionals, both within and outside the development community, the discussions frequently extended to topics well beyond the technical aspects of modeling *per se*. The consensus was that the state of the art of modeling is not a constraint on the development of effective modeling techniques but rather that, if models are to be effective,

there must be much greater cooperation between modelers and developers to generate a clearer understanding of the community development process and then better information and data exchange as modeling techniques are developed, applied, and refined.

Some of the most significant areas in which knowledge is lacking, many of which overlap into more than one seminar topic--economic, physical, and social planning--are identified below.

- There is a lack of understanding throughout the development community of what the components of community development are and of what constitutes an organized format for articulating community development goals. Among the frequently mentioned goal components are lower taxes, less crime, more open space, and a purer environment; however, systematic thinking and modeling require that these, as well as the many other physical, biotic, social, and economic environmental goals that could be cited--because they compete for scarce resources and interact with one another--be adequately defined, organized, evaluated, and ranked by priority. Modelers have been frustrated particularly by the lack of priorities, in that once the community development model is structured and the analyst has the capability of exploring the potential results of various combinations and sequences of goal components, he has no way of ranking the alternative community futures that result (e.g., the desire for low taxes might conflict with a priority for low-income housing). The need for organized criteria is becoming increasingly important as the secondary and tertiary environmental effects of developmental activity become more important to the quality of life. In essence, the modeler does not know what to maximize, and as a consequence, such questions as how much socioeconomic mixing can be achieved while maintaining an acceptable tax burden and a viable physical and biotic environment remain unanswered.
- Although limited goals (e.g., a high degree of socioeconomic mixing) sometimes can be specified, the ability to predict or to provide for adaptations to human behavior is much more limited (e.g., the number of workers commuting to jobs and residents shopping outside the planned community even though jobs and adequate shopping are available within that community and the consequences of that behavior). Thus, even when goals are established and a project is planned to achieve those goals, there is, as yet, no way of assuring that the planning will anticipate either the population mix that will result or the responses and behavior patterns of that population. Little is known also of the effect of changing population characteristics over time.
- A number of purely technical issues that have not been adequately addressed through research require attention; among the more significant of these are

1. Prediction of Housing Supply--Housing demand analysis has achieved a reasonable degree of sophistication; however, the ability to predict housing supply (i.e., the effective demand, or real market) is so greatly dependent upon such external influences as the availability of money--which in turn is dependent upon national economic conditions and governmental policies) that progress in developing long-range predictive capability has been minimal. Even less attention has been given to supply/demand interaction models such as are common to macroeconomic analysis.
2. Secondary Effects of Public Surface Transportation--Although it is possible to project direct benefits to users of public transit systems,

forecasting ridership or development patterns that will result from such systems is a less certain process. In addition, the effect of public transit on life-styles is little understood. Typical of the questions to be answered are: How much improvement in public transportation will bring about a given decrease--e.g., a 30 percent decrease--in auto use? Indeed, what improvements in or types of public transportation will be effective in reducing automobile use and how can they be priority ranked? Conversely, what disincentives to auto use will stimulate increased use of public transportation?

3. Impact of Organizational Structure--As is the case with any business entity, an organization's structure can have an important impact on the achievement of goals and objectives. Although the belief is growing that large staff commitments to new developments are inefficient, there has been little research focused on the effects of developer organizational structure, initially and over time, on the effectiveness of the resulting community. Advocacy participation in planning by early residents, town incorporation or other forms of municipal organization, the role of consultants in early planning--all these and more should receive much more attention to the end that sound organizational structures for the development and management of new communities and their ultimate transfer to self-government can be emulated and improved upon.

Other important topics are identified in the working group summaries. The data needed to explore many of these already exist in large, planned developments, and their study could make a valuable contribution to expanding the knowledge base of the community development process.

INEFFECTIVENESS OF MODELS

Advocates of modeling have often emphasized that the models offer a unique opportunity for accumulating knowledge because they (a) have a purely logical structure and their development forces identification of weak points in understanding; (b) require documentation and utilize modular design and therefore can be updated and improved as knowledge and understanding improve; (c) can accommodate complex phenomena (i.e., computers can easily store and sort information without forgetting and therefore can handle analyses that are interactive and beyond human intuition); and (d) can treat uncertainty through simulation and use of probability techniques.

Although these and other aspects of models have long been cited in support of modeling efforts, the working sessions' participants nevertheless concluded that in most cases models have been ineffective in advancing the state of the art of community development. Some of the reasons for this ineffectiveness, many of which illustrate unintended effects, are described below.

- Models that treat similar subjects can be of different types. Generally, there are descriptive models and prescriptive models. A prescriptive model permits a goal to be specified and a situation, which in some way responds to that goal, to be selected (e.g., to optimize present value of discounted cash flow). Equations and relationships specified in a prescriptive model, since they have been designed to satisfy a different objective, are not readily transferable to a purely descriptive form; they contain an obvious bias.

Additionally, even models of the same type treating similar subjects employ different levels of detail, and attempts at combining them can result in a mismatch.

- Models that have been developed to date cover many but certainly not all subjects; therefore, even if the ones that have been developed blended perfectly, they would nor form a "total system." Although it is possible to work with a model that treats less than the whole, efforts that have aimed at subsystem treatment often have proved to be too simple in practice. Maximizing cash flow, for example, does not necessarily consider social balance, environmental impact, or other important community development impacts, nor does it provide for a reaction to unknown future changes in county or city government policies.
- Models also exhibit differences in flexibility. The need for a model to be flexible and easy to use is often as important as its comprehensiveness and logic. In this context, the more inclusive and complete a model is, the worse it is since it may be clumsy and expensive to manipulate (e.g., one regional economic input-output model proposed for use at the Department of Housing and Urban Development required over one billion inputs to operate).

While these considerations make it difficult to relate various modeling efforts, a more basic question concerns the proper scope for future modeling efforts--i.e., should priority be given to models of specific subprocesses such as demographic mixes, land-use development, and organizational structures, albeit with a more appropriate scope than existing models, or should more integrated efforts be emphasized? A general framework could permit both if an appropriate systems structure could be defined. However, seminar participants did not feel that the state of the art has yet reached the point at which an overall structure for the development process can be agreed upon.

FURTHER EFFORT

As is illustrated by the many and important gaps in the state of knowledge identified by the seminar working groups, various aspects of the community development process are in need of study and clarification; thus, the stimulation of a coordinated research effort would represent a valuable contribution. Many organizations throughout the country, including numerous federal agencies, are initiating research to satisfy their specific needs. However, a much greater interaction among these various efforts is needed if maximum benefit is to accrue; research completed and in progress should be chronicled and research efforts guided toward the achievement of more comprehensive goals

Equally important is the function of information exchange and dissemination. One result of the seminar was that individuals representing groups that usually work independently were afforded the opportunity to share and exchange ideas. Since such an exchange rarely occurs, much work that is done is duplicated and not shared at all. Thus, the development of mechanisms to stimulate continuing communication both among modelers and between modelers and developers and to facilitate information transfer would contribute significantly to the building of an adequate community development knowledge base.

The magnitude of the effort required to accomplish these tasks would be significant and would require substantial resources. A first step, therefore,

might well be for the USNCCIB to identify potential qualified participants and establish an appropriate working group and charge it with identifying priorities and points of maximum impact, developing a plan for a feasible action program, and stimulating support of the program's implementation.

Part II

WORKING SESSION SYNOPSES

ECONOMIC/MARKET/FINANCIAL ANALYSIS AND MODELING

Group Leader: Dan Turner
Rapporteur: James Dykes
Participants: Gordon Bagby, John Crecine, John Gibson, Oliver Jones, Martin Matyas, Howard Moskof, Howard Stevenson, Kenneth Wren

STIMULUS

This working session began with five participants giving brief presentations on the state of the art of modeling in terms of their own experiences. Howard Stevenson commented on small models, Kenneth Wren on the British experience, John Crecine on urban interaction, James Dykes on new community simulation, and Gordon Bagby on spatial location. Presented below is a brief summary, developed by James Dykes, the group rapporteur, of some of the major points emphasized during these stimulus presentations.

Small Models

Corporate computer modeling began in the early 1960s with small special-purpose models that covered such things as job-shop simulation and inventory control. Since these early efforts proved useful, a trend toward linking various operating models into a "total system" developed. Unfortunately, however, due to a lack of sufficient computer capacity and limited knowledge of how to model important aspects of a total system, such as human behavior, these early efforts proved fanciful and of limited use.

As the field of systems analysis grew, the focus of model builders in the middle to late 1960s shifted to "top-down" total system models. These models were intended to devote more balanced attention to all aspects of system behavior while eliminating much of the detail of the earlier integrated systems. Nevertheless, these models also proved burdensome and required a vast quantity of data. The frequent result was that the time required to develop the model, collect and interpret the data, and validate the results was greater than the time within which the model's results would have been useful (e.g., forecasts were prepared after the actual results were observed and problems were identified after they were solved).

The most important flaw in these top-down total systems, however, was that they did not capture the attention of key decision makers. They provided information for exchange between specialists only; in effect, the systems analysts were trying to substitute capital investment for intelligence.

Within the past 5 years or so, the major emphasis has been on involving the decision makers in the development and use of models. The creation of

user-oriented languages (e.g., Basic, Joss, Simscript) and the use of time-sharing terminals have helped considerably in involving high-level executives in the use of models.

The models themselves also have become much simpler in concept, and their implementation requires much smaller capital investments. In addition to "disposable models" that are developed in several days and are used on one specific problem, the development and use of standard modules has become popular; for example, a standard module, or routine, that calculates mortgage principal and interest payments might be added to a standard depreciation program and other such special-purpose routines to make a development-project cash flow model.

In addition, the use of models has shifted from prediction and optimization to evaluation. Instead of using models, for example, to optimize development cash flow, analysts are using them to evaluate the impact of various factors, such as inflation, peak debt, cost of goods sold, and investment security, on cash flow results.

In summary, computer models in the corporate environment have evolved through various stages of global total system models in the realm of specialists to short-term, user-oriented, special-purpose models for use by decision makers. The current models have proven extremely useful and typically involve a relatively small capital investment.

The British Experience

In the development industry in Britain, models have been used most successfully to provide a blueprint to management of the likely outcome of key development decisions. Factors considered generally include cost of land, rate of take-up, inflation, and cost of main services.

Since the government in Britain plays a decisive role in most large-scale development, it is the most common sponsor of model development. Recently, the government has been interested in systems that would allow evaluation in sufficient depth to minimize the need for contingent control agreements and covenants. Development corporations are the stepchildren of the British Treasury and fulfill a function only in that they channel Treasury funds to achieve specific development goals. There are no subsidies on interest or tenant rents such as those common in the United States.

Recent development models have both a short- and a long-term focus. The short-term focus consists of year-by-year operating forecasts of cash resources for 5-year spans. Beyond the first 5 years, forecasts are grouped into 5-year summaries.

The models also consider development characteristics other than cash flow, although little emphasis is placed on market factors, since the market is controlled to a great extent through zoning. Non-cash-flow considerations include employment growth, forecast of consumer (retail) expenditures, and education and health system needs.

The most important application of these systems has been the evaluation of value contribution at each development stage: land acquisition and development, including sewer and water; site development, including major roads and other "off-site" support systems; building stage; and operating stage. Evaluations of value creation at each of these stages allow the government to

determine whether to continue its involvement from stage to stage or to perform sensitivity analysis.

Although recently developed British evaluation systems have been effective in forecasting the effects of development decisions, model results have not been effectively translated into action. If, for instance, the government decides to terminate its involvement in a project, there are few alternative organizations available to substitute for the government's development function.

Urban Interaction

Four significant aspects of urban interaction models were discussed: the state of the theory underlying the models, their degree of realism, the extent of validation of the models, and the degree to which models have been used to guide change.

The Penn-Jersey and San Francisco Transportation Models represent two of the most significant early urban interaction models. Each had a somewhat limited focus and concentrated on the spatial relationships between population groups having various socioeconomic characteristics, employment opportunities, and other commercial and service activities (i.e., what are the joint implications for the locational characteristics of an urban area of the complex of residential-workplace-shopping opportunity-public facilities interactions?). These models proved largely deficient as comprehensive statements of a theory of urban spatial location because both ignored important components of the system of behavior that determines outcomes.

Although these and most other urban interaction models were reasonably well developed on the demand-for-housing side, supply adjustment mechanisms were either ignored or were superficially simple (and inaccurate), assuming, for example, that supplies were always adjusted to meet demand. Important parts of the supply-demand adjustment process were ignored altogether (e.g., financial institutions, zoning restrictions). In general, the most important deficiencies in general-purpose models of urban property markets involved supply factors.

The theoretical deficiencies of the models contributed to their lack of realism; when such models generated forecasts of alternative physical development futures that seemed unrealistic from the standpoint of a range of local urban decision makers, the ability of model outputs to influence future decisions was diminished severely. Another deficiency in the realism of urban interaction development models that contributed to their lack of influence was the fact that the models rarely provided information consistent with the frame of reference of their intended users. The models, for example, did not incorporate or treat in any way the banker's typical rules of thumb in making construction loans or mortgage investment decisions and did not generate the sort of data used by bankers in reaching those decisions.

Two other important constraining factors contributing to the theoretical and realism limitations of urban interaction models are the disciplinary orientations of model builders and the lack of any comprehensive time series data base for an urban area that can be used to estimate model relationships and calibrate parameters. Partly because of the lack of an adequate data base, one that would capture the dynamic interactions of an urban system over a

period of time, urban interaction models have been very poorly validated. Unfortunately, the data required for validation are expensive to collect and come from several sources that are usually less than fully compatible. Different periods are covered, different geographical/locational codes are used, and different ways of describing housing units, population, and employment are generally found. The model builder and any potential model validator are forced to rely on census data generated only once every decade and a variety of secondary sources (e.g., telephone company and public utility records, school boards, credit unions). The familiar model-building testing and error correction system by which knowledge accumulates is severely handicapped as it applies to urban interaction models by serious data limitations.

Although the models developed to date exhibit marked deficiencies, there are few alternatives. The decisions model builders hope to affect will be made with or without realistic, validated models. Usually, the implicit models utilized by decision makers are considerably more myopic and poorly validated than the admittedly weak existing formal models. Even with weak models, one may be better off than with reliance exclusively on intuition and hunch.

New Community Simulation

As HUD implemented the early stages of the New Community Program (1968-1970), it was primarily interested in cash flow statements. Early models, therefore, were oriented toward producing such statements to portray where funds were coming from and what they were going to be used for over a 20-year period.

As the program became more complex, HUD became interested in more complicated models that not only would produce cash flow statements but also would treat the interaction between the growth of a metropolitan area (or market area) and the growth and development of proposed new communities. A model that was supposed to have these combined capabilities, called NUCOMS (New Community Simulator), was developed for HUD. Although the model works fairly well at the regional level, such as in forecasting population for a five-county area, it has serious shortcomings as it distributes growth to its subareas. At its ultimate level of detail, in forecasting the growth of a new town, it has practically no validity at all. The state of the art is simply not far enough developed to predict settlement patterns within census tracts over a 20-year period. Since the prediction of new community growth is not adequate, obviously the cash flow effect of that growth is meaningless also.

As has already been mentioned in regard to other large-scale models, many important variables are not treated in the model at all. Housing supply and zoning are two notable examples. Since the state of the art of modeling each of these was so poor, they were simply left out.

The most important problem in working with the model, however, is not that it does not treat all relevant factors adequately, but rather that one does not know whether it does or does not. The model documentation is about three and a half Manhattan telephone directories thick, and it would take intense study or pure genius just to figure out how the model functions, much less understand the detailed computer code and its rationale.

Another serious disadvantage is the cost of operating the model. It costs about $50,000 just to set it up for a new area. If several alternative sites are to be evaluated, analytical costs for using the model could easily amount

to several hundred thousand dollars. Most developers and lenders are just not that excited about analysis, particularly since they cannot understand how the results were arrived at without reading a collection of difficult and lengthy documents.

Spatial Location

The U.S. Government also has sponsored the development of models that will allow it to examine and analyze different configurations for government installations (e.g., an Air Force base). One specific model treats the location of facilities to achieve the minimum cost.

The most important use of this model is in evaluating the cost implications of different configurations of facilities and comparing these different costs with criteria other than cost. For instance, the residents might want the swimming pool within walking distance of the housing, but this might be twice as costly as some other location because of the need to extend water lines. Since many different such layouts have to be analyzed, they can be treated most economically with a preprogrammed model. Other types of nonconstruction considerations were included as well (e.g., the optimum location of troops for different kinds of emergency mobilization). Since the model was geared to finding optimum solutions, it was able to examine many more situations at the computer's fast operating speeds than could have been accommodated by manual analysis with a calculator.

Although this type of model also displays some of the weaknesses of the other models described previously, it typically achieved better results. The reason is that it evaluated scenarios surrounding fairly well-known engineering relationships instead of phenomena that relate to human behavior.

SUMMARY

> The following summary of the working group's discussion of the use of models in economic, market, and financial analysis was developed by the group rapporteur, James Dykes, and was presented at the plenary session of the seminar.

The first section of this summary presents the essence of the group's discussion and identifies, from different perspectives, the reasons for using models at different stages in the development process. The second section contains the group's four principal recommendations for further work in modeling and the criteria used in arriving at these particular recommendations. The group wishes to note that since there are so many topics, perhaps thousands, that could be studied and so many systems developed to improve the state of modeling, the use of criteria in selecting the four most important recommendations was essential.

Reasons for Using Models

The group's discussion of the reasons for using models can best be highlighted by considering the different categories of potential model users at varying

stages of development. The three main categories considered were public organizations, owners and underwriters, and tenants or occupants; and the three stages of development were prepurchase site evaluation, detailed planning, and management and operation. For each of these stages the most important reason for using a model was identified for each category of model user. This cross tabulation is summarized in Table 1.

The prepurchase site evaluation stage is the point in a new community's life when a developer first considers involvement in the project. The land is not yet purchased, and the local officials have not yet granted zoning permits or issued other necessary approvals. At this stage, public organizations would find models most useful for forecasting urban growth and its impact on infrastructure and transportation systems--systems for which local public organizations are largely responsible. These forecasts might address, for instance, whether the location under consideration is the best available or whether it provides a superior alternative to trend development in terms of future planning for community facilities and services.

From the perspective of the owner and underwriter, a model could be most useful in evaluating site speculative potential (i.e., the owner or developer is most interested in evaluating whether growth trends are sufficient to allow him sufficient site capture under reasonable market performance to earn a profit). Models lend themselves particularly well to this task by allowing "what if" questions to be asked about different market conditions throughout the project's anticipated life cycle.

Finally, once the project's potential existence becomes evident to local residents, they are most interested in its habitability; whether it will (can) contain a shopping center and other shelter-serving facilities is of prime

TABLE 1 Reasons for Using Models

	Categories of Potential Model Users		
Stage of Development	Public Organizations	Owners and Underwriters	Tenants and Occupants
Prepurchase site evaluation	Forecast urban growth: Infrastructure Transportation	Evaluate site speculative potential	Evaluate habitability
Detailed planning: Economic model development Zoning	Evaluate: Fiscal impact Social benefit	Forecast cash flows, evaluate risks	Evaluate and identify: Rents Payments Fees
Management and operation: Marketing Construction Maintenance	Forecast short-term economics Evaluate tax assessment	Control costs and operations	Forecast tenant mix

interest. Although it is indeed unusual for potential residents to use models in cursorily considering the merits of a proposed new community, the use of models in this way is being given consideration, at least in academic circles, as a first and necessary step to detailed professional site planning.

The detailed planning stage follows immediately after the site is purchased. The main task from all perspectives is the refinement of the development plan, and it is at this stage that the developer evolves an economic model, or quantified development plan, and receives zoning from local officials. At this point public organizations are most interested in the fiscal impact of the proposed development--the taxes it will generate and the public services it will require. Public organizations also are concerned about the social benefit, such as amount of racial or economic integration that the project hopes to achieve. The developer is most interested in forecasting cash flows and evaluating risks. With the use of a model, he would like to be able to test the sensitivity of financial results to different kinds and degrees of market performance and changes in economic factors. To the extent that prospective occupants have access to models at this stage, they are most interested in identifying whether the development plan will allow unit types that they can afford. In addition, they are interested in determining the economic impact of the developer's provisions for social services, whether they are planning to move into the development and use the services or whether they are hoping that his future service provision will relieve their current tax load.

The management and operation stage is the final stage in the development process. Marketing, construction, and maintenance are the three principal tasks of this stage.

