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ABSTRACT

Traditional master plan preparation examined alternative methods of accomplishing improvements in the community. The plan, however, did not state these alternatives in a formal manner, or in any way incorporated these alternatives in the text of the plan. The "policy plan" presented alternatives as one of its essential components. These alternatives were presented to the decision makers for final approval and effectuation of the alternative they chose to serve the community best. While the "policy plan" involved the decision makers in initial policy judgments, the process of projecting the outcomes of the policies remained on an intuitive level. Since the decision to accept a particular package of policies can set a reaction affecting literally thousands of other development decisions by private interest, the outcomes should be considered prior to the acceptance of the package.

This paper considers the drawbacks of previous methods of generating spatial development alternatives. This is accomplished by evaluating the works of the utopian writers and the more recent works published by the various planning agencies. These works point out the need for a comprehensive approach. They further point out the need for a rational decision making framework.

John Jacques Shannin

The concepts considered and developed as a framework for generating alternatives include: a goal formulation framework based on the needs, wants, and desires of the people, the systems approach for the evaluation of all the components, decision theory with special emphasis on the relationship between the strategies and the outcomes, and finally some operations research tools such as simulation models for the incorporation of uncontrollable variables into the decision framework.

It is the thesis of this paper that if the above tools are used, the decision makers can choose among the outcomes that he feels to be most desirable to the community. These outcomes,(the paper will stress the structural variety), can be translated to strategies and hence into plans. This method incorporates the advantage of considering all the possible factors of growth rather than just the factors that planners have chosen in the past to state and amplify.

GENERATION AND EVALUATION OF ALTERNATIVE SPATIAL PATTERNS FOR THE URBAN REGION

by

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INTRODUCTION

> "To make order again out of the present Metropolitan explosion we must begin with its antethesis: a small scale urban implosion or assemblage of urban elements. Only by first unifying the parts can a larger whole, the "urban grid", a highly organized regional network of cities and urban institutions, come into existence."
>
> Lewis Mumford

The above quotation is an eloquent statement suggesting a methodology to achieve order in the urban region. This thesis proposes a similar aim, that of considering the most significant alternative elements of urban growth in order to achieve an optimum arrangement consistent with the objectives of both the decision makers and, more important, the people themselves.

Planning is headed towards a larger and more responsible role in the decision-making process. The decisions will encompass greater numbers of people and a wider spatial coverage. It is, therefore, imperative that the planner should consider all relevant aspects of growth in order to propose and help effectuate policies in the format of a plan.

It is not sufficient to understand the physical land use arrangements and the "areal" patterns that can be

possible through the manipulation of the various elements, but the impact that the various arrangements can produce on the future well-being of the region. This new approach shifts the emphasis of the planner from the intuitive design approach to an objective approach using a wide range of methods to explain and relate all the environmental phenomena stemming from the interaction of man with his environment and to organize a new decision-making framework to guide development policies. In other words, the proposed approach will be related to management planning methods where the planner will be interested in defining the problems, issues, needs, and opportunities within his region; considering a set of alternative ways of solving the problems while abiding by certain restraints imposed on him; and finally recommending the possible outcomes taking into consideration various "costs" required of the community to achieve such policies.

In view of the above discussion; the purpose of this thesis is to present new considerations for the generation and evaluation of alternative spatial patterns for the region. This objective will be developed as follows:

Chapter I will introduce an approach to alternative selection based on fulfilling the human requirements as they are manifested in a hierarchy of goals to be achieved. The system approach will be used extensively since it incorporates desirable conceptual features that can clarify the processes under consideration. Other concepts also

utilized will include the "policy approach" and "decision theory". It is evident that all these concepts are interrelated and indivisible and thus should be discussed jointly.

Chapter II will present and outline the present problems, and issues as they affect the environment which will require our attention. Also, presented will be some of the current policy proposals to alleviate and solve these problems which should be utilized by the planner.

Chapter III will discuss some of the possible solutions in the form of 'utopias' or 'ideal communities' as they have been proposed by persons concerned with the issues of their own periods, along with lessons applicable to our own period.

Chapter IV will consist of a review of recent planning efforts dealing with the subject of alternatives and the results of such efforts on the immediate area of concern as well as the effect on the planning profession.

Chapter V will present considerations of further techniques that can be useful in alternative generation, projection, and evaluation. These will include methods loosely grouped under "operations research" such as programming and modeling techniques.

Chapter VI will sum up the discussion by reviewing the major concepts as they have been presented in the paper and the way these concepts can be applied to the process of generating alternative spatial patterns for the urban region.

CHAPTER I

A NEW APPROACH TO ALTERNATIVE SPATIAL PATTERNS

Since the inception of the urban planning profession, the planning process has been concerned with the preparation of a design, a conceptualization of the form of the city, and with policies for urban growth. All these attempts have had the same basic objectives - an understanding of and a device for planning the future of the community whether at the city, the metropolitan or the regional scale. There has not been, however, a consensus on the best way to achieve this objective. The planning profession has seized on various methodologies and, depending on the persuasiveness and appeal of the originator, whether a person or an agency, has followed and expanded that original proposal into a planning requirement which became indispensable until a new idea was accepted which replaced the formerly irreplaceable portion of the process. This transition of ideas and their implementation by the planning profession is a desirable feature, since imagination, thoughts and thoroughness are indispensable attributes of planning.

The latest vogue in the planning process is the "policy plan" and its accompanying feature, the consideration of alternatives. The alternatives have, however, been mere

illustrations in graphic form with very little reasoning why these patterns are suggested. In this paper some of these approaches and their shortcomings will be discussed in more detail.

The approach suggested in this paper is based on the criteria that make up the detail of the spatial pattern, rather than the generalized shape and form. It is the thesis of this paper that the spatial patterns for the urban region must be evaluated at the micro scale rather than the macro scale. The qualities that have been attributed to various patterns such as "flexibility", "linkages", "open space preservation" etc. can be obtained within more than one overall form for the region and this shifts the decision regarding the best form back to the more detailed decision level.

Prior to describing the approach suggested, we need to define and explain the concepts that are to be utilized. The discussion will cover: the planning process, the role of alternatives, the systems approach, decision making and policies, the goal formulation process, and finally the suggested approach.

The Planning Process

The planning process is discussed at this point as a means of clarifying the relationship of the goals, policies, and alternatives to the overall process and at the same time emphasizing the elements leading to rational decisions.

Webber provides a clear and concise definition of the process as follows:

> Planning is that process of making rational decisions about future goals and future courses of action which relies upon explicit tracings of the repercussions and of the value implications associated with alternative courses of action, and, in turn, requires explicit evaluation and choice among the alternative matching goal-action sets.[1]

The planning process (including the method of policy making) can be divided into four steps as follows:

1. Problem definition: This section of the process contains a description ofthe problems and issues facing the region at the time the study is being undertaken and the understanding of the situation through forecasting future conditions under the existing trends and policies of that period. This section must emphasize the determination of "critical factors" - the trends that must be altered if progress is to be brought about through new actions.

2. Policy making: General directions or courses of action are established in this section of the plan, in the interest of the population as it relates to the physical development of the community. The planner at this point proposes and formulates policies (policies are considered to

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[1] Melvin M. Webber. "The Prospects for Policies Planning," The Urban Condition, edited by Leonard Duhl, Basic Books, Inc., New York, 1963, p. 320.

be administrative judgments on broad objectives) designed to bring about the achievement of the community goals and guide the formulation of plans and programs. These policies should be adopted by the decision makers prior to proceeding to the next step, "the plan" itself.

3. The Comprehensive Plan: This document translates agreed upon policies into specific proposals for the future growth and development of the community. The plan will be concerned with general locations and extent of the specific recommendations, such as the need for general location, and size of regional parks.

4. The "Program": Sometimes this part of the process is called the "implementation phase" of planning. The term program, however, is a more suitable term since it connotes a schedule or a sequence of activities. The program in this case will combine an "action plan" (which is a detailed program for a specific series of actions to be taken, e.g. urban renewal project plan) with a time table for actions. It should outline the responsibilities of the various agencies involved and the costs to be shared or contributed.

This program phase should in turn be divided into long-range and short-range programs. The long-range program is general in nature and is most useful as a long-term guide to the various agencies involved in the planning process, regarding long range financial and administrative matters. The short-range program, on the other hand, is more of a "capital improvement program" where budgets are

specific, and the projects to be undertaken are listed in detail.

The process as it has been outlined above should involve the people, the legislators, and the administrators, especially at the "policy making" phase. This participation and the process itself are illustrated in diagram 1. Further in the paper the planning process will be presented in more detail to aid in the presentation of procedures suggested in this paper.

The terms used in describing the planning process in this section are the current terminology being used by the planning profession. The terms "plan" and "program" in the last phase described above can be interchangeable depending on the definition of each. In order to clarify this point, the following definitions are given:

Plan: The plan is a proposed course of action based on facts and projection of data into the future.

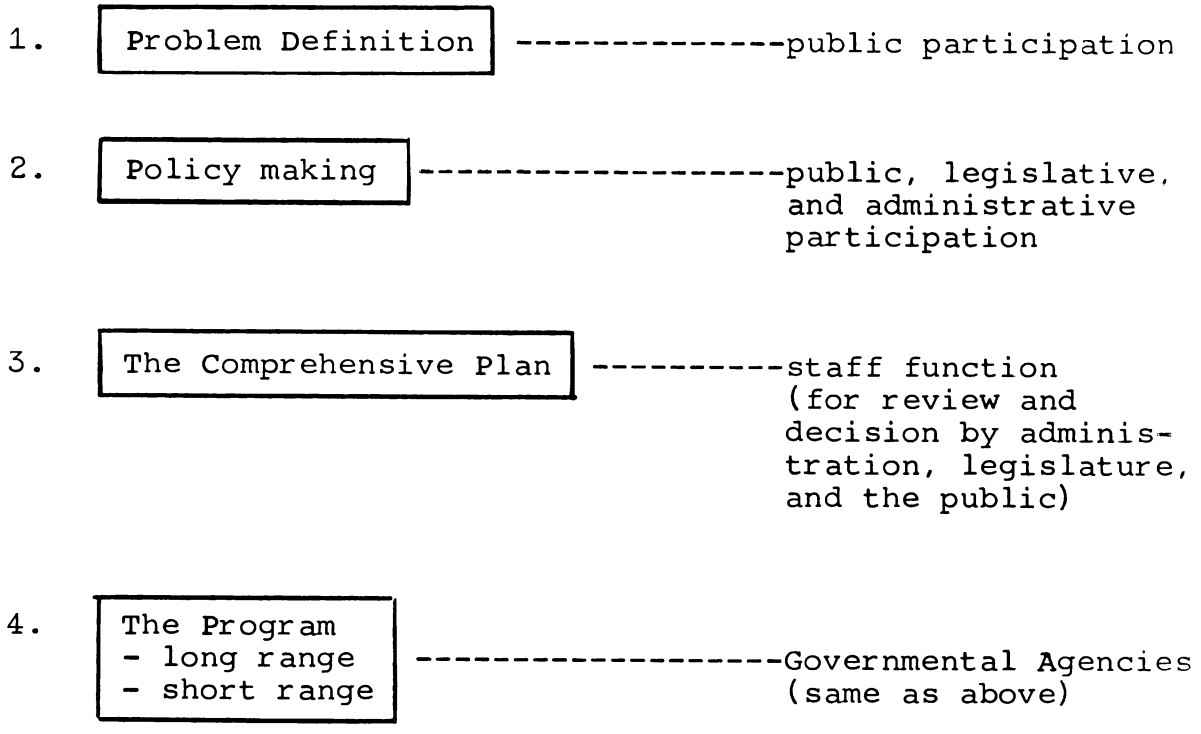
Program: The program is a sequence of actions proposed to be undertaken according to a prescribed time table. The program is based on the proposals of the plan.

The Role of Alternatives

Until recently the planning process concentrated all its efforts in producing a "master plan" which included recommendations based on professional judgment. The shift to the policy plan has provided an emphasis on choice by the people and the decision makers regarding the policies and actions they wish to pursue in order to achieve community

FIGURE 1

The Planning Process (General)



objectives. It also provides the decision maker with a means of selecting these community objectives.

Since the politician in the final analysis is going to accept or reject the plan, the planner has to provide him with reasons why a proposed course of action should be followed. This can best be achieved through the presentation of detailed information on the advantages and disadvantages of alternative courses of actions to achieve certain goals, clarifying the outcomes or consequences of each.

Herbert Simon elucidates the above discussion as follows:

> The professional decision maker, in city planning or in any field where he is in the role of technical advisor to a consumer, is in a position where, through his planning and projecting activities, he can propose alternatives. He can suggest new ways of building a city. He doesn't simply select out of a kit of existing designs the one that he thinks is going to be the best for the city. His job is to formulate alternatives which have not been proposed previously. Any theory of decision making, which would be relevant to the city planning process, would have to insure that alternatives are generated, so that the professional planners and the opinion leaders could decide among meaningful alternatives.

Simon further states that the professional planner plays a large role in

> Creating images of cities for the contemplation and consideration of the opinion leaders who must make decisions related to the selected image.[2]

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[2]Simon, Herbert. "Decision Making and Planning," Planning and the Urban Community, edited by Harvey S. Perloff, University of Pittsburg Press, 1961, p. 192.

The planning profession has shown its acceptance of the new role of planning - that of a thorough, objective analysis of all the facets of the urban problems in order to present "strategies" to be further utilized in the decision making process. The recent crop of plans and publications have reflected this new trend. A fuller review of these reports will be brought out in chapter four. The bulk of the work, however, has dealt with "mapped" "form alternatives". The various alternative spatial patterns have been analyzed with the specific region and its own unique problems in mind and a preferred pattern for future growth and development selected. Among the alternatives most frequently used are: "Present Trends", "Planned Sprawl","Radial Corridors", "New Towns", "Concentration", and "Linear City". Most of these alternatives have been based on "ideal" and "Utopian" communities, previously proposed by city planning theorists or philosophers. These works will also be discussed in more detail in chapter three.

It is relevant at this point to define what we mean by "Alternative Patterns", "Form", and "Mappable". Forms and patterns are interchangeable terms throughout this paper and thus have the same definition - a spatial arrangement of structural components in the region. The components consist of fixed and movable objects and spaces that reflect a particular shape. The fixed components are static facilities such as topography, drainage, roads and physical land uses (to differentiate it from land use activities).

Moveable components on the other hand consist of movable objects and activities, such as people, flows such as transportation, and land use activities. Whenever these components are drawn on a map, they reflect the actual land activities and structures. The map can, however, be a projection of component groupings, thus reflecting future form, this variety is what we refer to as "Mappable form".

The patterns defined above should be further classified as dealing with a hypothetical region that is not limited by size, terrain, or climate, and should be applicable to any existing urbanizing region. The patterns should identify structural characteristics significant at the metropolitan and regional scale which can be controlled at that scale and which can have totally different effects with different arrangements at that scale. This paper will be chiefly concerned with the physical aspects of the arrangements rather than the distinct distribution of the specialized activities within each city. We should not, however, lose sight of the implications of these physical arrangements on the social, economic, and psychological patterns of the region.

The use of alternatives should not, by any means, be confined to the "Mappable" variety. It is true, however, that the form alternatives provide the following advantages:

(1) They formalize the urban planner's conceptual thinking in regards to urban physical growth.

(2) They provide an ideal visual aid to convey possible outcomes to the public and the decision makers.

(3) They excite the imagination and thus help stimulate the thinking of the public in regards to their ambitions for the region.

(4) Through the stimulation of thought they encourage public participation in public hearings and public discussions regarding the community.

Besides alternative patterns, the planner should also consider verbal "policy" alternatives. This approach was proposed by Stephen Nelson,[3] in a thesis presented to Michigan State University. Nelson proposes a hierarchy of policies including strategic policies, which are divided into outcome and action policies, and tactical policies. Strategic outcome policies deal with the broad, spatial interpretation of goals and are verbal counterparts to spatial patterns. Strategic action policies, in turn, are broad actions designed to "promote and create their outcomes". Finally, tactical policies are "decision rules concerning specific methods of procedure for achieving the strategic policies." The policies should then be translated into detailed recommendations in the comprehensive plan. This approach is illustrated in the following examples presented by Nelson:

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[3]Nelson, Stephen C. The Policy Approach in Urban and Regional Planning, unpublished thesis presented to Michigan State University in 1964, pp. 76-79.

"1. a. Strategic Outcome Policy - a more balanced and stable economic base. This might be displayed as a statistical distribution of employment to manufacturing, service retail, wholesale, government, and agriculture; or as desirable economic input and output flow levels and rates.

b. Strategic Action Policy - encourage the expansion of heavy industrial activity in the planning area.

c. Tactical Policy - organize an industrial development committee; offer tax concessions to desirable industries; put a high priority on improving the functional environment of industry.

d. Comprehensive Plan Recommendations - develop industrial parks at such and such locations; improve the major highway access; put in a new sewage disposal plant.

2. a. Strategic Outcome Policy - a strong single central core area serving as the symbolic and functional focal point of the entire planning area.

b. Strategic Action Policy - increase the density of core area activities; renew the core area facilities functionally and esthetically; develop a strong symbolic image; promote residential living in the core; reduce traffic flow within the core area.

c. Tactical Policy - route through-traffic around the core area; provide perimeter parking lots so that core area visitors need not walk more than x minutes to reach their destinations; locate all civic facilities in this area; promote a land coverage of about x percent; encourage the renewal of the old residential portions of the core; give top priority for new schools and parks to the core area.

d. Comprehensive Plan Recommendations - a new freeway loop around the core area; renewal of such and such areas; construction of a new civic sports arena in such and such location; development of new parking lots on the inner edge of the freeway loop; allow higher density development in such and such areas; close such and such streets for malls.

3. a. Strategic Outcome Policy - a star-shaped urban pattern accomodating growth along a few radial channels extending from the central city and separated from each other by vast wedges of open space.

b. Strategic Action Policy - hold the wedge areas out of intensive development; promote radial growth along high speed mass transit and freeway routes,

decentralize employment centers to the radial channels; promote a high rate of growth; promote the development of well-balanced radial communities.

c. Tactical Policy - push for more restrictive rural zoning; allow tax increase immunity for wedge areas which are beseiged by spreading urbanization; use highways and rail transit lines to lead urbanization; top priority should be given to growth in the NE sector; radial community development should be at a density of x persons per acre and should have a population range of between y anx z.

d. Comprehensive Plan Recommendations - Such and such areas should be reserved as open space wedges and the corridors should be located in such and such areas; a new freeway should be built at such and such location.[4]"

It is important to note that Nelson's definition of the terms strategy and tactics differs from the usage of the terms used in "Decision Theory" which will be brought out further in this section. Nelson's usage of the terms should be considered as adjectives describing a certain hierarchy of importance related to policies, while the terms used in "Decision Theory" represent plans.

Another approach to alternatives is provided by the "growth model" or "simulation" techniques that have been very useful in traffic and transportation studies, and have recently been introduced to the planning process. A "model" can be any kind of conceptual framework for accomplishing an objective. In this case, a "model" is the expression in numbers of the complicated relationships between all the variables that exist and act on the

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[4] Ibid., pp. 80-83.

development of the region. An example of this process is the attempt at "modeling" land use "growth" by the Penn-Jersey study. The study has assumed five alternative patterns for distributing the land uses in the region. Another model has been developed since the original "Regional Growth Model". The present "Simplified Distribution Model" will distribute the various land use activities, e.g. industry, household and so on, among the Penn-Jersey districts. The model has been developed for projecting the distribution of population, socio-economic characteristics, and transition over a period of time.

The new techniques can be adapted to urban planning procedures and will in the future provide accurate projections of the impact of various alternative policies on the region and thus provide an accurate tool for decision making. The drawback in this approach is that the techniques have not been sophisticated enough to date to provide prediction of intangible cultural factors.

In order to use any of the techniques discussed in this subsection, whether "alternative forms", "alternative policies", or "models" for the region, the planner has to have a thorough understanding of his area, its problems, and its goals. The goals have to go beyond the community goals that planners have been proposing as the bases of their plans. The goals must reflect the individual and group objectives as well as those of the community. This understanding and its subsequent clarification of the

objectives and their translation into workable plans can be accomplished through the use of the systems approach.

The Systems Approach

The systems approach is a comparatively new innovation in the planning profession. It has, however, been used by some powerful intellectual proponents in both academic and professional circles, such as Britton Hams, Russell Achaff, Stewart Marquis, Robert Mitchell, and John Gifford. These men, among others, have adapted the general systems theory and the systems engineering theory into an approach to further the understanding of the urban community as a system. This subsection will draw heavily on some of the works of Stewart Marquis[5] in order to explain the systems approach and its usefulness in this proposed framework.

The basic task of this paper is to look at the region as an entity or a whole and search for the best method of guiding future development. This is another facet of the same problem of looking at the patterns of development in order to find the ideal pattern for the region.

The systems approach is therefore an ideal framework to carry out the above objective. The systems approach is

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[5]Professor Stewart Marquis is Assoc. Prof. of Urban Planning at Michigan State University. The writer has drawn heavily on notes from classes as well as personal conversations and unpublished papers (by Professor Marquis) in writing this section.

based on the concept of looking at the parts (components), grouping of parts (sub-systems) and the interactions between the parts and groupings, or the components and sub-systems in order to comprehend how the whole (system) works and thus be able to design a new system or improve on existing one.

The last point leads to the discussion of optimization. Optimization of a system can be achieved through the application of the system to its environment in order to receive the best performance from the system. Optimization, however, can not be achieved for all aspects of the design equally. The designer has to choose a goal toward which he will gauge his system to perform at its optimum capacity.

Systems techniques have been used by men in other conceptual fields and disciplines for looking at their own concepts in terms of interacting or interrelated elements, with meaningful relationships between the attributes or properties of those elements. Examples of these disciplines include; biologists, natural ecologists, engineers, sociologists, geographers, psychologists, and researchers in business and industry. This approach can, therefore, be utilized to bridge the gap of knowledge and increase the interaction of ideas between these conceptual fields.

So far we have dealt with theoretical systems and defined the various kinds of possible systems in existence. We have not, however, applied the systems approach directly

to the community and the region. An attempt in this direction was made by Stewart Marquis in various publications which have been synthesized for this section. Marquis' system model incorporates subsystems made up of human, manmade, and natural components as "man-artifact-natural resource" subsystems. Further, the components and subsystems interact through flows of people, vehicles, goods, energy, and messages. Finally, control over the system can be internal or external depending on the location of the people exerting that control. The system boundaries start where you have a positive control over the operations and functions of the subsystems and end where this control is lost.

In regards to location or spatial information systems, Marquis suggests that urban communities tend to build up from smaller specialized subsystems within the urban complex into larger agglomerates in a hierarchical fashion. The hierarchies of subsystems interact with increasing complexity as we progress from the individual subsystem to a group of more complex subsystems. In order to analyze this complex system on a regional level we can separate and analyze its sets of subsystems. In other words, subsystems such as industry, commerce, households will be grouped into sets of industrial subsystems, commercial subsystem, and so on. The interactions between the subsystem will take place through "sequential flow and decision processes" or transactions. These transactions

will involve the flows of people, organisms, substances, antifacts, money, messages, signals and energy.

The subsystems mentioned above can be classified in order of their importance to the overall system. Those which function to satisfy survival needs such as water, food, shelter, protection from death or injury or disease are critical subsystems. The subsystems dealing with key resources such as people, land, space, water, and air are key subsystems. Subsystems which generate or accomodate various flows such as railroads, and highways, are major subsystems. This classification will help in relating the subsystems in accordance with the important role they play in the overall regional systems framework.

In summary, this systems approach provides the planner with an ideal analytical framework. Its major contributions are in turn summarized in the words "Design", "Performance" and "Control". The planner can combine the various components and subsystems in such a way that he can optimize the objectives he has set out to achieve. The way in which the system works is itsperformance. This performance can be measured relative to the system objective to determine whether the subsystems are functioning at a desirable efficiency. Finally, control is the implementation of desired ends through the wise selection of the means.

The methodology applicable to any community should proceed as follows:

1. Analyze the components of the community in question.
2. State and describe the major controlled subsystems.
3. State and describe the major uncontrolled subsystems.
4. Show the interaction between the subsystems wherever possible.
5. State the limit or boundaries of the system and how has it been derived.

This process is further illustrated in Diagram 2.

The Goal Formulation Process

Since one of the advantages of the systems approach is the optimization of the various subsystems in order to have a viable overall system, this optimization has to be based on specific goals and objectives to be met by the subsystem.

The planning process has always utilized goals and objectives, however, these were not always specifically stated in the plans and generally stayed in the planner's head. Recently, with the acceptance of the policy approach, the goals and objectives to be achieved by the community have become featured sections of the overall plan. Outstanding examples of this approach include the Philadelphia Plan, the Washington, D.C. Year 2000 Plan, and the Southwestern Pennsylvania Region State of the Region 1964 publication.