Public organizations, now committed to the basic project concept, are interested primarily in checking results to date and periodically forecasting short-term economic trends to ensure that the near-term project results will meet expectations, particularly since most fiscal problem remedies tend to be applied on a short-term basis.

The developer's concerns in this final stage also tend to be of the short-term type, focusing mainly on cost control and the achievement of operational results. Critical path models and programmed evaluation and review techniques (PERT) are of the variety most applicable to these types of concern.

Finally, prospective (and current) occupants are most interested in occupant mix and whether neighborhoods are developing along the social and economic lines originally described by the developer. Although evidence of development plan fulfillment is physically observable, computer models can be particularly helpful in quickly summarizing large masses of data or plotting trends.

Principal Recommendations

Since there are many ways to improve economic, market, and financial models, the group chose the following three criteria for its evaluation of recommendations to identify those having the greatest merit:

1. Improvements that would have the greatest impact on the largest number of people.
2. The seriousness of the deficiency that the recommended improvement hopes to correct.

3. The extent to which the deficiency can be corrected if the recommendation is adopted.

Although these are by no means a perfect set of criteria, they did provide reasonable guidance in selecting and identifying useful recommendations. The purpose of the criteria, then, was to identify high-impact recommendations that addressed a serious problem that had a reasonable chance for improvement.

The four principal recommendations, in decreasing order of importance, are as follows:

1. *Develop a basic objective function for evaluating the total costs and benefits by local officials at the detailed planning stage.* In the experience of the group, federal, state, and local public planners, while quick to levy standards and requirements on developers, were seemingly lacking in firm reasons for their requirements. For instance, how much additional aesthetic appeal is worth how many dollars (e.g., in disallowing strip shopping), or how do we measure "high planning standards" or aesthetic appeal? Aside from these somewhat amorphous areas, planners do not yet even seem to have a grasp of what the municipal cost-benefit implications of single-family detached versus multifamily are, much less new community versus sprawl. This lack of objective, well-defined, logical planning and zoning criteria is further aggravated by the multiplicity of forms of control--economic, environmental, social, and fiscal. In summary, since zoning and planning control affects everyone, is seriously disorganized, and is amenable to research and agreement, the group concluded that objective function or planning standard development is a top priority. Systematization of planning standards would similarly improve economic modeling through their incorporation.

2. *Develop the parameters necessary for a developer to assess in the detailed planning stage the economic effects of physical plan location changes.* Very little is now known about the economic effects of physical plan changes. What is the effect on the project cash flow if the developer adds or deletes a park, juxtaposes the high- and low-income areas or mixes them, or moves the shopping center to another part of the site? At the crude level of impact, on the sewer, water, and road layouts, effects are immediately analyzable, but the effects on consumer buying habits are less well understood, although the data needed for analysis are collectable.

In addition, little is known about the economic advantages of having trees, bushes, shrubs, and other greenery and aesthetic amenities. At present, the addition of such amenities and aesthetic standards in general are largely in the province of developer whim and are not related to any organized body of thought. Many developers believe that high aesthetic standards are more than worth their price, but no one knows for sure.

In summary, the development of economic parameters for physical plan changes will affect fewer people than the first recommendation since not all development is planned. The problem, however, is serious and is amenable to study and solution.

3. *Develop better methods of estimating housing supply.* The problem of supply estimating particularly affects developers at the prepurchase site evaluation stage. While housing demand is affected by both easy-to-plot demographic changes and unemployment rates that are more difficult to forecast, housing supply is affected by widely swinging interest rates that are tied to

complex movements in the overall economy. Since site absorption is affected by changes in both supply and demand, the determination of absorption is crippled by the lack of adequate methods of supply determination.

While this problem certainly affects most people (i.e., it inhibits planning by developers and planning officials and is a serious deficiency in attempts to model absorption), its solution would require a significant redesign of national economic models--certainly a difficult if not an impossible task in the near term of the next 5 years.

4. *Develop standards for the full disclosure of the weakness of models.* One frustration expressed by most of the session participants was the inability to readily understand the capabilities and weaknesses of different existing models. As a result, distrust or lack of proper documentation has led to the redevelopment of models already in use. While the immediate effect of this problem on large numbers of people is not so great as that considered in the three previous recommendations, it does lead to serious misuse of model development funds; this problem could be solved easily through the development of uniform documentation standards.

LAND USE/SITE ENGINEERING/PHYSICAL DESIGN AND MODELING

Group Leader: Charles M. Eastman
Rapporteur: John King
Participants: Paul Buckhurst, Britton Harris, Glenn Johnson, John Rahenkamp, William Wallace

STIMULUS

This working session began with the following presentation by the group leader, Charles Eastman.

Modeling, as I perceive it, is simply a tool. Like all tools, it is meant to augment certain capabilities already existing in the user. A model, like other tools, then, is a very pragmatic thing. Its purpose is to be used.

Classes of Models

There are many types of model and many ways to classify them. Each academician or consultant will have his own taxonomy. Let me propose a taxonomy that may be useful in later discussions. For our purposes, it might be most appropriate to group models into two classes.

First, there are *descriptive models*. These simulate or replicate some phenomenon of interest, such as soil structure, housing market, population growth, or the strength of a piece of steel. Descriptive models provide insight to decision makers because they either describe a phenomenon in particularly useful terms (e.g., a series of purchases and expenditures in terms of cash flow) or extrapolate current phenomena into the future (e.g., the population of a region). Cash flow models, simulations of traffic flow, or a critical path model are all descriptive types of model.

A second type of model is decision-oriented, and we might call it *prescriptive*. A prescriptive model incorporates within it a descriptive one but adds two other processes: (a) a means for varying some aspects of the situation and (b) a means for specifying a goal and selecting a situation that, in some sense, responds to that goal. Examples of prescriptive models in the land-use area might be ones that, given some estimates of the market over time, derive the optimal mix of units to maximize cash flow or that, given some terrain and the average lot size, lay out roads to minimize road construction costs.

What Models Do

If we consider these two types of model as tools, we can recognize that the prescriptive model provides a means of augmenting the search of a wide range of

alternatives and finding one that, in some sense, is most desirable. The descriptive model's potential contribution to decision making is less easily described, but I believe even more important than the prescriptive. Descriptive models translate a situation described in one set of terms into another set of terms. For instance, they translate a situation described in terms of a set of expenditures and sales into one described in terms of cash flow, average rate of return, or payback period. The value of the descriptive model, then, lies in the insight it provides through this translation--i.e., an analysis as well as a prediction of the effects of a set of actions.

Values and Models

Before we proceed, it is imperative to make explicit what is likely to be an underlying issue in the later discussions. Models reflect the values of the model builder in the variables they incorporate and (if prescriptive) in their decision criteria. Models are sometimes promoted to subvert the decisions of users. The model builder wishes to allow only a limited range of alternatives. Therefore, users beware! This problem is particularly acute in the modeling of social phenomena. One reason for the many failures of modeling in this area is the poor fit of variables incorporated in the models with the criteria used by the decision makers. For this seminar, I wish to require that model builders be explicit about the outputs of models and their internal criteria. I also encourage developers to be honest about their priorities. Would you use a model if it did not make a development more profitable?

Why Models Fail

Modeling for use in decision making in new towns presents some unique problems. First, new towns are really too large to be simply responses to market demand. The traditional market survey just is not adequate. A new town, to succeed, must not only capture a large proportion of existing demand, but also contribute to creating a market. It does so by bringing in industry and offering alternative life-styles. I think it is also well accepted that a new town cannot exist with only newly generated markets. Industrial locations are too strongly influenced by state, regional, and international considerations. At the regional level, a new town can only take advantage *of existing* demographic movements. Thus, new towns are not going to be really "new" but only a means of responding to regional market influences, and it is necessary to amplify these influences by adding to the industrial base to make the new town concept viable. I believe that it is still too early to determine if the long-range control needed for new town planning can be exercised.

In terms of modeling, the unique issue is that the large exogenous market influences are probably the most important ones to new community planning. Also, the potential market is not existing but comes about through growth over a 5- to 20-year period. Within that horizon, how can models respond to the externalities of competitive developments, price changes, new legislation, and inflation? It is questionable whether a new community is an isolatable entity. The corollary question, then, is whether they can be modeled.

Many models applicable to land use and site engineering exist; yet they have not been heavily utilized, and one of the goals of this seminar should be to ascertain why. I volunteer one set of answers--why I think these tools are ignored. My own interpretation is based on a view of the development process as highly uncertain and risky, where economic considerations are critical, and careful but quick response to market information is imperative for survival. Moreover, I consider market information to be highly uncertain and changing, and adaptive action based on short-term information is the necessary mode of decision making for success. In planning amenities, social or aesthetic concerns are either supportive of market penetration or are extras that are included after the market "imperatives" are fulfilled.

In this context, existing models for land use and site engineering are not attractive because

1. Most such models are planning oriented over relatively long time spans and do not respond to short-term information. In reality, it is not the long-run plan that determines success or failure, but rather the ability to deal with short-term issues (e.g., drainage problems or a labor strike).
2. Most models are much too limited. Most models grind away on a limited set of variables. In fact, what is needed is not more analytic power devoted to a few variables, but rather a means of considering broader ranges of diverse variables, even if only simplistically.
3. Few of the models have any proven value--and they are expensive. Few land-use or site-engineering models have been shown to save money or effort, allow more profits to be derived from given resources, or improve the marketability of a development. Any positive claims in these areas are usually offset by the costs of acquiring and preparing input data.
4. Quantitative approaches to decision making are not the "style" of most new community developers. Models are quantitative and assume that users are comfortable around mathematicians or, at the least, engineers. In fact, most developers are closer to contractors, many come from this origin, and an accounting sheet and its arithmetic is just about the limit of their abstract planning. More concrete forms of planning--e.g., how to deal with a particular contractor or how to organize a presentation to a potential financer--are the issues most easily accepted for attention.

Each of you can judge for himself the validity of the different viewpoints presented. If they are generally valid, their interpretation leads to the conclusion that the major reason models are not used is because of the poor quality of the tools developed thus far. Their inability to respond or to take into account short-term adaptations, their limited scope, and their poor payoff are challenges for the development of a new generation of modeling tools.

Although the last reason explained why models for new community planning have not been forthcoming, it also explains why they are not likely to be forthcoming in the future either: A model can become a useful tool only if the context of its use is well understood by the model's designer. This understanding comes about most easily if model builders can learn (at first hand) the developer's operation. While this may be done by bringing model builders into the development firm, a less risky approach is to develop an ongoing interchange between developers and modelers--our purpose at this seminar. Model builders would benefit from a critique of existing modeling efforts or a statement of a problem

that could be responded to through modeling. Developers, on the other hand, may learn that some of the tough issues they are grappling with can be resolved with the model builder's products.

I would like to propose an agenda that may lead to some progress in our days here together. First, we must determine where tools would be useful in development as now practiced. Where have developers made significant errors, and where could better analysis and decision making pay off? Our focus is land use, site engineering, and physical design. Possible areas where development problems might exist are

1. In choosing the site for new community development, based on availability, markets for housing, access, and so on
2. In the mix of relations involved in developing the master plan for the community, phasing its development, front-end investment for preservicing of land, and the distribution of utilities (here the issue is flexible response to market demand and generating good profits while minimizing front-end cash (out)flow
3. Determining best use for a particular parcel--that is, what are the total development costs and net profitability if town houses go on parcel A and apartments on parcel B or vice versa
4. The site layout of groups of units so as to maximize their marketability
5. The design of units in terms of plan, amenities, and the like.

Once we have identified where tools would be useful, I propose that we examine each of these problem areas in some depth, with the consultants and academics proposing approaches and the professional developers criticizing. Third, I propose that we stay away from the grandiose forms of models that predict over long time periods or encompass large parts of a new community development. The most useful tools, I believe, will be rather small, simple (simplistic) ones that respond to quite specific issues.

I believe the best result that can be gained from this meeting is the opening up of some new opportunities--opportunities for developers to increase their successes and opportunities for model builders to develop more relevant tools. I hope, too, that this seminar will promote other meetings between the two groups.

SUMMARY

This summary of the group's discussion of land use, site engineering, and physical design modeling was presented at the seminar plenary session by the group leader, Charles Eastman.

At the outset of its discussions, the working group chose to focus on the effects of a new community on its context. Thus, its discussions focused on one of the most perilous areas of development, the interface between different interests. Public interests in the development process were emphasized.

It was unanimously agreed that it was meaningless for land-use policy to approach regulation from a zoning viewpoint, and instead the group adopted a *systems approach* for examining the impact of land development. In this case the group viewed the environmental system as consisting of (a) land use, (b) support

mechanisms for human use of the land, (c) natural resources, (d) social institutions, and (e) economic resources. These were taken to be the five dimensions of impact of any large-scale development.

The view taken was that regulation of land development should be concerned with the capacity of the land and other systems associated with it to absorb and sustain certain uses. Philosophically, the group's view was antithetical to zoning, which prescribes a *best* use, and it concluded that in many cases there is *no best* use. Instead, regulation should be concerned with negative effects of uses. The group also adopted and extended an environmental impact perspective that places a set of constraints on all uses of land and allows any use that satisfies those constraints.

The environmental impact philosophy requires prediction of the impacts of different actions, and these predictions are meaningfully based on models of different environmental systems as well as their interaction. Modeling was accepted as an important tool for both developers and planners if the effects of a particular form of development are to be understood. It was noted that models can be used to obscure future effects as well as to clarify them. At some later time, regulation may consist of arguing the merits of one model over those of another (e.g., the planner's model versus the developer's).

Procedurally, the group developed a matrix of impact factors identifying 29 different areas that are potentially impacted by a land-use plan. These, shown in Table 2, include engineering considerations (such as sewage and utilities), pollution impacts, energy impacts, the impacts on social institutions (such as schools, health care, and local government), plus social interaction impacts (such as change in life-style or the capacity of social institutions to absorb a new population). The factors were drawn from the experience of all members of the working group.

After identifying the impact factors, the group evaluated each of them to determine the degree to which current knowledge would permit their prediction. In some cases, basic models are missing; in others, models allowing predictions of effects exist, have been calibrated, and require only refinements or dissemination.

The group also examined the *legal precedents* for intervening in development actions because of the impact of each factor. Along with legal defensibility, the group considered its complement, the negotiability of the impact available to the developer. In the air-pollution area, for instance, the group concluded that both the realm for negotiation and the legal precedent for controls are moderate, while in public safety institutions (fire and police), there is low negotiability and high defensibility.

Given the assessment of the state of knowledge regarding environmental impact factors depicted in Table 2, the group concluded its deliberations by attempting to identify those categories most deserving of research. The importance of the impact factor in societal terms, its tractability, and the current state of knowledge all were considered in this final assessment. The method of making this final determination was by voting, and all group member votes were combined to reach a final assessement.

Overwhelming priority was given to a category that might not have been anticipated as an area of contextual impact--that is, on the technological know-how for management of new community development. It was generally agreed that it was only poorly understood how different management and organizational structures affected the success, or more generally the results, of new community planning.

TABLE 2 Matrix of Land-Use Plan Impact Factors

Impact Analysis Factors	State of Knowledge	Legal Status	
		Negotiability	Defensibility
Environmental			
Sewage			
Centralized	Ready for codification	*a*	*a*
Decentralized	Extensions needed	*a*	*a*
Transport			
Highways	Ready for codification	Medium	High
Pedestrian	Basic models lacking	High	Low
Transit	Basic models lacking	High	Low
Bike	Basic models lacking	High	Low
Rail	Basic models lacking	High	Low
Air	Basic models lacking	High	Low
Pipeline	Basic models lacking	High	Low
Marine	Basic models lacking	High	Low
Utilities			
Gas	Ready for codification	High	High
Electricity	Ready for codification	Low	High
Telephone	Ready for codification	Low	Low
Cable TV	Basic models lacking	High	Medium
Water			
Supply	Extensions needed	High	High
Distribution	Ready for codification	Low	High
Soils			
Agricultural	Extensions needed	High	Low
Structural	Extensions needed	Medium	Medium
Open Space	Basic models lacking	High	Low
Visual	Basic models lacking	High	Low
Air	Extensions needed	Medium	Medium
Noise	Extensions needed	Medium	Medium
Drainage	Ready for codification	Medium	Medium

TABLE 2 (Continued)

Impact Analysis Factors	State of Knowledge	Legal Status	
		Negotiability	Defensibility
Energy	Basic models lacking	High	[a]
Flora/Fauna	Extensions needed	High	[a]
Social			
Health	Extensions needed	High	Low
Education			
Mandatory	Ready for codification	Low	High
Voluntary	Basic models lacking	High	Low
Services			
Goods/services	Ready for codification	Low	Medium
Social welfare	Basic models lacking	High	Medium
Safety	Ready for codification	[a]	[a]
Hazards	Basic models lacking	Low	High
Population	Extensions needed	High	Low
Cultural	Basic models lacking	High	Low
Privacy/social interaction	Basic models lacking	High	Low
Recreation	Extensions needed	High	Medium
Institutional/management/fiscal			
Social structure	Basic models lacking	[a]	Low
Government	Extensions needed	Medium	Low
Fiscal			
Regional	Extensions needed	Medium	Low
Micro	Ready for codification	Medium	High
Development industry	Extensions needed	Medium	Low
Management	Basic models lacking	High	Low
Economic			
Employment	Extensions needed	Medium	Low
Income	Extensions needed	High	Low
Financial	Ready for codification	Medium	Low
Resource Base	Extensions needed	High	Medium

[a] Not determined.

A particular issue here is the uneven level of detail of planning by a private developer and public agencies. The developer works up an intensive plan of development, possibly over a long period. The public agencies are expected to respond to any type of planning proposal, and the gearing up to respond may take a long time. Both the consultants and municipal planners participating in this session agreed on the importance of the problem. The only solution proposed was to institute new forms of cooperation.

The group also agreed that research was needed to improve our ability to deal with nonhighway types of transportation (including rapid transit, bicycle transportation, pedestrian movement, and their points of intersection and interchange) and to define their positive or negative impact.

Open space was an additional high-priority item recognized by the group. Here the question was how to deal with open space--its use, its amount, its maintenance, and, possibly, its justification.

A fourth concern was the rate of assimilation of new members into social structures. Combined with this were the issues of privacy and social interaction. Also identified as high-priority areas were energy impact studies, resource base studies, and demographic studies on the basis of population transience.

In general, the major priority was given to the development of models, available to both public and private interests, for predicting impacts in these 29 categories. Second, the group identified various factors for which its members believed that research was feasible and important and could lead to positive improvements in planning new communities. The capital base to support this research program is generally lacking, it was agreed. Further, it was pointed out that while much work is going on in each of these areas, it is being conducted by many different agencies and is completely uncoordinated. Thus, a management model for guiding research was suggested. The group concluded that the adoption of the impact-oriented land-use policy it outlined is not likely, but that it represents the logical perspective, given current knowledge.

SOCIAL AND COMMUNITY SERVICES PLANNING AND MODELING

Group Leader: Marshall Kaplan
Rapporteur: Mark Freeman
Participants: Anne Apgar, William Chase, Joan Demers, Robert Ducharme, Harvey Gantt, J.D. Hill, Carl House, Robert Marans, Robinson Newcomb, Barry Richmond, Richard Rosenbloom

STIMULUS

This working session began with the following presentation by the group leader, Marshall Kaplan.

One would assume that a seminar with as imposing a subject and list of participants as this one would generate significant conclusions. I would hope, however, that we could temper our expectations somewhat, since most of us have, literally and figuratively, been here before. Unfortunately, jargon and rhetoric have more often than not substituted for a hard examination of the conventional wisdoms that govern our related professions. Because of this, we are still almost at point zero in determining the linkages, if any, between the physical and social environment--between people's life-styles and their three-dimensional communities. Clearly, we have been better at criticism (although not by too much) than at policy formulation and better at evaluation than at recommendation.

If my purposely negative appraisal of the state of the art is at least partially accepted by some, then I propose that we begin this discussion in somewhat of a stream-of-consciousness fashion. For discussion purposes, I would like to outline some of the tough problems impeding efforts at "modeling," particularly as they affect the social planner in new communities or supposed new communities.

GOVERNING "ISMS"--AN IRRELEVANT STRUCTURE

Most of us have come out of, or been heavily influenced by, the growth and increased popularity of the city- or urban-planning profession. In that context we, like the city planner, have found it difficult to depart from at least three errant "isms" governing our professional perceptions.

First and foremost of these is *logical positivism;* quite simply, at least for public consumption, we like to claim that we deal in facts[1] and not in values--particularly if these values are our own. To protect our professional

[1] In effect, as indicated in later paragraphs, this is a claim more for public than professional consumption. Ideology (and values) plays a major role in our lives as social planners, but we rarely admit it or lay our cards on the table.

virginity and perhaps build our professional legitimacy, many of us have claimed methodological certainty concerning our efforts, relating social planning to community development where none exists; built a professional vocabulary where none was necessary; abstained from "dirty" or policy/program-relevant urban research where such research was clearly in the public interest; and converted necessarily subjective but useful judgments with respect to urban policy or programs into generally unnecessary, often abstruse, quantitative statements.

Related to our benign acceptance of "positivism" is our almost complete adherence to environmental determinism--paraphrasing Robert Frost, good social or physical environments make good neighbors. We forget that what one man defines as good is often another man's tax burden and that our "goods" tend to be based more on our own moral or professional imperatives than on understanding of complex human behavior patterns.

Clearly, the relationship between and among the various environments--social, economic, and physical--is a complex one. Equally important, we are clearly still at the margin in our knowledge of the impact each has on individual households and aggregates of households, let alone on the interrelationship of all three environments on human beings. Only the clairvoyant among us would go beyond "guesstimates" at the present time. Yet, earlier in our history, with far less evidence than we now have, all but a few of us were willing to lend our support and credentials to many public programs based on "good environments make good neighbors" assumptions (e.g., urban renewal and public housing). In the process, many of the anticipated good neighbors were excluded from the neighborhood, and their lives and the lives of their children permanently damaged. It is to be hoped that we won't do the same with respect to new communities.

Acceptance of *political separatism* as part of our trilogy of "isms" has sheltered us from those "evil" politicians or their counterparts in the private sector, those "not-to-be-trusted" builders, and their ilk. Conversely, it has made our efforts less real and our contributions to the public minimal. Because their tasks were undefined and their contributions to daily operations hard to perceive, social planners have rarely been relevant in the offices of city halls or private developers. Although the growth of positive programs in the 1960s made us popular at parties, this legacy now seems more cosmetic than real.

Social Policy/Social Planning--An Unresolved Ambiguity

Typically, most of those concerned with determining predictive linkages between behavior and environment came out of a background oriented toward social policy issues. Indeed, the supposed relationship between the two fills many of the pages in our papers and speeches at conferences. Perhaps related to our marginal successes in the social policy area, planning a better environment or building better new communities is now our focus. To it we have brought our hopes and dreams for a better world.

If new communities and/or community development efforts provide an efficient means to resolve social policy dilemmas, then maybe we are on the right track. If they do not, then our research and modeling efforts may be based on a mistaken context. To put it bluntly, we may be working on the wrong side of the street, testing the wrong assumptions and/or the wrong hypotheses.

My own biases should be clear by this time. I believe that there is a vast distinction between issues relevant to the policy analyst and maker and the presumed concerns of the social planner involved in present new community building. Given the public and private context of most new communities, only the negative issues related to social policy should be addressed by the community builder/planner. Clearly, the scale and context of new communities and larger developments suggest only a peripheral relationship to such major social policy concerns as income redistribution and welfare reform. Nothing we do environmentally or through social engineering in the environment can make a major dent in the human pathologies evidenced in our urban areas. Unfortunately, we may not be able to "do good" or do "as good" as we want to do in our efforts. If this is so, our questions to the model builder may be more temperate and precise. Certainly, they will be less ideological. (Because of the failure to develop a means to recapture externalities built into new communities and the absence of a meaningful national housing and industrial location program, one could argue that new towns are at least mildly regressive, particularly those using public funds.)

Prediction--Possibilities, Not Probabilities

Most of the models that I have seen (or been involved in developing) are based on defining a predictable population base and, subsequently, converting this base into a determinable model input (Figure 1).

Right here, we face an unresolvable methodological problem. Only the consultants (or ex-consultants) among us would claim that present techniques of population projection are anything other than rudimentary. For example, at the new community scale, most are based on general step-down techniques based on

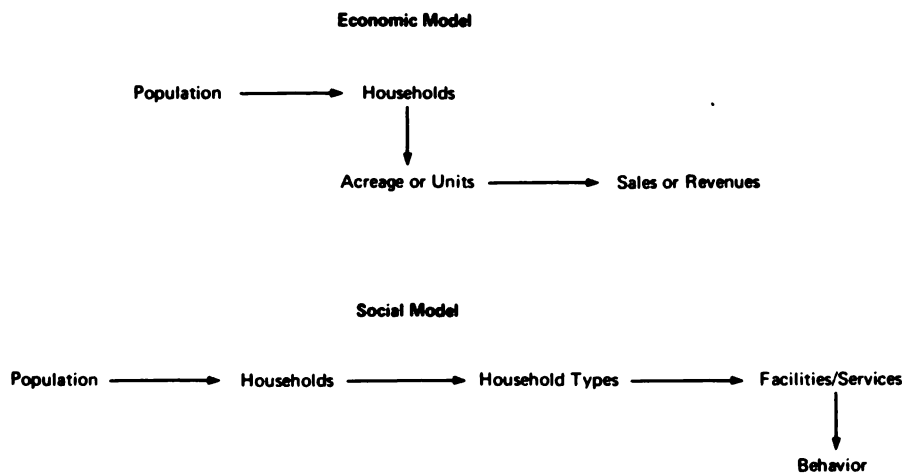

FIGURE 1 Sample models.

trend line on time series analyses. Ultimately, most are justified on the basis of one part intuition and two parts salesmanship or optimism.

If we have minimal control over the basic population estimate, we have less over the conversion process (i.e., over the translation of population data into relevant model input information). Just as the demographers of the early 1960s missed the boat in projecting national and local rates of natural increase, so did sociologists and economists find themselves in tough shape when it came to anticipating life-style and mobility patterns and their subsequent impact on land values, for instance. In effect, the "pill," the automobile, the bulldozer, and, lately, the concern for the environment often, each in its own way, overwhelmed historical data with respect to population growth and household behavior patterns. People just didn't live the way social scientists wanted them to.

At present, I would suggest that when we move beyond predictive techniques associated with the next 1 or 2 years, we're in deep trouble. The state of our art is marginal, and our models ought to be structured to deal more with possibilities than probabilities.

Whither or Whether--The Exogenous Event

Very few model-building processes, whether of the social or economic variety, can easily handle exogenous factors or those factors that create the context or environment that defines the nature of considered community development variables. In effect, what we cannot control, we avoid or, often mistakenly, simplify. For example, inflation in the economic model almost always becomes an assumed level rate of increase or is not considered at all because the "tradeoffs" are supposed to be even. Similarly, political decisions affecting land use or life-styles are rarely anticipated or, conversely, are always assumed to occur in just the way we want to make our discounted rate of return come out or the plan buildable. If model-building efforts are intended to generate understanding, then our failure to find a way to define and continuously include the impact of this type of factor could be serious.

Interdisciplinarians--Much Talk, Little Impact

Model building, at least in the past rhetoric with respect to new towns, is seen as an interdisciplinary effort. To be holistic and synoptic in consideration of development objectives and variables is read as a "good"; to include in a singular process all the talents of the varied social scientists around this table, almost a "must."

Unfortunately, we have little but good feelings to show for most of our efforts at interdisciplinarianism. Jargon and overhead gaps aside, descriptive analyses relative to community development processes are not yet tough enough to generate reasonable rigorous multivariate hypotheses upon which to generate operational multidisciplinary models.

Cultural Biases--Or, People Must Behave the Way We Want Them To

Models pertaining to human behavior often have been based more on assumptions and hypotheses that reflect the value set (never really described or subject to

analysis) of the "modeler" than on behavior patterns of the studied or involved population. Were these value sets put on the table, we would be able to reconcile them with available facts and use them accordingly, but they rarely are. Instead, they are treated as fact and often mistakenly built into the behavior model as an anticipated result or an aggregated input. When professional value sets bear little resemblance to reality, the model's capacity to predict or help us understand is diminished accordingly. [For example, in the Model Cities program, we were ostensibly asked to weigh the impact of new or amended social service delivery systems on supposed social pathologies, the assumption being that there was a causal relationship between the system and the incidence of pathology. Apart from the Hume-istic difficulties that complicate attempts at ascertaining cause and effect, the HUD planners' definition of new or amended (generally equated with good, better, and best) often did not generate a positive response on the part of either the deliverer or the recipient. Further, the presumed pathology often was not seen as such by the involved participant. In this context, the HUD behavior model had little relevance.]

Space/Nonspace--The Meaning or Nonmeaning of Space

The linkages between space and people remain opaque. Most of our conversations in this regard seem pompous, and most model-building efforts appear premised on a too casually derived set of assumptions. As implied earlier, the impact of the environment on human beings is neither direct nor simple. Descriptive studies we have undertaken offer sufficient data to at least hypothesize the relationship of such related variables as household income, race, and education to positive or negative household perceptions and use of different types of space. In a similar vein, these studies also indicate the irrelevance of certain types of conventionally desired spaces or geographic areas (e.g., the traditional neighborhood) to the life-styles of most households, particularly most affluent or near-affluent households.

It could well be that the level at which we are working is too high or, at times, not high enough. More than likely, other factors play a far more important role than space in affecting human beings. Indeed, in a nation inhabited by an increasing number of mobile people, space of the type we are used to working with (community building) may assume a marginal role in people's lives.

Where Do We Go from Here? One Alternative

Hopefully, acceptance of all or even some of the above comments will stimulate our willingness to, literally, go back to the drawing boards. Our assignments should be based more on description of human behavior than on prescription relative to that behavior, more on understanding what does happen in given situations than on anticipating what could happen under assumed conditions. Induction rather than deduction should govern our work processes, and attention to the microscopic, rather than synoptic, our work programs.

Agenda

Several "new communities" funded by Title VII now are being built (e.g., Flower Mound, Riverton, Jonathan) and several others, blessed by private financing, are well under way (e.g., Columbia, Reston, Irvine). Unfortunately, given the status of our knowledge, an adequate evaluation program relative to the impact of these new towns on their residents, old and new, does not exist. Fortunately, given the limited size, time frame, and sponsorship of most of these entities, a legitimate evaluation effort is possible.

Such an effort, if it is to provide the type of data necessary for us to move forward in the model-building[2] area, should combine descriptive longitudinal studies pertaining to residents' perceptions of their environment with snapshot analyses concerning resident life-styles. Certainly, the studies should be linked to a "before" series of consumer- or market-oriented interviews suggestive of satisfaction/dissatisfaction indices with pre-new-town environments and similar in-depth interviews concerning behavior patterns in that environment.

Assuming a large enough sample of communities and residents, typologies relating varied household characteristics to perceptions and use of environmental/service components could be prepared and initial assumptions relative to impact stated. Again, assuming a large enough sample, diverse institutional factors related to development decisions could be identified and, where relevant, their relationship to demographic/environmental/service patterns noted (Figure 2).

Obviously, alternatives to secure the necessary baseline data for modeling efforts are available. But, to avoid doing the above would be a shame, given the "live" laboratories available and the apparent willingness of the developers.

Initial Experience

Prior to my joining Flower Mound New Town as general manager, my firm undertook studies for several new town or large land developments concerning the definition of appropriate community service and planning ground rules. To do this, in each instance we initiated a number of diverse techniques to get at consumer/resident perceptions; included were mail questionnaires to appropriate samples, face-to-face in-depth interviews, leadership meetings, and game playing among residents.

While the data are not complete, or without problems, evidence gathered does support the need to look for amended planning and social service criteria and to take a tougher look at some of the assumptions governing present modeling efforts. For example:

1. By far, the majority of people interviewed in each area claimed little loyalty to the neighborhood as a social or economic entity (i.e., friends tended to be scattered throughout the metropolitan area and shopping trips tended to be oriented toward larger centers).

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[2] I doubt whether we will ever get to the stage at which we can provide an 18-year model similar to a cash flow model. Our efforts should be much more incremental. Indeed, even the cash flow model, where variables are more controllable, has limitations as an operational tool.

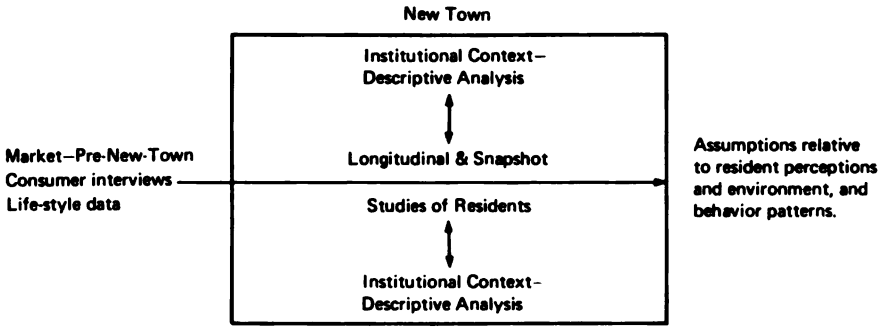

FIGURE 2 Data needs.

2. People's perceptions of open spaces and the adequacy of recreation facilities/activities seem to vary at least by income and race.

3. People's perceptions of most community services related more to cost, quality, and attitude of supplier than to geographic location.

4. By far, the majority of people preferred automobile travel to other modes.

5. Amenity packages tend to take second place in consumer rationale (varied by income) for house purchase decisions; most households indicate "house for the money" and protection of their investment as key factors in buying into an area.

6. The street and the area immediately surrounding a unit is seen as the most valued piece of turf by most households; beyond the street, most think in terms of specific projects or areas, rather than traditional planning areas--i.e., the shopping center rather than the community.

SUMMARY

This summary of the group's discussion of social and community services planning and modeling was presented at the plenary session by the group leader, Marshall Kaplan.

It was clear from the outset that no ready consensus existed among participants in the session concerning an appropriate agenda. Some desired to jump immediately into the relationships between and among social planning, community building, and modeling, while others, perhaps a bit more cautious, wished to concentrate on seemingly definitional issues: What is the meaning and relevance of the term "modeling" to social planning and community building?

Because of the group's diversity, it was decided to allocate the initial agenda to a "sorting" of terms. Generally, most agreed that for purposes of the session, models could be considered as abstract representations of the real world. The level and degree of abstraction, the willingness of the model builder to use *a priori* assumptions, and the degree of comprehensiveness preferred and time span involved appeared to rest more on each participant's view of the state of the art than on any proven set of factual premises.

In effect, participants who viewed model building and community building in the context of the law of thermodynamics or experiences in the hard sciences were more prone to argue the wisdom and appropriateness of synoptic, seemingly

prescriptive modeling processes and products. Conversely, participants who questioned the relevance to social science of rules related to physics and who doubted the substance of the data base in the behavioral area sought agreement on a more incremental set of approaches. Both groups agreed, however, that

1. More empirical evidence about how people live is needed before model builders can help improve community building efforts
2. "Causal" model building efforts, as opposed to descriptive ones, provide more of a risk (less benefits, more costs) at present
3. Exogenous events or events outside the "control" of the model builder (e.g., politics, economics, changing life-style) may play a more crucial role in the community building area than in the "hard" sciences
4. Ideological assumptions may, more than in the "hard science area," tend to skew community development model-building efforts.

All agreed that, if model building was to be valuable in a community development context, it would have to

1. Increase public/private understanding of the "wisdom of assumptions and alternatives"
2. Ultimately improve decision-making efficiency and results

Most participants, as they tried to relate the discussion on model building to social planning and community building, identified the following as problems:

1. No easy link exists between the physical environment and human behavior or indices of human satisfaction.
2. No easy laboratory exists in which to test the relationship between alternative models and varied types of community.
3. Given assumptions concerning the possible minuscule importance of spatial boundaries to most households, no particular value exists in concentrating on one type of spatially defined community rather than another.

New communities were seen as valuable, not because of anything particularly unique to their development, but because "the slate was clean"; research could be conducted over an 18-year period and developers seem willing to provide the "laboratory." Unfortunately, social planning in new communities seemed to many to be an amalgamation of art and science, of untested and often borrowed tenets from city planning, of ideological premises related to the planner's concern for social policy issues rather than factual ones based on data or actual human behavior.

Conferees, after much debate, reached agreement on a modest but, it is hoped, practical recommendation--that a working committee of academicians and community builders be created to

1. Inventory existing efforts at model building in the social planning/community building area ("in order to avoid re-inventing the wheel")
2. Examine alternative definitions of model building in a community-building context
3. Expose developers and model builders to each other's thought processes (possible alternatives being the placement of operations researchers on developers' staffs and short university-based training programs for developers)

4. Generate funding for and monitor alternative efforts at model building in new communities (such efforts to emphasize or grant priority to limited, inductive approaches over more comprehensive ones, at least at the outset)

5. Generate funding for and monitor evaluation efforts with respect to household behavior in new communities ("perceptions of self, of services, of institutions, of environment")

Part III

FRAMEWORK PRESENTATIONS

A FRAMEWORK FOR EXPLORING THE ROLE OF MODELS IN COMMUNITY PLANNING AND DEVELOPMENT

Mahlon Apgar IV

The idea of large-scale planned community development presents alluring ultimate prospects to public policy makers, potential residents, and developers alike; however, the hazards entailed in executing this concept are more numerous and complex than those associated with smaller, more conventional single-purpose housing and real estate projects. Efforts to reduce the resulting uncertainties have been made by modeling the planning and development process, but recent experience confirms that considerable care must be exercised both in developing new models and in selecting and adapting models and planning techniques from the wide variety, but varying quality, of those now available.

The purpose of this presentation is to provide some perspective on the use and abuse of models in community planning and development and a framework for the seminar papers and discussions by summarizing

1. Major difficulties confronting the community developer as the concept of the new community is refined and implemented
2. Conceptual and operational problems faced by the model builder in understanding the development process and assisting the developer
3. The key elements of a proposed approach to guide planning and model-building

In the conclusion, I suggest preliminary criteria that both developers and research sponsors might apply in assessing proposals for the design, use, and evaluation of community development.

For two reasons, my viewpoint throughout this presentation is that of the developer and user rather than the technical specialist and researcher. First, the decision maker must ultimately take action on, and responsibility for, modeling results. Since he is the "client," any research or analysis that he is expected to participate in or support must be useful in resolving the issues before him. Second, the decisions and problems facing development executives are surprisingly similar, in both private companies and public agencies such as the New York Urban Development Corporation or the British new towns corporations (unlike the specific techniques and requirements that are unique to a particular organization and thus less generalizable for discussion).

This user's perspective permits one to take a broad view of models in community development that embraces any description of the relationships between end results and the factors that are assumed--or proved--to determine them. Hence, to the developer a conceptually simple model of project cash flows may be just

as respectable for planning as a complex development simulation model and, as is often the case, may even be more useful if it provides more relevant and timely information for decisions.

By broadening the definition of models, I do not intend to bias the discussion against more complex models and techniques; rather, I wish to clearly distinguish the purposes and characteristics of *analysis* models from those of *research* models. Analysis models, as I shall use the term, are designed to assist development executives in making rapid decisions. They synthesize a large volume of factual data, opinions, and even vague feelings on a given issue, structuring and interpreting them in a way that can help project teams and decision makers first to take sides on, then to discuss, and finally to agree on a course of action. Thus, at any one time in a development organization there are likely to be dozens of ongoing analyses and a variety of relatively simple models rapidly being built, used, modified, and discarded.

Research models, on the other hand, provide information--on underlying assumptions and implications of existing knowledge about the development process--and develop new knowledge to serve as a foundation for analysis models. Building, testing, and modifying such models may take many man-years of effort; their complex structures, detailed input requirements, and voluminous output--as well as the more abstract intellectual style of the typical research model builder--impede easy, rapid, and frequent use by the community development team. While unlikely to be directly relevant to specific day-to-day decision issues, the research modeling process should provide substantive insights and baseline data on which issue analyses can be grounded.

Let us now turn to the types of problem facing the model builder's primary client--the development organization.

DIFFICULTIES FACING THE COMMUNITY DEVELOPER

Three characteristics of the community development process impose a particularly heavy burden on the development organization: (a) an inherently risky development concept, (b) deferred cash break-even, and (c) high vulnerability.

An Inherently Risky Development Concept

Compared to most enterprises of any type and to other real estate "products," the new community is a high-risk venture from inception to maturity. While the concept is still so new that it is difficult to compare performance, the problems it presents to analysts and decision makers alike contrast markedly with those of other types of private investment and of routine business and governmental processes.