The methodology that has been followed in these efforts usually proceeded as follows:

Goals Objectives Principles Standards Specific Proposals

This methodology was altered slightly with the acceptance of the "values" concept as it was proposed by the Twin Cities Joint Program, in which the values (defined as "irreducible absolutes of quality") were classified as follows:

1. Survival Values: Security, Sustenance, Continuity
2. Development Values: Cooperation, Extension, Surplus
3. Fulfillment Values: Beauty, Goodness, Truth, Immortality, Recreation, Happiness[6]

This approach further proposed the utilization of these values as a basis for formulating goals, which in turn can be converted into policies for the region. The proposal therefore changed the methodology presented earlier to the following:

Values Goals Policies Implementing Devices

The above methodology with minor variations is currently the favored procedure in the planning field. It does, however, have some glaring drawbacks, among them are the following:

1. The procedure while trying to keep the planning process from being "esoteric and arbitrary" is itself esoteric and arbitrary.

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[6]Twin Cities Metropolitan Planning Commission, Values and the Planning Process, St. Paul, Minnesota.

2. The planners and the people will have difficulty distinguishing between values and goals.

3. The problem of avoiding personal bias by the planner will not be solved by the value system since it too, might lead to certain bias.

For the above reasons as well as the conviction that a better goal formulation procedure can be achieved through the utilization of the "Needs" framework leads to the suggestion of new considerations.

Prior to launching into the exploration of the proposed framework a definition of critical terms is in order.

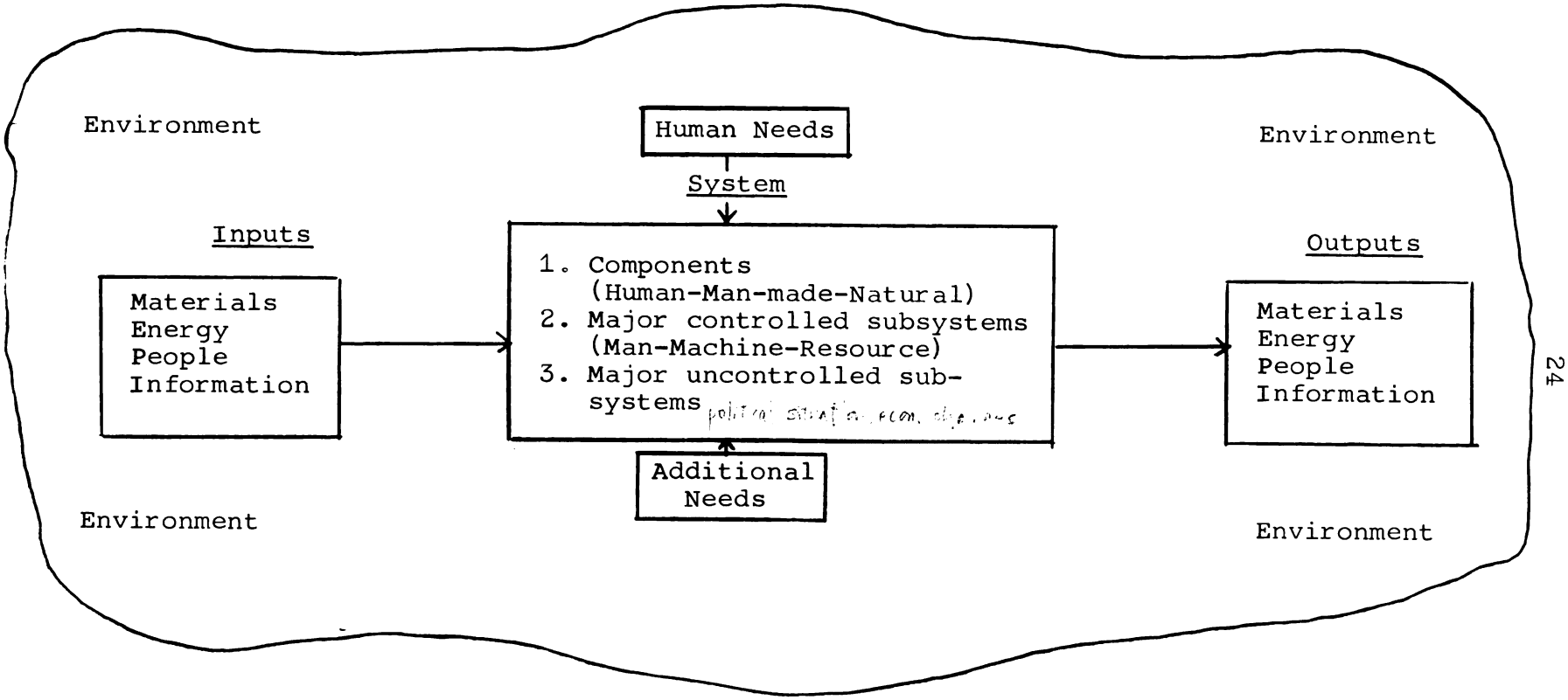
1. Goals: These are statements of higher aims or ends which reflect the problems and issues and towards which certain criteria will have to be implemented to achieve a desirable outcome. Goals usually reflect the needs, wants, desires of the persons controlling the system.

2. Objectives: The next step is the development of criteria leading toward decision. Objectives are usually positive or desirable manifestations of goals in contrast to restraints.

3. Restraints: Complementing objectives in purpose, yet exerting its power as a

FIGURE 2

A Systems Analysis Framework



control of the system. Restraints are manifestations of outcomes which are not desired or definitely to be avoided.

The approach suggested here is based on a need framework to provide the goals for the community. The general need framework is in turn further classified by proposing a hierarchy of human needs, wants, and desires*. The "needs" imply basic survival requirements composed of things, conditions, and feelings that are the minimum biological requirements for the human body to develop and to survive. The "wants" reflect additional requirements that are essential for human welfare in a given culture but not necessary for survival. The "wants" progress beyond the survival state and start reflecting cultural requirements and group traits. Finally, the "desires" are personal requirements that are not essential for either survival or comfort. Desires, however, can be important motivators and increase in importance with increases in the standards of living. It is readily discernible from the above breakdown that the needs framework is a continuum of needs, wants, and desires. The continuum in turn reflects socio-cultural standings that vary with individuals, groups, organizations, and cultures in given areas (continents, countries, states).

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*This "needs framework" also draws on ideas and notes of Professor Stewart Marquis.

If we compare the continuum as it is reflected in the United States with that of a representative of the so-called underdeveloped nations we can readily perceive that their "desires" might be out "wants".

If we take "food" as the requirements to be met, in this case the biological requirement, then "need" can be met with a determined amount of calories for survival. This can be in the form of wheat (bread), rice, or fruits, depending on the continental location. Wants, on the other hand, are reflected by the requirement of a "balanced meal" which the nutritionist claims to consist of a certain amount of protein, carbohydrates, and legumes, in this case meat, potatoes and bread, and vegetables or fruits. Finally, the "desires" are reflected in the requirement of an addition which might not at all be connected with the meal itself such as a cocktail or even coffee.

"Values" are related to this concept in the form of preferences. In other words, values are dimensions by which a preference ordering is instituted. In this context we can use values without classifying them as biological, psychological, social or economic. Through this device we can eliminate the static, abstract ideals from the connotation of values.

There are two aspects or facets of this need framework, the positive and negative aspects. Needs, wants and desires can be positive such as the need for food, water, shelter, health and love and their accompanying degrees of

sophistication with progression along the continuum mentioned above. The needs framework can also be negative such as the need not to get hurt, succumb to disease or have emotional frustrations.

Goals are means of providing and maintaining the systems required for the satisfaction of the needs framework as it was discussed above. Since the needs framework was positive and negative and goals are based on fulfilling these needs, then goals are both positive and negative. The positive goals will be referred to as achievement goals since their main purpose is the achievement of a positive thing, condition or feeling. The negative goals are referred to as avoidance goals that can produce positive results by identifying them as undesirable and then simply by avoiding them in the planning process.

Thegoals in turn are translated into objectives which can be utilized in the planning process. The objectives can also be positive and negative. These have already been defined earlier as objectives and restraints. The objectives are implemented through the use of specific criteria designed to produce an outcome or a plan. This process is illustrated in figure 3.

This framework is related to the systems approach in the following manner. First, the significant interaction processes, which constitute the linkages between the subsystems and components of the community, are those which serve to directly satisfy the goals as they reflect the needs,

wants, and desires of the people within the community system. Secondly, the objectives discussed can be translated into processes which also serve the requirements of components and subsystems and thus enable them to flourish and continue serving the human goals. Thirdly, once the components, subsystems and processes have been established to satisfy the goals, some of their functions can be optimized to improve their performance even further thus increasing the satisfaction of needs, wants and desires of the people.

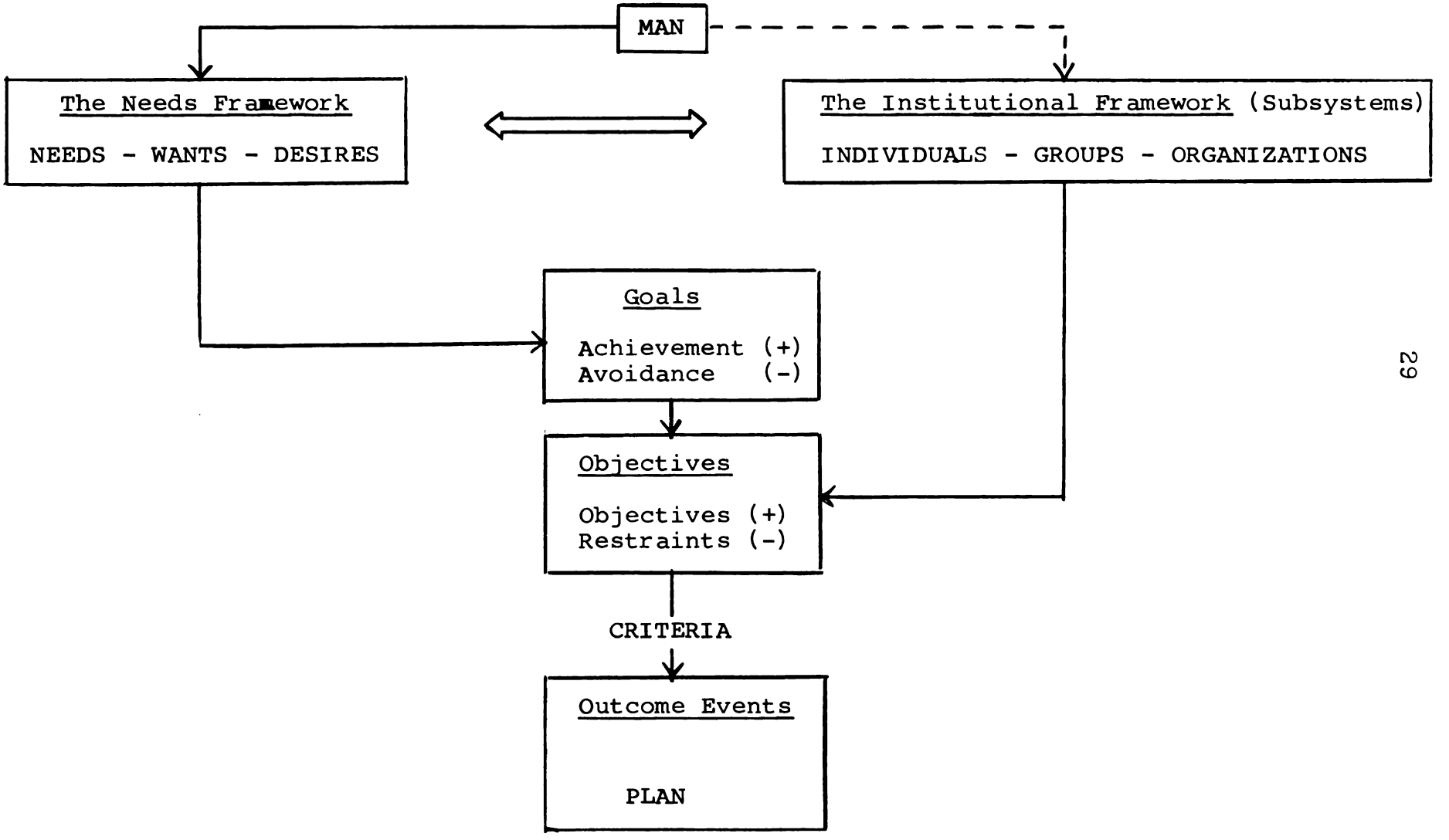
This approach also serves the decision process, and thus the alternative spatial policies which are our primary concern, through the design of alternative sets of outcomes based on alternative sets of objectives. These outcomes can be combined to optimize and to select the best possible system.

Finally, this approach is a useful device in plan evaluation. As will be brought out in the section following, alternative outcomes are based on alternative sets of strategies and alternative policies. The evaluation of these strategies has so far either been overlooked or carried out in an unsatisfactory manner (this is discussed further in chapter 4).

The evaluation process does not have to be applied to the total plan but can be applied to the parts of the plan as it is being formulated. This can be accomplished by testing the degree which the goals (performance criteria)

FIGURE 3

The Goal Formulation Process



have been met or will be met in the system or subsystem as it has been designed (course of action to be taken).

Decision Theory

The theory of decision making has until recently been confined to such conceptual fields as philosophy and economics. Various professions realized some of its valuable contributions and have adapted it to their field. The outstanding example of such a profession is business management, which has developed its own theories and models and has utilized all the available techniques in the pursuit of maximizing business objectives.

The planning process can greatly benefit by evaluating both the zeal of business management for new theories and applications, and from the adaptation of the decision-making techniques already developed. These applications can help the urban planning process achieve the following goals.

1. Better understanding of the urban planning process itself and what it can achieve.
2. Better techniques for choice among various alternative plans of action.
3. Better communication of possibilities between the planner and the decision maker.
4. A higher acceptance of proposals through the involvement of the decision maker.

The methods of decision making are not all theoretical, complex processes. They vary in complexity with the variables that have to be considered in making the decision. The simplest and most basic type of decision involves man himself and the decisions he has to make for biological survival. These decisions are made by instinct in response to a biological need. When the goals become more complex, man has to resort to deliberate choice among alternative possibilities for solution.

Another method involving human response, except at a higher level, is the method of trial and error. In this case man has to depend on his learning abilities and his memory in making a decision. If he fails in his attempt to solve the problem at hand he reacts in two ways; first, he reflects on possible causes of his failure and thus possible future actions, and second, he stores the information in his memory for referral purposes if the same situation should come up in the future. This process cannot be used in its simple form (as it has been described above) at the organization level since it would consume time to acquire the knowledge to make accurate decisions. Another drawback is that the price of "failure" is too great. On the other hand, the introduction of the high speed computers has opened new possibilities for this method. The computer can assimilate vast quantities of information and store them in its "memory" and thus be in the position to weigh various situations prior to their happening. This method has already

been a useful tool in planning and is commonly referred to as "simulation techniques".

The next logical method after the above is the "appeal to authority" method of making decisions. This method, the authority in this case, can take four various aspects, they are: arbitrary power, interaction, precepts of some ethical systems, and a number of mathematical criteria. The first of the four alternative "authorities" takes the form of an arbitrary direction backed up by superior persuasiveness, guile, or sheer economic, political, or physical force. This is usually reflected in the policies and laws of governmental systems. Intuition can take the form of any spontaneous generation of an idea which serve as a means to an end. This alternative is not as impulsive as it may at first appear since the originator usually goes through a mental process that is scientific in its reasoning even when it is based on emotional appeal, since this in turn has been based on learned cultural precepts. The third authority, that of ethics, was one way to avoid reliance on intuition. Ethical systems reflect deep philosophy of behavior that can guide both the actions and the attitudes of the men doing the acting. This method can be translated into the planning process by the reliance and use of goals reflecting the democratic ideology. The last of the four alternatives is mathematical criteria. These criteria include a variety of methods that would minimize risk and optimize opportunity. A thorough

discussion of these criteria is impossible due to the limitations of the subject.[7] A model discussing some of the relevant criteria applicable to city planning will, however, be introduced in the coming section.

In summary, decision making is a class of methods that can be utilized to choose a strategy from a set of alternatives. It is usually objective in nature and is distinguished by the fact that it is relatively free from human judgment intervention. The last statement is not always applicable in urban planning since the planner cannot control all the components and interactions within the system which concerns him. The planner, however, can determine the decision criteria that can be used to choose a strategy or a plan which will be used from a set of alternative plans for the controllable components. The alternative plans will consist of alternative allocations of components and subsystems to be used in the design of the region as a system.

We must not lose sight of the fact that the ultimate decision will be made at a higher level of "human judgmental intervention". This can be an individual decision maker - the mayor, a group - the city or regional council, the citizenry in general, and/or a combination of all the above.

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[7]For a discussion of "Statistical Decision Making and Games" refer to A. D. Hall, A Methodology for System Engineering, D. Van Nostrand Co., Princeton, New Jersey, 1962, pp. 296-320.

The role of the planner is to use the techniques as tools to classify his own thoughts and as a means of providing the final decision maker with a choice of alternatives and their accompanying implications.

Considerations of a New Methodology

Up to this point we have simply tried to prepare a framework for the proposal of a conceptual model for decision making. This model will hopefully illuminate and clarify our knowledge of planning decision, planning alternatives, planning outcomes, and the use of goal formulation in the planning process. In short the most efficient way to generate and evaluate alternative spatial patterns for the region.

The decision framework is composed of five basic elements.

They are:

"1. Strategies or plans constructed of controllable variables.

2. States of nature composed of noncontrollable variables.

3. Outcomes which are observations of results that occur when a specific strategy is employed and a particular state of nature exists.

4. Predictions of the likelihood that each state of nature will occur.

5. The decision criterion which dictates the way in which the information above will be used to select a single plan to follow."[8]

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[8]Martin Kenneth Starr. Production Management, Systems, and Synthesis, Prentice-Hall, Inc., Englewood Cliffs, N.J., 1964, p. 67.

Strategies:

Strategies are usually long term plans that project the most plausible solutions to the problems at hand. They take into consideration all the resources which they can control in achieving the solutions of that problem. Another term that is closely allied to strategy is tactic. This term connotes a method or a concrete procedure that can be used to carry out a strategy. In other words, it is the tool for converting a general plan into a specific course of action. Tactics use the basic components of the system in carrying out their purpose. In the case of the urban system the components can consist of men, artifacts, and natural organisms and substances. These components can be manipulated to produce various alternative arrangements. Such design strategies might include such theoretical patterns as "concentration", "decentralization" and "linear" patterns. A summary of this subsection follows:

1. Strategies are long term plans reflecting possible outcomes using controllable variables now available or that will be available at some future date.
2. Tactics are short term plans reflecting actions that can be taken within the strategies framework.
3. It is possible to have a number of tactics for each strategy. The best design will usually consist of the best groupings of

tactical possibilities.

4. A choice of tactics will have to precede the choice between alternative strategies, since a method for grouping or arranging the components is a prerequisite to the various systems designs.

5. In a mechanical insensitive system the strategies can be chosen first and then the means of carrying them out spelled out in detail. However, the urban system is a sensitive system, whereby the performance of tactics are interrelated and affect the outcome of various strategies. It is, therefore, imperative that the tactics be specified at the same time that the strategies are proposed. This concept is illustrated in figure 4.

States of Nature:

The next step of decision is the "state of nature" function. States of nature describes those factors that affect the result of a plan and yet are beyond the control of the planner. Such factors include; climate, political situations, economic changes, and so on. These factors can hinder the planning process. On the other hand, the planning process might be able to adapt to these conditions and work with or despite them. When the process can assume

a given state of nature the decision problem is called "decision under certainty". This example frequently occurs for short term planning situations. For long term planning situations, however, the alternative states of nature must be recognized and taken into consideration. This might require deep involvement in such perceptual fields as sociology, psychology, anthropology, political science, and economics. Until recently the planning process has grudgingly accepted the existence of these limiting factors but has chosen to avoid the issue by listing them as "assumptions" that will not hinder the process.

Outcomes:

Outcomes are the products of strategies and specific states of nature. Such outcomes might include the following examples; a given drainage system design (S_1) operating under a given state of nature (N_1) which in this case is "pouring rain" will flood (O_{11}), under drought conditions (N_2) it will dry up completely (O_{12}), and so on. This can be illustrated as follows:

	N_1	N_2	N_3	N_4	N_5
S_1	O_{11}	O_{12}	O_{13}	O_{14}	O_{15}
S_2	O_{21}	O_{22}	O_{23}	O_{24}	O_{25}
S_3	O_{31}	O_{32}	O_{33}	O_{34}	O_{35}
S_4	O_{41}	O_{42}	O_{43}	O_{44}	O_{45}

The table presents a decision matrix where four designs (strategies) interact with five different environmental

FIGURE 4A

Tactical Evaluation of an Insensitive System

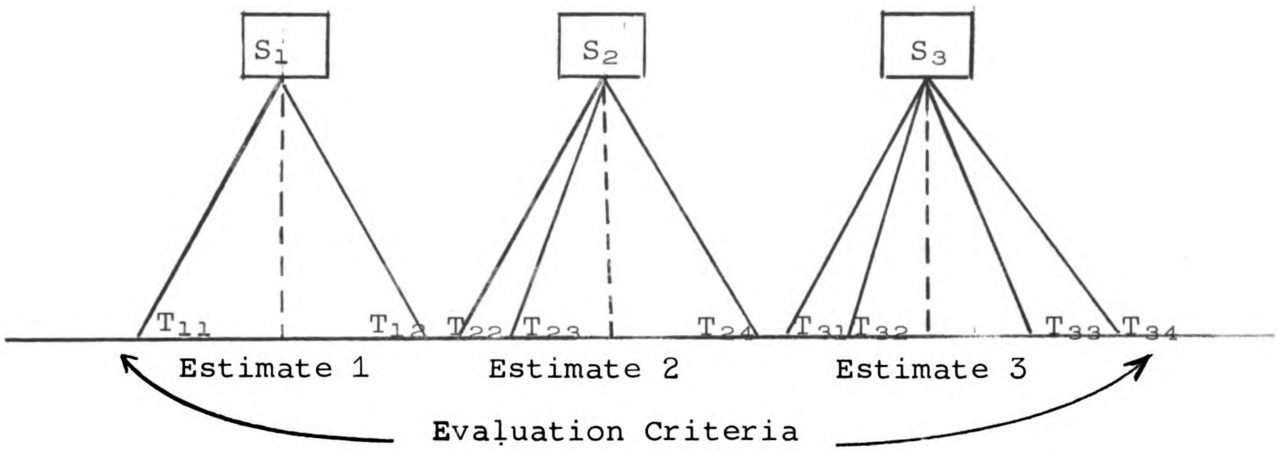
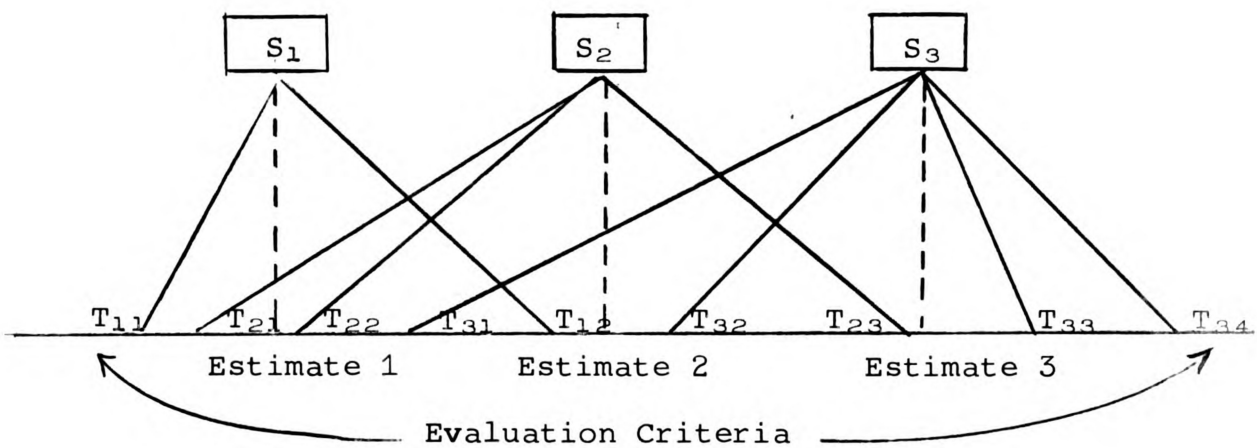


FIGURE 4B

Tactical Evaluation of a Sensitive System



conditions (states of nature) resulting in a whole series of expected or projected outcomes. These outcomes can be stated in numerical terms such as the number of hours that a drainage system can work efficiently under flooding conditions, or it might be the cost in dollars in constructing a facility, and so on. These criteria can then be evaluated to select the outcome which would satisfy a given objective. Relating this to the needs framework, the goal might be "safety" in which case the outcome reducing or eliminating flooding will be the desirable one.

Outcomes are obtained in at least three different ways:

1. By means of estimates and guesses
2. By observation and experimental results
3. By a knowledge of relationships that have previously been hypothesized (a theory).[9]

Planners have already utilized all three methods and combination of these methods. They have, however, seldom related these outcomes deliberately to the decision process. The third alternative has only recently been utilized by pioneering efforts in systems analysis, simulation, and other operations research techniques.

The whole process described above can be represented in mathematical form and thus as a mathematical "state" model. This can be achieved only under the following conditions. The strategies can be represented in numerical

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[9] Ibid., p. 80.

form only if the controllable variables lend themselves to such representation. The noncontrollable variables which make up the states of nature can also be represented by mathematical terms. The outcomes in this mathematical framework will be called dependent variables in contrast to the controllable and uncontrollable variables which are also called independent variables. Since the dependent variable is a function of the independent variables it can be represented by the following equation -

$$Oij = f(Si, Nj)$$

where: O = the outcome
f = function
S = strategy
N = state of nature
i+j = subscripts of certain strategies and states of nature

This function in turn might have the following hypothetical relationship:

$$Oij = S_i^3 - SiNj + N_j^3$$

where: Oij = outcome (in i and j)
S_i^3 = strategy to the third power
$SiNj$ = the product of strategy (i) times state of nature (j)
N_j^3 = state of nature (j) to the third power
$(i+j)$ = subscripts denoting strategies and states of nature.

In view of the above relationship we can readily perceive the need for numerical representation of the independent variables. This in turn will limit the applicability of this model to processes that can be expressed in numerical representations. The problem of evaluating alternative

spatial patterns for the urban region might be applicable to this model only if we remain in the physical spatial spheres and distributions. The social processes and interactions might be included with the further sophistication of these techniques at some future date. This might not be too far in the future, since we can presently accurately estimate these variables through the reliance on the first two alternate methods of determining outcome and the utilization of the electronic computers to sift through the large amounts of data which is essential in this case.

A statement made above regarding the usefulness of the model whenever the variables are not quantifiable might erroneously give the impression that the model is therefore of limited usefulness. It is therefore imperative to point out that the model can help clarify the decision process regardless of its ability to generate a quantitative product (the outcomes). Just the mere concept that the variables can be separated into controllable and uncontrollable variables can be a useful concept of looking at the problems at hand.

Prediction: The process utilized in converting the uncontrollable variables into a usable framework is called prediction. This process compensates in knowledge what we lack in direct control. We can predict such phenomena as sunrise, sunsets, high and low tides, forecast weather, and

so on. Since we know through experience what to expect from nature, we can choose an appropriate strategy and thus indirectly gain control over outcomes. In a similar manner to prediction of physical phenomena we can anticipate group behaviors from previous observations - this type of prediction improves as we move from the specific to the general, in this case, from the individual to large groups. This ability is, however, lessened by the existence of complex interaction processes between individual social and cultural systems.

The Matrix:

Whenever the outcomes vary across the matrix in incremental stages and the strategy remains constant although the "states of nature" change, the matrix is a "single state" matrix and can be represented with just one set of alternative outcomes. If, on the other hand the outcomes vary under both the uncontrollable variables and controllable variables, then the outcome matrix (single state) becomes a decision matrix. The problem in devising the full decision matrix is the reliability of the observed data that is ascribed to the "states of nature" variables. When considering the reliability of the variables we should ask the following questions:

1. How many states of nature are relevant?
2. Are we able to identify all the relevant states of nature?
3. Can we determine the "true" frequencies

of occurrence of these states of nature?

4. Are these frequencies fixed, that is, is the state of nature (causal) system stable?[10]

Decision Criteria: The final aspect to be covered under the decision framework suggested is that of criteria. The first type of criterion is that of (DMUC) "Decision Making Under Certainty". This method can be applicable only when there exists a single state (as has been described in the previous subsection). Therefore under a simple decision matrix where complications are negligible and the strategies are few, then DMUC would be a feasible criterion.

The second type of criterion is that of (DMUR) "Decision Making Under Risk". This exists when two or more states of nature are relevant, when all the relevant states of nature can be identified, and when a high degree of believability can be relied upon in respect to probability of occurrence of the states of nature. If all the probabilities of the states of nature are low except for one, then the DMUR can be elevated into DMUC. It is important to note that long-term predictions are dubious under DMUR and thus its highest contribution is in the short term problem solutions.

The third major class of decision criteria covers cases that can not be covered by either DMUC or DMUR. The method is DMUU "Decision Making Under Uncertainty". This method is useful in enumerating a finite set of states of nature. These, however, can not be evaluated in terms of

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[10] Ibid., p. 93.

likelihood of occurrence or probabilities. There are ways of dealing with such "uncertainty" through complex decision criteria.

Suggested Application to the Urban Planning Process:

The previous discussion has presented a framework of decision making, and defined the workings of all its parts. It is suggested that the urban planning process can utilize this model and adapt it to all types of decision-making problems like the following:

1. Alternative Strategies: Various "community" spatial form arrangements
   Alternative States of Nature: Varying demand levels for housing types.
   Outcomes: Measure acceptance
   Objective: Maximum choice
2. Alternative Strategies: Different traffic system "designs"
   Alternative States of Nature: varying traffic loads on highways
   Outcome: Measure average and peak loads
   Objective: a better systems design
3. Alternative Strategies: Different types of urban system (towns) designs.
   Alternative States of Nature: Varying occupational requirements
   Outcome: Measure demand for new communities

Objective: Maximum variety of environment

4. Alternative Strategy: Scheduled development growth programs

   Alternative States of Nature: economic fluctuation of housing

   Outcome: Measure rate of expansion

   Objective: A controlled rate of orderly growth.

5. Alternative Strategies: An industrial location layout

   Alternative States of Nature: Industrial competition of other regions

   Outcome: Measure desirability of sites

   Objective: Efficient distribution of industries.

6. Alternative Strategies: a program of water management

   Alternative States of Nature: (1) Variability of rainfall and,
   (2) urban development affecting rainoff.

   Outcome: Measure (1) average and peak accumulations
   (2) rate of run off per urbanization increment.

   Objective: An adequate supply of ground water and elimination of flood conditions.

Summary:

The planning process has always relied on decisions in one way or another, the planner has not, however, stated how he arrived at the various decisions. This fact did not matter at the time when the plan was merely a guide for development through specific recommendations. The planning process has developed to the point where the planner is part

of the public management team and is expected to contribute his knowledge and skill toward making rational decisions affecting the future development of the community.

It is in this context that the terms "choice", "alternatives", and "decisions" have entered the general planning terminology and have played a major role in developing new planning theories as well as adapting existing theories, heretofore used by other disciplines such as business management.

Considering this shift in orientation, this chapter has discussed various methodologies and concepts applicable in the decision-making process, and has suggested a new approach which can be used for the following purposes:

(1) It will clarify the factors (variables) required to make a rational decision.

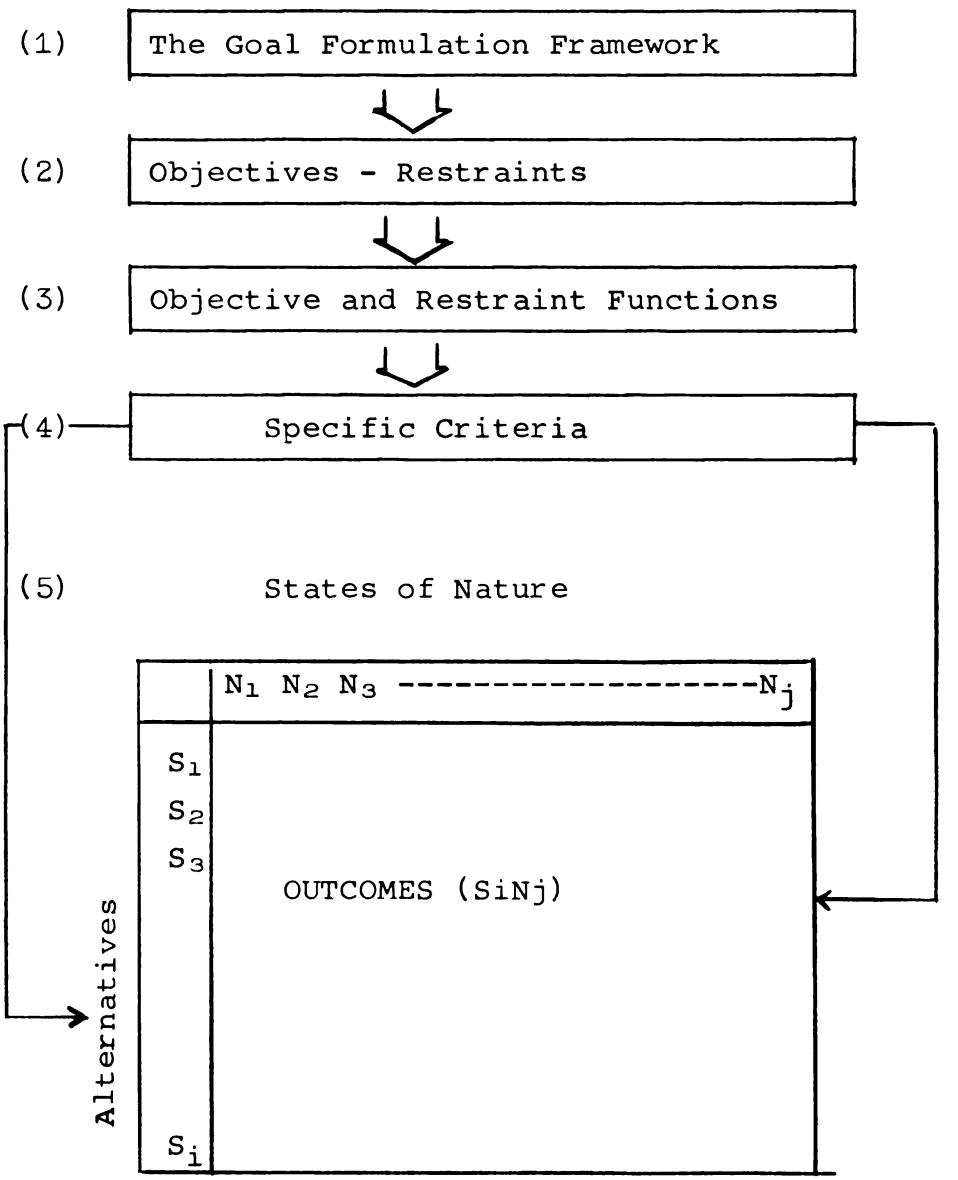
(2) It can present the alternative possible choices (strategies) for evaluation.

(3) It can help evaluate the strategies in terms of the results (outcomes) produced.

This framework will be further developed in subsequent chapters by linking it to regional problems and goals, to past and present alternative pattern usage, and finally to the evaluation of these patterns through the application of the framework and supplementing it with further analytical techniques.

FIGURE 5

A Decision Making Model for Urban Planning



CHAPTER II

FOCUS ON GOALS, PROBLEMS, ISSUES, AND POLICIES

A problem is precipitated when the goals of the individual, group, and community are not satisfied. Conversely solving a problem is tantamount to achieving a goal. This statement serves two purposes, it defines the term "problem" and links it directly to goals and the goal formulation process as it was discussed in the first chapter.

Problems are also composed of issues which for the sake of clarification are defined as public matters that require a solution through decisions arrived at on an administrative level. These issues can be the whole problem or only part of it, for example, water pollution is a problem while control of industrial sewage effluent and the question of constructing better water purification facilities are issues.

If we were to correlate the problems and issues with the goal formulation framework discussed in chapter one, we will find that there is a direct relationship between goals and problems, and objectives and issues. This concept is illustrated in figure 6.

In order to arrive at a set of policies the decision maker has to search for the problems of the region, translate these problems into goals - to carry out the solution of the problems, then into particular objectives reflecting the issues, and finally into a set of alternative policies requiring adequate evaluation in order to make the best possible choice of the alternative type of development to be effectuated in the region. This process will utilize all the steps presented in the decision-making approach discussed in chapter one.

It must be kept in mind, however, that while this approach advocates the use of the individual's needs, wants, and desires as a basis of an eventual choice of a particularly applicable decision, the decision maker should also weight the goals of the total system. Since the goals of all the individuals can't possibly be met, a preference system has to be established. This preference system can utilize the very same decision matrix presented in chapter one, with one variation. Instead of evaluating the strategies by their expected outcomes, we choose the preferred strategies by a combination of preferred outcomes. The preferred outcomes can be gathered by a census, a poll or a survey of the people within the community.

We must also take into consideration the feasibility of achieving the goals. To take the example of the problem of water pollution again, it might be a desirable goal to eliminate the problem entirely. This goal would require a series of decisions regarding methods which would involve

such objectives as the construction of additional sewage treatment facilities. If the facilities presently available are satisfactory but do not produce a "hundred percent" purification of effluent, and in order to do so, it would require doubling the facilities already present at a tremendous rise in cost, then the objective has to be weighed against other goals in the community requiring consideration.

This type of logic leads still further. Except for the most affluent region, it is impossible to optimize all the goals and objectives of a community simultaneously. Since our "modern" society is a complex system with interacting goals, to optimize one goal means many other goals are sacrificed. It is therefore of dubious logic to try to "optimize" any goals. It might be much more fruitful (to quote Simon[1]) to "satisfice" the goals. In other words, to work toward the satisfactory solution of the problem rather than attempting to maximize the goal (which reflected the need for a solution in the first place).

To summarize this subsection: we find that goals are reflections of problems which in turn are reflections of the "needs" of people. In order to achieve these goals the decision maker has to make a series of decisions which

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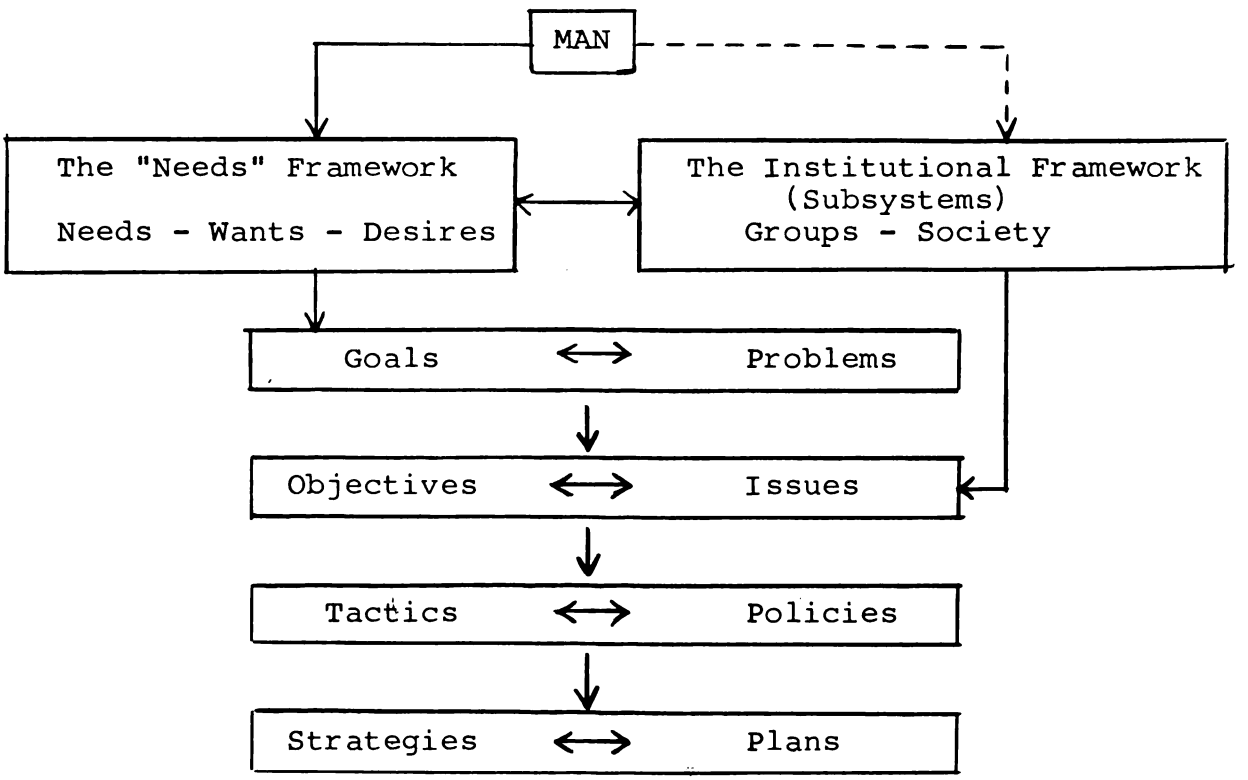
[1]Herbert Simon. Models of Man, John Wiley & Sons, New York 1957, p. 205.

FIGURE 6

Correlation of Goals and Problems



will affect the total system of events, and thus has to try to find the best possible decision to achieve the objectives and the goals of the community.

Since this framework starts with the recognition and the analysis of the problems and issues, the subsequent sections of this chapter will present some of the most pressing regional problems and some of the policies that have already been promulgated toward their solution. It must be pointed out, however, that no attempt was made to separate the issues from the problem and thus they will be treated together. This procedure is quite satisfactory at this point since the objective of this section is not to propose solutions but rather stimulate an awareness of the problems at this point. Further in the paper alternative patterns (solutions) will be discussed in detail.

A Synopsis of Regional Problems, Issues and Trends

The following problems, issues and trends do not cover the entire scope of regional problems that necessitate study, analysis, and solution. It is, however, hoped that the problems discussed can be used as a first step towards a further search for further problems that might not have been mentioned in this subsection or might be an outgrowth of the problems stated below.

The Rise in Population:

A sharp decrease in mortality, especially in infant mortality, and an increase in the fertility level combined to

produce a sharply increasing population rate. The 1960 census gave the U.S. population figure almost 180 million at which is an increase of 18.5% over the figures given for the 1950 census, and 58% over the 1900 population. At the present rate the U.S. population would double to 360 million by the year 2000.

In addition to the increase in net population, there has been a marked increase in the number of households and an accompanying decrease in the size (number of persons) of such households. This trend is very meaningful since it portends the need of more and more space per individual household.

The Shift to the City:

The U.S. has evolved from a country which is predominantly rural to a country which is predominantly urban within the twentieth century. In 1900, 30 out of the 76 million people (approx. 40%) lived in urban places while in 1960, 120 million out of the 179.5 million people (67%) lived in urban areas. At the present rate 85 percent of the nation's inhabitants will live in urban areas by the year 2000.

It is also significant that out of the 54 million rural residents only one third of them live on farms and get part of their livelihood from agriculture. Furthermore, one third of the population that live on farms are not primarily engaged in agriculture and are economically dependent on non agricultural urban jobs. In summary all the above

statistics only confirm the fact that our population is socially and economically dependent on the central city.

The Growth of the City:

In contrast and in opposition to the shift to the city, the city itself is growing outward into the countryside and forming something that is semi city, semi country; semi paradise, semi slum which has been referred to by such titles as "Urban Sprawl", "Scatteration", "Suburbia", "Subutopia", "Exurbia" and "Slurb". Today the central cities suffer from the loss of population and of economic vigor as can be easily discernible by the amount of vacancies and the poorly-kept homes and businesses close to the "down-town areas". The suburbs in turn suffer from the lack of ability to keep up with their new "blessings" and are ill equipped to render such vital services as adequate schools, roads, and utilities not to mention social and cultural facilities. The qualities can usually be discerned by the tumble of supermarkets, used car lots, drive-in restaurants, drive-in movies, and above all housing tracts and empty fields.

It is significant that all the major old established cities show a higher percentage of population loss since they have already saturated their incorporated boundary limits, while the newer cities that do show increases within the central city have either extended their corporate limits, or have not been fully developed.

The Motor Vehicle:

In examining the many factors affecting the urban pattern we find that the motor vehicle has had the highest impact in precipitating change. With the introduction of the automobile, man was free to move at will, rapidly, and comfortably. These advantages however, have their corresponding disadvantages, (1) requirement of adequate roads necessitating large outlays of funds, resources and space, (2) storage problems both at the origin and terminus of the trip, also resources, especially space. (3) Congestion, this problem is related to the storage problem especially when it is coupled with sheer magnitude or quantity of cars, (4) safety. The accident rate within cities has consistently risen each year in spite of all the safety devices introduced and the improvement of the road networks. The major problem here again is lack of room and the unreliability of the human senses.

The car has become an indispensable tool of transportation and is ranked along with food, clothing, and shelter as a "need" in our culture. Except for two periods in our history - the depression and World War II a graph curve of motor vehicle registration will show a steady and steep incline. The 1960 motor vehicle registration count amounted to 74 million vehicles - 61.6 million passenger cars and 12.3 million commercial vehicles. Three out of four U.S.families own at least one car (seven million families own more than one).

Since the motor vehicles have become such an entrenched institution in our everyday life it undoubtedly has affected many of our other traditional habits, behavior patterns, and even our economy. The most important of these effects as they have been felt by the developing region and the ensuing patterns will be discussed briefly in this section.

1. There is a direct relationship between car ownership and the socioeconomic level of the people. There is also a corresponding relationship brought out by the doctoral dissertation of Dr. Leo Schnore[2] showing that the growth differential between the metropolitan rings and the central cities is clearly related to two sets of factors: (1) The size of the central city - the larger the central city and the greater its population density the earlier its ring growth (suburban growth) exceeds the growth of the central city and the higher the ratio of the "ring" population to that of central population. (2) The ratios of ring growth to that of the central city vary directly with the level of median income or socio-economic status.

When we relate both Schnore's correlations with the relationship stated at the beginning of this section, it is not surprising to arrive at the conclusion that there is a direct ratio between car ownership and suburban population and development.

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[2]Leo F. Schnore. Patterns of Decentralization, University of Michigan, 1954.

2. The development of most large cities and their downtown areas in the past have depended on public transportation. This has changed with the progressive decrease in the use of mass transit and the increase in the use of the automobile for all types of trips. These trips and their implications will be discussed in this subsection. These include Home Based Trips, Work Trips, Social-Recreational trips, Shopping and Business trips, and School trips.

(a) Home-Based Trips: Between 87 to 95 percent of all auto passenger trips originate and terminate at the home. This means that the home is the source generator of most of the traffic.

(b) Work Trips: This category accounts for one fourth of the home based trips. This ratio goes up to 40 percent of home based trips in cities that are commuter oriented such as Detroit, and Washington.

(c) Social-Recreational Trips: The second most important trip destination with an average of 20 percent of all house-based trips.

(d) Shopping and Business Trips: Separately they constitute 17 and 10 percent of home based trips. If considered together, this category surpasses the previous one in importance.

(e) School Trips: This category is variable depending on the reason and the school age population of the area. Although least numerous of all trip categories it should be

considered as one of the planning problems.[3]

There is also a trend that can be very meaningful in future development - Future nonwork trips will be of even greater significance than work trips and will affect our land use distribution drastically.

The implication of all the above information that is applicable to this chapter and the rest of this paper - that all the generating components of travel should be considered separately in the planning stage of a metropolitan network pattern.

3. Changes in Land Use: The decentralization process has already created new patterns of Land Use distribution but has not yet jellied into a significant form. The urban metropolis and the region are in the midst of transition. These changes have mostly been influenced by the increased mobility along with economic and social motivations. It is for this reason that this subsection is included under the "Motor Vehicle" section. These trends will be discussed by Land Use classification below:

(a) Residential Trend: This part has been discussed under the section titled the "shift to the city" and the findings of Schnore's dissertation presented in the previous subsection. A recent attitude survey conducted in

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[3]Wilbur Smith and Associates. Future Highways and Urban Growth, New Haven, Connecticut, 1961.

Providence Rhode Island in 1956 showed that "there is a compulsive urge among residents of the city to move to the suburb or to the country, and there is little compensating urge among residents of the suburbs or the country to move to the city."[4]

(b) Industrial Trends: Industry is heavily dependent on transportation, markets, materials, and a labor force for its location criteria. Transportation has made decentralization possible, however, industry still has to remain close to the market and worker population. It is for this reason that most new industrial expansion has occurred on the periphery of well established urban areas rather than in areas with small labor supply and market conditions. A case in point is the tremendous industrial development that has occurred and is still mushrooming on the perimeter freeway circumscribing the Boston Metropolitan Area.[5] Two years after the completion of the freeway saw the location of new industrial and commercial plants costing $100 million and employing 17,000 persons; 70 of the new plants have moved from sites that were either in Boston proper or within its close environment.

(c) Commercial Trends: The regional shopping center has become part and parcel of the American way of life.

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[4]Prutt, Robert W. Attitude and Practice of Residents of Greater Providence Concerning Downtown Providence, 1956".

[5]Bone, A.J. and Wohl, Martin. "Massachusetts Route 128 Impact Study", Highway Research Board, Washington, D.C., 1959.

This phenomenon started after World War II and since has become an indispensable part of the general decentralization process. As of 1961, there are approximately 100 large regional shopping centers in the U.S. Each of the centers includes 400,000 square feet of stone building area. All of the centers are located on sites between 40 and 100 acres, and include a minimum of one major department store of 150,000 square feet or larger.[6]

This trend of dependence on the shopping center to service not only the new suburban population but the central city as well has many implications relating to future regional growth and land use allocation.

(d) Central Business District Trends: The shift of population and the subsequent shift of shoppers to the regional and community size shopping centers has adversely affected the central business district. Between 1948 and 1954 retail sales in suburban areas increased 53 percent while the central business district increased only one percent, this amounted to a 25 percent drop for the CBD.[7] The trend does not seem to reverse, as a matter of fact, there is a direct ratio between increase in the construction of interceptor rings around downtown (which makes ideal locations for central shopping centers) and decrease in retail trade in the central business district.