The most critical elements of risk arise because the development concept, with its multiple aims, broad scope, large scale, and resulting complexity, entails such an extraordinary investment of time, talent, and money and requires an unusually large land inventory. Moreover, when the developer identifies a suitably large and well-located site, an early purchase or option commitment usually must be made because of the rapidly diminishing supply of reasonably priced land in sufficient quantity in all metropolitan areas. These first decisions, often made on the basis of cursory analysis, are crucial in that

they influence the entire direction of the project. For example, while the initial direct cost of the land might be relatively small, subsequent financial commitments are implied for infrastructure, planning, staff, facilities, and ongoing construction and operating programs. Upper limits on profitability also are set during initial purchase negotiations since ultimate revenues are largely a function of specific site characteristics and the size and growth of the local market. The impact of this *commitment multiplier* can be enormous as Figure 1 illustrates for a relatively small planned development.

Nonfinancial commitments also are made as a result of the initial purchase decision. Even though the local market often has not been fully explored or its potential risks determined by the developer at the time of purchasing site options, an implicit *market* commitment based on perceived local opportunities is made with the choice of site. A *political* commitment is made because a decision not to implement aims and intentions expressed at the time of purchase and in the outline zoning agreement would result in a crippling loss of local credibility. Finally, a managerial commitment of immense importance is made to existing corporate and project personnel for an assumed staffing level and probable growth pattern to be maintained in the project.

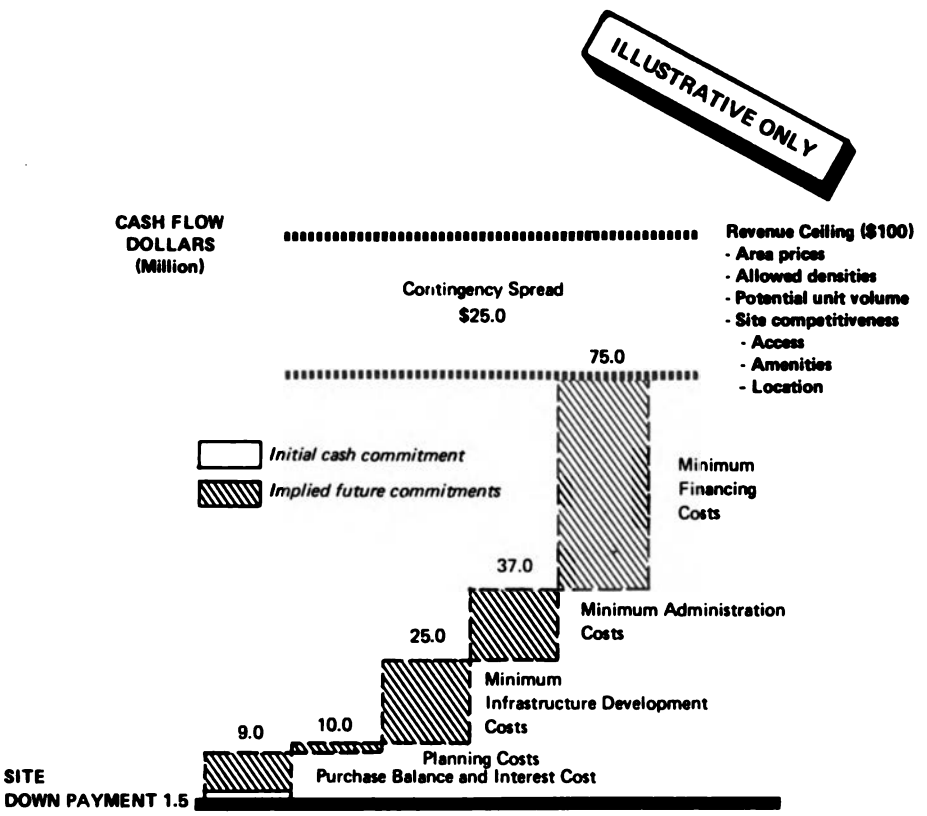

FIGURE 1 The impact of commitment decisions for a relatively small planned community development.

Deferred Cash Break-Even

It normally takes from 5 to 8 years to recover the initial cash outlays in a new community project, substantially longer than in smaller, less complex projects or alternative investments. This phenomenon results from the imbalance between the large amount of front-end cash required and the proportionately slower generation of revenues.

Net cash requirements are abnormally high in the early years of the development cycle for three reasons. First, heavy outlays are required (whether the site is optioned or purchased) both to ensure a sufficient land supply and to finance a large and widely dispersed infrastructure network. Second, the variety and extent of land uses, activities, buildings, and community services in the concept create a demand for numerous specialized staffs and, hence, an exponential increase in overhead costs in the early planning and predevelopment phases. Third, the development organization, whether private or public, tends to incur additional responsibilities and associated expenses beyond those normally expected from an entrepreneur or public agency because of the grand scale and extensive visibility of the concept.

Yet while the front-end cash requirements are substantial, break-even is deferred compared with conventional single-use, single-product developments, principally because of the time required to earn market acceptance. Faced with the alternative of living in an already established neighborhood with schools, libraries, clubs, community facilities, and social programs, many potential residents are reluctant to be among the first to settle in a still untried and untested community. In addition, the prospect of having to endure the perceived (if not real) inconvenience and noise generated by a major construction program may be daunting. Thus, even well-conceived projects are likely to take at least 3 to 4 years to reach their full projected market capture rate. Marginal adjustments and fine-tuning of the product/market mix may help to speed up the absorption rate and take maximum advantage of any competitive weaknesses, but the basic profit economics and cash structure are unlikely to be materially affected.

High Vulnerability

The comprehensive aims and scope of the community development concept naturally increase its visibility and the interest taken in it by politicians and numerous constituencies. This widens the range of external bodies on which the developer must rely for approvals and support and multiplies the inherent uncertainties in critical planning assumptions. Thus, the developer rapidly finds himself in an extremely vulnerable position and a variety of opportunities are opened up to any interest group wishing to upset his plans. Because the scale and "progressive" nature of the project also tend to concentrate political opposition, delays for the developer invariably result. For example, because high-amenity land is often used, environmentalists become concerned and must be reassured. The prospective increases in tax and administrative burdens likely to be created by the project threaten the *status quo* for local government officials and existing residents, often causing them to delay or restrict zoning approval or infrastructure support.

The developer must depend on myriad organizations for the successful completion of the project, including local government (for schools, roads, services, and fire and police protection), institutions, builders, voluntary interest groups, and other providers of services that form part of the total community concept. Delay, failure to agree, or lack of commitment on the part of any of these bodies can result in the project's being brought to a complete standstill.

Finally, at the time of planning the community, the developer must make critical assumptions about the likely demand for his specific product, the interest rate on development loans over the life of the project, the availability of retail financing for residents, and the potential escalation of construction costs. The potential for extreme miscalculation is great, creating a high degree of uncertainty about the project's viability.

The least tractable problem in accommodating these constraints is that once the developer's initial commitments have been made, it is very difficult to shift the overall direction of the project. For example, to change from a second-home to a primary-home community, or from a high-income to middle-income mix after the development concept and image already have been established would incur resistance from existing residents; the differences in market and project economics would severely limit alternative layouts, product mixes, or land uses that might be more marketable even if they could be physically accommodated on site.

Thus, the developer faces a high degree of uncertainty as he undertakes community development. While the risks are high, there is still relatively little documented experience on which the developer or model builder can draw to help in decision making; thus, in principle, both analysis and research models that help reveal crucial relationships in the development process and implications of proposed development decisions should be welcomed.

CONCEPTUAL AND OPERATIONAL PROBLEMS FOR THE MODEL BUILDER

The developer's difficulties, however, raise a host of problems that the model builder must face as he works with the developer's team to test his hypotheses and design his model. In my experience, there are particularly important problems.

Inadequate Framework for Analysis

Because the state of the community development art is still embryonic, there is no agreed-upon framework for defining the elements of community development, explaining the critical linkages, and identifying the uncertainties in the process. The *concept* and *end products* of the new community often are stated in such global terms as "providing a complete, balanced community in which a wide range of people can live and work, with a variety of housing and services to meet their needs." Further, the *roles* of the various participants in the process are not linked consistently to the *tasks* required to plan and develop the project, and these in turn often are defined as discrete analyses or actions rather than as integrated steps in a single coherent process. Finally, objectives for housing, employment, and community services inherent in the original

concept are not translated into *programs* relating actions, resources, responsibilites, and desired results to the needs to be met by the concept.

These shortcomings hamper the model builder in two ways. First, he must spend an extraordinary amount of time and effort simply in defining terms and clarifying relationships between these elements. This may be regarded as unnecessary and counterproductive by the developer staff and can result in repetition and wasted effort. Second, he will find it difficult to apply the findings of various disciplines and past research in other fields. The indicators of community "quality" and determinants of social interaction are much less well understood than economic and physical variables, and the lack of a coherent structure further impedes transfers of knowledge to aid in social, community services and governance planning.

Insufficient Understanding of the Process

The protracted development cycle and the complexity of the concept make most forecasts and assumptions of future events suspect without rigorous sensitivity testing and extreme probabilistic analyses; yet these are terribly cumbersome and difficult for the project team to grasp. The structure of market demand and the corresponding product mix are likely to change dramatically as the project moves through its 15- to 20-year life. Government policies and priorities may altogether change the basic economics and decision rules--as current monetary and environmental policies are now proving to community developers in contrast to less complex and uncertain businesses. Key external variables--such as fuel prices and interest costs--will have high impact as the project moves through national economic cycles. With such major uncertainties, contingency planning would seem axiomatic; yet few developers have done it on a systematic basis, and few technical approaches have been adapted to accommodate the exigencies of community development.

On the other hand, inconsistencies in concepts, analytic methods, and professional perspectives occur routinely. There are likely to be 25 to 30 discrete specialties involved in the planning process--each having its own decision rules, techniques, and priorities on what is "critical." This may seriously impede the model builder who is trying to embrace even a few types of approach and is the primary reason so many "comprehensive" community development models have failed to produce acceptable and usable results. Moreover, since the development concept is multidimensional and cross-functional, many linkages have to be modeled between disparate planning processes (e.g., marketing, finance, land use) and phases (e.g., predevelopment, construction, operations); yet the linking concepts are not well developed. There are few "completed" projects to serve as controls for testing hypotheses on system behavior, and even in those projects that are maturing (e.g., Columbia, Reston, and Irvine), performance to date is so uneven and performance measures so primitive that comparisons and evaluations are hazardous at best. Assessing the potential value of a model, and specifying its structure and output, is thus burdened by incomplete or conflicting views of the system itself.

Reluctant and Rigid Organizations

Development organizations often present an ironic spectacle to the uninitiated. They may well *appear* to be highly fluid in structure and working relationships--if not altogether disorganized--yet even the small development project team, as well as the larger, more highly specialized organization, exhibits a lack of integration in working through development plans. While the specialists may be well coordinated, their products and techniques are not integrated. Thus, compartmentalized organizations reinforce the divergent and limiting perspectives and methods outlined above. Data are likely to be analyzed whether they are essential or not. Detail often will greatly exceed decision requirements. And each planning specialty, without the overview and comprehensive perspective that is required, often will proceed initially with little attention to fundamental constraints (e.g., absorption capacity, building capability, funds availability).

Quite naturally, executives also may be reluctant to endure a prolonged period of research and development to build a model, field-test its hypotheses, and then find that results are likely to be of more benefit to the researchers than to them. The pressures they face are extraordinary and favor a highly pragmatic, action-oriented approach. Hence, analysis models may well be accepted for the demonstrable benefits they can provide. But research modeling projects have to offer some incentive to be attractive suitors for the project team's time and attention.

Experienced analysts and developers will recognize these problems. The model builder undertaking his task will be well advised to understand the constraints they impose and to develop a strategy for tackling them with as much craftsmanship as he devotes to the modeling effort itself.

Having reviewed developer risks and conceptual and operational difficulties, let us now examine an approach to assist the model builder in defining the development process and identifying major uncertainties.

DEFINING A FRAMEWORK FOR MODEL BUILDING

To overcome the limitations discussed above, the proposed framework encompasses both the *structure* of community development projects and the *process* of planning and evaluating those projects.

The Structure

Six elements comprise the framework structure: (a) the *concept* of the community to be developed, (b) the *programs* that translate the concept into actions and end results, (c) the *tasks* entailed in planning and implementing the programs, (d) the *participants* involved in the foregoing elements, (e) the *roles* played by each participant in the development process, and (f) the *end product* that is envisaged. Figure 2 identifies the basic relationships among these elements and illustrates that once a concept is defined, the process of detailing and evaluating programs, tasks, participants, and roles is highly iterative and requires substantial cross-linking. In practice, the importance of such a structure is not to refine mathematical relationships, but rather to provide a system

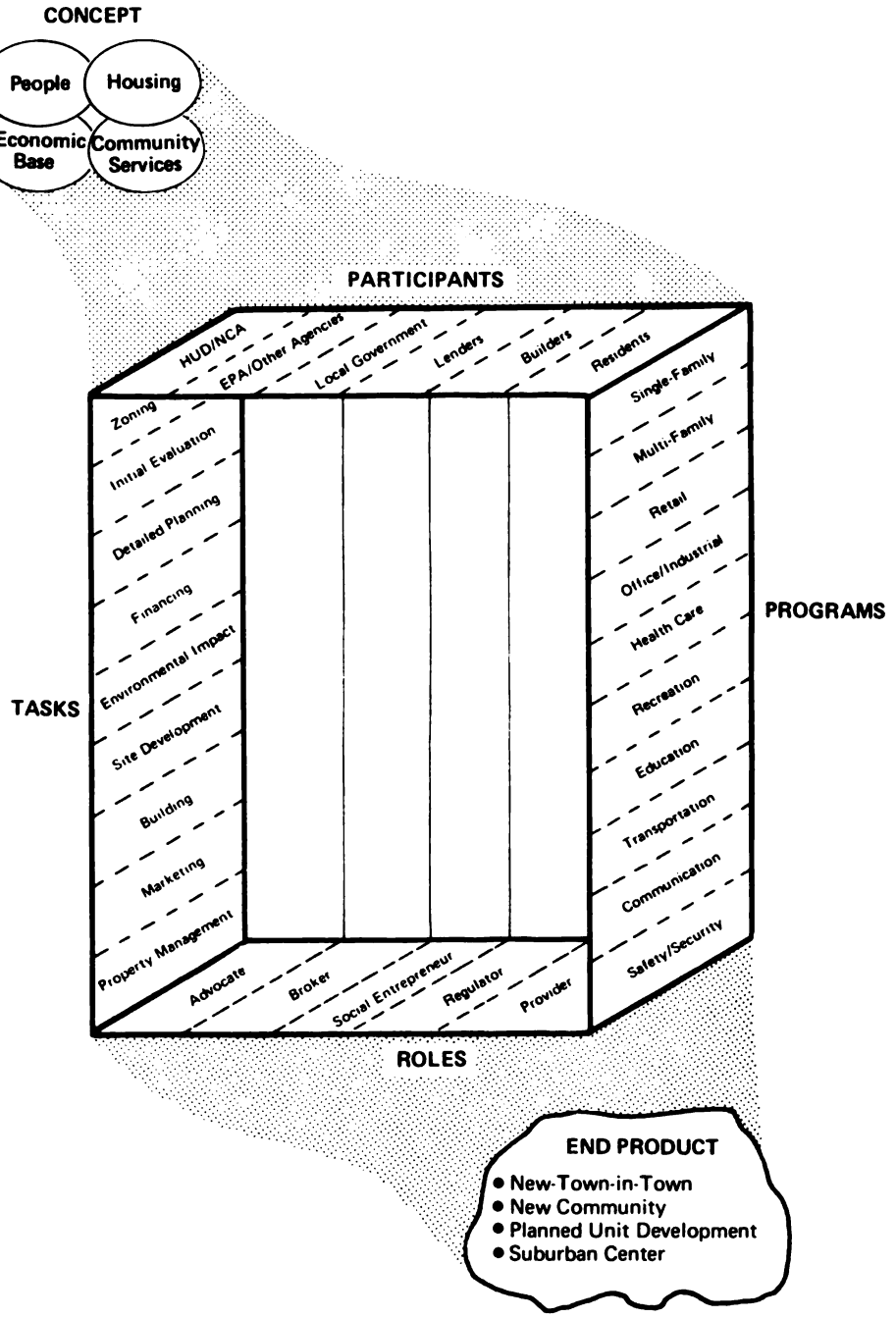

FIGURE 2 Framework for the development process.

for checking that assumptions, plans, and decisions are consistent for each element and appropriately sequenced in the development process. For example, the goal of a new community is so general (even within the Title VII program definition) that as many development concepts exist as there are new community projects. In turn, these varied interpretations of the concept mean that programs and

tasks are defined uniquely for each project. Hence, even the most simple model must be carefully tailored to each project, although, in theory, the relationships should be clear-cut and common to each project.

Definition of Concept

Because of its crucial importance, let me explain the principle of a development concept. It is a description of the eventual community to be created in terms of (a) the planned distribution of *people* described by a few basic indicators such as age, income, occupation or skill type, family size, and social characteristics; (b) the *economic base* by size and type of firm, job structure, and so on; (c) the distribution and mix of *housing* by size, type, and the like; and (d) the *community services*, facilities and institutions, that will be required to support those who live and work there (Figure 3).

The development organization inevitably has some concept--however abstract--for the community project before planning begins. The problem lies in making this concept explicit and in refining it sufficiently that it can actually serve as a guide for the entire development process. Several alternative concepts always should be considered, and inevitably many changes will have to be made. It is important, therefore, to ensure that the *concept definition* captures the essence of each alternative without overwhelming the project team with unnecessary detail. For instance, alternative population profiles can be described using the same few indicators cited above. Changes in concepts then can be made easily, and alternatives can be documented simply, without requiring the time and expense of updating masses of data. During this process of building up concepts, initial definitions also should be made of the likely *community structure* arising from each concept. The community structure is linked very closely to each of the four elements and should include initial site layouts

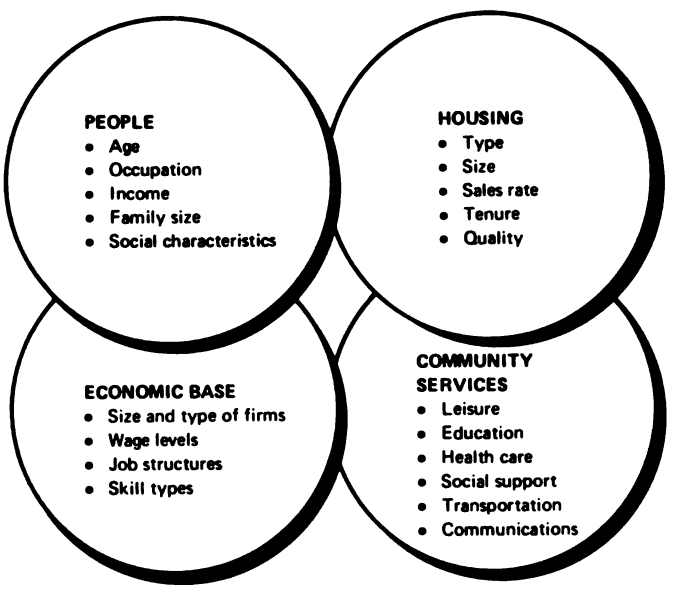

FIGURE 3 Components of the development concept.

and distributions of housing and services and the ties with local, area, and regional institutions and legislative bodies.

The concept finally selected for development should meet two essential requirements. First, it must be consistent with the fundamental *goals* of all the major participants (e.g., the developer and planning authority). Second, it must be firmly based on the economic, social, and physical *environment* of the project. Thus, contrasting alternative concepts need to explicitly

1. Clarify goals
2. Test the opportunities and constraints of the environment
3. Highlight issues fundamental to the success of the development

The goals of the parties involved in development rarely are sufficiently explicit at the outset of the project to be of practical use in guiding strategic planning, and inevitably they will not match one another precisely. In my experience, the best way to deal with the problem and achieve the broad measure of agreement required for development to proceed is not by building a sophisticated theoretical structure of goals and objectives but rather by making trade-offs between goals in response to practical problems encountered in developing a concept.