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[6]Hoyt, Homer. "The Status of Shopping Centers in the U.S." Urban Land, Vol. 19, No. 9, Urban Land Institute, October 1960.

[7]McMillan, Samuel C. "Changing Position of Retail Trade in Central Business Districts," Traffic Quarterly, July 1957.

Other downtown strongholds such as consumer trade, hotels, motels, and movie theaters have also felt the pinch of competition from the new suburban facilities.

Summary: Figure 7 will serve as a summary of the urban travel factors and their future trends. It is noteworthy that at the present trend the motor vehicle will have a very decided impact on future land uses and the patterns they can assume.

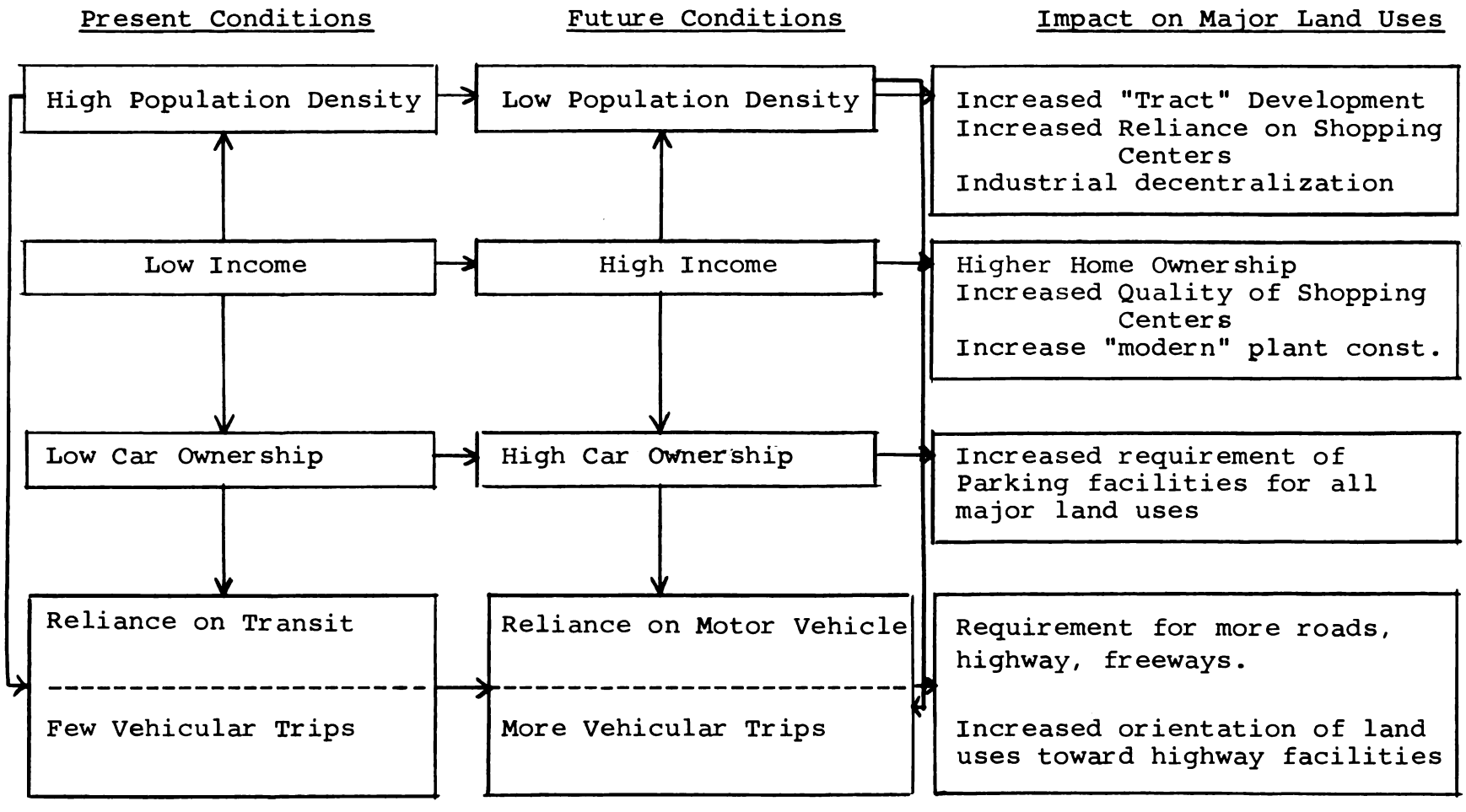
The Highway: Related to the problem of the car and its impact on regional development in the issue of the role of the "Highway". Unlike the car, however, the highway is a controlled component and is dependent on policy decisions which in turn can implement or alter conditions leading to stabilization of the urban pattern or the introduction of new patterns of growth and development.

Historically the major highway networks of the U.S. can be traced to the stimulus of the Federal Aid Road Act of 1916 which stimulated joint federal and state highway construction. Since then highway building has flourished with increased automobile ownership and usage and accompanying dependence of commerce and industry on the highway for transportation. Following are some trends noteworthy in their impact on regional development.

1. Road Mileage: Road mileage has increased from 2,000,000 miles of roads (only six percent surfaced) in 1904 to 3,500,000 miles of road (70 percent of which are

FIGURE 7

Urban Travel Trends and Consequences



surfaced).[8]

2. Land Usage: The above figure of 3,500,000 miles of highways occupy an estimated 22,000,000 acres, or an average of six acres of land per road mile. The projected 41,000 mile system of Interstate and Defense Highways will require an additional 1,500,000 acres three quarters of which will be located on new rights-of-way. The new system, however, will utilize land more efficiently since it requires only a 5 percent increase in land usage while serving an estimated 20 percent of all travel requirements.

3. Vehicular Travel: There is a close relationship between highway travel and the gross national product. Except for a decrease in travel during the second world war a graph would show approximately parallel courses. This trend links travel behavior to our economy but might also be interpreted to indicate the effect of travel on our economy.

Summary: The development of transportation facilities has and will always play the part of opening new areas for development and intensifying the present uses in already existing agglomerations with consequent increase in land values. This role has become more selective with the inception of the "freeway" (a limited access highway). Where the traditional highway tended to attract ribbon commercial

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[8]U.S. Department of Commerce, Bureau of Public Roads; Highway Transportation, Background Information prepared for the National Academy of Sciences, National Research Council, Transportation Research Study, Woods Hole, Massachusetts, August 1960.

development, the freeway has encouraged more intensive uses such as industrial parks, and regional shopping centers near interchanges. In addition to precipitating change the freeway has played a dual role of stabilizing the land uses by limiting the rate of turnover and by delimiting basic long range patterns. It is for this last reason that this chapter has put so much stress on the car-oriented developmental issues. The planner can utilize transportation facilities asa means to link, stabilize, and/or buffer his land use arrangements depending on the objectives to be carried out.

The Vanishing Countryside: Our cities are growing at the rate of 3000 acres per day.[9] At this rate of land consumption the Urban Land Institute estimates that by the year 2000 the expansion of 300 metropolitan areas will consume some 55,000 square miles of additional space surrounding these centers. This space is preempted from surrounding farm areas through sheer economic advantage. Even rugged topography and swampland have not hindered this urban spread due to superior technical skills of the large scale developers.

In light of the above statistics, urgent action is required if we as a nation are going to save some open space not only for recreation but for breathing space and visual relationship to nature amid the heavily urbanized negulopolitan developments. Recently the urban planner has been

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[9]Architectual Forum. "The City's Threat to Open Land", January 1958, p. 87.

concerned with programming and phasing urban growth. This concern has emphasized the sequence of metropolitan growth rather than form. The planner should modify this philosophy to consider the areas that cannot or should not be developed because of open space needs for recreation, conservation, agriculture, and an efficient and aesthetic urban development. The last point will be developed further in the next chapters.

Smog and Dead Fish: Related to the previous discussion of open space is the issue of pollution and conservation of natural resources. In order to do justice to these issues we should analyze each topic separately.

1. Water Pollution: Like everything else in our lackadaisical society a problem is not considered to exist until a catastrophe is precipitated. This is also true in the attitude toward water conservation and pollution. Such a catastrophe occurred at the end of the 19th century in the form of virulent typhoid epidemics in various U.S. cities. The outcry that ensued resulted in (1) health authorities set aside certain streams for waste disposal purposes while protecting other for water supply, which in turn resulted in protected watersheds and water reservoirs. (2) The second method was the resort to sanitary engineering technology in purified drinking water and processing the used water for later purification and reuse by other communities further down stream. These methods solved the

health issue and the populace was satisfied into a state of indifference. The issue of pollution, however, remains as any fisherman would readily testify. Unprocessed affluent from water using industries and partly processed effluent from some sewer systems of cities, combine to ruin numerous streams for recreation and aesthetic purposes. To aggravate the problem, technology has introduced such substances as pesticides, detergents, and petrochemical wastes that are highly resistant to breakdown by ordinary water treatment methods. Some laws and controls have alleviated the problem through lengthy court battles, the problem, however, still exists and should be of grave concern to the planner.

2. Air Pollution: Society is starting to realize that "the air around us is not a limitless sea into which we can continue to pour waste without serious consequences."[10] Air is affected by the pollutants as: (1) gaseous substances such as carbon monoxide, sulfur dioxide, and various oxides of nitrogen. The substances behave like air and thus do not settle out. (2) Particulate pollutants are minute solid or liquid droplets that float with air movements and thus rarely settle out. It is obvious from the preceding statistics that smoke is not always the main culprit. These pollutants are not usually readily seen or felt unless they

[10]Brandt, Stafford. "Air is for more than Breathing", A Place to Live, the Yearbook of Agriculture, Washington, D.C., 1963.

are in high concentrations like the infamous Los Angeles "Smog" - and can be detrimental to the health of the human beings and other animal and biological organisms.

The planner should be concerned with this aspect of pollution since it is an integral part of all the factors that produce the "good life" that we are all striving for.

Summary: The urban planner has to know all the factors affecting the elements that he is manipulating to produce the optimum arrangement of uses. Recreation, health, beauty and future ecological development should be considered as interwoven factors to be implemented with any ideal arrangement of Land Uses.

Major New Policies Affecting the Region

Up to the present this chapter has dealt with problems and issues affecting the urban pattern. In part it pointed a gloomy picture and justifiably so. However, there has been some policy decisions and recommendations at all levels - Federal, State, Local government and private interests - toward a new attitude toward the problems discussed and urban problems in general. In the following section we will attempt to list some of these pertinent policies.

The Administrative Branch:

President Johnson has been keenly interested in the urban problems and has striven to propose and implement

policies that are very significant considering the tremendous power at his disposal. A cursory review of these important speeches follows:

1. On January 27th, 1964, President Johnson delivered his Housing Message to Congress in which he introduced the 'Housing and Community Development Act of 1964' and a bill to establish a department of Housing and Community Development. The Bill contains two sections that contain potential for the shaping of regional growth.

(a) The proposal - inaccurately identified as a "New Towns Program" - which proposes "New Communities" which can be adapted to our metropolitan growth pattern and needs, and to already existing methods of private development.

(b) A new FHA mortgage program which will assist private developers in financing both land requisition and development costs.

2. On May 22, 1964 President Johnson introduced his dream of "The Great Society" in a commencement address at the University of Michigan from which the following quotations are excerpted.

> "Your imagination, your initiative, your indignation, will determine whether we build a society where progress is the servant of our needs, or a society where old values and new visions are buried under unbridled growth."
>
> "In the next 40 years, we must rebuild the entire urban United States. -- There is the decay of the centers and the despoiling of the suburbs. There is not enough housing for our people or transportation for our traffic. Open land is vanishing and old landmarks are violated."

"The water we drink, the food we eat, the very air we breath, are threatened by pollution. Our parks are overcrowded, and our seashore over burdened. Green fields and dense forests are disappearing".

3. In his most recent speech - the State of the Union message to Congress on January 5, 1965, President Johnson made the following statements:

"In our urban areas the central problem today is to protect and restore man's satisfaction in belonging to a community where he can find security and significance."

"The first step is to break old patterns - to begin to think, -- work, and plan for the development of the entire metropolitan area."

"New and existing programs will be open to those cities which work together to develop unified long-range policies for metropolitan areas".

"We must make a massive effort to save the countryside and establish - as a green legacy for tomorrow - more large and small parks, more seashores and open spaces than have been created in any period in our history".

The Legislative Branch:

1. The open space land program under the administration of HHFA provides grants up to 20 percent of the cost of acquiring open space for parks, recreation conservation, and scenic or historic purposes. Where applicants act for an entire urban region, the grants may be increased up to 30 percent.

2. In 1962 Congress passed "The Highway Act of 1962". This Act requires after July, 1965, that before any Federal highway can be built in an urban area of over 50,000 population, that there be under way a continuing comprehensive transportation planning process conducted with the

participation of the local communities involved.

3. Congress recently passed the "Land and Water Conservation Fund Act of 1965"[11] which has been effective since January 4, 1965. This Act was created for the purpose of procuring and developing facilities for present and future recreation needs of the American people. This should be accomplished by (1) providing funds and authorizing Federal assistance to the states in planning, acquisition and development of needed land and water areas and facilities and, (2) providing funds for the Federal acquisition and development of lands and other areas.

The act provides for advance appropriations for any of the primary purposes of the act such as planning, acquisition of land or water properties, and/or development of the properties for outdoor recreation. The state has to repay the advance appropriations. The state however, can receive up to 50 percent of the cost of planning, acquisition or development projects, providing that the project is approved by the secretary of the Interior. It is noteworthy to point out that "a comprehensive statewide outdoor recreation plan shall be required prior to the consideration by the Secretary of Financial Assistance."

The Federal government agencies such as the National Park System, the National Forest System, and

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[11] U. S. Public Law 88-578, 88th Congress H.R. 3846, September 1964.

wildlife conservation agencies will receive their allotments directly from the President. The Federal agencies cannot, however, use appropriations from the "fund" for acquisition purposes unless it is authorized by law.

Private Development Decisions:

Recently private developers have been sold on the advantage of comprehensive planning. As a result two important courses of action are being followed. (1) The large developer is looking to the regional agency for preliminary guidance and abiding by its long range plans, where those plans make sense to him. An example of this is the development of the city of Reston, Virginia in accordance with the National Capital Regional Planning Commission's plans. (2) Private developpers are taking the initiative and proposing a plan (prepared by professional planners) for the entire development and its relation to its environment. Examples of this type are, El Dorado Hills, the City of Irvine, California.

Public recognition and demand for action on urban problems have also been manifested by such private groups as "California Tomorrow" which has published two scathing reports on existing urban problems in California entitled California Going, Going . . . , and The Phantom Cities of California.

CHAPTER III

CONCEPTUAL BACKGROUND OF SPATIAL PATTERNS

In order to fully understand the various pattern' proposals that the "present day" planners - to distinguish them from the "utopian" planners - have been recommending as alternative patterns or forms for the region, it is necessary to discuss the origin of these proposals. The utopian writers, philosophers, as well as some planners, discussed in this chapter have set a precedent for our present thinking through their ideas, principles and illustrations. It must be kept in mind, however, that the utopian was concerned with the solutions of a problem that existed in his epoch. The problem was not always confined to the physical aspects and usually reflected a social or political problem. For this reason it was deemed necessary to present a background for each of the proposals discussed.

The historical precedents section will be followed by a brief evaluation which in turn will be followed by a summary of theoretical patterns that can be utilized as examples of ideal spatial patterns for the region.

Historical Precedents

Since evolution rather than importance of concepts is stressed in this section, the proposals will be discussed

in chronological order. It is also important to point out that this section will not attempt to cover all the ideas and plans proposed by utopian writers, architects, and planners. It will rather cover a selection of ideal proposals that are applicable to large scale planning and each group will represent a diverse set of ideas which will set the stage for further discussion.

1. Soria y Mata, La Ciudad Lineal, 1882

a. Background of Proposal - Soria y Mata was a Spanish newspaper writer who devoted his column to city administrative and social reform in Madrid. He repeatedly preached the use of the new scientific innovations such as electric power, steam heat, telephone, and elevated and underground railway lines, for the betterment of life in Spain. This concept was developed by him over a period of time, but finally published in a detailed article headed "La Ciudad Lineal".

b. Outline of Proposal: The main concepts of Soria's proposal for a Lineal City consist of -

1) The use of a street, 40 meters (122 ft) wife, and of indefinite length, as the axis of "backbone" for land development.

2) This street would be intersected at intervals of 300 meters (925 ft) by secondary streets 20 meters (61 ft) in width, thus forming large superblocks of 40,000 to 60,000 square meters' area.

3) A track for both trolleys and railroad will be located in the center of the axial street.

4) The super blocks are to be further subdivided into residential lots with compulsory setbacks (5 meters) (15.3 ft).

5) Workshops, stores, markets, and community facilities were to be placed in the center of the blocks.

6) The total of width of this (1525 ft) development will total to about 500 meters extending indefinitely and joining together two, older, established, "point-cities".

c. Effect on Planning: Soria was the forerunner of the use of strip development as a planning concept. The use originally contemplated by Soria is both organizationally and aesthetically acceptable. Other artitects and planners have incorporated some of the major principles of using a transportation axis, separating uses by strips of green belts, and the limitation and consolidation of development within a strip. The later schemes have been worthwhile additions to regional planning theory.

2. Ebenezer Howard, Garden Cities of Tomorrow, 1898

a. Background of Proposal - Ebenezer Howard attempted to solve the problems that were precipitated by the industrial revolution in 19th century England. Congested dwelling units and lack of open space were two of the major issues that concerned Howard. His proposal used London as the problem area, and this suggested that its population should be reduced by utilizing his new satellite towns.

b. Outline of Proposal - Howard recommends the following guidelines for his proposal:

1) Each town should be constructed according to a predetermined size, accomodating 32,000 people.

2) The towns should be separated from each other by "greenbelts" of open land devoted to agricultural, institutional, and recreational uses.

3) Each town should be self sufficient, thus should contain industrial, commercial, and professional facilities for the employment of its own population.

4) Land should be owned by the municipality and leased to the individual occupants.

5) A regional pattern should consist of a series of new towns, about ten in number, surrounding a core city in the center and bound closely by public rapid transit.

6) The design of the individual towns should consist of concentric circles of uses starting at the center with a central park and progressing through; a commercial ring, a residential ring, an institutional ring, another residential ring, and finally an industrial ring next to a circumferential railroad and, of course, the "greenbelt".

7) The density in the residential areas should be about twenty dwelling units per net acre.

c. Effect on Planning: Howard's proposals have the unique distinction of being accepted and effectuated both in England and the United States. "New Towns" and "Greenbelts" have been accepted as national planning policy in England and with minor variations in the construction of the three "Greenbelt Towns" in the U.S. (1935-38). The regional implications, therefore, do not have to be imagined since the proof that this proposal works can already be seen by actual examples. The proposal does, in fact, help create an orderly pattern of efficient cities that help decrease the population pressure of the central city.

3. Erich Gloeden, Die Inflation Der Gross-Städte, 1923

a. Background of Proposal: The author, a German, reflected the feelings of change brought about after the

first World War and the ensuing inflation that struck Germany at that time. The translation of the title "Die Inflation Der Gross-Städte" is - The Inflation of the Large City.

b. Proposal Outline: The author proposes a metropolis of

1) A number of identical cells of 100,000 population.

2) Each unit has its own characteristic function and is completely self contained and is not dependent on a central city for employment or any other urban function.

3) All the units should function together as one whole unit with equal parts.

4) The units are linked by an inter urban railway system and are served by public facilities located in the greenbelts surrounding each individual cell.

5) Each unit has a diameter of 1½ miles which is equivalent to 15 minutes walk from the edge to the center. The design includes a core of establishments unique to that cell surrounded by residential districts grade in intensity from high to low in outward progression. The greenbelt envelopping the whole honeycomb measures 1/2 a mile between the edges of any two cells.

6) Growth would be accomplished through the addition of more individual cells with no apparent limit to the number of additions.

c. Effect on Planning: Since its inception, this idea provided an alternative to the satellite town approach suggested by Howard since it is completely detached from any previous core city. The elements that have been accepted and further developed in other forms include the walk to work distance relationship, and the segregation of

activities, especially the offensive ones, to a greenbelt outside the proper boundaries of the unit.

On a regional scale, the proposal would permit the construction of a whole urban pattern by constructing the individual cells separately. Interrelationships between the cells and the connecting transportation will require much planning and forethought.

4. Le Corbusier, the City of Tomorrow, 1924

a. Background of Proposal: Le Corbusier is a renowned French architect who at this period in his career was enchanted with the American skyscraper and visualized unlimited possibilities for this technological phenomenon. This proposal was recommended by him as an essay in planning, or rather replanning, the City of Paris.

b. Outline of Proposal: Le Corbusier's proposal emphasized a concentrated highly imaginable plan made up of the following points:

1) The core of the city is composed of a series of skyscraper office buildings set in green open spaces.

2) A residential zone surrounds the inner district and it also is composed of high rise structures set in green open spaces.

3) The final boundary or zone is a greenbelt which also includes some community facilities but is mostly devoted to recreation.

4) An industrial area is set aside outside the proper zone, but is underemphasized.

5) All the zones are on a superblock scale of approximately 200 to 400 meters long. These blocks are connected by an underground rapid transit as well as multilevel

circulation facilities.

6) The population density in the residential area is set at 50 dwelling units per acre while the office core density can reach 1200 workers per acre.

c. Effect on Planning: This proposal in spite of its failing cannot help but inspire the imagination with its visual grandeur. The principle of conservation, or the creation of open space through the use of high rise structures set in green open areas is a meritorious one and is proving to be beneficial in present day renewal efforts. The separation of transportation uses to high speed, high capacity systems is also of great value. The regional implication of this proposal is simply that growth will be shifted inward and upward rather than indefinitely outward.

5. Frank Lloyd Wright, Broadacre City, 1932

a. Background of Proposal: Wright presents an antithesis to Le Corbusier's proposal in this plan. It is a pure, rural, ideal society where the author's midwestern origin is readily obvious.

b. Outline of Proposal: The basic philosophy behind this proposal is the closeness of man to land and the agrarian American heritage. The main aspects which give this philosophy "form" follow:

1) The major land uses are grouped together by type of use with the public facilities (serving the land uses) located near highway intersections.

2) The highway is an indispensable link tying all the land use groupings to each other while at the same time separating the categories of Land Use into groupings. The grid is therefore the general formative transportation system in this proposal.

3) The ideal of one acre per family is the general density for this proposal.

4) There is no limit to growth as long as there is land available.

c. Effect on Planning: The regional planner does not have to strive too hard to emulate the "Broadacre" proposal. The only difference between the design and the present trend of city growth is Wright's architectural organization and discipline. In fact what Wright proposed as "the City of the Future" might bet become "the Region of Today".

6. Jose Luis Sert, Human Scale in City Planning, 1944

a. Background of Proposal: This proposal is made by a European trained architect-planner with an excellent knowledge of the Western world. He is both aware of the post World War II reconstruction problems and is a willing contributor toward the solution of those problems. This proposal was submitted as a symposium contribution to the CIAM (The International Congress of Modern Architects). The theme pertained to the establishment of criteria, for new development and a concomitant approach to forms of post-war "three dimensional organization".

b. Outline of Proposal: Sert's proposal can be classified as a linear-city concept. The extent in which

his proposal goes beyond the basic concept is outlined below:

1) The author assumes the existence of a direct causal chain from a physically organized environment to a viable social structure and thence to an individual's good life. There is, therefore, a hierarchy of identically similar units except that they grow in scale as they progress to a larger environment.

2) The human rather than the vehicle is stressed as the unit of design.

3) The most ideal housing type permits high immediate density within open surroundings.

4) The hierarchy of units mentioned above consists of eight neighborhoods around a "township" center; and a number (usually two) of "townships" around a "Civic Center", finally a group of civic centers run the length of the proposed metropolis and are joined to the main artery of traffic.

5) A heavy industrial district runs along the main artery.

6) A greenbelt envelops the residential neighborhoods, townships and civic centers and is used as a buffer along the traffic artery and heavy industrial district.

7) Circulation within the individual neighborhoods is by foot, while a rectangular grid of rectangular highways connect the individual townships to the main linear artery serving the region.

8) Expansion and growth is accomodated by the addition of units.

c. Effect on Planning: This scheme was picked as one of the more sophisticated variations of the newer utopian proposals by such other proponents of the lineal city as Garnier, and Hilberseimer. They all propose a drastic reorganization of the city as we know it today. According to the proponents of this reorganization it is

imperative if the city is to survive in this modern world of industry and its resulting artifacts.

7. S. E. Sanders and A. J. Rabuck. New City Patterns, 1946

a. Background of Proposal: Both authors are site planners with experience in the Federal government building programs and are especially familiar with the Washington and Baltimore metropolitan areas. Their book is concerned with the various aspects of post-war city rebuilding and the economic justification of such action.

b. Outline of Proposal: The authors place high emphasis on control of the various urban elements in order to achieve certain objectives. These are spelled out as follows:

1) The semi-independent, low density neighborhood is held to be a desirable objective of the new physical environment.

2) The core of the city will consist of a commercial district. Emanating from the center outward, and following a radial street pattern, six (or more) linear neighborhoods are developed. Each of these neighborhoods are separated from the adjoining sector by a wedge of open space which in turn accomodates institutional and recreational facilities.

3) Each radial sector will house an approximate 3,000 to 10,000 population.

4) The circulation pattern is made up of both radial and ring, limited access highways that help channel traffic away from the neighborhoods.

5) The optimum density of this proposal is thirty families per net acre.

6) Industrial developments are placed outside the neighborhoods in the periphery of city and serviced by both a ring road and a railroad.

c. Effect on Planning: This proposal was a forerunner to various schemes presented for the development of both the Washington and Baltimore regions. These plans will be discussed in greater detail in the next chapter.

8. Victor Gruen. "How to Handle Congestion and Scatteration", 1956

a. Background of Proposal: Victor Gruen is an architect-planner and a consultant on city planning who has achieved fame in "Downtown Renewal" in various American cities. He was asked by Architectural Forum Magazine to propose a new method of planning to solve the problems of congestion and scatteration.

b. Outline of Proposal: Gruen utilized many concepts already proposed by other utopian writers. He has, however, achieved a functional amalgamation of both theoretical thought and practical understanding as can be gathered by the following points.

1) The regional pattern will be made up of a hierarchy of "Clusters" that escalate from the individual to family, social unit, neighborhood, community centers, town center, metropolitan center, and finally a regional cluster.

2) All the subclusters are based on a walking distance standard devised for its specific conditions and purposes.

3) Each cluster unit and their grouping are outlined and separated by "neutral open areas" which serve recreational or agricultural uses.

4) A transportation system of railroad, freeways, and express roads will utilize the neutral open spaces to connect the individual clusters without piercing any protected zone of human activity.

5) All loop terminal points will include automobile storage facilities of all classes from simple surface parking to more complex underground and high rise facilities. This feature is particularly important at the hierarchy of centers serving their respective cluster units.

6) Population limit for the individual town units will range from 50,000 to 200,000 people.

c. Effect on Planning: The concepts proposed are not new Gruen's arrangements and organization, however, are new. For example, Gruen's proposal for isolated neighborhoods with their own service facilities of education and commercial facilities have been proposed by Purdy; the separation of traffic from residential areas and the maximization of walking facilities has been proposed by Stein, the hierarchical order of communities has been proposed by Doxiadis.

The positive contribution that this proposal does make is its conciliation of the technological and the human factors. Its synthesis of previous proposals can serve as a new framework to control and channel growth through the control of the facilities for movement and the areas they serve.

Evaluation of the Ideal Patterns

The patterns presented in the previous section have served a very useful purpose. They have provided the people of their time with a possible solution to the problems

plaguing them, and the people of today with a useful reference to possible solutions to similar problems that exist today. The problems that faced each of the authors presented varied in nature and goals. The nature of the problem can also be stated as the season for its existence. The regions might be of a pure physical (structural) nature but more often were of a social, political and economic nature with the categories combining to include more than one of the categories. The goals and the methods of carrying them out, however, differed while the nature of the problem remained the same. For the sake of this evaluation the goals that were stated most often and thus the goals that will be used to evaluate the various proposals will consist of the following:

1) Congestion
2) Open Space
3) Spatial Organization
4) Flexibility of growth

The above are grouped according to their importance. This importance was objectively deduced from the proposals and thus reflect the values of the authors. The goals also include numerous subgoals and objectives that will be brought out in the evaluation which follows.

Congestion: Congestion was the primary problem of Y Mata, Howard, Wright, and Gruen. Soria Y Mata was concerned with the congestion in Spain's large cities, especially the working class housing problem. His proposal suggested a method of acquiring, developing, leasing, and servicing land

thus enabling the workingman to live in comparatively spacious surroundings while at the same time being able to go to the central city via the train which was the "spine" of Soria's proposal. Howard was concerned with the same problem - congestion of the city of London. His proposal, like Soria's, proposed acquiring, developing, leasing and servicing land. The proposal, however, differed in its linkage to the central city. Where Soria's development would be tied to the central city by the railroad, Howard proposed an independent entity complete with all the urban facilities of the larger city. Wright exceeded both previously named authors in the scope of his solution to congestion. He proposed widespread home ownership on "one acre" parcels. Where all three above authors were concerned with population congestion Gruen added a new dimension, congestion of the motor vehicle in addition to the congestion of housing and people. Gruen proposed a functional separation of the motor vehicle from the activities of the people. His land use proposals considered the need of the motor vehicle and provided separate facilities for its performance without encroaching on human activities.

Open Space: The next major problem is that of open space. This space was used by all the authors in various way including: space as a separator, space for health reasons, space for recreation, and so on. Since all the authors emphasized open space in some form or another we shall confine the discussion to proposals that placed emphasis on

open space as an "end" in itself. These included such authors as Howard, Le Corbusier, Wright, and Sanders and Rabuch.

Howard considered open space as a desirable objective to alleviate the congested conditions that existed in London. He proposed the use of open space in the form of parks within the new towns and "greenbelts" to separate them from the central city. Le Corbusier viewed open space as both precious land to be conserved and as an aesthetic surrounding for health and recreation. His high rise buildings concentrated development on land otherwise preempted by urbanization and thus freed the land for all the other purposes mentioned above. Wright used tact that is directly opposite to Le Corbusier in order to achieve a similar objective. Wright's proposal provided the "open space" on an individual basis rather than the community approach suggested by all the other authors. Finally, Sanders and Rabuck proposed a system of open space "wedges" to separate the urban "sectors" and to provide space for recreation and community facilities.

Spatial Organization: The goal of spatial organization like the goal of providing "open space" was advocated by all the authors presented. This is only rational since the nation of "ideal pattern" incorporates a nation of "spatial organization". The term might, however, sound nebulous and thus an explanation is provided. Spatial organization connotes an orderly arrangement of spaces which in this case

include both static uses and activities. More specifically "spatial organization" is concerned with relationships and linkages such as land distributions, production distribution, "home to work" relationship, and "transportation to land use" relationships.

Since all the authors suggest some sort of spatial organization, only the authors who emphasized organization as a unique goal and provide an example of the above definition, will be discussed. These include Howard, Gloeden, Sert, and Gruen.

Howard's suggested a wide scope of land use organization ranging from the arrangement of houses within the city to the arrangement of individual cities in relation to a central city. His proposal specified location, sizes, densities, and type of land use through the use "rings" (circular land use areas). Gloeden was more concerned with an economic spatial organization. His distribution of cells included all the urban elements required for the maintenance of a town with the exception that each of the cells also had a "specialty" - an activity that was unique to that cell such as government, industry, higher education, and so on. Sert was concerned with the relationship of living and working functions to each other. His "township" and "neighborhood" units were located within a walking distance to work, education, and commercial facilities. Finally, Gruen epitomized many of the spatial organization features of the other ideal patterns and added a distinct

contribution by focussing his attention on the relationship of transportation to land use and the vehicle to man.

Flexibility of Growth:

Unlike the previous goals mentioned, not all the authors fulfilled the goal of flexibility of growth in their proposals. We have to limit flexibility in this evaluation, since any proposal can become flexible if it can be reproduced in total without consideration of cost. This section will, therefore, limit flexibility to the ability to add increments of growth to an already established pattern without disrupting its continuity, its wholeness, and/or its spatial organization.

According to the above definition we automatically eliminate the following proposals as inflexible: Howard's "New Towns", Gloeden's "Cells", Le Corbusier's "concentrated city", Sanders and Rabuck's "Radical Sector's" proposal as they state it is inflexible, however, the design can be very flexible if there is no limit to place on the population of each sector. Through the process of elimination we, therefore, have the following patterns which are flexible: "The lineal city", Wright's "Broadacre City", Sert's proposal, and Gruen's proposal. It might relevant to note that Gruen's proposal in spite of its resemblance to the satellite pattern, is not strictly limited in that each of the subgroups can grow independently through the addition of "Neighborhood Units", and for that matter, so can the central city.

Further Critique:

One glaring ommission from any of the proposals was the subject of cost. This is only natural since the proposals are "ideal" and "utopian" and thus "cost is no object". If these "ideals" were to be translated into reality then by all means cost is a major object.

Another major assumption that the authors have taken is that the proposal can be implemented the way they have described it. In other words, using our decision model terms from the first chapter, the authors consider their proposals as "strategies". This is also understandable if, and only if, we consider these proposals as theoretical models.

Theoretical Spatial Patterns

The previous section dealt with the various proposals suggested by utopian thinkers as ideal communities. They have been chosen as a representative selection of historical ideals, but they can also be used as a basis of deriving theoretical patterns with no regard to the background issues that spurred their proposal. These pure forms can serve as ideal theoretical form possibilities.

In order to simplify the selection of the theoretical patterns the previous eight proposals are further limited to six basic irreconcilable patterns. This process is demonstrated in figure 8. The patterns are:

1. Satellite or New Town Pattern
2. Polynucleation
3. Linear Pattern

4. Radial Corridor
5. Uniform Dispersion
6. Intensive Development

Each of the above alternatives will be discussed separately in the following section and illustrated in Figure 9.

1. The Satellite or New Town Pattern

The Satellite pattern is based on the theory that growth emanating from a large, already-established urban community will take place in individual smaller towns which can be self-sufficient (New Towns) or can be dependent on the large city for the provision of work (Satellites). This pattern will require the following control requirements for its effectuation: Density control in both the central city and the satellites, control of open space in order to create a buffer zone between the cities involved; in the case of the dependent satellites an adequate transportation linkage to the central (core) city is needed.

2. Polynucleation Pattern

In comparison to the satellite scheme each of the towns within the Polynucleation Scheme is totally self sufficient in regards to its immediate urban functions, yet due to its specialization in one means of livelihood it is dependent on all the other specialized units for the remainder of the urban needs associated with a metropolis.

This pattern will require controls that exceed those of "new towns". In addition to density controls this pattern will require very thorough planning of the physical and economic developments as well as the network of freeways

required to tie all the units together.

3. Linear Pattern

The Linear Pattern is based on the principle of a contiguous line of development bordering a transportation facility. Controls will not be as stringent as the previous two patterns. The most important requirements of this pattern is the transportation "spine" that will serve as well as unite the development bordering it. It must be pointed out that the development does not have to take place immediately adjoining the transportation facility. It must, however, be continuous.

4. Radial Corridor Pattern

This pattern is based on the combination of two principles; a dominant core and a linear pattern of expansion. The urban development on the radial transportation facility are generally termed as "corridors". The difference between this pattern and the linear pattern is the control exerted on the preservation of open space between the corridors usually referred to as "wedges". The radial pattern of highways is an important form factor that is indispensable to the affectuation of this pattern.

5. Uniform Dispersion

Dispersion of housing, industry, commercial facilities and other facilities usually along a grid pattern of roads is the basis of this pattern. Controls will be required to maintain "dispersal" possibly through large lot zoning or the prohibition of concentrated developments.

FIGURE 8

A Classification of Ideal Patterns Reviewed

Author	Author's Terminology	Present Classification	Remark
Soria Y Mata	"The Lineal City"	Linear Pattern	
Ebenezer Howard	"Garden Cities"	New Towns and Satellites	
Erich Gloeden	"Cellular Development"	Polynucleation	
Le Corbusier	"La Ville Radianse"	Intensive Development	
Frank Lloyd Wright	"Broadacre City"	Uniform Dispersion	
Jose Luis Sert	(Grouping Urban Functions into a string of clusters)	Linear Pattern	A variation of Linear Pattern (1)
Sanders and Rabuck	"Radial Sectors"	Radial Corridors	
Victor Gruen	(a hierarchy of "clusters")	New Towns and Satellites	A variation of New towns and Satellites (2)

The grid system of roads will be an indispensable factor in maintaining and servicing this pattern.

6. Intensive Development

This scheme proposes the concentration of all urban activities, thus it is diametrically opposed to all the previous alternatives of growth. The symbol and tool of this pattern will be the high rise building whether for residential, industrial, or commercial purposes. In order to achieve this concentration high development controls will be required. The transportation system will also need to be very intensive at the local level since it has to serve large volumes of people within a relatively small area.

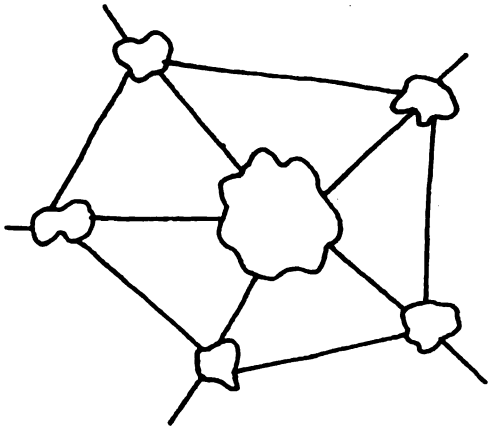
The theoretical alternative patterns presented in the previous sections were in fact used by the city planning profession as a guide in suggesting alternative spatial patterns. Most of these attempts were undertaken as part of the "policy plan" discussed in chapter I. Seven reports were chosen for review in the next chapter for their coverage of the concept and use of alternative patterns in the planning process. As a way of introducing the patterns used in each of the above mentioned reports and as a summary of this chapter's introduction to form patterns, the following two figures (figures 10 and 11) have been compiled.

Figure 10 presents a summary of alternative patterns as they have been used by the reports reviewed in the next chapter. The following observations are notable: (1) that

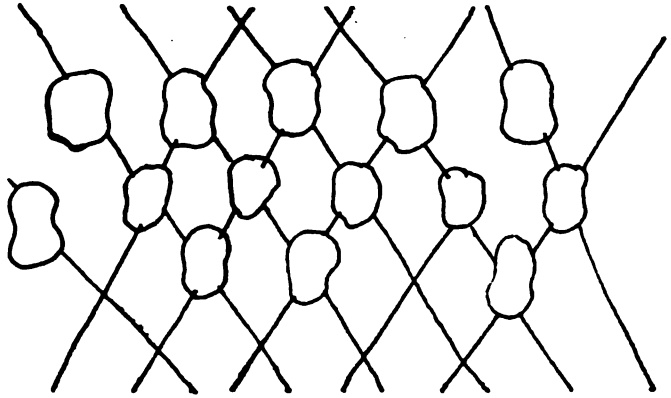
Figure 9

A Graphic Illustration of the Spatial Patterns

1. Satellite or New Town Pattern

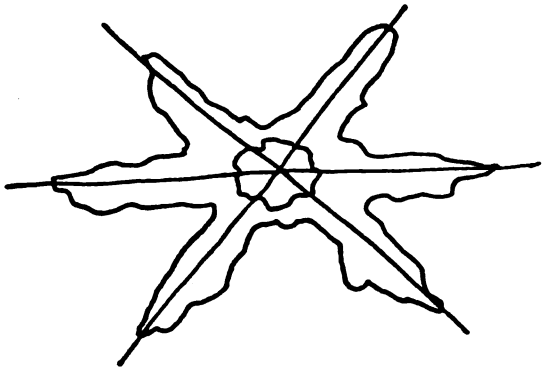


2. Polynucleation

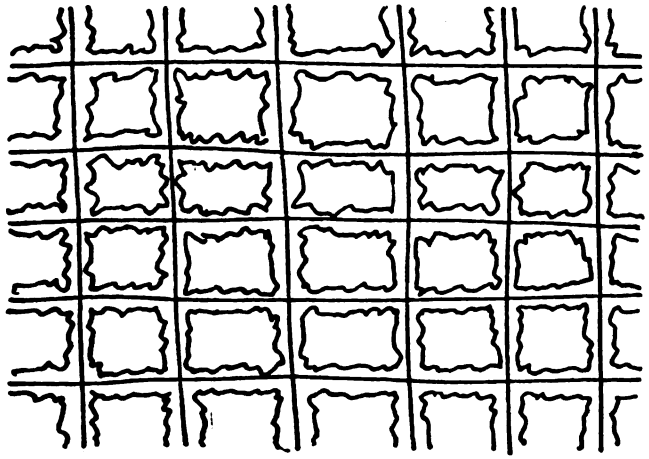


3. Linear Pattern

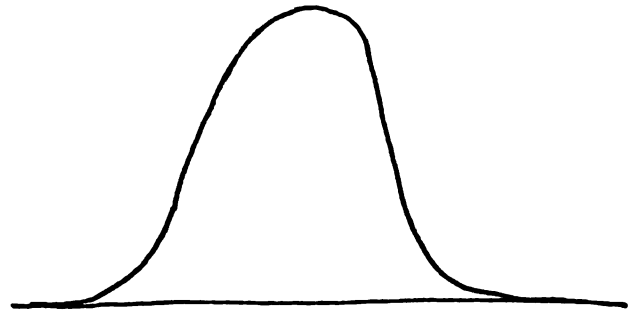
4. Radial Corridor



5. Uniform Dispersion



6. Intensive Development (Profile)



there is a shift of emphasis from the practical basis of generating form, such as the Erie and Hartford plans, to a theoretical basis, to the point of duplicating the list of "ideal" forms presented in this chapter. This point will be discussed further in the next chapter. (2) That the terminology used to describe the various patterns were not standardized and varied with each plan. The contents, however, were similar. (3) That the more theoretical the plans were the longer the list of alternatives (such as the Twin Cities' Study).

Figure 11 translates all the proposed alternatives in the various reports and reduces them to the basic list proposed in this chapter. It is interesting to note that there were only three patterns, based on theoretical growth form, that did not conform to the basic list. These are, however, variations of the other patterns.

Prior to terminating the discussion of theoretical patterns it is relevant to state that even the list of six alternatives which is a summary of the various theoretical possibilities, can further be narrowed down to four variables; concentration, dispersion, dependence and independence. The last two variables refer to the autonomy of spatially separated units from the control or influence of a major central city or an adjoining unit. This factor is particularly important when we consider the economic and cultural dependency of the units in question.

Since the four variables make up two continuums each consisting of two opposite variables, they can readily form a framework for identifying and evaluating a whole series of alternative forms that will not be necessary based on previous proposals. This framework can then accomodate practically an infinite amount of ideas that might possibly relate to regional growth. This framework is illustrated in figure 12. The basic six categories can now be described by their location within this framework.

FIGURE 10

A Summary of Alternative Patterns Reviewed

ERIE	HARTFORD	WASHINGTON	MARYLAND WASHINGTON REG.	TWIN CITIES	PUGET SOUND
1. Existing Trend	1. Balanced Plan (Note 3)	1. Restricted Growth	1. Sprawl Pattern	1. Dispersed Sheet	1. Continuation of present trends
2. Moderate Concentration	2. Satellite Plan	2. New Cities	2. Average Density pattern	2. New Towns	2. Metro Towns
3. (Note (1))	3. Linear Plan	3. Planned Sprawl	3. Satellite Pattern	3. Peripheral Growth	3. Radial Corridors
4. Satellites	4. Strong Center Plan	4. Dispersed Cities	4. Corridor Pattern	4. Radial Corridor	4. Linear Corridors
5. (Note 2)		5. Ring of Cities		5. Polynucleation	5. Centralization
		6. Peripheral communities		6. Sub-regionalism	6. Satellite Towns
		7. Radial		7. Lineal Radial Polynucleation	
				8. Lineal	
				9. Intensive Development	

NOTE: (1) A proposal based on the intensive development of the Port facilities
(2) A proposal based on a balanced industrial economy to serve the city and its satellites
(3) The "Balanced Plan" is based on equal distribution of industrial facilities

FIGURE 11

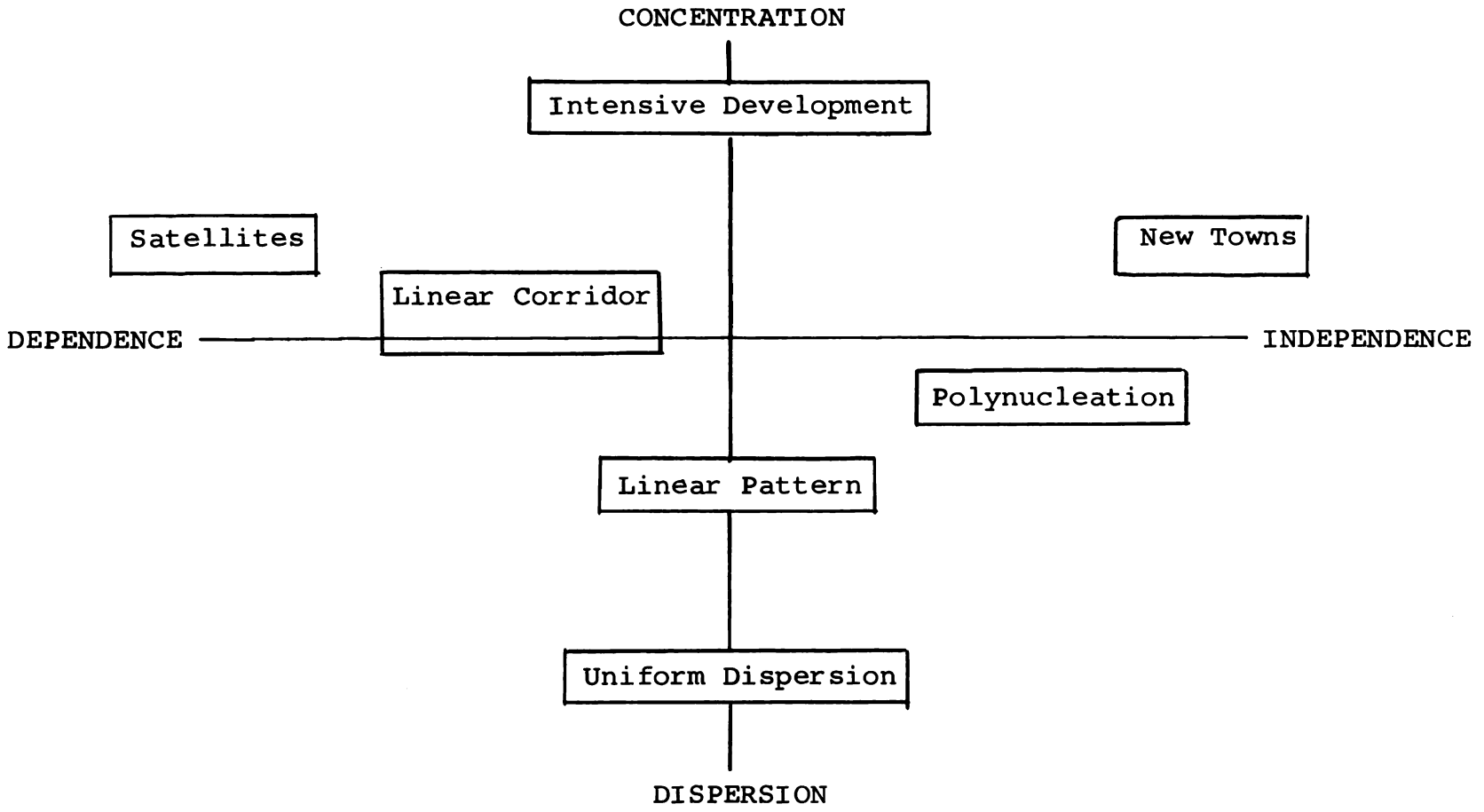
A Classification of Patterns Reviewed

Major Classification	ERIE	HARTFORD	WASHINGTON	WASH. MD. REG.	TWIN CITIES	PUGET SOUND
Satellite or New Towns	✓	✓	✓	✓	✓	✓
Polynucleation			✓		✓	
Linear		✓			✓	✓
Radial Corridor			✓	✓	✓	✓
Uniform Dispersion	✓		✓	✓	✓	
Intensive Development		✓	✓			
Present Trend	✓	✓	✓	✓	✓	✓
Other Patterns	(1)	(1)	(2)		(3)	

NOTE: (1) Patterns based on industrial development
(2) The Washington plan also includes a "Ring of Cities" pattern
(3) The Twin Cities studies also consider "Lineal Radial Polynucleation" and "Subregionalism" patterns.

FIGURE 12

A Classification and Evaluation Framework



CHAPTER IV

RECENT UTILIZATION OF SPATIAL PATTERNS IN THE FIELD OF URBAN PLANNING

The previous chapter helped set the stage for the present discussion by presenting an ideal and a conceptual framework for generating alternative spatial patterns for the urban region. The discussion stressed the idealism of such patterns throughout to the point where an erroneous conclusion can be deduced that alternative patterns are "utopian" thinking. The planner has recently relied on alternative patterns as a guide to future possible development. The patterns are still 'ideal', however, the connotation of the term has changed. The "ideal" in this case, connotes the best possible future growth development based on the goals and resources of the community, and not a "dream" or a "philosophical ideology".

Since the patterns per se have been thoroughly discussed in the previous chapter, the present discussion will dwell on techniques, methodologies, and reasons behind the usage of such patterns.