While the physical environment in which development will take place (e.g., the site itself and road and rail links) is one of the most obvious determinants of a project concept, the general economics and market conditions and the opportunities for creating a desirable community structure and supporting institutions are equally important. It is a common (and, in my view, mistaken) practice in conventional physical planning practice to allow the content of a project to be determined by a fixed view of the opportunities offered by the market environment when, in reality, the market presents a *range of choices* to be evaluated rather than a *single course* of action to be adopted. Thus, while market analysis has a critical role to play in strategic planning, an optimum project concept can be achieved only by (a) setting market opportunities in a total physical, social, and economic context (Figure 4 shows an initial assessment of residential economic/market opportunities and constraints for three areas); and (b) establishing limits of feasibility for the project and criteria for decision making (Figure 5 illustrates for two variables--population profile and development pace--how practical limits can be defined from relevant knowledge and experience).

Finally, highlighting issues fundamental to the success of the project at an early stage will avoid major (and expensive) revisions of detailed plans. In addition, it will permit trade-offs to be made between conflicting goals.

In achieving a consistent development concept, *goals*, *issues*, and *decision criteria* should be constantly reviewed by the project team as a whole (Figure 6) to ensure that new or revised elements of concepts are clearly defined, fundamental issues for analysis are highlighted, goals for the project and participants are agreed upon and mutually reinforcing, and new criteria for decision making are established.

The other five elements (shown in Figure 2) serve to interpret and implement the development concept. Because these individual aspects are better known, I will comment on them only briefly.

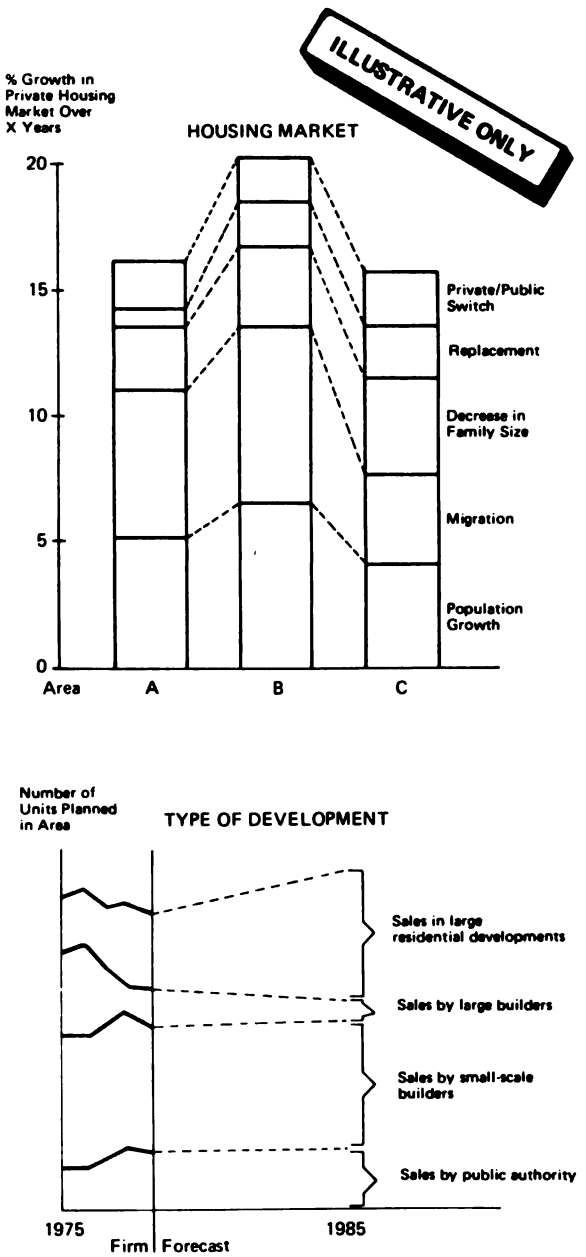

FIGURE 4 An initial assessment of residential economic/market opportunities and constraints for three areas.

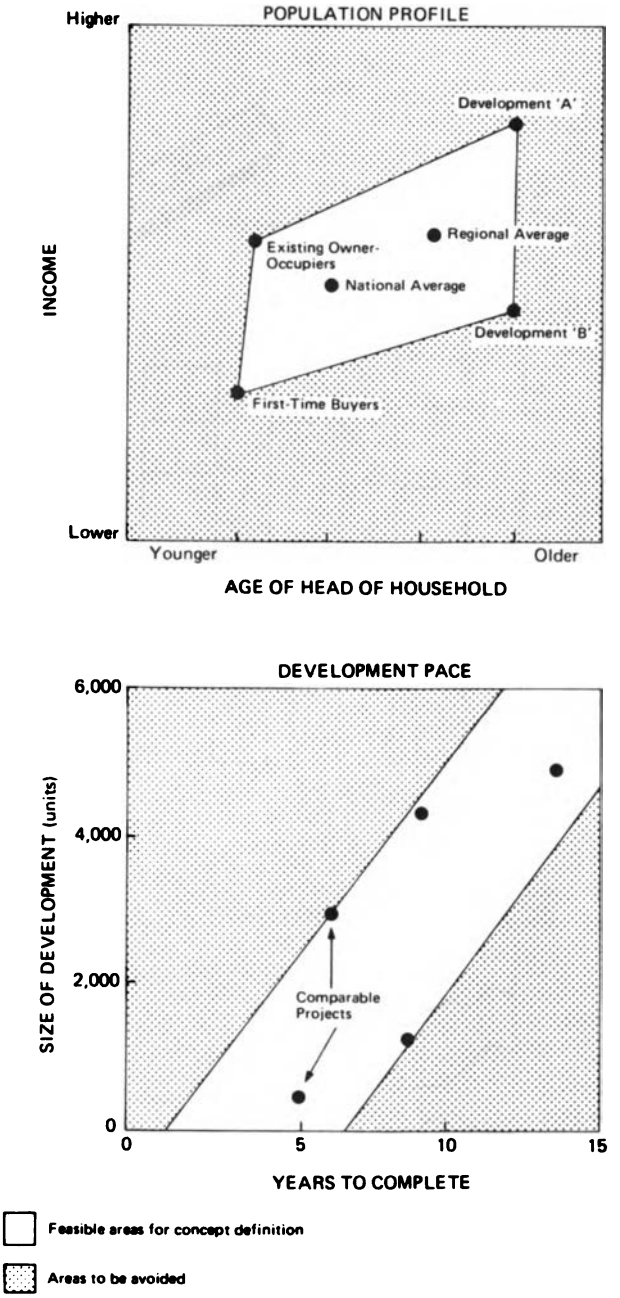

FIGURE 5 Establishing likely limits of feasibility involves an examination of such variables as population profile and development pace.

End Product

In practice, the broad objectives of community development can be achieved by a variety of different end products, depending upon the specific situation. For example, the satellite new community, the planned unit development, the new

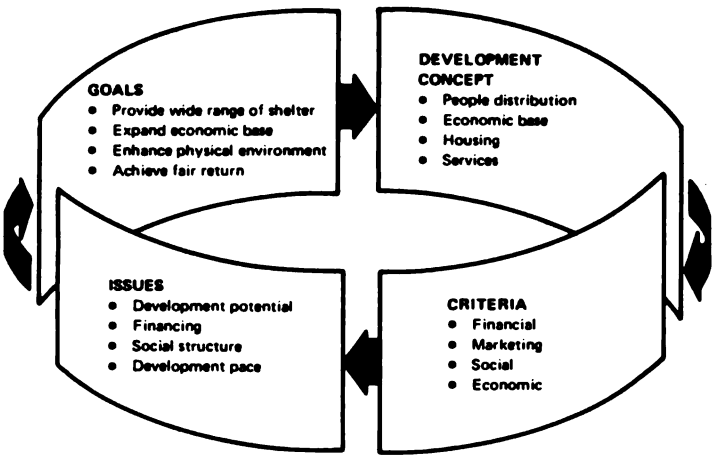

FIGURE 6 The continuing process of analysis and clarification needed to achieve a consistent development concept.

town in town, and, increasingly, the multiuse but single-unit urban complex all entail mixed markets and uses and a combination of public and private, civic, commercial, and individual objectives.

Programs

The development concept is implemented through a series of programs, such as multifamily, retail, and education, that provide the operational framework for translating the concept and objectives into bricks, mortar, and services.

Tasks

Beginning with initial evaluation and allocation of the cash, land, and manpower resources required by the development concept, a myriad of planning and management tasks are required. Indeed, the typical new-community network models that have been developed include some 5,000 discrete tasks, and even these are incomplete in many areas.

Participants

The number and scope of tasks and programs means that a wide variety of individuals and groups participate in the development process--to contribute to realizing the concept, to regulate the developer and process, or to dissuade him from continuing. The goals, interests, and perspectives of these constituencies are fundamental to system behavior and must be specified fully in any model.

Roles

While developer objectives and participant interests are usually recognized to some degree, the fact that both the development enterprise and other organizations can play a variety of roles in meeting project objectives is not. This is particularly true when opportunities for innovation--financial, marketing, social, and architectural--exceed the tolerance or capacity of public agencies or entrepreneurs.

Each type of need or demand in the community will require a different mix of roles and participants, and each stage in the development cycle provides opportunities for each key participant to adopt different roles, including the following:

1. Advocate--using influence with other participants to ensure that development objectives are met and encouraging participation
2. Broker--analyzing demands, arranging for users and providers to meet, and monitoring resulting agreements and programs
3. Social Entrepreneur--providing "seed" funding and enlisting outside support and advice
4. Provider--delivering facilities and services and providing major program funds
5. Regulator--ensuring public accountability and control over the agreed-upon purposes and programs of development.

Using this structure as a guide and checklist to ensure consistency in breadth and depth of coverage, I will now turn to the proposed process framework for assessing models.

The Process

For purposes of discussion, the possible roles of models can be classified according to the major stages of development (Figure 7). The structures, characteristics and output of analysis and control models in stages 2 through 5 are now widely known in the industry, and the rest of this summary will focus on the initial strategic phase of *commitment planning*. It is here that both the decision maker and analyst have their greatest leverage in guiding the development process and the rigor of modeling can produce the greatest benefits. The major weaknesses at this stage in most organizations are (a) the lack of discipline in defining a concept of development and operations to begin with and (b) inadequate techniques for analyzing the options for product/market mix, land use and infrastructure patterns, construction phasing, financial structure, investment levels, and developer commitments.

The principle of commitment planning is to focus analysis and opinion on the key decision issues that will determine the course of the project. This requires deferring many decisions and technical studies that are not critical until later stages and structuring negotiations and project covenants to maintain flexibility by keeping the maximum number of options open without firm commitments of funds, land, or staff. Once development is under way, further commitments are made only when there is high confidence in forecast performance based on proven success in the earlier stages. Figure 8 illustrates the

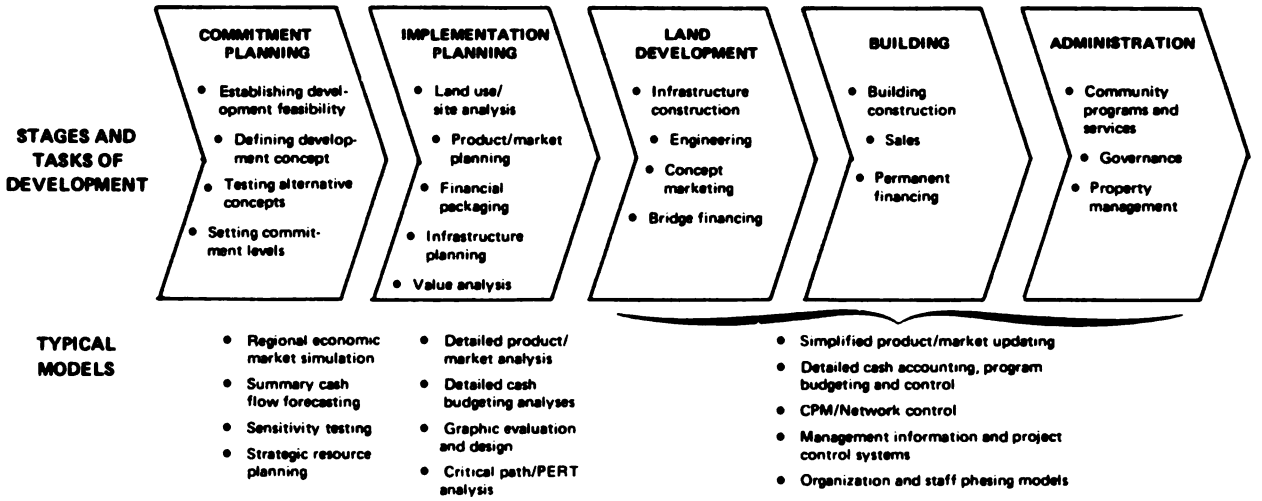

FIGURE 7 The roles of typical models during various stages of the development process.

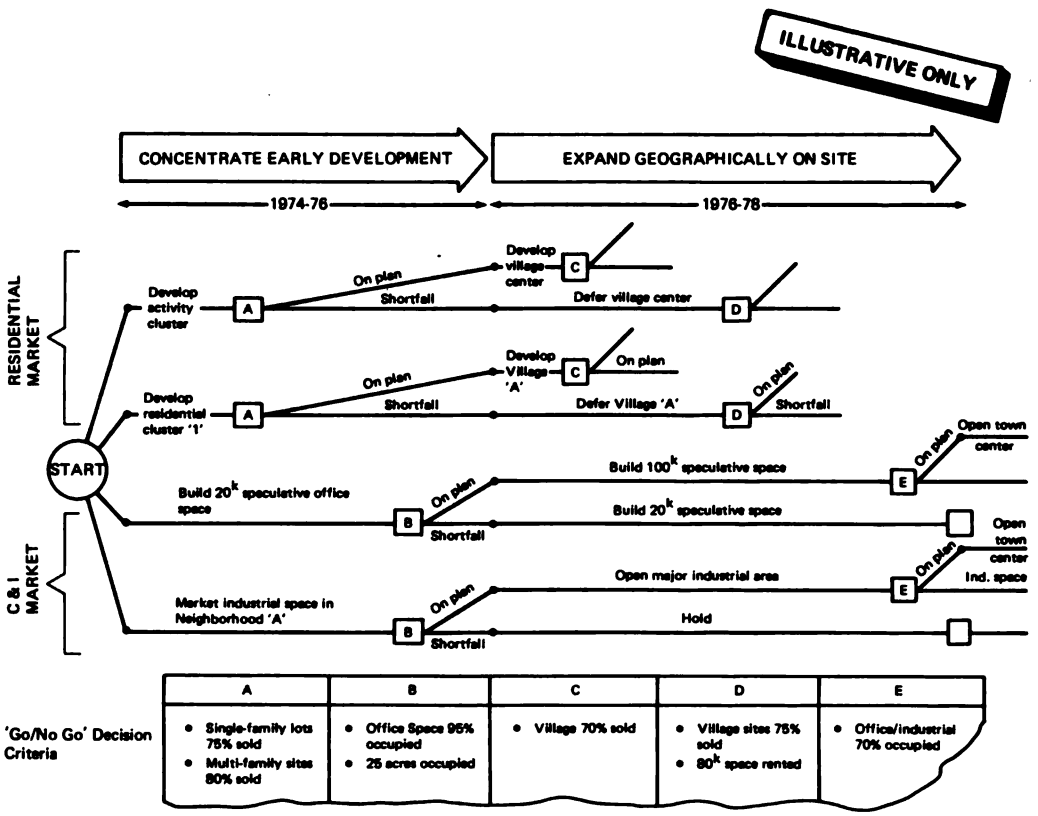

FIGURE 8 The analytic method of commitment planning; strategic "decision map" progressively commits land, financial, and staff resources based on proven success.

analytic method. As in all aspects of this approach, the keys to successful analysis and model building are (a) highlighting the few crucial issues amid the welter of technical ones, (b) aggregating the structure of operational models to ensure consistency with the strategic models, and (c) simplifying the computational techniques and output format to permit rapid and easy access and use.

The focus on results is aided by developing simple models based on desired outcomes and known relationships. These need not be stated as performance or program objectives; both quantitative and qualitative measures such as financial return, production, resident satisfaction, and political acceptability will suffice. The variables are structured according to the hierarchy of desired results in a series of "determinant trees" (Figure 9 illustrates such a tree for the issue of determining housing potential). When there is a need to assess the impact of new constraints or establish new criteria, it is relatively easy with such models to work through the variables, examine previous assumptions, determine which need further analysis or fresh judgments, and specify new limits within which the assumptions can change.

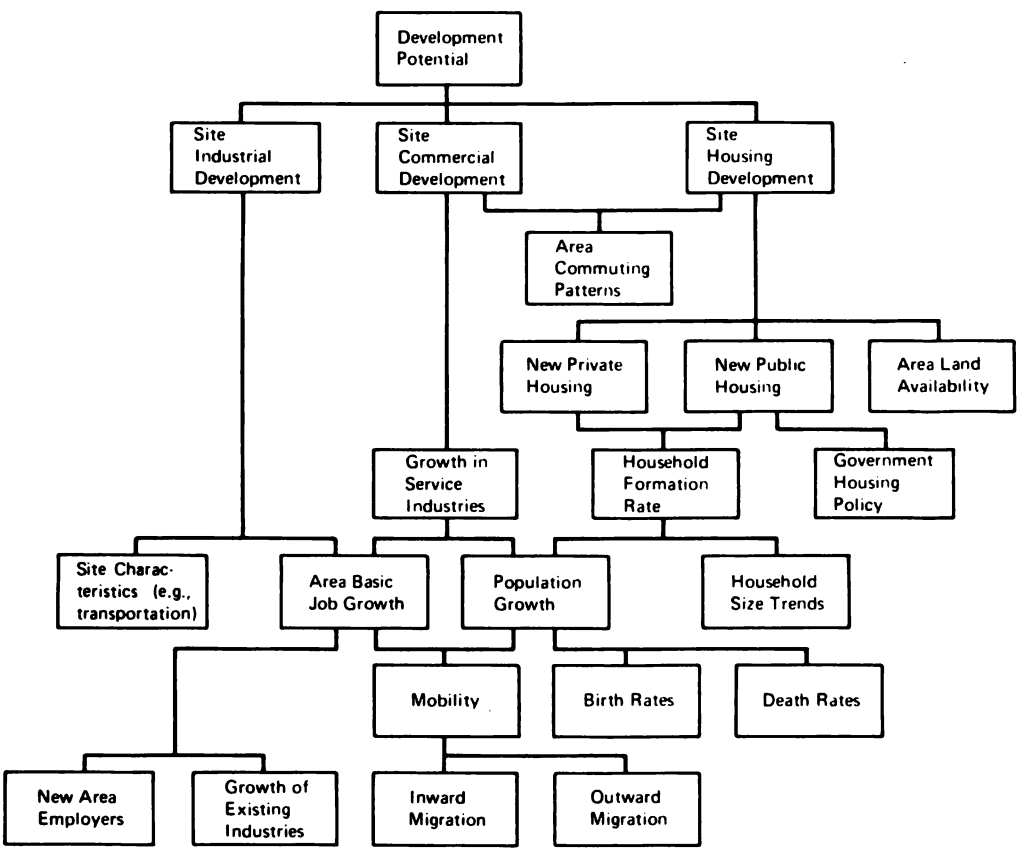

FIGURE 9 Determinant tree for assessing development growth.

CONCLUSION

The framework for community planning and development discussed in this paper is designed for an era of growing uncertainty in which

1. Flexibility must be built into every current decision on development strategies and plans to avoid foreclosing future options
2. Models must be designed to allow frequent and rigorous evaluation of each incremental action and effect, identifying for each step the decisions and actions that will be required, the criteria by which they will be made, and the consequences of each step once taken

These requirements imply that the model builder is wise to start with definable problems and work incrementally, watching constantly for frequent changes both in the perception of "the problem" and in the decision rules governing development actions.

It is also essential that developers and research sponsors impose benefit and operational criteria for selecting and supporting model-building efforts. These might focus on such questions as

1. Does the model, whatever its technical purpose, help to analyze the major decisions that the development organization faces (e.g., financial, land use, phasing, management)?
2. Does the model cover all the important variables that are part of the decision, whether implicitly or by choice?
3. Is the output sufficiently detailed to be useful in decision making (e.g., residential demand by size, type, and price) and yet not so detailed that it requires an enormous amount of new data and analysis?
4. Does the model reduce the time required to make a decision and give the developer greater flexibility without any loss of quality?
5. Can the model builder demonstrate proven success in terms of usefulness and benefit gained from his design, based on experience elsewhere?

Without such criteria, the modeling effort is unlikely to produce the relevant knowledge and results so needed in the development process.