A Review of Recent Planning Publications

The use of alternative spatial problems for the development of the region until recently has been mostly of

academic interest. The rise of the regional planning agency into prominence coupled with a shift in the planning profession to the policy plan approach, described at the beginning of this section, have resulted in a rising number of publications dealing with the subject. The following section will review some of the most recent publications. These publications were chosen for their use of slightly different approaches in the utilization of alternative spatial patterns. The following six publications were chosen:

1. Erie, Pa. Planning Concept Report, 1960 (part I & II)
2. Regional Plan Alternatives (Hartford, Conn.)
3. A Plan for the Year 2000 (Washington, D.C.)
4. On Wedges and Corridors (The Washington-Maryland Region)
5. The Joing Program, Metropolitan Studies (Minneapolis-St. Paul)
6. Alternative Patterns of Development (Puget Sound

In order to standardize the discussion and thus arrive at a common evaluation criteria for each of the reports, the following framework will be utilized:

a. Introduction: agency, location, year of publication
b. Planning approach: Relation of alternatives to the overall planning process
c. Purpose: Evaluation and selection of alternatives
d. Results: If any results have developed since the proposal

e. Contribution to the planning profession

1. Erie (Pa.) - Planning Concept Report, 1960

a. Introduction: A two part report; the first dealing with Alternative Concepts, and the second, with Operational Research. The reports were prepared for Erie County, the City of Erie, and a Citizen Action Committee, by Maurice Rotival & Associates, Planning Consultants. The plans were published in 1960.

b. Planning Approach: The "Alternate Concepts" stage is the second step in a four step process outlined as follows:

Step 1	Step 2	Step 3	Step 4
Reconnaissance	Concept Study	Master Plan	Action

The concept studies are therefore a synthesis of the potential possibilities uncovered in the research work undertaken in the reconnaissance stage. One important assumption was the thesis that the St. Lawrence Seaway would open up new "zones" with new or invigorated economies. On the basis of this assumption the City of Erie could serve as a link between the Pittsburgh economy and the rest of the national economy including the drawing power on Canadian resources. This thesis became the anchor of four alternative concepts:

1 - Continuation of existing trends

2 - Moderate growth with planned concentration

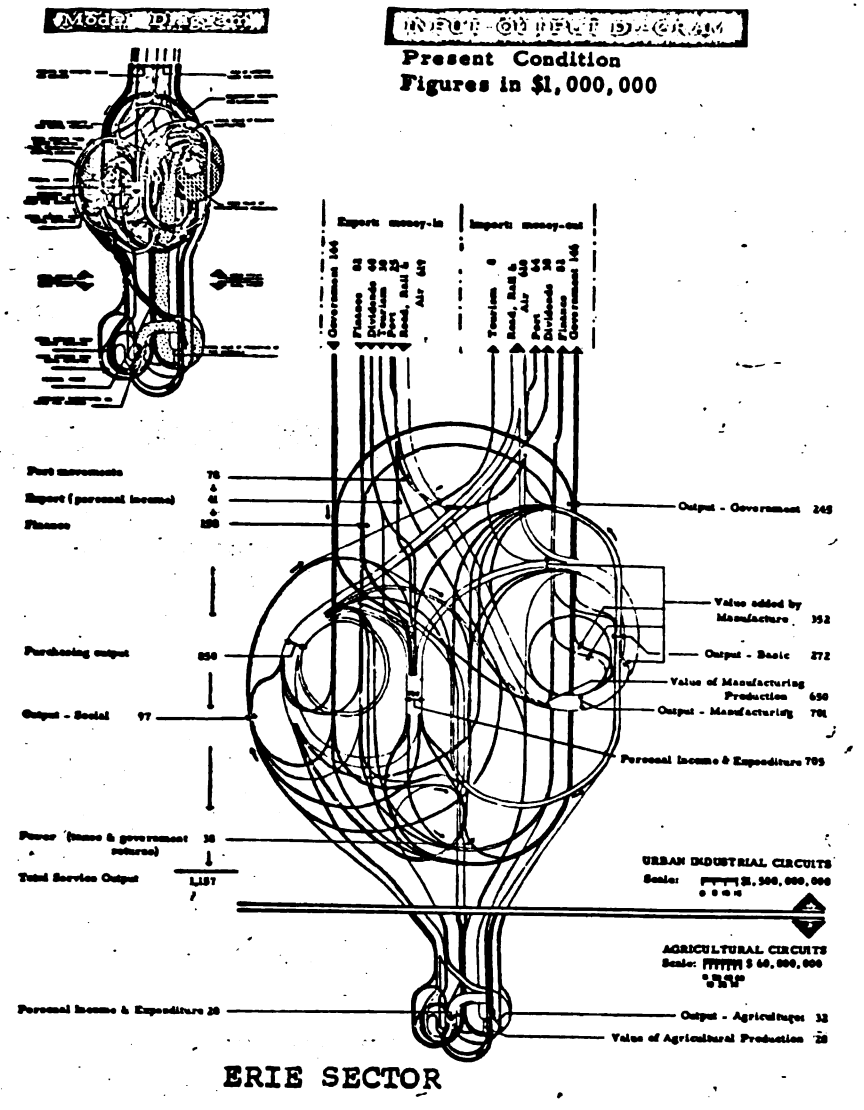
3 & 3a - Large port with extended industrial zone on harbor; Port and peninsula serving Pitsburgh.

4 & 4a - Balanced industrial economy. Developed industrial harbor serving city, county and satellites. Strong regional retail center in the central business district.

Each of the alternatives were scrupulously backed by a set of elaborate economic input and output statistics and charts under the title of "operational research". These charts graphed the economy and future requirements of the region over four periodical intervals: 1960, 1965, 1980, and 2000. These were in turn illustrated in the form of flow diagrams that have the advantage of revealing inside movements between different sectors or components of the economy. An example of such a diagram is reproduced for illustration purposes in figure 13.

The report further discusses and illustrates the consequences of each of the four concepts chosen on the county (region) area, the city, and the CBD. Detailed discussion of concepts as well as decisions required to bring about change are stated for each of the hierarchy of spatial areas.

C. Purpose: The planners concerned already had a receptive and eager audience since the reports were commissioned and supported mainly by the "Citizens Action Committee" which had already shown its civic interest and understanding of planning benefits through the publication of their own report "Community Answers to Planner's Questions" which dealt with goals and objectives for the community.



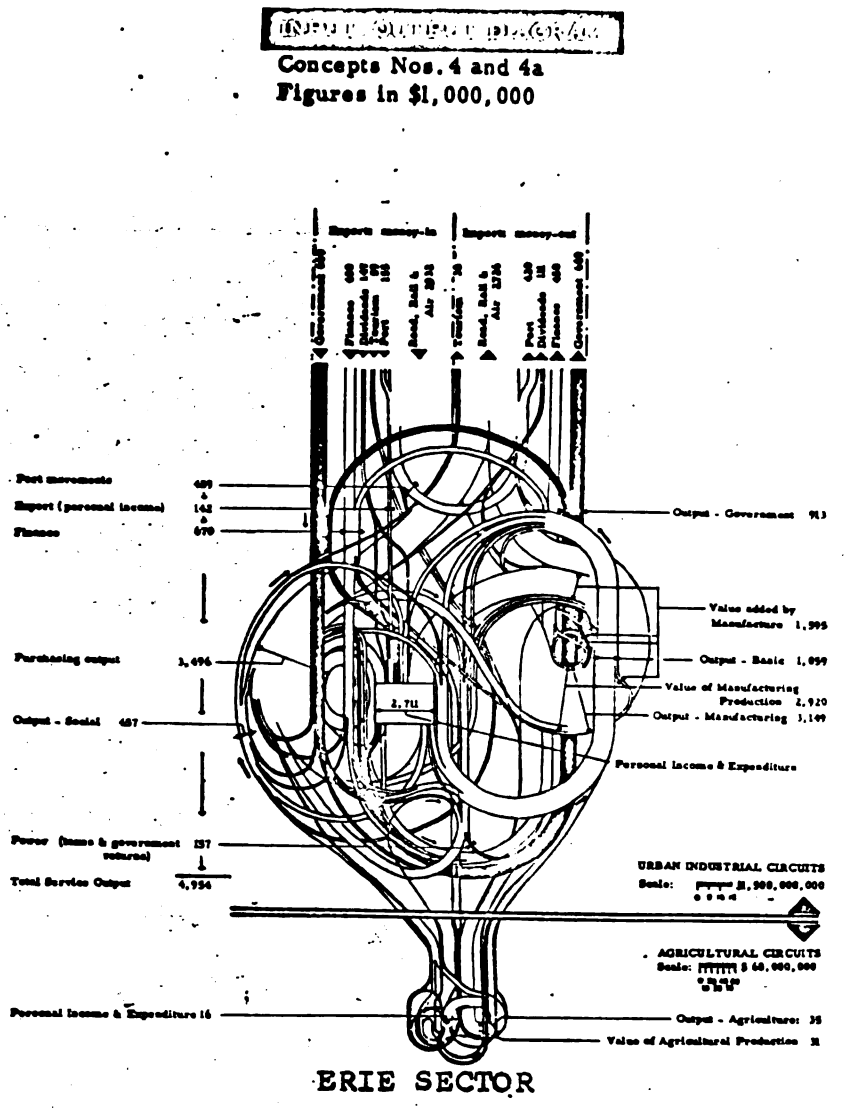


Figure 13

An Input Output Model*

*Erie County, City, CBD, Plans for the Future, 1962.

The use of the alternatives was therefore a device to rational decision making by the responsible elements of the community. The citizenry accepted the fact that "no single decision can be made in isolation since all factors need to be intimately interrelated and in balance one with another within the entire community."

The purpose of the study of alternatives (spatial patterns) was therefore, to facilitate the understanding of the issues and consequently to execute the accessory decisions.

D. Results: The concepts were studied and discussed by the "Citizen Action Committee," its sub-committee, and the Public Agencies involved with the following results:

(1) Concepts 1 and 2 were rejected because the present rate of growth and economic development was considered unsatisfactory.

(2) Concepts 3 and 3a were rejected because they were not deemed economically feasible.

(3) Concept 4a (a variation of 4, whereby, multiple access to the region is possible instead of a single highway approach to the city) was accepted, because it was made in keeping with the cultural traditions of the region, and was the most logical direction of future growth.

E. Contributions to the planning profession were made through the utilization of a technique that was foreign to the design conscious planning profession of the time - the use of the economic input output theory as a tool to scientifically substantiate alternative spatial decisions.

This was a precursor of future usage of mathematical and computer techniques as decision making aids.

2. Regional Plan Alternatives (Hartford)

a. Introduction: This report was prepared by the staff of the Capitol Region Planning Agency, with headquarters in Hartford, Connecticut. The plan was presented to the constituent municipalities and the general public in November 1961.

b. Planning Approach: The capitol Region Planning Agency is an advisory commission with no power to enforce its recommendations. In order to develop a policy guideline for a regional land use plan, it had to first, coordinate the various existing policies in the 30 constituent municipalities and get a policy concensus as a starting point in the planning process.

The Capitol Region Planning Agency proposed four alternative land use patterns for review and discussion by the various municipalities. These consisted of:

(1) The "Balanced Plan" which reorganized the popular policy of balancing residential development with non-residential tax sources. Thus, a deliberate distribution of industry according to the existing population of each individual town.

(2) The "Satellite Plan" proposed the distribution of future development among five or six major urban clusters of municipalities. Each of

these clusters would, theoretically, be relatively self-sufficient.

(3) The "Linear Plan" in which all intense urban development would be located in the Connecticut Valley. This area already contains the majority of new industry, and the highest concentration of urban development as well as most public water and sewage disposal facilities.

(4) The "Strong Center Plan" was proposed for the purpose of objectivity but was labeled with "THE STRONG CENTER PLAN IS NOT RECOMMENDED FOR FURTHER CONSIDERATION." Under this plan, development would be concentrated in the core of the region.

The various plans alternative were backed up by statistical data regarding population, density, land requirement, and job distribution. The plans were further supplemented by a list of implications resulting from the following factors. Local government, local taxes, public services, central city, community identification, economic forces, land suitability, residential development, transportation, and conservation.

c. Results: The report was given wide distribution among public and private officials, and the alternatives received intensive newspaper and television coverage. The planning agency's efforts were concentrated between the individual representative decision makers and public town

meetings. An example of the evaluation criteria presented at such meetings is included as an example of the planning effort as figure 5.

Initial reaction of the public favored the "Balanced Plan" due to its appealing tax policy. This feeling, however, gradually shifted to the "Linear Plan" when it was noted that; many towns did not possess suitable industrial land, a large expenditure on new public facilities would be required, and finally that many towns with suitable industrial land would be penalized by such a policy.

The final vote of 24 of the 26 member towns in 1963, showed that 19 favored the linear plan, 3 desired to remain with the present zoning policies, and 2 preferred the balanced plan. The linear plan was thus chosen and is presently being incorporated into a regional land use plan that is under preparation.

e. Contributions to the planning profession were made by this report since it conclusively showed the advantage of a well-thought-out and well-conducted public education program combined with citizen participation in the decision process can give an advisory planning agency implementation powers it lacks under legal procedures. Director Brown made the following statement in a paper presented at the 1963 ASPD conference.[1]

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[1]Brown, op. cit., p. 35.

FIGURE 14

SUGGESTED CRITERIA
For Evaluating the REGIONAL and LOCAL Implications of
the ALTERNATIVE REGIONAL PLANS

Use of Land

- Makes best use of land capabilities
- Is compatible with existing land use
- Reserves adequate open space
- Provides open space near urban concentrations
- Provides for clustering rather than sprawl

Housing

- Offers choice in housing type
- Offers choice in housing location
- Satisfies housing needs of all segments of population

Transportation

- Offers choice of mode of travel
- Provides for short journey to work

Economics

- Enhances Region's competitive position
- Economically feasible
- Makes best use of existing facilities

General

- Provides opportunities for cultural development and participation
- Promotes regional attractiveness
- Provides for visual variety
- Permits retention of community identification

Attainable

- Under present system of local governments
- Under present property tax system
- Under present land use controls

"Preliminary Draft"
Published by the Capitol Region Planning Agency
May 29, 1963 - R. D. Brown

> I think it is fair to say that if we had started out to prepare just one recommended land use plan, the staff would probably have come up with something quite similar to the chosen linear plan, so this lengthy review process probably did not produce any great planning concepts. But without the participation of the decision makers in its preparation, I am sure that the regional plan would never have received the endorsement of so many towns.

3. A Plan for the Year 2000

a. Introduction: A Plan for the Year 2000 - the Nation's Capital is a joint undertaking by the staffs of the National Capital Regional Planning Commission. It is primarily concerned with development of the Washington, District of Columbia, regional area, the city itself, and the "metro-core", however its influence goes beyond this area into the greater region including parts of the state of Virginia and blends with the Baltimore Regional Area in the state of Maryland. The plan was published in 1961.

b. Planning Approach: The "Year 2000" Plan became a classic example of a "policy plan" immediately upon its reception by the planning profession, since it embodies all the features and advantages that a policy plan is supposed to achieve (these features have been discussed earlier in this section).

The report presents the following important factors for the consideration of public officials and citizens.'

1. A forward look at the prospective growth of the region and its consequences.

2. A statement of goals to serve as a basis for policies on regional development.

3. An evaluation of alternative patterns of regional growth, and a recommendation in favor of a pattern that seems both to hold the greatest promise and to be possible of achievement.

4. A set of recommended policies to guide governmental decisions in the direction of a sound design of the entire region and each of its parts. Separate policies are proposed for the region, for the District of Columbia, and for the all-important core where governmental and business activities are heavily concentrated - Metro center.

5. A description of the next steps that should be taken in deciding upon and carrying out policies for regional development.

This report is, therefore, not a detailed plan for the physical development of the region, but rather a preliminary framework of policies to guide the decision making process in the preparation of a more comprehensive plan.

The regional spatial patterns discussed included the following: Restricted Growth, Planned Sprawl, Dispersed Cities, Ring of Cities, Peripheral Communities, and the Radial Corridor Plan. The last alternative was the one selected for the development of the region by the staff.

c. Purpose: The purpose of the plan was to outline some fundamental decisions necessary in guiding the growth of the region. These decisions were submitted in the form of policy recommendations based on regional goals. These decisions were designed to guide the governing body of each

county and city, the District of Columbia, the states of Maryland and Virginia, the various Federal agencies, and the various congressional committees.

A second purpose of the plan was to present a framework that can help the design of more detailed plans.

Thirdly, the policies presented can serve as an interim plan to guide development decisions until final agreement is reached on a development pattern of growth and methods for its implementation.

d. Results: The plan received a welcomed boost by a presidential memorandum from President Kennedy, directing all new federal building locations to be made according to the radial corridor policy as presented in the plan.

The purpose of the plan to serve as a framework for further detailed plans was also fulfilled through the decision of the National Capital Planning Commission among others, to develop the <u>District of Columbia Plan</u> for 1985.

e. Contributions to the planning profession included first and foremost an excellent professional guide to the development of a "new breed of plan", a process of openly arrived at decisions, and actions to shape the growth of the region or any other area. This process was later referred to as the "Policy Plan".

4. <u>On Wedges and Corridors</u> (The Washington-Maryland Region)

a. Introduction: The Maryland-National Capitol Park and Planning Commission accepted the year 2000 Plan

prepared by the National Capital Planning Commission and the National Capital Regional Planning Council. This Wedges and Corridors plan represents a further detailed outcome based on the framework presented by the Year 2000 Plan. The document was published in 1962.

b. Planning Approach: In contrast to the Year 2000 Plan the Wedges and Corridors plan was one step further in the planning process, in other words, the wedges and corridor plan chose a pattern and its concomitant policies as they were proposed in the Year 2000 Plan, and proceeded to elaborate on the policies as they should be applied to the actual region.

The plan, however, went back in retrospect and discussed why the present design pattern was chosen by evaluating the following alternative patterns: sprawl, average density, satelite, and the corridor pattern. The advantage of this type of procedure is that it enables the staff to diagram the patterns with more detail than the schematic level possible when the plan is discussing theoretical alternatives, for the facilitation of the decision making process.

Since this report was "a general plan" it proposed development recommendations putting the proposed policies into effect. It was therefore obvious from the recommendations that policies regarding the control of open space especially agricultural land, ranked high on the priority level and required urgent action. It is not surprising

that the spatial alternative chosen optimized the preservation of open space and controlled urban development to specific areas or corridors.

c. Purpose: The purpose of the report was the establishment of overall policies for the development of the Regional District in relation to the metropolitan framework discussed in the Year 2000 Plan. It also served to update and strengthen the previously published general plan which covered only 294 out of the 900 square mile area under the jurisdiction of the Maryland-National Capital Park and Planning Commission.

d. Results: The plan was rejected by the Maryland-National Capital Park and Planning Commission upon its submital in 1962. The staff has since then modified some parts of the plan thus satisfying the demands of the commission.

e. Contributions to the Planning Process: The staff in this case undertook the task of the preparation of the policies and made all the required decisions without the involvement of the commission members or any other influential group. The preceding comment might be precisely the reason for the plan's rejection and failure. This then might be moral lesson to planners to utilize the involvement of the decision makers and the public wherever it is feasible to do so without endangering the process through the addition of an unwieldly element.

The plan also offered another major, although elementary at this point, contribution. The staff attempted

to relate the goals to the form alternatives proposed. This was done simply by stating the goals in one column and by scoring with; a plus (+), a minus (-), or a zero (0), how well the specific alternative achieves that goal. This chart is illustrated in figure 6. Although this attempt was not meant to compare the alternatives, but rather to justify the selection of the previously selected pattern, it set the precedent for future plans to utilize this method to greater depth.

5. The Twin Cities Program

a. Introduction: The Twin Cities Metropolitan Planning Commission was created in 1957 by the State of Minnesota to serve the adjoining cities of St. Paul and Minneapolis. The comparatively new agency has not yet formulated a plan for the region, but has conducted and published numerous highly professional reports dealing with the problems of growth and the formulation of alternative patterns for the region. Most of the papers reviewed were dated in 1963.

b. Planning Approach: The Twin Cities "Joint Program" staff is organizationally divided into specialized "teams" or sections. The problem of deciding on how to best develop a set of policies to guide growth in the region through the formulation and choice of a spatial pattern was undertaken by three separate teams taking three separate tasks. The first, using "values" as a basis of formulating goals which in turn would lead to policies and

FIGURE 15

COMPARATIVE ANALYSIS OF DEVELOPMENT PATTERN*

Goals	Alternatives			
	Sprawl	Average Density	Satellite	Corridor
1. Use land efficiently	-	0	+	+
2. Encourage an orderly conversion of undeveloped land to urban use.	-	+	-	+
3. Protect natural resources and encourage their proper use.	-	+	+	+
4. Maintain large open spaces	-	0	+	+
5. Expand opportunities for outdoor recreation	-	+	+	+
6. Facilitate the orderly and efficient arrangement of public utilities and services	-	+	-	+
7. Provide an efficient transportation system including rapid transit	-	-	+	+
8. Encourage greater variety of living environments	-	-	+	+
9. Invite imaginative urban design	-	-	+	+
10. Assure implementation of the Plan	+	+	-	+
Total	-8	+2	+4	+10

*Wedges and Corridors Plan by the Maryland National Capital Park and Planning Commission

alternative patterns. The second, derived the patterns of development through the use of present issues and trends as a base for future policy proposals. Conversely, the third team chose a design approach of visualizing the ideal patterns as they would apply to the actual region, from this point the design team would develop goals and policies for the region. The objective of the three-pronged approach was the final synthesis of a more comprehensive and objective way to arrive at a decision of the best possible method to use in guiding the development of the region. Each of the above methods was published separately in the form of a "paper" and was oriented to be used primarily by the staff.

c. Purpose: The purpose of the multi-solution approach taken by the staff of the "Joint Program" of the Twin Cities Metropolitan Planning Commission, was to investigate and utilize the best possible methods and techniques in the development of a plan for the Metropolitan area.

d. Results: The program has not to date accomplished the preparation of a plan or any part of the plan. The various papers have been highly useful as educational tools and have established an enviable reputation for both the staff and the Planning Commission. This writer can, however, hypothesize that a well-informed Commission and "public" can only create a favorable milieu in which good planning can take place. This "planning" was hopefully

provided by the individual planning agencies comprising the metropolis.

c. Contribution to Planning: The Joint Program has had its highest achievement as a source of intellectual, thought-provoking, innovative concepts, theories and ideas. Some of these contributions, as they relate to alternative policy formulation, include the following:

1. Design Contributions

a. Relating the elements of growth to each other graphically in order to show the various combinations for the various alternatives.

b. Devising a new technique portraying such elements as: Intensity (development and interaction concentrations), linkages (communications), intensity of linkages, flow systems, and volume of flow.

c. Evaluating various sketch alternatives in terms of basic policies required to make them possible.

2. Comparative studies.

a. A comparison of 14 cities - the selection including cities from all over the world. These cities were compared in terms of setting, history, planning history, and present planning.

b. A series of charts portraying population growth of each city and its metropolis over a period of time.

c. A comparison of densities in the central area, urbanized area, and the urban fringe.

3. The use of "values" in the planning process.

a. The values are discussed under three headings: Philosophical (basic human) values, societal (Socialogical) values, and Environmental values.

b. These values are related to the generation of alternative policies and consequent patterns through their incorporation into a decision making framework.

6. Alternative Patterns of Development (Puget Sound)

a. Introduction: This report is a preliminary draft published by the Puget Sound Regional Transportation Study, in January 1964. It is also titled "Staff Report #5". The two planners responsible for the work are: Rajanikant Joshi and Fred Utevsky.

The study is a joint effort of the Washington State Highway Commission and the Puget Sound Governmental Conference in cooperation with the various Federal agencies.

b. Planning Approach: The Puget Sound study is utilizing two approaches:

1) Future development is projected through the study of past land development trends and the use of a land use distribution model. The resulting projection of future development can then serve as a basis for determining future travel needs and consequently a transportation system.

2) Alternative spatial patterns for the region are formulated as a basis of choosing the most desirable pattern for the region. These patterns are evaluated in terms of development policies and costs required to

achieve this desirable pattern.

Both approaches compliment each other since the first does not consider the impact of various decisions while the second does not consider the existing issues as they are manifested in the region.

The two approaches are used to produce two separate plans, "Plan A" and "Plan B". Plan A will represent the projection of the present trends using the existing network of highways as the basis of the spatial pattern of 1985.

Plan B, on the other hand, would reflect a desirable pattern of land use arrangements arrived at through the agreement of the decision makers on a course of action after thoroughly reviewing the various alternatives and their concomitant policies.

Elements of both Plan A and B would be consolidated for the purpose of planning possible future transportation facilities and a more specific integrated plan for land use and transportation.

c. Purpose: The purpose of the publication is to prepare the way toward the formulation of a transportation plan as part of a general development plan for the region. The best system of transportation for the region is linked to the best selected land use plan. It is for this purpose that the alternative land use patterns are studied.

d. Results: The transportation and Land Use Program across the U.S. is in its comparative infancy since 1962.

Federal Highway Act (discussed in the first chapter of this paper). The results are, therefore unknown to date.

e. Contributions to Planning: The Puget Sound Regional Transportation study staff is quickly acquiring a reputation in the planning profession comparable to that of the Twin Cities Joint Program discussed in the previous section. The Puget Sound staff, however, differs in its more technical orientation. This is only reasonable since transportation studies in general have been technically oriented ventures.

Some of the significant contributions brought out in this report include.

1) A new method of mapping was utilized. The process is called the "data plotter method". The data plotter is an automatic device for drafting symbols, lines, etc. from computer-prepared instructions using a grid coordinate system. The unit (of space) of such a system consists of a quarter of a square mile. Each quarter square mile represents the predominant use of that area and is punched on a computer card.

To prepare the alternative map, the planner allocates the projected number of square miles allotted to that use and this is transferred just to cards, then to magnetic tape and finally to the actual drafting machine for the plotting operation.

2) The staff evolved an evaluation process for the alternative patterns. This process consisted of a rating

form and the use of weights and scores applied to every alternative and based on the evaluation criteria which consisted of the following sub-grouping:

I Desirability Criteria

A. Open Space Goals

B. Efficiency and Accessibility Goals

II Feasibility Criteria

A. Legislation and Government Structure

B. Costs of Governmental Services

The weights were distributed first among the major criteria listed above and these in turn were distributed among the sub-criteria. The next step consisted of first scoring each alternative pattern and then weighting that score through multiplying that score by the weight assigned to the sub criteria. The total sum of weighted points can then be used to rank the various alternatives. This process is illustrated in the accompanying figure 16.

Evaluation, Critique, and Conslusion

The review of the plans, publications and documents presented in the previous section show that although alternative spatial patterns were consistently used as a decision-making device for projecting future development and growth, they also served other purposes as well. These purposes are:

1. An alternative pattern study can serve as an exploratory work. It can research hypothetical situations in order to maximize certain criteria the planner wants to

CRITERIA FOR EVALUATION	WEIGHTS FOR CRITERIA		CONTINUATION OF PRESENT TREND POLICIES		METROTOWNS		RADIAL CORRIDORS		LINEAR CORRIDORS		CENTRALIZATION		SATELLITE TOWNS	
	Major Criteria (2)	Sub-Criteria (3)	Score (4)	Weighted Score (5)	Score (6)	Weighted Score (7)	Score (8)	Weighted Score (9)	Score (10)	Weighted Score (11)	Score (12)	Weighted Score (13)	Score (14)	Weighted Score (15)
DESIRABILITY CRITERIA														
A. OPEN SPACE GOALS	20													
1. Generous open space should be interspersed between development so that it is accessible to the largest number of people.		9	2	18	5	45	9	81	7	63	2	18	10	90
2. Open space should be utilized to give legibility to urban development patterns.		7	1	7	8	56	8	56	7	49	3	21	10	70
3. Areas for agriculture should be preserved in close proximity to urban development.		4	2	8	7	28	9	36	7	28	2	8	10	40
B. EFFICIENCY AND ACCESSIBILITY GOALS	30													
1. National and state parks and forests and other major recreation facilities should be conveniently accessible to the region's residents.		6	2	12	8	48	8	48	8	48	2	12	7	42
2. Future travel between major destinations should be minimized.		7	4	28	10	70	8	56	8	56	7	49	2	14
3. Congestion of circulation facilities serving major employment areas should be reduced.		7	4	28	10	70	8	56	8	56	4	28	5	35
4. Circulation facilities should be utilized to guide development.		5	2	10	6	30	10	50	10	50	4	20	3	15
5. Development patterns which would make rapid transit feasible should be created.		5	2	10	4	20	8	40	9	45	10	50	1	5
FEASIBILITY CRITERIA														
A. LEGISLATION AND GOVERNMENT STRUCTURE	20													
1. The extent to which new legislation, policies or programs of land use controls would be needed to implement the development pattern.		10	10	100	5	50	7	70	5	50	2	20	5	50
2. Implications for change in government structure or the way in which governmental services are provided or paid for.		10	10	100	4	40	7	70	5	50	5	50	4	40
B. COSTS OF GOVERNMENTAL SERVICES	30													
1. Public utilities costs.		6	2	12	7	42	7	42	8	48	10	60	3	18
2. Transportation facilities costs.		7	4	28	10	70	8	56	7	49	8	56	4	28
3. School costs.		9	2	18	9	81	6	54	6	54	10	90	4	36
4. Police and fire protection costs.		3	2	6	8	24	7	21	8	24	10	30	6	18
5. Costs of preserving open spaces.		5	10	50	7	35	4	20	7	35	9	45	2	10
TOTAL SCORE	100	100		435		709		756		705		557		511
RANK				VI		II		I		III		IV		V

S-11 1/10/64 (*) See instructions in Alternative Patterns of Development, A Staff Report ... January, 1964.

FIGURE 11

Figure 16.

research. This research in turn can be of technical or descriptive nature.

2. The use of alternative patterns can also demonstrate the issues involved and thus lead to a better understanding of the situation. This use has possibilities of serving as a stimulus for thinking and discussion and consequently as an educational tool.

3. Finally, the process of utilizing alternative patterns can assist in the presentation of the final development plan, or in some cases, an interim plan.

The publications presented in this chapter were deliberately chosen to reflect one or more of the above uses and thus amplify as well as clarify our understanding and knowledge of the subject. For review purposes the publications will be listed below with a number (or numbers) denoting the place it occupies in the sequence presented above.

1 - Erie, Planning Concept Reports	(2)
2 - Regional Plan Alternatives (Hartford)	(1) (2)
3 - Year 2000 Plan (Washington, D.C.)	(2) (3)
4 - On Wedges and Corridors (Maryland)	(3)
5 - Twin City Reports	(1) (2)
6 - Alternative Patterns of Development (Puget Sound)	(1) (2)

The reports discussed have, by no means, covered the entire subject of alternative spatial planning. There were numerous gaps and flaws that require further travail. Some of these gaps and deficiencies will be discussed at

this time.

1. In order to present the decision maker with alternative possibilities of development in the future, the planner has to also present an accompanying set of consequences clearly researched and spelled out in detail so that the decision maker can weight the comparative advantages and disadvantages. This is a very complex process that has, so far, eluded the planner. The various reports have, however, attempted to do this, e.g. The Year 2000 Plan, the Regional Plan Alternatives, the Wedges and Corridor Plan, and the Puget Sound Study's Alternative Patterns of Development. The latter is by far the best attempt of the four studies mentioned since it develops an intricate evaluation criteria using performance criteria such as cost in the appraisal of the various alternatives. The fact that the Puget Sound effort is the newest attempt in the use of alternative patterns is encouraging since it shows that the pioneering efforts of the first two plans mentioned above have been learned and improved upon first by a sketchy evaluation table by the Wedges and Corridor Plan (presented in figure 6), and finally a sophisticated attempt already described, by the last entry on the list. It is pertinent to point out, in spite of all the praise, that this too, is far from an acceptable evaluation. The Puget Sound evaluation criteria first distributes weighted scores arbitrarily amongst its major criteria, 20, 30, 20, and 30 points respectively

(refer to figure 7) and then proceeds to break this sum amongst its respective sub-criteria in the same arbitrary unobjective fashion. The writer would like to stress that, through his own experience with a similar work conducted for the Detroit Region, he has found it practically impossible to be purely and mathematically objective in scoring the various alternatives.

2. Most of the examples reviewed in this chapter have dealt with mappable alternative spatial patterns. This is indicative of the planner's persistent interest with a map. This should not be construed to imply that maps should be minimized in the planning process. Until a better medium of presentation and explanation is produced the planner has to depend heavily on a map. He does not, however, have to rely solely on it. Policies can and should be discussed and evaluated verbally and analytically whenever possible. The analytical aspect can utilize such tools as statistics, mathematics, and diagrams of involved complex processes.

Works illustrating such techniques are still in the minority but show great promise for the future. The Erie, Concept Plans, the Twin Cities Reports, and the Puget Sound Study, incorporate elements of the new techniques. The Erie work is an operational use of the "input-output" economic concept that shows promise of becoming an important decision factor in regional and local interactions and decision making. The Twin Cities efforts are more

conceptual in nature, the notable feature is their consideration of human values as part of the decision process. Finally, the Puget Sound Study utilizes statistical as well as graphic methods to discuss future development patterns. All the above criterion with the addition of modeling techniques will be further discussed in the following chapter of this paper.

3. The most important lesson learned from the review of the various studies discussed is the great importance of the involvement of the decision maker in the preparation or the evaluation of policies. All the works discussed presented some aspect of policy planning, and all made a decision or choice as to the best alternative to adopt, the crucial question at this point is how did they make that decision?

The Year 2000 Plan was completely developed by the staff. They formulated the goals for the region, devised the policies, generated the alternative spatial patterns and even made the decision on which alternative the region should follow without any involvement by its respective "collaborating" planning commissions.

The plan would have failed except for the good fortune of obtaining the strong endorsement of two influences, the President of the United States, and the Council of Metropolitan Government. The President, through a presidential memorandum, directed all new federal construction to locate according to the "radial corridor" policy

presented in the plan. The Council is influential in educating the citizency toward acceptance of the policies recommended.

A similar plan, On Wedges and Corridors, was also fully developed by the staff and presented to the Maryland National Park and Planning Commission. The Commission in this instance, under strong pressure by groups against the plan, rejected the original proposal and requested the staff to make lengthy revisions.

A good example of the opposite extreme, the full utilization of a hierarchy of community involvement from the Regional decision maker to the general public, is the Capitol Region (Hartford) Planning Agency's program. As it was explained earlier in this section the program presented in Regional Plan Alternatives stimulated public approval of the Commission and endorsement of a plan for the region.

Another successful example discussed earlier is the Twin Cities Joint Program which publishes a monthly publication entitled the Newsletter. This publication presents the public with challenging, thought provoking and educational planning ideas and concepts, along with planning news about various undertakings by the agency. This publication, along with its other similarly excellent "papers" have earned the Commission the respect and acceptance of the decision makers, the public, and professional planners.

4. There is a distinct shift in attitude in regards to the usage of alternatives in the planning profession.

First, the alternatives were visualized as being complete plans where the choice of one alternative is tantamount to accepting a plan for the region. Using the framework presented in chapter one, the alternatives are considered as "strategies". This attitude is reflected to a minor extent in the Erie Plans reviewed.

With the acceptance of the "policy plan" the attitude regarding alternatives shifted to visualizing them as a set of policies based on "goals" and "objectives" for the community. The alternative chosen by the decision makers would then become the basis of a plan for the region. Referring back to the framework presented in chapter one, this process would be described as choosing "outcomes". This process is certainly more conducive to better planning. This approach is illustrated by the Year 2000 Plan reviewed.

Finally, the policy approach is still lacking. It considers the outcomes separately from the controllable and uncontrollable variables. The decision approach presented in this paper would suggest the consideration of all the variables and thus eliminate the constraints of already conceived notions and images that are characteristic of preconceived patterns. This approach would serve the "goals" more efficiently through the facilitation of objective, rational decisions regarding the "set of outcomes" that the decision makers desire to achieve.

CHAPTER V

MODELS AND OPERATIONS RESEARCH TECHNIQUES

This paper started with the introduction of a new approach to alternative generation, the decision matrix and its concomitant criteria for decisions. The subsequent chapters included applications relating to the framework such as problems, issues and policies discussed in chapter two and spatial patterns created in response to historical problems and their counterparts in modern usage in chapter three. Finally, the recent usage of alternative spatial patterns by the urban planning profession was discussed and evaluated in chapter four. In the process we formed many discrepancies between current efforts and the suggested new approach.

In this chapter we shall propose a further illumination especially in techniques that have proven their usefulness in planning as well as other disciplines. These techniques are usually grouped under the general term of "Operations Research" which will be discussed further in this chapter. The usefulness of these techniques to the various professions and disciplines and thus their possibilities as a "bridge of understanding" were discussed by Branch and diagrammed as figure 17.

These techniques will specifically be related to the decision framework introduced earlier, to the generation of alternatives, and to the planning process in general.

In order to refresh our memory, the decision framework will be summarized in the following section and thus can serve as an "anchor" to tie the earlier sections together.

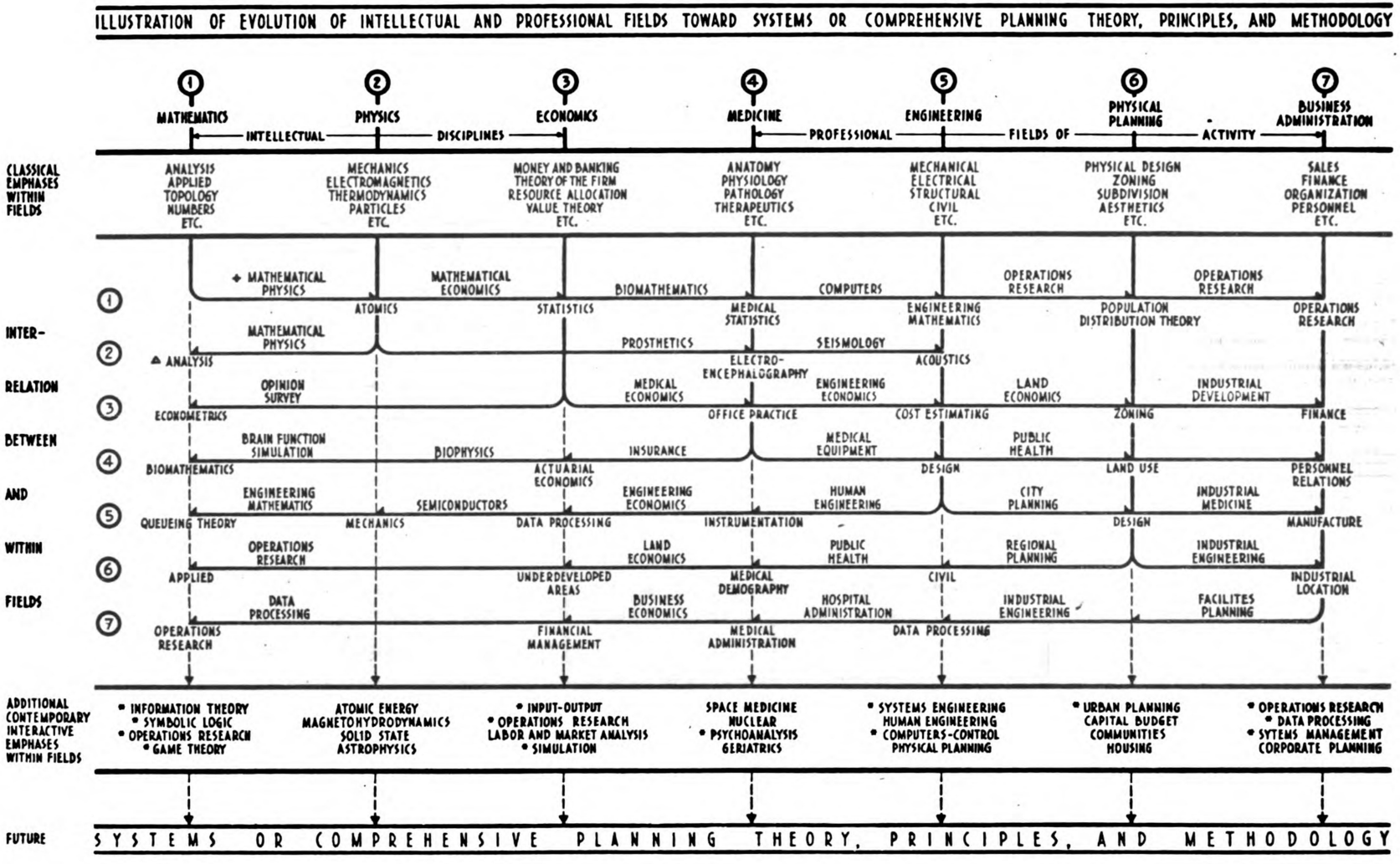
The Decision Framework

The framework and its components were discussed in chapter one. This section will, therefore, assume that all the terms to be used are already familiar and will not require further definition.

The usefulness of the decision framework is, of course, as a guide in making decisions, usually to achieve a desired objective. The decision maker has to select "strategy" from a number of alternatives that are open to him. When this strategy is considered in view of the "state of nature" that will exist in the future an "outcome" occurs. This outcome can then be a guide towards his selection of a strategy and thus the basis for further action (Figure 18).

The above description is a simplification of the detailed framework, which will be used as a starting point towards further complicated techniques applicable to the generation of alternative patterns. At this point we need to start applying the framework proposed to the question

FIGURE 17

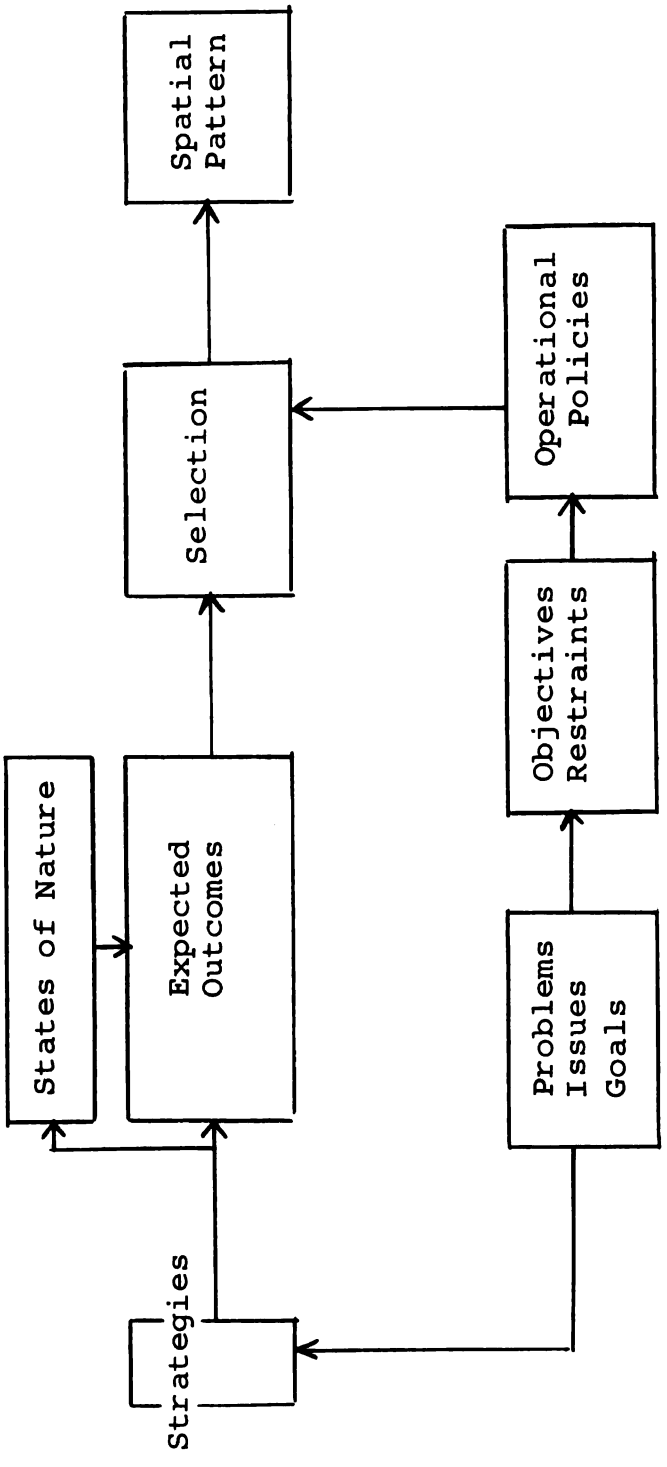


▲EXPLANATORY NOTE: UNDER EACH NUMBERED FIELD AT THE TOP ARE LISTED SUB-CONCENTRATIONS WHICH RELATE TO THE OTHER FIELDS, AS SHOWN BY THE ARROWS ON THE HORIZONTAL CONNECTING LINES EXTENDING FROM EACH NUMBERED FIELD.
+ BETWEEN THE VERTICALS FROM EACH NUMBERED FIELD AT THE TOP ARE COMPOSITE SPECIALIZATIONS CONNECTING WITH OTHER FIELDS, AS SHOWN BY THE ARROWS ON THE HORIZONTAL CONNECTING LINES EXTENDING FROM EACH NUMBERED FIELD.
* THOSE EMPHASES LIKELY TO CONTRIBUTE SIGNIFICANTLY TO THE DEVELOPMENT OF SYSTEMS OR COMPREHENSIVE PLANNING.
M.C. BRANCH, MAR. '59.

From: "Comprehensive Planning as a Field of Study" by Melville Branch in Planning and the Urban Community edited by Harvey Perloff (p.208).

FIGURE 18

THE DECISION FRAMEWORK



at hand, namely, alternative decisions regarding the generation, choice, and testing of alternative spatial patterns.

The spatial patterns described in chapter three and four, are assumed urban forms. They are structural (basic design) outcomes resulting from assumed strategies and assumed states of nature. These forms were supposed to be based on goals or objectives. These goals and objectives are not, however, related to the structural outcomes, (patterns) since they are not related to the design criteria which form the basis of the desired pattern. Sometimes, the strategies and the outcomes were reversed where the outcomes (patterns) were considered plans and the strategies (plans) were considered as goals to be achieved.

The present framework will consider the strategies as plans based on various sets of controllable policies such as various forms of transportation, sewer extension policies, annexation policies and possibly a taxation policy. The states of nature, on the other hand will be based on important yet uncontrollable elements that affect the plans (uncontrollable variables) such as population, economy, political situation, and world situation. Finally, the outcomes will be the results of projecting the strategies through the states of natures thus obtaining various consequences. This process can be accomplished more efficiently by using a "growth model". In the last step described above the outcomes are evaluated against

certain criteria which has been derived from the functional goals and objectives. The criteria to date, have been limited to such goals as economy, efficiency, and safety. However, with more sophistication in the use of models, we can obtain much more complex relationships such as functional land use activities.

Models

A model is a replica of an object or a situation. This definition can be applicable to all types of models whether they consist of a scale model of a building or a city, a symbolic model of that city on a map, or a mathematical model translating the symbols into mathematical variables and incorporating them into complex equations that also reflect the objects and actions contained in that city. A model, therefore, as the illustration of the city demonstrates, is an abstracted reflection of a real life situation. A model can even be narrowed down in definition to just the word "abstraction". As an "abstraction" planners have always used "models" without specifically using that term.

Since we have defined models, the next issue consists of the question, "why use a model?" The answer to that question is simply "it is easier to work with and can provide pragmatically better answers." This can be illustrated by the following example. In order to prepare land use and transportation plans the planner has to amass

large amounts of data relating to population and its distribution, economic factors and employment statistics, travel habits and movement desires, as well as social and cultural factors effecting behavior. The analysis of the aforementioned data can get cumbersome and overpowering. A model can:

(1) utilize the data in the form of mathematical equations, expressing all the above factors;

(2) analyze all relevant and significant interactions;

(3) forecast a travel or land use pattern depending on the data utilized.

The model in the above illustration can be designed to forecast various situations which in turn can be tested fora satisfactory or optimum solution.

It should be clear from the above that models can be very useful devices in facilitating the work of the planner as well as increasing the precision of the planning process. It is also inferred by the last example that there are a number of different tasks involved in model building that should be understood and manipulated by the planner for ultimate success in achieving the objective he is seeking. The model can be a device thatcan test the various proposals he is considering and signal him if they exceed the bounds of theoretical reality.

The planner will have to realize that the model has to be built with data existing and reflecting its environment.

Only through the use of actual data can the model become a useful tool for forecasting the future, for assessing the effect of some given action, for integrating diverse factors that otherwise might be utilized, and finally for use as a testing device. The relation between the hypothetical or symbolic world and the real world is diagrammed in figure 19A. This sequence is however, only a part of a chain process that is further illustrated in figure 19B.[1]

Each successive model is a refinement of the previous models. The first part of the sequence might not yield the desired information, thus the subsequent new data will be vital in correcting the situation. New situations also develop over a period of time, thus necessitating further testing and evaluation. Another reason for future continuation of the chain as it is illustrated in figure 19B, is the introduction of more sophisticated data measurement tools through improved technology.

To summarize this discussion of the model building process, an actual example is illustrated in figure 18C. The model in this case is a probability model but it can very well take the form of any of the models which will be described in the following subsections (Figure 19C).

Model Classification:

The classification scheme adopted for this subsection

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[1] Irwin Bross. Design for Decision, McMillan Co., New York 1953.

has been proposed by Forrester[2] who uses the following classification: (1) physical or abstract, (2) static or dynamic, (3) linear or nonlinear, (4) stable or unstable, (5) steady state or transient, and (6) open or closed. These will each be briefly described below.

(1) Physical or abstract models: Physical models are actual objects that are sealed replicas of other objects while abstract models are made up of symbols rather than objects. The symbolism can be in the form of a written language, an idea, or mathematical notations.

(2) Static or dynamic models: A static model describes a situation that does not vary with time while a dynamic model stresses the time variation factor.

(3) Linear or nonlinear: A linear model represents a static system that performs exactly according to design regardless of new inputs and/or changes in variables. The total result of such a model is exactly the sum of the separate components of system response. This type of model can be useful in the physical sciences, it is however, grossly inadequate for representing sociological processes. The nonlinear model is usually made up of many submodels that can reflect the behavior of all new inputs. This can be accomplished with the same simulation methods used on the linear system.