CRITERIA FOR EVALUATING PLANNING AND DEVELOPMENT MODELS

Richard S. Bower

It has been observed that the real jumps in knowledge are made by the fools rather than the scholars. The point is that the scholars are so committed to digesting and respecting each others' analysis that only the fools have the time and tendency to take a chance on new ideas. I am sure I was placed on this program to be one of these fools. Unhappily, two decades of academic involvement have made me too cautious to forsake the literature entirely. And the literature is of some help, even if it does not provide criteria on which all of us can agree.

To begin, we need some definition of a criterion and a model. A criterion, *Webster's Seventh New Collegiate* notes, is a "standard on which a judgment or decision may be based." It is a characteristic that wins applause when we discover it in a model. A model is defined by M. G. Kendall as ". . . a specification of the interrelationships of the parts of a system, in verbal or mathematical terms, sufficiently explicit to enable us to study its behavior under a variety of circumstances and, in particular, to control it and predict its future."[1] A model is a set of descriptive statements that permit us to go from specified input conditions to the forecast of outcomes.

Planning and development models are a subgroup of all models, and models, in turn, are part of our information system. Recognizing this, my discussion of criteria will start with information, move on to models in general, and end with planning and development models.

CRITERIA FOR INFORMATION

Plans for community development always have an element of error because events are uncertain and relationships are unknown.[2] With error goes private and

[1]M. G. Kendall, "Introduction to Model Building and Its Problems," *Mathematical Model Building in Economics and Industry* (New York: Hafner Publishing Co., 1968), p. 1.

[2]In his review article on the theory of information, Jack Hirshleifer writes: "Uncertainty is summarized by the dispersion of individuals' subjective probability (or belief) distributions over possible states of the world. *Information*, for our purposes, consists of events tending to change these probability distributions. . . . it is *changes* in belief distributions--a process, not a condition--that constitute here the essence of information" ("Where Are We in the Theory of Information," *American Economic Review*, May 1973, pp. 31-39).

public loss. The benefit of information, as Theil[3] and others point out, is that it avoids some of this loss by reducing uncertainty and limiting the unknown. The proper criterion for acquiring information, therefore, is that of any investment decision: The discounted present value of losses avoided through time must be greater than the cost if the information is to be worth acquiring. This criterion is conceptually clear, but the characteristics that distinguish information acquisition from other investments make it difficult to implement. The problems involved are important for anyone with an interest in planning and development models.

Recognizing Incremental Benefits

There may be no reduction in losses when a new model totally replaces an old one. This means that as a mutually exclusive alternative to the old way of getting information the new way fails to satisfy the present-value criterion. The problem is that the new and the old should not be considered mutually exclusive alternatives. Salesmen's expectations do not have to give way to predictions produced on a computer by an exponential smoothing model. The old and the new can be used together and can complement one another. Arthur Okun demonstrated this by predicting investment spending with a combination of intentions data and a mathematical model of investment behavior.[4] The important thing to consider is not what the new method can do alone but what it does when combined with the old. The incremental gain from combined use must be compared with the cost of new information if the present-value criterion is to be implemented properly. Doing this is not trivial when the advocates of old and new information approaches are separated by philosophy, training, and vested interest.

Choosing Proper Life for the Information Instrument

Just as a piece of equipment or a plant can be built to last 5, 10, or 20 years or to have possibilities for extension, retooling, or reorientation, so can an information instrument. With an information instrument such as a model, however, the costs and benefits of versatility, longevity, and alterability are even more difficult to determine. The tendency is for the model builder to strive for an instrument that will be versatile, alterable, and have a long life, a monument to his art. But, when ideas and techniques are in a period of rapid change, short-lived, frequently replaced models may offer a sequence of greater value than another sequence involving more durable and costly models. The problem in applying the present-value criterion is to recognize the replacement sequence and to anticipate advances in information technology when deciding how much additional investment should be devoted to increasing the durability of a model.

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[3]Henri Theil, *Applied Economic Forecasting* (Chicago: Rand McNally and Co., 1966), Chap. 2.
[4]Arthur Okun, "The Predictive Value of Surveys of Business Intentions," *American Economic Review*, May 1962, pp. 218-225.

Accounting for the Contributions of Failures

In any research process the latest useful discovery will be the result of earlier failures as well as earlier successes. There is no point in investing in information simply to put it aside as useless. But there can be present-value justification in following a path that is expected to produce some failures on its way to a useful model. Applying the present-value criterion to the development sequence is not easy, but if it is not done, then underinvestment in failure will become more of a problem than overinvestment in durability.

Dealing with the Freeloader Problem

Information can be owned and sold only imperfectly. As a result, the discoverer of new information or the developer of a better model may not have all the benefits from his work summed up in his own future income stream. In applying the present-value criterion from a social point of view, unappropriated side benefits must be counted in. Recognizing them and designing institutions that help the innovator to capture them and so to have the incentive to invest optimally in information is a major problem of public policy.

Distributing New Information

Giving the developer complete control of new information has its problems, too. If he limits distribution of the information or charges a fee for it in excess of the cost of duplicating it and passing it on, then some uses of the information that meet the present-value criterion are discouraged. We want better models developed, and we need incentives to accomplish that. We also want the widest possible use of these models once they are developed, and we need to avoid barriers that prevent this. The conflict is evident, and it is a substantial problem in applying the present-value criterion to investment information.

CRITERIA FOR MODELS

The present-value criterion is satisfied when users save more with a model than they sacrifice in its operation and development. Just what the chances are that this basic criterion will be satisfied depends on the setting in which the model is used and on the quality of the model. There are some criteria for the quality of a model in the literature, and they offer some help when it comes to estimating the chances of successful application.

All models seem to develop through specification, estimation, validation, and application. Specification involves theory, imagination, and a practical eye for essential elements. It is the step in which key variables are identified, causes and effects are indicated, and the whole system of interrelationships is set down in a sufficiently explicit form. Estimation is the process of putting numerical values on coefficients in the specified relationships. This step is often one of fitting values by statistical methods, but it also can be accomplished or aided by asking for the judgment of experts on these

values. Validation is the step in which specification and estimation are tested against actual experience. It is in this step that one tries to find out whether the model does a good job of predicting outcomes and how accurately it represents the real world that it claims to describe. Application is the last step and the objective of the model-building process; however, it often provides the motive for another round of specification, estimation, and validation. In application, the model is put to use in planning or policy making.

The descriptive models that are the work of econometricians and that have come to prominence in macroeconomic forecasting usually are screened against criteria that deal with estimation and validation. The normative models that come out of work in operations research and industrial dynamics are reflections of criteria that emphasize specification and application. For a chance of real success, however, a model must meet both sets of criteria.

Criteria for descriptive models are suggested by Zellner, Shapiro, Theil, and Dhrymes and Associates.[5] The first criterion is *logical consistency*. The equations in the model should be consistent. They should have appropriate units of measurement. They should have a unique solution. In short, the model should present an explicit system defined so that outcomes can be traced from input conditions in an unambiguous, testable manner.

The second criterion is *theoretical acceptability*. The logic of the model not only has to be consistent but also must fit into some larger body of theory that has been developed. People and firms in the model should have specified behavior that is explained by basic theories of psychology, sociology, or economics. A model of the national economy, for example, should not be a set of ad hoc relationships that "work" but should have its origin in the established principles of macroeconomic theory.

The third criterion is *statistical measurability*. There should be available a body of objective historical data from which the coefficients of the model can be estimated. The data and model should lend themselves to use with a well-defined statistical methodology. The emphasis is on estimation that is so systematic that anyone fitting coefficients for the model can replicate the results of the originator.

The final criterion for descriptive models, and perhaps the most important, is *empirical validity*. Forecasts with the model must check out against actual data that were not used in estimating coefficients for the model. There must be objective evidence in repeated runs that the model produces the outcomes it is supposed to and that those outcomes are consistent with the behavior of the real system. Putting these four criteria together suggests quite properly that for econometricians who build descriptive models, the primary concern is statistical test, not policy use.

For people in operations research and industrial dynamics, it is policy use that takes precedence. John Little[6] provides a good list of their criteria,

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[5]Arnold Zellner, *The Care and Feeding of Econometric Models*, University of Chicago Selected Papers No. 35 (Chicago: University of Chicago Press, 1970); Harold T. Shapiro, "Is Verification Possible? The Evaluation of Large Econometric Models," *American Journal of Agricultural Economics*, May 1973, pp. 250-258; Theil, *Applied Economic Forecasting*; and Phoebus J. Dhrymes *et al.*, "Criteria for Evaluation of Econometric Models," *Annals of Economic and Social Measurement*, July 1973, pp. 291-324.

[6]John Little, "Models and Managers: The Concept of a Decision Calculus," *Management Science*, April 1970, pp. B466-B484.

and all of them emphasize appeal to and acceptance by policy makers. The model should be *simple* to understand. It should leave out unimportant phenomena and should avoid unnecessary detail. It should be *robust* or safe in the sense that it will be difficult to force the model into bad answers. This is particularly important for acceptance because, as any practicing model builder can testify, one foolish model outcome exposed to user intuition cancels out a very large number of reasonable results. The model should be *easy to control*. The policy maker should be able to make the model behave as he wants it to. It should complement his thinking, not substitute for it, share his values, use his subjective estimates, and, basically, leave the decision to him. It is not a replacement for the policy maker, it is an aid; if it differs with him and he cannot control it, then it is the model not the policy maker that will go. The model should be *adaptive*, capable of revision in both coefficients and structure when new information becomes available. It should be believable. Outcomes from the model should be as expected, or variations from the expected should have a very clear explanation that can be developed in the context of the model. Finally, the model should be *easy to communicate with*, and the medium should fit the user. An on-line television-type computer terminal may distinguish a policy maker as an innovator who takes advantage of the latest technology or may mark him as a man who has given part of his power to a "machine." The interface has to make communication easy, but it has to be chosen so that it will permit communication to take place. These six criteria, quite different from the four noted earlier, emphasize that for some groups of model builders it is use, not statistical test, that matters.

Those of us who want to see formal models make a real contribution to community planning cannot afford to ignore either the econometrician's or the operations researcher's criteria. If we ignore the econometrician's, then we may find models implemented a little sooner, but we also are going to find disillusioned users discouraged by the erratic performance of their statistically untested tools. If we disregard the operations researcher's, then we will find ourselves selling the finest of products but without any buyers to try them. Clearly, we want users and we do not want to disillusion them. This means considering all these general criteria for model quality and some specific criteria for community planning models as well.

CRITERIA FOR COMMUNITY PLANNING MODELS

I have borrowed from capital budgeting in describing present value as the basic screening criterion for an investment in innovation, and I have searched the literature to find ten criteria to judge the quality of models. When it comes to the specific criteria for community planning models, however, I am forced to my own peculiar prejudices and my limited experience.

My first criterion is a warning: *Don't make it global.* Kendall tells us to ". . . curb an ambition which tempts us to build models of too great a generality . . . start with simple and modest models, and work towards the more complicated systems by integration, rather than start with attempts at comprehensive models."[7] I agree with Kendall. What we do not need are grand failures,

[7]Kendall, "Introduction to Model Building," p. 2.

shelved and left out of any sequence of discovery and improvement. What we do need are small blocks that have descriptive validity and normative usability.

As a second criterion, my suggestion is that community planning models should *go beyond accounting and beyond production relationships*. Not really a contradiction of the first point, this is a plea for some models that do not just produce the accounting record, *ex post facto* or *pro forma*, but that go on to build explicit descriptions that may feed into financial statement generators. Models that reflect the technical requirements and art of community construction are in use and do generate spending requirements and test financial plans. The models of buyer behavior that recognize inventory feedbacks, advertising effects, and price elasticities are mostly in decision makers' minds. The former are helpful, but the incremental benefits from combining them with the latter seem so large to me that it is a violation of the basic present-value criterion not to go forward with the combination.

My third criterion calls for inclusion of *government and the constituencies that affect government in the model*. In some nations a normative decision on a land-use plan can be made by some government official or commission and it will be executed. In this country, the execution is where the ultimate plan develops. Models for community planning and development that ignore the various levels of local government, environmentalists, or other interest groups are dangerously incomplete and can have a negative value. By ignoring important contributors to the process, they produce unpleasant constraints and obstruction as their natural but unanticipated feedback.

My final criterion comes out of some experience I have had in studying development in Wilmington, Vermont. The model should include *the differential effects on the micro-units involved*. Community planning and development will always affect some units adversely. In urban development the displaced may have only poorer alternatives to turn to. In rural second-home development, land owners may benefit and the poor who own no property may see their job alternatives reduced and their asset holdings unchanged. Aggregative models may disguise this and sweep under the rug crucial questions of interunit comparison that should be central to decision making.

CONCLUSION

I have provided a basic criterion for information, some general criteria for models, and a few pet prejudices for community planning and development models. What you will provide is a start on better models that are probably destined to show the inadequacy of my criteria.

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GROWTH PERSPECTIVES FOR THE 1980s

Robert G. Ducharme

As we focus on perspectives for community growth in the 1980s, one of the major factors to be considered is a substantially changed national context in which local community growth is likely to occur. The outlines of this new national context are already evident, and, in fact, we can see some of the impact at the local level. Generally, the new context involves a slowing down in the rate of population growth across the nation and changes in the geographic patterns of population growth, especially within metropolitan areas. I will focus on three aspects of the new growth context and trace some of their major growth implications: (a) a lower national population growth rate, (b) a new environmental-conservation ethic, and (c) an energy squeeze.

LOWER POPULATION GROWTH RATE

A declining national population growth rate has been evident for some time. During the 1960s the U.S. population increased by 13.3 percent--the smallest percentage gain in any decade in U.S. history except the 1930s. The latest census figures show that the population growth rate has continued to decline in the 1970s and has now dropped below 1 percent per year. A major factor behind this trend is the dramatic drop in the birth rate. The pill and other birth control devices have given American women virtually complete control over the number of children they produce, and the result has been a substantial decrease in the national birth rate. From 1960 to 1972 the total fertility rate (the total number of children born per 100 women) dropped more than 44 percent from 365 to 203. The 1972 figure is below the replacement (or zero growth) rate of 211 and represents the lowest level on record for the United States. The latest evidence indicates that the rate is still falling. Demographers tell us that the full effects of low fertility rates are not fully felt for several decades so that, if a zero growth fertility rate were to continue, the national population growth rate would not decline to zero until about the year 2040. Nevertheless, we are already feeling some of the impact.

The U.S. Census Bureau has taken these trends into account and in 1972 reduced its high U.S. population estimate for the year 2000 to 296 million, 80 million less than the previous high estimate. Of the four most recent estimates prepared by the Census Bureau, three assume a fertility rate higher than the actual U.S. experience in 1972 and 1973; therefore, even these new lower estimates are likely to be too high.

These national trends will have obvious repercussions at the local community level. Basically, they will translate themselves into reduced growth pressures all over the country, and, as a matter of fact, they already have. The growth rate for metropolitan areas as a group was one-third less in the 1960s than in the 1950s, and the trend was pervasive. Of the 100 largest Standard Metropolitan Statistical Areas only 7 had a higher population growth rate in the 1960s than in the 1950s, and we can look ahead to further reductions in local growth rates in the 1970s and 1980s as the national rate continues to decline.

To adjust for these trends in the Chicago area, the Northeastern Illinois Planning Commission's population estimate for 1995 has been reduced by 1.2 million. The growth rate in the Chicago suburbs in the 1960s was only half of what it was in the 1950s, and we expect a further substantial slackening in the 1970s and 1980s as must most metropolitan areas.

NEW ENVIRONMENTAL-CONSERVATION ETHIC

The second aspect of the new national growth context is the changing public attitude toward the physical environment. The growing emphasis on improving and protecting the environment is leading to a new attitude toward growth. One contributor in a recent issue of a city managers publication noted that relatively recently growth was an unchallenged goal of local governments but that now it has become a very controversial topic at the local level (and, one could add, at the state level, too). In fact, a new environmental-conservation ethic is emerging that challenges the long-held notion that any and all growth is good and in which the broader social and environmental aspects of growth will be given more consideration and the public benefits of growth will be scrutinized more carefully. I am among those who believe that this trend is irreversible. I see it as part of the early stages of what economist Kenneth Boulding describes as "spaceship economy," in which resources are conserved and preserved and everything is recycled.

While the world may be a long way from this nirvana, the new environmental ethic already is having an impact on community growth. I see this influence increasing during the 1970s and 1980s as we learn how better to reconcile our new environmental concerns with our economic interests. Let us now consider some of these implications. The most obvious result from the standpoint of population growth is that the direct money cost of new developments will increase. More money will have to be spent on protecting the air, land, and water through better air- and water-pollution control, through better drainage and erosion control, through the protection of plant and animal life, and so on. Part of this increased cost will fall on the developer and be passed along to the buyer or renter of the property in the form of higher purchase prices and rents. Another part will be carried by the taxpayer as a result of federal and state grants and other financial incentives for air- and water-pollution control facilities and other environmental protection. New governmental involvements will inevitably create more bureaucracy and longer delays and lead times in development decisions and add further to the cost of growth.

Increasing the cost of new residential, commercial, and industrial developments will price some would-be buyers or renters out of the market and thereby reduce growth pressures. In addition, higher development costs will tend to change the calculus of investment decisions in favor of already developed areas and reduce growth prospects and pressures in newly developing areas.

THE ENERGY SQUEEZE

The third major aspect of the new growth context in the 1970s and 1980s is the changing energy picture. The energy problem has been surrounded by a great deal of uncertainty and conflicting testimony, but the consensus that seems to be emerging is that the energy shortage is here to stay and that energy costs will continue to increase. The basic fact is that our energy needs have outrun our ability to meet these needs from domestic petroleum supplies. With 6 percent of the world's population, the United States uses 35 percent of the energy. On a per capita basis we use twice as much energy as the West Germans even through our standards of living are very similar. In recent years total energy consumption in the United States has been increasing at the rate of approximately 4 percent per year--a factor that will double our energy needs in 18 years.

It is declared national policy that we move to solve our energy problems by making the United States self-sufficient in energy. Under the name "Project Independence" goals have been established to make the nation completely independent of foreign sources of energy by the end of the decade. This is intended to free us from the threat of disruption of oil imports and from sharp price increases for oil from abroad.

In a report evaluating the state of the U.S. economy under conditions of self-sufficiency in energy, a team of Massachusetts Institute of Technology professors has concluded that self-sufficiency might not be the wisest policy. To quote from the conclusions of their report:

> . . . prices of $10.00 to $12.00 per barrel (oil equivalent) will be necessary to bring forth enough additional supplies of fossil fuels to satisfy demands in domestic energy markets by that time [1980]. This means that . . . there would have to be yet another round of price increases for consumers as great as that experienced in 1973-74.
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> In short self-sufficiency as a form of "insurance" against disruption or price increases will be purchased at a very high cost. The curtailment of imports acts to replace a temporary embargo, or the threat of a temporary embargo, with a permanent embargo that increases prices beyond present levels.[1]

There are, according to the MIT group, cheaper ways of dealing with the problem. But, self-sufficiency or not, all of the alternatives point in the direction of higher energy costs. How will these higher costs work themselves out in terms of future population growth? The answer can be presented mainly in terms of the spatial distribution of population, especially within metropolitan areas.

Since the early 1900s decentralization has been a dominant feature of our national demographic and economic life. Population and economic activities have become more evenly distributed geographically as the western and southern parts of the country have grown more rapidly.

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[1] Policy Group Study, MIT Energy Laboratory, "Energy Self Sufficiency: An Economic Evaluation," *Technological Review*, May 1975.

Decentralization (or, more popularly, suburbanization) within metropolitan areas has been equally dramatic. The suburbanization picture is familiar to everyone, and I will cite only a few statistics to give the picture in broad outline. In the 20 years between 1950 and 1970 the suburbs grew by 35 million people, accounting for about two-thirds the total U.S. population growth during the period. Over the same period, the suburban share of metropolitan population increased from 43 percent to 55 percent, while the share of the central cities declined from 57 percent to 45 percent.

The spatial structure of metropolitan economies also has changed dramatically. The suburban share of economic activities in metropolitan areas has been growing steadily, and when measured by employment, they now have more than 50 percent of the manufacturing industry, 50 percent of the retail industry, 40 percent of the wholesale industry, and more than 30 percent of the selected services industry.

The development of the motor vehicle has been a major factor in these decentralization trends. The automobile freed the urban dweller from his ties to urban transit systems and his place of work and broadened his choice of job and housing immensely. Similarly, the truck freed the producer from his ties to the railroad and the waterfront and gave him a much wider range of locational choices.

The urban development pattern that has emerged is one of declining densities, with housing, shopping, and industries spread out over large areas of land. Travel requirements have increased rapidly because of the need for longer and more frequent trips. The spread pattern has undermined public transportation systems and led to near total dependence upon the private automobile. Plentiful, cheap energy, especially for transportation, has been one of the major factors underpinning the low-density spread pattern of growth and development in evidence during the past several decades.

In a recent study on regional energy consumption the New York Regional Plan Association pointed out the crucial relationships between urban density patterns and energy requirements. Energy consumption estimates were made for four major sectors, including residential, commercial, and public facilities, industry, and transportation. Overall per capita energy consumption in 1970 was about 30 percent lower in New York City than in the balance of the 31-county region. Per capita consumption was lower in New York City in all four sectors, with the largest differences in the industrial and transportation sectors. The differences in the industrial sector are attributed to differences in industrial structure. Differences in the transportation sector can largely be explained by differences in the density of development. The high-density pattern in New York City generates fewer and shorter trips, and more travel can be handled on the more energy-efficient public transportation system. Using an overall measure of consumption per dollar of income, annual energy needs for transportation range from a low of 9,000 Btu in Manhattan to about 30,000 Btu at the outer edges of the region.[2] Anthony Downs has traced some of the implications of higher energy costs on future urban development

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[2] New York Regional Plan Association, *Regional Energy Consumption* (New York: NYRPA, 1974).

in a recent article.[3] Increasing the cost of auto and truck travel through higher fuel costs will make people more distance-conscious and help retard the decentralization of population and economic activities in metropolitan areas. Every driver will have an incentive to reduce travel whenever possible by cutting back on the number and length of trips. The pressures to economize will obviously be greatest on those people who have to drive the most.

How strong this incentive might be can be assessed by calculating the potential savings involved. During the recent energy crisis the price of gasoline increased about 50 percent from $0.40 to $0.60, thus adding about $0.018 cents per mile to travel costs (assuming 12 miles per gallon) and increasing the average commuter's cost by about $9.00 per mile per year. On this basis the potential savings would be on the order of $18 per year for every mile a commuter could live closer to his job. If gas prices go up another 50 percent to $0.90 per gallon, the potential savings per mile would increase to $48 per year.

The greater the potential savings, the greater would be the incentive for commuters to move closer to their jobs; however, we must be careful not to overstate the potentialities. Even large increases in the price of fuel are not likely to produce dramatic shifts in American driving and living habits. Public preference for private autos and trucks and decentralized low-density residential, commercial, and industrial development will continue to dominate the urban scene, assuring future suburban growth. Nevertheless, higher fuel costs will act as a constraining influence on future decentralization trends by creating an incentive to reduce the amount of travel.

The greatest impact would be on the less affluent exurbanites living on the urban fringes who are completely dependent upon the automobile for commuting, shopping, and the like. Long-distance commuters in these areas would be under increasing pressure to form car pools, buy smaller cars, take an apartment closer to work and commute home on weekends, or move their families closer to their jobs. With poorer access to economic, social, and cultural activities, the cost of living in these areas will be higher and their attractiveness will be lower relative to other parts of the metropolitan area. In short, property values and growth pressures will decline.

The new town concept may well be one of the major casualties of the energy pinch, especially those new communities located on the urban fringe with poor access to major job centers, shopping, and other amenities. Some of the new communities already have serious financial problems, and others have fallen below their original growth expectations. If a more energy-conscious public turns against living on the urban fringe, the market potential for residential, commercial, and industrial development in new communities would be seriously undermined, causing many of them to fail. The parts of metropolitan areas that stand to benefit most from a persistent energy shortage and higher energy prices are the central cities and close-in suburbs, especially those with good public transportation systems and no serious problems of crime and vandalism.

Some people view the energy crisis as the key to rejuvenating our central cities and stemming the outward movement of industries and middle-income families because of the lower per capita energy needs and costs associated with

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[3]Anthony Downs, "The Impact of the Energy Crisis upon Future Urban Development," *Real Estate Report*, Winter 1974.

higher densities. Whether or not this is the case, the tighter energy situation seems certain to change the calculus of investment decisions in favor of central cities and other more densely developed parts of our metropolitan areas where per capita energy needs are lower. New investment opportunities for residential, commercial, and industrial development should be improved; property values should increase; and, in general, the prospects for growth and development should be enhanced.

CONCLUSIONS

In summary then, my perspectives for population growth in the 1980s include

1. A continued decline in the national population growth rate and a reduction in growth pressures across the country.
2. Growth rates further moderated by the higher cost of new residential, commercial, and other developments due to higher standards for environmental protection.
3. Persistent energy shortages and higher energy costs, which will moderate the forces of decentralization and suburbanization and thereby improve the growth prospects of central cities and close-in suburbs and reduce growth rates in the farther-out suburbs; a more compact and tightly structured urban development pattern will emerge.

The perspectives I have outlined underscore the basic purpose of this seminar, which is to improve the decision-making capabilities of people involved in the community development process. This process has been characterized as a high-risk venture, and it probably will be even riskier in the changed growth environment that I have described. The metropolitan growth pies will be smaller, the competition will be tougher, and it will be more of a buyers' market. In these circumstances developers will need all the help they can get from models and other management tools at every stage in the development process and most especially in the initial stages when the basic economic feasibility of projects is determined.

PERSPECTIVES FOR COMMUNITY DEVELOPMENT

Paul Buckhurst

Much of the discussion at this seminar has centered on the difficulty of accurately forecasting our future needs in terms of land development policies and programs. This, of course, is not a new problem; however, despite the considerable interest in developing new and more sophisticated predictive techniques, we often find ourselves in the position of having to forecast events in some detail for time periods of 15 to 20 years. Unfortunately, it is not known--with any degree of confidence--what events will occur (most of which are usually outside the control of the planning effort) that may significantly affect the future. Such things as trends in population growth and migration and changes in life-styles and income affecting demand for services and in market conditions affecting industrial production cannot be forecast accurately. As a result, the descriptions of the future used as a basis for planning are invariably very different from the future that actually occurs.

This problem is aggravated by the frequent absence of relevant data to take advantage of what predictive techniques exist--inadequate as these might be. Uncertainty of future trends can be limited, to a certain extent, if emphasis is placed on improving

1. Predictive and forecasting methods so that a more accurate picture of the future we are planning can be obtained
2. Urban models so that the consequences of alternative actions proposed in planning can be better understood
3. The planning process itself so that more realistic and "robust" plans can be prepared

It is this last point that I want to refer to in detail, with particular reference to the new communities program in both the United Kingdom and the United States. Before doing so, I think that it is worthwhile to look briefly at some aspects of the earlier efforts undertaken in the British new towns program.

The earliest new towns (known somewhat mysteriously as Mark I) were all started between 1946 and 1950; they had a target population of 60,000 people and it was generally agreed that there need be no provision for further increase. They were designed as self-contained towns where work opportunities were provided for all residents. Considerable emphasis was placed on the clear separation of different land uses, and a similar rigidity was applied to the social structuring of the town with a clear hierarchy established of

neighborhoods, districts, and the town itself. A further characteristic of these early new towns was the great reliance placed on public transport and the low private-car-ownership level predicted for future residents; it was thought that there would not be more than one car to about ten people.

Of course, none of these early ideas or objectives was fulfilled, and all of the Mark I town plans have undergone extensive change and adaptation in order to try to adjust to new demands and conditions. First, most of the earlier towns are undergoing major expansion (e.g., Harlow is currently being expanded from a projected 80,000 population to 124,000). Second, a large percentage of residents commute to jobs away from the new towns (especially those in the new towns around London). Third, revisions of the earlier plans now include a greater dispersal of varying land uses, particularly in terms of employment areas. And fourth, earlier transportation networks are being extensively revised to try to adapt to the greater reliance on private-car usage.

The lessons learned from these earlier experiences have not been entirely lost on us despite a seeming unwillingness to learn systematically from such a unique program. By the 1960s a series of regional studies had been conducted by the British government and from these a new series of much larger new towns (or cities) were designated (now called Mark III). These later plans are characterized by an emphasis on open-endedness and on the need to avoid having to fix an upper limit on population. More emphasis also is placed on the dispersal of employment sites and social facilities with access to various land uses planned for both private car and public transport. A good example of this sort of program can be seen at Milton Keynes.

THE PLANNING OF MILTON KEYNES

In 1966 work began on the planning of Milton Keynes, a city designed to hold a population of some 250,000 people, located between London and Birmingham. A major objective of the plan was to develop a set of proposals in which certain fixed elements of the plan were designed to allow for the greatest possible freedom and change while the city was being built. Here is an example of a major effort being made to plan for flexibility. I want to explore how successful this particular goal has been, based on the first 4 years of implementation.

The plan is based on a grid of arterial roads spaced at 1-kilometer intervals and was designed to respond to a dispersed pattern of land uses that would give a relatively even flow of traffic throughout the new city site. Major activity centers also are dispersed evenly across the site, and a series of "opportunity sites" were identified as locations for local neighborhood centers. Public transport routes also are evenly distributed throughout the city. Another aspect of the plan is the designation of a number of reserve sites for which specific uses can be identified as need and market dictate at a later date. These, then, are some of the characteristics of the plan, which already has been subjected to a number of significant changes in land use and layout. Some examples of such changes are that:

1. A significant shift has occurred in the nature and location of employment sites. Originally, about 2,000 acres (out of a total of 22,000 acres) were allotted for light industrial uses. The latest projections suggest that only three-quarters of that area will be required, because of a substantial

increase in office employment at Milton Keynes. Original projections for office needs failed to predict the marketing advantages offered by the new city in comparison to central London (in terms of rental costs and amenities), and this has resulted in a significant saving of land due to the higher workers-per-acre density characteristic of office development.

2. The rate of buildup in terms of increased population is considerably slower than originally predicted. The recent enormous increase in building costs and the shortage of available financing has resulted in a significant slow-down of housing starts; probably this will mean that there will be some lengthening of total development period (originally 20 years).

3. Present predictions of school needs suggest that only two-thirds of the number of school sites originally predicted will be required, due to changes in the size of families expected to live in Milton Keynes.

4. A similar decrease in the number of local neighborhood centers also is very likely. For this case the initial assumptions concerning the need for local shops and services have had to be revised.

5. The final major shift concerns the likely change in the scale of the city center. The original proposals already look too modest as a result of the extraordinary interest being shown by commercial land developers. Commercial office development and new government proposals aimed at decentralization of some offices from central London have spearheaded the present interest in the city center.

These five shifts appear to be the significant changes from the plan presented some 5 years ago. Only one would appear to be incompatible with the original set of proposals, and that concerns the change in the scale of the proposed city center. It is likely that the increase in scale of commercial uses, in the jobs generated, and in traffic use and volume will result in some change in the design of the road grid, at least in the area around the city center. Given the original goal of wishing to distribute jobs and activities throughout the city, it would seem that this particular trend marks a significant change to the original concept of Milton Keynes.

I have tried to show some of the changes that have occurred in the recent planning work being undertaken in the new towns program in the United Kingdom. I want to conclude this talk by briefly examining the ways in which this problem of planning for flexibility can, to some extent, be met when one is dealing with long-term plans.

LONG-TERM PLANS

We are being increasingly made aware of the inadvisability of spending too much time and effort on the production of overdetailed long-term plans. Instead, we must seek ways to provide for plans and programs that clearly attempt to address the issues of flexibility and realism.

I believe that the first thing we should do is abandon the traditional "master plan" altogether (a good example of the sort of master plan I am referring to is that requested as part of the Title VII program requirements for detailed proposals for 15- or even 20-year development periods). We should instead be placing more emphasis on shorter-term plans and on plans that emphasize known commitments and needs at the expense of elements obviously subject to considerable change.

A first example is what might be called *framework plans*. These are likely to be a number of elements or programs that can be identified as firm commitments and that together will act as a framework for other less firm proposals. Examples of such "structuring" elements could include decisions on the location of industrial sites, the safeguarding of reserve sites where there is great uncertainty about future uses, decisions on the presentation of significant open space areas, the location of a major center, and the siting of the initial development phase. It should be possible to predict the needs for such elements over the first few years' development and to design for them with some degree of assurance that they will not be subject to significant change.

A second idea involves the use of *alternative plans* with no specific commitments to one set of proposals but rather to a series of long-term plans that would reflect a variety of different conditions or policies. An ongoing study for a new city outside Toronto, for example, is examining proposals that will result in two basic alternative long-term plans--one that assumes the development of a new airport site nearby and one that assumes that no such development will take place. Within each of these major alternatives a number of other variables will be tested (e.g., alternative assumptions on absorption rates of different land-use elements, on varying locations for regional highways and transit facilities, on the degree of control to be exercised on adjoining property). In such cases it is likely--and even desirable--that no firm preferences be determined, and the temptation of recommending one single set of proposals must therefore be resisted.

This leads us to a third thought: Long-term plans must be *flexible plans* in order to allow for change during implementation. The design and distribution of land uses and major facilities should be responsive to changing market conditions and to other future needs that can be determined only during the later stages of development. This could mean that considerable choice can be permitted in locations for different land uses, that transportation networks should be designed to respond to different traffic generation patterns resulting from changes in residential densities or employment locations, and that reserve sites could be established for subsequent land uses that would be identified at a later date.

A fourth and final point places emphasis on first-phase or *initial-action plans*. In my view much more emphasis should be placed on the early examination of initial development needs, at least in conjunction with, if not prior to, the work on developing the long-term plan. An early and determined look at initial commitments and agreed policies for, for example, the first 3- or 4-year development period will give the overall plan a realistic and firm framework with which to guide less committed policies and decisions. In addition, early emphasis on detailed and realistic proposals prepared for the short-term future may help to counter a feeling that flexible plans, alternative plans, framework plans, and the like, have merely been invented by planners who, in preparing detailed master plans, have been proved wrong too often and too emphatically for comfort.

APPENDIX A

BIOGRAPHICAL DATA ON SEMINAR PARTICIPANTS

AGPAR, ANNE N. Consultant, Llewelyn-Davies, Weeks, Forestier-Walker and Bor Associates (Town Planners), London, England (1971-present). Specializes in market analysis to assess commercial and residential development potential, national and local government housing policy and program analysis, and economic evaluation of the environmental impact of transport. Formerly member of the evaluation staff of the New York Model Cities Administration, residential development project analyst for The Rouse Company, and member of the economics faculty at Wellesley College. Received M.Sc. from the London School of Economics and Political Science.

APGAR, MAHLON, IV. Principal, McKinsey and Company, London, England. Responsible for new community planning, development, and management. Has advised the House of Commons Expenditure Committee on the planning and management of the U.K. new towns program and, at the request of the U.S. League of New Community Developers, the British New Towns Association, and the French Groupe Central des Villes Nouvelles, organized a symposium on international new towns policy and development programs. Formerly assistant to James Rouse and real estate analyst for the Columbia project, visiting lecturer on city and regional planning at Harvard University, and research associate with the Harvard Program on Technology in Society. Social science research scholar, Oxford University; received M.B.A. from the Harvard Business School.

BAGBY, GORDON. Operations Research Analyst and Chief of Master Planning and Systems Building Branch, Department of the Army, Construction Engineering Research Laboratory, Champaign, Illinois. Possesses extensive experience in urban planning, zoning regulations, and community development. Currently developing least-cost methods for allocating land to various uses based on initial construction costs plus costs of providing roads and utilities. Also working on procedures for use in determining most cost-effective initial quality of construction using life-cycle cost considerations. Received Ph.D. in economics and urban planning from Harvard University.

BOWER, RICHARD S. Professor of Business Economics, Amos Tuck School of Business Administration, Dartmouth College, Hanover, New Hampshire (1962-present). Formerly assistant professor of economics and business administration at Vanderbilt University, instructor of economics and business at Alfred University, instructor of economics at Kenyon College. Serves on the editorial boards of the *Journal of Financial and Quantitative Analysis*, *Journal of Bank Research*, and *Journal of Business Research*. Member of the Vermont Council of Economic Advisors; director of the

Manchester Management Corporation; consultant to Chase Manhattan Bank, the Boston Financial Technology Group, the American Stock Exchange, and the Department of Justice; vice chairman of the Science Advisory Group to the New England River Basins Commission-Connecticut River Basin Program; vice president of the program of the Financial Management Association. Received M.B.A. from Columbia University and Ph.D. from Cornell University.

BROTCHIE, JOHN FREDERICK. Head, Systems Research Section, and Principal Research Scientist, Division of Building Research, Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia. Work has involved systems studies; computer-aided design; development of decision models for planning, design, and policy making; application of systems techniques in decision making at various levels from national development planning to building design. Formerly engineer-in-charge of the Structural Design Office, Commonwealth Department of Works (Australia); research assistant at the University of California, visiting associate professor in the Department of Civil Engineering, Massachusetts Institute of Technology; and lecturer at Melbourne University. Received D.Eng. from the University of California.

BUCKHURST, PAUL. Partner, Llewelyn-Davies Associates, New York, New York (1968-present), and faculty member, Department of City and Regional Planning, Pratt Institute. Formerly project leader for study on poverty and transportation in Nassau County, New York; director of a revitalization study for the Southside Neighborhood, Racine, Wisconsin; director of consulting planning teams on new communities in a number of U.S. cities; involved in detailed planning of a residential development in Glasgow, Scotland; project director for a recreation center development scheme, Oxford University; senior planner, third London airport urbanization studies; taught at Canterbury School of Architecture. Received M.Arch. from Harvard University and diploma in town planning from Regent Street Polytechnic.

CHASE, WILLIAM W. Project Director and Program Officer, Division of Technology and Environmental Education, Office of Education, Department of Health, Education, and Welfare, Washington, D.C. Responsible for providing leadership in the planning and development of educational facilities and working closely with educational planners at all levels. Formerly consultant in education facilities planning at Ohio University; director of the Division of Schoolhouse Planning, State of Indiana; professional lecturer in educational program and facility planning at George Washington University, University of Colorado, and Ohio University. Received Ph.D. in educational administration from Indiana University.

CRECINE, JOHN P. Professor, Department of Political Science and Sociology, University of Michigan, Ann Arbor, and President, B.P.T. Inc., Consulting Firm. Formerly fellow at the Center for Advanced Study in the Behavioral Sciences; economist with the Rand Corporation; director of the Institute of Public Policy Studies; consultant to the U.S. Bureau of the Budget; and economist with the U.S. Department of Commerce. Received M.S. and Ph.D. in industrial administration from Carnegie-Mellon University.

DEMERS, JOAN F. Social Development Officer, New Town Development Corporation, Washington, England (1965-present). Work involves community development, research and statistics, press and publicity, and the arts and information services. Formerly worked with Youth Employment and Housing Department of the London County Council, did community work combined with sociological

studies with the Midlands Local Authority Housing, and conducted geriatric research with the Nuffield Foundation covering the counties and city boroughs of Nottingham and Leicester. Trained in socal science at the London School of Economics, University of London.

DICKEY, JOHN W. Associate Professor and Director of the Center for Urban and Regional Studies, Virginia Polytechnic Institute and State University, Blacksburg. Work focuses on transportation planning, urban systems methodology, land-use modeling, land-use allocation in urban areas, interactive processes between planners and decision makers, implementation strategies and urban performance indicators. Received Ph.D. in civil engineering (transportation) from Northwestern University.

DUCHARME, ROBERT G. Consulting Executive Director, Northeastern Illinois Planning Commission, Chicago. Formerly held various posts with the City of Milwaukee, including planning coordinator in the mayor's office and chief planning analyst with the City Planning Commission. Received M.S. and Ph.D. in economics from Syracuse University.

DYKES, JAMES M. James D. Landauer Associates, Inc., Real Estate Consultants, New York, New York. Specializes in strategic planning of large-scale land development projects and new communities, including strategic market analysis and diagnostic review of market assumptions. Formerly senior associate, McKinsey & Co., where he was involved in conducting a diagnostic review of residential, commercial, and industrial plans for Brandermill New Community; director of the Washington Office, Decision Sciences Corporation, where work involved economic, market, financial, and organizational analyses of a variety of privately financed and federally assisted proposed new communities and assisting the HUD New Communities Administration in the development of advanced analytical techniques for evaluating economic, market, and financial viability of proposed new communities; director, computer operations, and associate, Gladstone Associates, Washington, D.C.; systems analyst, Advanced Systems Development Division, Defense Intelligence Agency, Joint Chiefs of Staff, Pentagon; and analyst--cash planning, Federal Systems Division, IBM. Received M.B.A. from Amos Tuck Graduate School of Business Administration, Dartmouth College.

EASTMAN, CHARLES M. Associate Professor of Architecture, Computer Science, and Urban Planning and Director of the Institute of Physical Planning, School of Urban Affairs, at Carnegie-Mellon University, Pittsburgh, Pennsylvania. Formerly practicing architect in San Francisco. Research focuses on computer-aided and automated design methods in architecture and urban planning, evaluation of facility performance in economic, social, and functional terms; and the psychology of design. Currently directing the development of a computer-aided design system for architecture and civil engineering.

ENGELEN, RODNEY E. Senior Vice President, Barton-Aschman Associates, Inc., Chicago, Illinois. Major work has included comprehensive planning for cities, regions, states, new communities, central business districts, university campuses, residential and multiuse developments and community facilities. Formerly chief planner, Minneapolis City Planning Commission; executive director and director of planning, St. Paul Housing and Redevelopment Authority; faculty member, University of Minnesota and Northwestern University; lecturer, University of Pittsburgh and University of Chicago. Received M.S. from Harvard University.

FREEMAN, MARK H. Executive Director, League of New Community Developers, Washington, D.C. Formerly consultant to the President's Advisory Council on Management Improvement; executive director, local OEO-funded agency in Winston-Salem, N.C.; executive director, Winston-Salem Urban Coalition; professional staff member, Senate Intergovernmental Relations Subcommittee; intergovernmental advisor, Office of Regional Economic Development, Department of Commerce. Received M.A. from the American University.

GANTT, HARVEY B. Partner, Gantt/Huberman Associates, Architects & Planners, Charlotte, N.C. Formerly intern architect, A. G. Odell & Associates; associated with W. Edward Jenkins Associates and Harvard Medical School Planning Office; staff architect and planner, Physical Master Plan Development; staff architect, Housing Innovation, Inc.; consultant to Boston Model Cities for Urban Designs and Physical Development; director of physical planning, New Town of Soul City, Warren Regional Planning Corporation; visiting lecturer, Department of City & Regional Planning, University of North Carolina; visiting urban design critic, College of Architecture, Clemson University. Received M.C.P. from Massachusetts Institute of Technology.

GIBSON, JOHN E. Commonwealth Professor and Dean of Engineering and Applied Science, University of Virginia, Charlottesville. Formerly instructor of electrical engineering, Yale University; assistant professor of electrical engineering, Yale University; associate professor and professor of electrical engineering, Purdue University; director, School of Electrical Engineering, Control and Information Systems Laboratory; Dean of Engineering, Oakland University; consultant to the Electronics Research Center--Cambridge. Received M.S.E.E. and Ph.D. from Yale University.

HARRIS, BRITTON. Professor of Transportation Planning, Professor of City and Regional Planning, and Professor of Statistics and Operations Research, University of Pennsylvania. Formerly research coordinator, Penn Jersey Transportation Study; director, Office of Economic Research for the Economic Development Administration of the Puerto Rican government; consultant to or member of numerous planning studies, conferences, and committees, including the Ford Foundation Delhi Team; chairman, Dartmouth Conference on Urban Development Models, Highway Research Board, National Research Council. Supervised studies on industrial, residential, and retail trade location. Recently completed a number of articles and conducted small-scale studies relating mathematical optimization techniques with planning. Principal interests in transportation and location theory and modeling and in plan-making procedures.

HILL, J. DOUGLAS. Manager, Community and Economic Development Section, Battelle Memorial Institute, Columbus Laboratories, Columbus, Ohio. Research experience includes methods of system identification, development of basic concepts of adaptive and learning control systems, development of optimization techniques, optimization of the Project Apollo Unified S-Band Communications System, and basic studies in character recognition techniques for postal address reader applications. Director of a major planning study for the development of a Microwave Landing System (MLS) to replace, on a worldwide basis, the currently standard Instrument Landing System; co-principal investigator on a 3-year study to develop a unified approach to systems engineering; director, Battelle Institute-sponsored study directed toward the development of interdisciplinary research processes and methodology for the

design of new communities and the renewal of existing cities. Received M.S. in electrical engineering from University of Manitoba and Ph.D. in electrical engineering from Purdue University.

HOUSE, CARL. Director of Economic and Financial Analysis, The Rouse Company, Columbia, Maryland. Primary responsibility is building economic models for new community projects to test economic feasibility, alternative land use or marketing strategies, alternative financing structures, new demand for commercial and social services, and economic impact for existing local authorities. Another major project has been the construction of a regional life-support system resource model for the 29-town Hartford capital region. Received M.B.A. from Harvard University.

JOHNSON, GLENN O. Principal Planner and Head, City-Wide Planning and Development Division, City Planning Department, Los Angeles, California. Responsible for directing the development of city-wide plan, zoning codes, planning research activities, and Operations Manager for city's Community Renewal Program. Formerly chief, Systems and Data Services Division, Los Angeles City Planning Department; planner, City of Los Angeles; city planner, Associated Community Planners. Received M.S. in city and regional planning.

JONES, OLIVER H. Executive Vice President, Mortgage Bankers Association of America, Washington, D.C. Formerly analyst, Division of Selective Credit and Technical Assistant, Division of Bank Operations, Board of Governors of the Federal Reserve Systems; senior economist, Financial Section, Research Department, Federal Reserve Bank of Cleveland; associate research economist, Real Estate Research Program, Graduate School of Business Administration, University of California; economist, Stanford Research Institute; director of research, Mortgage Bankers Association of America; consulting economist and expert advisor to the Secretary of HUD and the President of the Federal National Mortgage Association; senior director, Mortgage Bankers Association of America. Received M.A. and Ph.D. in economics from Pennsylvania State University.

KAPLAN, MARSHALL L. General Manager, Raymond D. Nasher Co., Flower Mound New Town, Ltd., Dallas, Texas. Responsible for coordinating planning and development activities. Formerly principal, Marshall Kaplan, Gans & Kahn, a nationwide urban policy and socioeconomic planning consulting firm directing the HUD-funded 21-City Study of the Model Cities Planning Process; chairman, HUD Task Force on Program Simplification and Consolidation; member, Resource Staff, President's Committee on Model Cities (the Banfield Commission); directed the Inter-Agency Oakland Task Force on Federal Decision Making and Impact; advisor to Sen. Robert F. Kennedy on the Bedford-Stuyvesant Project in New York; consultant on urban issues to numerous federal agencies, governors, and mayors; report coordinator, Governor's Advisory Commission on Housing in California; special assistant, Urban Economics, HHFA; senior planner, City of San Diego. Received M.A. in public administration from Boston University and M.C.P. from the Massachusetts Institute of Technology.

KING, JOHN M. President, THS, Inc., Rockville, Maryland; a residential builder in and near Columbia, Maryland, and Vice Chairman, USNCCIB. During 1974, presented seminars on better land planning and new housing concepts for builder-developers, design professionals, and local officials in 25 cities. Also speaker for the National Association of Home Builders, American Savings and Loan League and Institute. Formerly vice president-general manager,

Tricore Corporation; research director for NAHB Research Foundation, Inc.; director, NAHB Environmental Design Institute; Assistant Head of Research and Development, National Homes Corporation; designer of custom and production houses for individual and business clients; city planner of Merced, California. Received degrees in architecture and engineering with a minor in planning from Washington University and the University of Illinois. Owner of the Housing Scene Company and currently writing weekly column, "The Housing Scene," for the *Washington Post*.

MARANS, ROBERT WARREN. Senior Study Director, Survey Research Center, Institute for Social Research, and associate professor, Doctoral Program in Architecture, University of Michigan, Ann Arbor. Formerly architectural engineer and intermediate city planner, Detroit City Planning Commission; associate, Architectural and Planning Practice, Michigan and Ohio; head planner and urban designer, Blair Associates; instructor, Regional Planning, Technion-Israel Institute of Technology, Haifa; consultant architect-planner, Artur Glikson, Architect, Tel-Aviv; lecturer in environment design, School of Urban Planning and Landscape Architecture, Michigan State University; regional planner, Detroit Regional Transportation and Land Use Study; research associate, Institute for Social Research, University of Michigan; adjunct faculty, School of Social Work, Wayne State University; assistant professor, Department of Urban and Regional Planning, Florida State University; lecturer in urban planning, University of Michigan. Received Master of Urban Planning from Wayne State University and Ph.D. in urban and regional planning from University of Michigan.

MATYAS, MARTIN E. Deputy General Manager, Raymond D. Nasher Company, Flower Mound New Town, Ltd., Dallas, Texas. Formerly Secretary-Treasurer, Beck Companies and Royal Coach, Inc.; Head of Management Service Department, Alexander Grant & Company (CPA). Received B.S. in accounting from the Ohio State University.

MOSKOF, HOWARD R. Partner, Hogan & Hartson, Washington, D.C. Current principal legal activity--real estate and municipal law. Formerly assistant director and deputy general counsel, New Haven Redevelopment Agency; executive director, New Haven Legal Aid Society; assistant U.S. attorney, District of Connecticut; associate, Donohue, Kaufmann and Shaw; deputy director and general counsel, District of Columbia Redevelopment Land Agency; associate, Hogan and Hartson; executive director, President's Committee on Urban Housing; vice president--operations and treasurer, National Corporation for Housing Partnerships; general manager, Flower Mound New Town; consultant, Ford Foundation; guest lecturer, Yale Law School; lecturer, Yale College; lecturer, Practicing Law Institute. Received L.L.B. from Yale Law School.

NEWCOMB, ROBINSON. Consulting Economist, Vienna, Virginia. Formerly principal, Robinson Newcomb Associates; consultant to Amman and Whitney, Standard Oil of New York, Departments of State, Interior, and Commerce, and Bureau of Mines; economist with President's Council of Economic Advisors, Office of the Secretary of Commerce, and Office of Management and Budget; member of the Census Bureau Advisory Committee on Construction Statistics. Received M.A. from Oberlin College and Ph.D. from the Brookings Graduate School.

RAHENKAMP, JOHN. President, Rahenkamp, Sachs, Wells & Associates, Philadelphia, Pennsylvania. Specializes in planned unit developments, application of ecological principles to the specifics of site planning, and a broad range of public and private planning activities, including municipal master

planning, environmental impact studies, and economic and market analyses; firm has developed the impact zoning system to adjust land management procedures to the recent advances in technology of environmental assessment and the recent changes, judicial and legislative, in zoning law. Received M.S. in landscape architecture and regional planning from the University of Pennsylvania.

RICHMOND, BARRY M. Consultant, Sea Pines Company, Hilton Head Island, South Carolina, 1974, and Manager of Operations Research, Sea Pines Company. Responsible for development of an "interactive" financial strategy model (the community development financial strategy model) designed for testing and evaluating a series of financial strategies under a wide variety of assumptions about financing requirements and restrictions, economic scenarios, and so on; developed Sea Pines amenity analysis model (a resort development forecasting package) and a generalized site selection model. Recently completed preliminary work on the development of the Sportsgarden simulation model. Formerly associate economist, Investment Company Institute, Washington, D.C. Received M.B.A. from Columbia University; Ph.D. candidate, Department of Operations Research, Case Western Reserve University.

ROSENBLOOM, RICHARD S. David Sarnoff Professor of Business Administration, Harvard Business School, Boston, Massachusetts (on leave 1974-1975; serving as visiting professor, Hebrew University, Jerusalem). Major field is production and operations management; conducting research on the interaction of business strategy and technological innovation.

SUTERMEISTER, OSCAR. Career federal civil service official in urban planning field currently working with the Office of Policy Planning under the Assistant Secretary for Community Planning and Development, U.S. Department of Housing and Urban Development. Formerly assistant director for housing codes, National Commission on Urban Problems; environmental health planning consultant, U.S. Public Health Service; National Security Resources Board, National Resources Committee.

STEVENSON, HOWARD H. Associate Professor, Harvard Graduate School of Business Administration, Boston, Massachusetts. Major field in real property asset management and development. Formerly vice president, Simmons Associates, Inc. (Investment Bankers); assistant professor, Harvard Graduate School of Business Administration; director, Wolfe Industries; trustee, Realty Income Trust; director, Sno-Engineering, Inc.; and consultant to various firms with heavy involvement in real estate. Received M.B.A. and D.B.A. from Harvard University.

TURNER, DANIEL S. Consultant, real estate economics and finance, Jenkintown, Pennsylvania. Specializes in developmental appraisals and progress monitoring models. Formerly economist, Strouse, Greenberg and Co.; senior associate, Gladstone Associates; acquisitions analyst, F. W. Woolworth Corp. Received M.B.A. from the University of Pennsylvania.

WALLACE, WILLIAM A. Professor of Management and Director, Program in Public Management, Rensselaer Polytechnic Institute, Troy, New York. Formerly, research engineer, Armour Research Foundation; communications officer, U.S. Naval Communications Station, Alaska; instructor and research assistant, Department of Management Engineering, Rensselaer Polytechnic Institute; director, Urban-Environmental Studies, Rensselaer Polytechnic Institute; consultant to Dunn Geoscience Corporation, A. T. Kearney & Co., New York State Department of Education, New York State Division of Budget, State

Identification and Intelligence System, RRC International Inc., U.S. Bureau of Mines. Received M.S. and Ph.D. from Rensselaer Polytechnic Institute.

WREN, KENNETH. Partner, Roger Tym and Associates (Urban and Land Economists), London, and member, Chartered Institute of Public Finance and Accountancy. Work in public sector finance and investment analysis has focused on planning and development of new town communities. Formerly borough treasurer of Bradbury and financial director and deputy general manager of Milton Keynes New City Development. Also has undertaken consultancy commissions in Thailand, Colombia, and Australia and has advised the governments of Iran; Jamaica; and Victoria, Australia.

APPENDIX B

SUMMARY DESCRIPTION OF THE CIB AND THE USNCCIB

THE CIB

Objectives

Established in 1953 as a result of recommendations made by the United Nations Economic Commission for Europe, the International Council for Building Research, Studies and Documentation (CIB) is a nongovernmental group formed to stimulate and encourage an international collaborative effort to attain more efficient and effective programs of research, information exchange, and development in the field of building. This effort is directed at the various aspects of construction, applied science, technology, economics, and sociology/psychology that are involved in the ultimate realization of the total "built environment." In carrying out its objectives, the CIB:

- Seeks to develop international cooperation between all types of governmental, academic, and industrial research organizations
- Encourages the exchange of researchers between organizations in different countries
- Seeks practical methods for cooperative planning of research programs to eliminate duplication of work and to achieve planned assessments of different approaches to largely identical problems
- Promotes the comprehensive exchange of building and construction information and research documents
- Strives for the proper recognition, at the international level, of the importance of the building industry and the related research effort required to keep it viable

Members and Organization

CIB membership consists of public and private research bodies, professional associations, industries, and enterprises as well as individual experts. Members of the CIB, currently found in 48 countries, send representatives from building-oriented activities to participate in CIB efforts.

Each CIB full member--currently representative of institutions and organizations in Australia, Austria, Belgium, Bulgaria, Canada, Cuba, Czechoslovakia, Denmark, Ethiopia, Federal Republic of Germany, Finland, France, German

Democratic Republic, Ghana, Hungary, India, Iran, Ireland, Israel, Italy, Japan, the Netherlands, Norway, Pakistan, Poland, Portugal, Rumania, Soudan, South Africa, Spain, Sweden, Switzerland, the United Kingdom, the United States, the Union of Soviet Socialist Republics, and Yugoslavia--appoints a representative to the CIB General Assembly, which meets at least once every 3 years and in which the authority of the CIB is vested. The General Assembly elects representatives from full-member institutions to serve 3-year terms on the CIB Board, which meets yearly and is charged with the management of CIB affairs. The Board formulates the policy and program of the CIB, subject to control by the General Assembly to which it is responsible, and also appoints and delegates certain administrative and executive tasks to its Administrative and Program Committees.* The Board engages a Secretary General to function as its executive agent and to direct the CIB General Secretariat in Rotterdam. CIB obtains total support from the dues of its members.

Activities

CIB activities are broad in scope and include steering group and working commission efforts on the following: climatology and building; structural safety; fire, heating and ventilation; aspects of timber structures; large concrete elements; basic structural engineering requirements; safety of load-bearing walls; dimensional and modular coordination; concrete surface finishings; heat/moisture transfer in materials and structures; tall buildings; human requirements and building design; tolerances; acoustics; building information and its computer application; long-term forecasting methods; selection/management of research projects; building economics; lightweight constructions; performance concept in building; joints in exterior walls; water supply and drainage for buildings; low-cost housing; organization and management of construction; industrial buildings; and energy conservation in the built environment.

These groups are charged with the collection, interpretation, and documentation of data that become the bases for reports and recommendations for international standards and practices or for continuing study.

To convey research information to practitioners, the CIB sponsors an international congress every 3 years. The 6th CIB Congress (1974) focused on the Impact of Research on the Built Environment. Particular topics included user requirements, the impact of research on design and on the management process, standards and regulations, the impact of information development on building, and the sponsorship and future development of building research.

The CIB also publishes the reports of its various groups and a bimonthly magazine, *Building Research and Practice*.

THE USNCCIB

Objectives

The U.S. National Committee for the International Council for Building Research, Studies and Documentation (USNCCIB) was organized in 1962 under the aegis of

*The USNC/CIB Representative to the CIB is an elected member of the Board and its Program Committee.

the National Academy of Sciences to represent the United States in the International Council for Building Research, Studies and Documentation (CIB).

The basic purpose of the USNCCIB is to effect appropriate U.S. participation in the CIB on behalf of public and private building research organizations and users of building science and technology information. Its primary objectives are

- To serve as a liaison between the U.S. building research community and the CIB and thus provide a mechanism through which the ready exchange of building research data generated by U.S. organizations and other CIB members is encouraged
- To stimulate, through the establishment of counterpart groups to CIB activities, the generation of research studies and information on the state of the art in building research and technology
- To motivate organizations to take positive action in furthering building research studies and documentation and improved practice

Members and Organization

The USNCCIB has two main classes of membership, each appointed with the approval of the President of the National Academy of Sciences: Representatives of Participating Organizations and Members-at-Large. Participating Organizations consist of private nonprofit national groups and federal agencies that conduct, sponsor, administer, or utilize building research studies or documentation. Members-at-large are appointed as individuals recognized for their competence in building research and related activities without regard to their organizational affiliations.

An Executive Committee coordinates USNCCIB activities and provides for review of the activities of CIB commissions in light of the needs and interests of the U.S. building community to identify areas in which the USNCCIB might make appropriate contributions through the establishment of counterpart commissions or simply by naming liaison and corresponding members. Those serving on USNCCIB groups or as USNCCIB representatives to CIB activities are selected for their competence and experience in the field from the building community at large. Contracts or grants from various organizations provide the financial support for the USNCCIB.

Activities

While the USNCCIB itself is a relatively small organization, it serves and involves a much larger group by enhancing the linkages between members of the U.S. and the international building communities. Thus, the USNCCIB

- Identifies individuals to represent U.S. competence and ability in building fields and designates U.S. representatives to CIB meetings and activities
- Provides U.S. consensus input to CIB activities
- Serves as the mechanism for exchange of information and communication between the CIB and the U.S. building community

In fulfilling its communication objectives, the USNCCIB pursues a variety of activities, the most important being the stimulation of direct contact between individuals that is provided those involved in the USNCCIB through counterpart commission and other working group efforts and through participation in CIB activities as liaison and corresponding members.

Counterpart commission activities may include the preparation of state-of-the-art and position papers designed to stimulate research programs; the organization of workshops, seminars, or symposia to communicate both research needs and results; and the identification and definition of mechanisms for translating research results into improved practice.

Examples of typical subject areas of interest to the USNCCIB for counterpart commission and working group activities are building and community interface, energy conservation in the built environment, feedback of information on livability, noise control for buildings, organization and communication of research information, organization and management of construction, planning and design for fire safety, and water supply and drainage for buildings.

Among USNCCIB general communication activities is the publication of *Building Research Notes*, a newsletter designed to provide interested parties with an opportunity for identification of research and researcher at an early stage. The USNCCIB also publishes selected reports on activities of its counterpart commissions and task groups as well as an annual activities report.

To provide those in the United States and abroad who request information with appropriate data, the USNCCIB serves as an informal referral agency by inviting the best-informed national and international organizations to respond. In addition, a loan library of international building-related publications is maintained for use by members upon request.