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[2]Jay W. Forrester. Industrial Dynamics, John Wiley & Sons, N.Y. 1961, Chapter 4.

FIGURE 19

THE "MODEL" BUILDING PROCESS

Figure 19A:

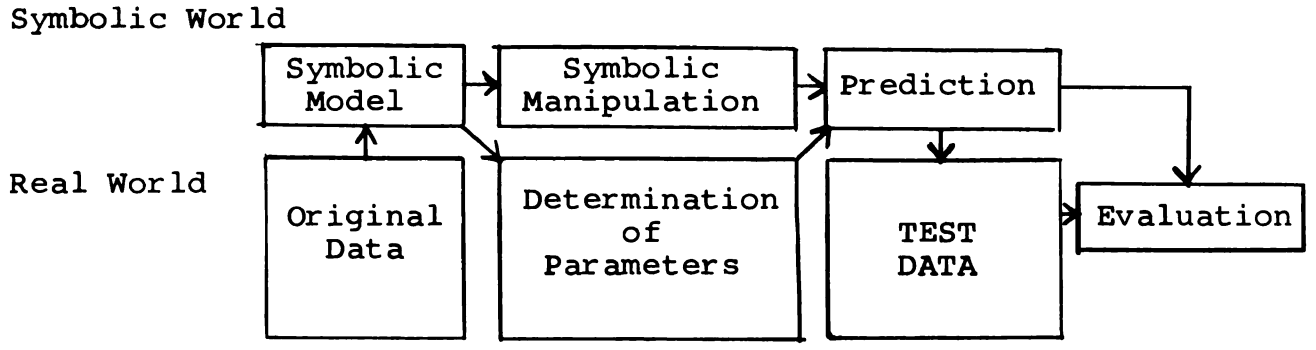


Figure 19B:

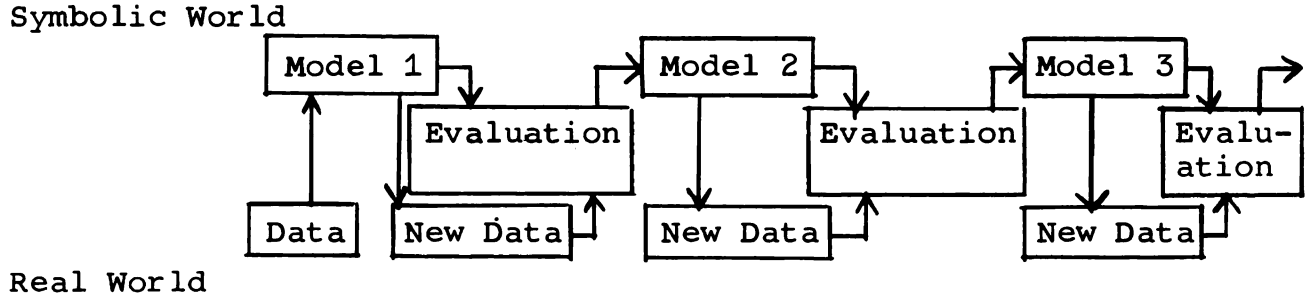
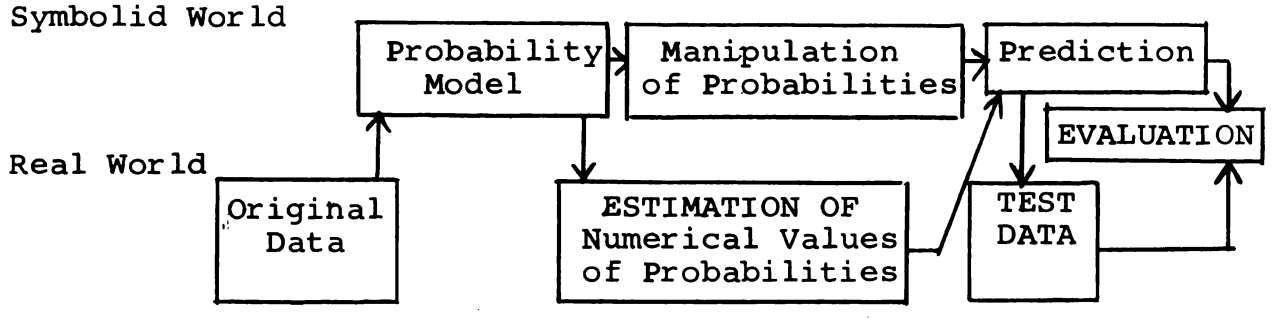


Figure 19C:



Diagrams adapted from Irwin Bross, Design for Decision.

(4) Stable or unstable: This classification refers to the system being modeled as well as the model itself. The stable system will remain in its original state or will return to its initial state after being disturbed by an outside source or condition. The unstable system will keep oscillating until, and if, another restraining force is exerted. The latter type is exemplified by the present economic system in the United States.

(5) Steady-State or transient: A steady state model refers to a system whose behavior over time is repetitive. In other words an occurrence will repeat itself in exactly the same manner after a certain lapse of time. This state is also similar to the undulations of the national economic system. The transient state is a reflection of constant change. This state is characteristic of any system which reflects growth or decline.

(6) Open or Closed: This classification again is determined by the system being modeled. The closed system is wholly independent in its functioning from any outside variables. The variables within the closed system maintain themselves through constant interaction. An example of such a system is an "information-feedback" system. The open system, on the other hand, is dependent on inputs supplied from outside the system proper.

In order to illustrate the classification system presented above as well as to bring out the various combinations possible by combining categories, a model classification

figure follows (figure 20). As a summary to this section the following points should be noted: (1) There exists a strong interdependency between the systems approach (discussed earlier in Chapter One) and the model building techniques being presented in this section. This fact is evident from the descriptive terminology used in the classification scheme just presented where the terms "system", "components", "variables", "inputs" and so on were necessary to clarify the technique being described. (2) The "steady-state" models typify the behavior of corporate and economic systems and to a certain extent the community system as well. (3) The "abstract" models generally referred to as "mathematical models" are particularly pertinent in this general discussion of model and thus will require further elaboration in the next subsection.

Mathematical Models:

This section will deal strictly with the various type of mathematical models and will discuss the theory and applications of each. All of these models are based on sets of assumptions concerning the behavior of variables. The assumptions are supplemented by constraints which limit that behavior. Constants are usually introduced to serve as substitutes for unknown variables or to adjust the dimensions of the equations. The mathematical modelsto be discussed have been very useful in the following areas of urban planning: (1) in traffic generation, (2) in analyzing

and projecting interzonal movement, (3) in projecting land use patterns in urban areas.

There are three general types of mathematical models.[3] The types are:

1. Deterministic models
2. Stochastic models, and
3. Optimal models

Each of these models in turn can be either analytic or numerical, except for the Optimal models which can be either "Plain Optimal" or "Twin-goals Oriented Optimal." The above information is illustrated by figure 21.

1. The Deterministic-Analytical models include simple and multiple correlation analysis and usually include one dependent variable and one or more independent variables. By using predetermined constants definite values are obtained for the dependent variable. These models constitute the bulk of the traffic generation models[4] derived from multiple correlation analysis and some land use models. The basis for these models is a definite knowledge of past trends and the projection of those trends into the future. Thus, these models can be both descriptive and projective.

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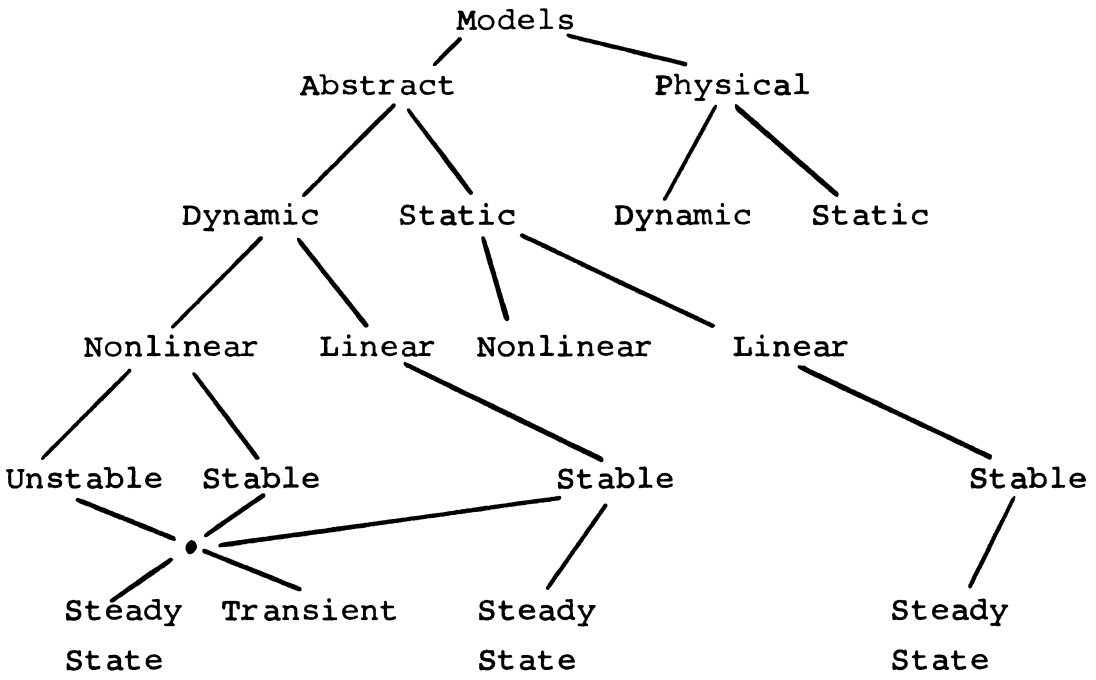
[3]The description of the mathematical models is based on a very thorough discussion by Anthony Tomazinis in "paper #8" for the Penn-Jersey Transportation Study.

[4]This type of model is commonly referred to as a "gravity model" because of the premise that all trips emanating from one area are attracted or pulled to another area.

FIGURE 20

A CLASSIFICATION SYSTEM OF MODELS



Adapted from: Forrester, Industrial Dynamics, p. 49.

2. Deterministic-Numerical models express relationships between variables, and can accomplish this through graphical rather than mathematical methods. This model is most useful when the behavior of the variables is not well known. It is therefore used in plotting hourly distribution of traffic, or the relationship between distances to the C.B.D. and the density of development. An example of this model is the Chicago Area Traffic Study land use model.

Both Deterministic models described above have limited predictive ability and are most useful in tracing historical data. The major limitation is their inability to combine relationships involving more than two variables.

3. Stochastic-Analytical models incorporate a non-linear relationship and a degree of probability of the occurrence of events. The frequency of occurrence of the specific event is given in relation to the numbers of attempts. In other words, the model can predict the frequency of events that will occur in a given area in a specific time interval. These models require a knowledge of the events being studied as well as the behavior of all the variables which make up the model. Stochastic models are used by transportation studies for trip distribution and traffic flow behavior at certain critical points.

4. Stochastic-Numerical models represent a stochastic process in a numerical presentation. Thus, like the

FIGURE 21

A CLASSIFICATION OF MATHEMATICAL MODELS

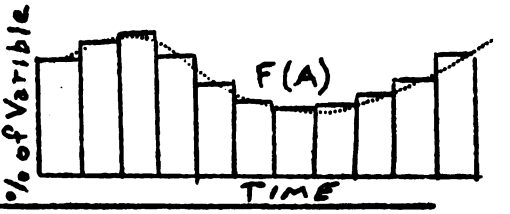
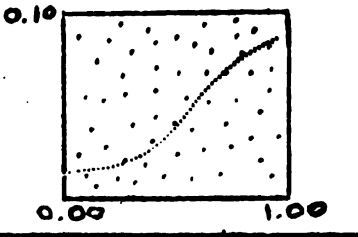
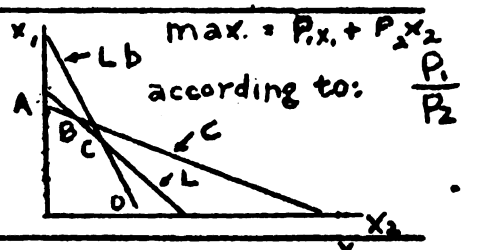
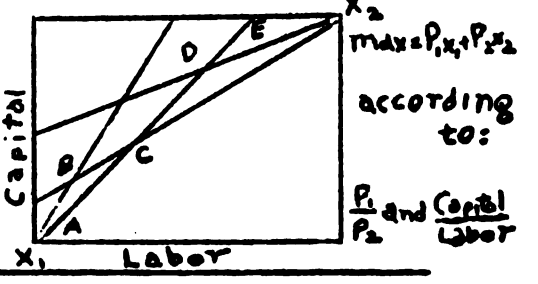
TYPE OF MODEL	KIND OF MODEL	FORMATION
Deterministic	Analytical	$y_1 = a + b_1 x_1$ $y_1 = a + b_1 x_1 + b_2 x_2 \cdots + b_n x_n$
	Numerical	
Stochastic	Analytical	$y = \frac{\lambda^n e^{-\lambda}}{n!}$ or $g(A) = \mu e^{-\mu\lambda}$
	Numerical	
Optimal	Plain-Optimal	
	Twin-Goal Oriented Optimal	

Table reproduced from the Penn-Jersey Transportation Study, Paper #8 by Anthony Tomazinis.

deterministic numerical models, it can be presented in a graphic form and is of most value in solving for the value of an integral having more than two variables. The use of this model like the stochastic analytic model is useful in the simulation of urban traffic.

5. Plain-Optimal Models (commonly referred to as "Linear Programming") show how a linear function of several variables affected by certain constraints is maximized or minimized depending on the objectives of the problem. For example, if we have two products produced by the same industry requiring three resources and we wanted to allocate these resources to each product, we find that each will require a different combination of resource (it will have a different transformation curve). However, if we were to set a maximum return goal for each resource we can determine the best combination of any two resources and eventually reach the most efficient combination. The "plain optimal" model has three main characteristics. They are:

    1. It establishes a system of simultaneous equations that are affected by a certain number of constraints, which will consist of a set of variables and a set of technical coefficients of inputs.
    2. The model will require a definite universe and a quantified function to be maximized (or minimized).

3. The model will select a combination based on relative ratios of variables (constraints). The weakness of this model, in its adaptation to urban planning, is the inability to provide clear cut objective functions, input coefficients as well as sets of variables and constraints.

6. Twin-Goal-Oriented Optimal Model (sometimes referred to as non-linear programming) considers two alternative goals to be weighted simultaneously while trying to maximize or minimize the various functions presented by the problem. While the "plain optimal" method has an implicit choice of processes the "twin-goal oriented optimal" method does not. This method is much more sensitive to the various non-quantifiable variables that are peculiar to the urban process and, once the mathematical complexities are mastered, can be of great value as both an information and a problem solving tool.

In summary it is relevant to point out that the methods presented and discussed cover a wide range of models based on a mathematical translation of the existing variables. The methods although used as part of various proposed models applicable to planning are applicable to mathematical models in general. The next section will therefore focus our attention more specifically on "Planning" models.

Growth Models:

"Growth model" is a term that has been applied to a variety of models that have primarily dealt with the phenomenon of city or regional growth. These have mainly been the by-products of "land use and transportation studies." The pioneering efforts by such projects as the Chicago Area transportation study, the Penn-Jersey Transportation Study, and more recently by the Baltimore Land Use Study and the Boston Regional Planning Project, are worth examining for further applications in planning. These models will, therefore, be discussed in this subsection.[5]

1) The Chicago Area Transportation Study: This study utilized a "deterministic-numerical" model based on projecting past trends graphically into the future. The data used is of a "time series" variety, which means that it is gathered at equal intervals. The advantage of such a model is its simplicity. The disadvantage, however, lies in the fact that the data has to be available over a long period of time. Some of the features of this model include: (1) A first attempt at relating accessibility to land uses such as residential and manufacturing activities, and some very useful information regarding the location of the CBD were found.

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[5]This subsection relied heavily on a report by Keith Crane, Community Systems Foundation, for the Regional Planning Commission (Lansing, Michigan), "Models for Predicting Employment, Population and Land Use," Lansing, Michigan, 1964.

2) The Penn-Jersey Transportation Study: The Penn-Jersey Study was the first operation to actually venture into the use of nongraphic models. The model adopted was called an "optimization model", it corresponds to the "plain-optimal" model discussed in the previous subsection. Although the model has not yet become operational, it set the stage for the use of a potentially powerful tool. The advantage of such amodel is its ability to predict outcomes such as the distribution of household types, once the household types have been forecast. The disadvantages of this type of model, however, are its heavy reliance on theory, and its limitation of spatial coverage (it can cover only part of an area at one time). The model in summary is of the linear variety discussed in the classification subsection and thus is limited in the objective that it can achieve at one time.

3) The Baltimore Land Use Study: The Baltimore Study chose to use still another type of mathematical model, a regression model which is comparable to the "deterministic-analytical" model previously described. It is based on the estimation of one dependent variable from one or more related independent variables. The equations reflecting the variables are nonlinear in nature and can be solved by a "heuristic" approach (trial and error) through the use of a high speed computer. The advantage of such an approach is its ability to show which independent variable has the most effect on the dependent variable.

Another important advantage is the comparative simplicity of the model to construct and operate. The disadvantage of such a model is its need for a large collection of data for each one of the variables.

4) The Boston Regional Planning Project: The Boston project used a variation of the regression model described above, a "deterministic-analytical", simultaneous equation model. Unlike the previous model where each two variables (and equations) would be solved in relation to each other, this model is structured in such a way so that each unknown variable has an equation. The equations are then solved simultaneously for the differential values of all unknowns. The advantage of such a model is its ability to operate in a closed system unlike the regression model. The disadvantage of this model is its complexity of construction.

In summary this subsection provided actual examples of models classified and discussed in abstract form in this overall model discussion. We are not in any position to choose the "best" or "worst", model applicable to planning procedures since this subsection has shown that there are advantages and disadvantages connected with all the models presented. The final decision will, therefore, depend on the existing variables, the complexity of the problem, the amount of data already available, the time required for a solution, and finally the most important fact of resources available to undertake the project.

Advantages and Disadvantages of Models:

The previous subsections have dwelt mostly on the definitions and techniques of particular models. As a summary to this section on models we need to look at the general picture again and evaluate the past discussion in terms of the usefulness of the general concept. First, the advantages:

1. The model provides a frame of reference for considering the various local, metropolitan, and regional planning problems.
2. Through the assembly of data and preliminary testing, informational gaps become apparent, thus suggesting further required actions.
3. The model accomplishes an explanatory function for the decision-maker by its ability to simplify complex problems through the abstract techniques involved.
4. The symbolic language used in models serves the dual purpose of facilitating the manipulation of the variables involved, and of possessing superior communication qualities.

Some of the disadvantages are:

1. The mathematical requirements might require gross over-simplifications.
2. The symbolic language required might be a hindrance in obtaining quick comprehension and thus hinder results.

3. Acceptance and dependence solely on models might lose sight of the "real world".
4. It is possible to obtain contradictory results from various models.

It is important to point out, in view of the above disadvantages, that the judicious balancing of data collection, model building and testing (as was illustrated in the above diagram) can minimize and even eliminate most of the drawbacks, and thus maximize the advantages of the process.

Operations Research Techniques

Operations research is an approach that deals with "operations" or "behavior" of systems and thus an approach towards problem solving. It is basically an approach based on the intensive usage of all possible fields that can be helpful in clarifying the problem to the point where a clear and accurate decision can be made. These techniques can be utilized to great advantage in the planning process. It is for this purpose that some of the techniques developed and used by the operations research analyst are discussed in this section. These techniques will include: Sampling techniques, Operational simulation, Programming, Queuing Theory, and Inventory.

Sampling Techniques: The sampling procedure as part of statistics is not new. However, as part of operations

research, it has been developed and applied to practical situations. As a result of some of the work already done, we have knowledge on: (1) the selection requirements of a sample from the total runs; (2) the size of sample required; and (3) the relationship between the sample and the whole problem. The analyst should maximize the use of the least amount of data through the sample by reducing the error to minimum and thus, incidentally, saving costs in the process.

Operational Simulation: This method consists of a combination of probability techniques and sampling methods. It is used in complex situations where it is impossible to set up analytical expressions which can yield immediate answers. This technique will simulate the operation systematically, thus facilitating the study of the major factors and their interaction.

Some of the advantages resulting from this method are that it: (1) systemizes complicated operations; (2) uses simplified operations that are comprehendable by individuals without technical background; (3) yields an idea of the magnitude of the answer; and (4) can statistically test the sensitivity of the result in relation to the factors involved. The latter point is important in elimination of irrelevant data which does not affect the outcome.

Programming: Recently, operation research has been developing numerous programming techniques, the most popular of which is the PERT (program evaluation and review technique) approach. Briefly, this approach: (1) Can provide a

uniform and logical way in expressing a specific program; (2) specifies the methodology to be followed in carrying out that program and thus a way to check on the progress of that program; (3) provides a desirable flexibility to update the program while it is in actual operation; and (4) finally, becomes a tool in evaluating the impact of variation from a specific plan, and can be used as a prediction device in anticipating major problem areas and providing a way for their solution.

The methodology used in carrying out the PERT approach is referred to as "critical path" or a "Network diagram" which is basically an advanced concept of a flow chart showing steps required to reach an objective. This network has three basic components: (1) events; (2) activities; and (3) relationships.

In addition to specifying the activities and relating them to each other, the PERT method provides a system of evaluating the time, cost and resource allocation necessary to carry out each activity and therefore the whole program. The longest path between all the events from the start of the program to its completion is the "critical path". The length of the path chosen for final implementation of the plan will depend on the values that are tied into the program.

The usefulness of the PERT approach in planning is very extensive. The following are some of the planning advantages possible: (1) PERT can be an inventory tool -

by listing all the processes and activities required to achieve a certain objective, the planner can realize whether the information he has on hand is adequate; (2) PERT can be a guide in planning or scheduling the work; (3) PERT can assess different alternatives possible in achieving the plan; (4) PERT can be an information tool in communicating ideas to the decision makers (Mayor, Council, etc.) and to the public; (5) PERT can be a decision making tool in the choice of strategy to be followed in conducting the program; and (6) finally, PERT can be a coordination tool in carrying out the plan by tying together the work among the various agencies involved in the planning process.

Queuing Theory:

The queuing theory is concerned with problems involved where there is a line formed due to an overload of people or goods at a particular point. This problem can cause disfunction in the system itself and poor performance with the processing of additional inputs. This situation can be solved through the use of techniques that can be summarized as follows: (1) analysis of the problem in order to determine the characteristics of the waiting line. A method that has been used frequently to determine the characteristics is the Monte-Carlo method where a random sample is gathered to provide the history of the problem. This procedure is repeated many (thousand) times to arrive at an approximation close to the actual situation.

The Monte Carlo method also provides the advantage of experimentation through the variation of the controllable variables. (2) Once the various factors are known then costs can be imposed on them such as cost of service, cost of items, cost of waiting and so on. (3) The manager can then manipulate the variable in order to minimize cost and maximize profit.

This process has related applications in the field of planning. Such applications include: (1) Analysis and solution of delays at tool booths of terminal facilities of all sorts. (2) The problem of congestion due to peak traffic loads. (3) The design of efficient transportation terminals, and so on.

Inventory Problems:

The problem faced by most managers is "how much stock" do they need? The problem in this case is the determination of the quantity which would serve the essential needs of the enterprise without using precious space for storage over long periods of time. Cost is therefore the basis of this problem. It is, therefore, imperative that costs of the various components be identified, measured, and relationship between the amount stored and the costs involved be recognized. The cost of the stocks on hand or cost of ordering stocks can be easily measured. The cost of running out of stock, on the other hand, is more complex. This can include loss of sales, loss of production time, loss of good will by prospective

customers, losses associated with increases in costs due to emergency orders, and so on.

Once these costs are derived (or assumed) then the manager can choose a policy which will produce the highest possible return. In order to do so he can use a decision matrix similar to the matrix proposed earlier in chapter one. The matrix will consider cost of extra units (strategies) against failures (states of nature). The matrix is illustrated below:

		States of Nature			
		N_1	N_2	N_3 ----------	N_j
Strategies	Extra Units	Failures			
		0	1	2	N_j
S_1	0	\$0	\$1200	\$2400	\$ $(1200xN_j)$
S_2	1	\$150	\$ 150	\$1350	\$
S_3	2	\$300	\$ 300	\$ 300	\$
=	-				
Si	Ni	\$(150xNi)			

The inventory problem described above can also have related applications to urban planning in addition to the obvious policy and decision approach. Some of these applications might include: the inventory of vacant lots for future city expansion, the inventory of structures that can be used for commercial or industrial uses, the inventory of housing to accomodate future populations, and so on.

CHAPTER VI

APPLICATION AND SUMMARY

The past chapters have outlined and described concepts and techniques that have been applied or can be applied in the planning process towards the formulation of alternative spatial patterns. These concepts and techniques were not, however, applied to either the generation or evaluation of alternative pattern. In this chapter we will apply the techniques of "models" to the task of generating and evaluating alternative spatial patterns (structural outcomes) and outline its sale in the planning process. Both the description and summary rely heavily on the use of diagrams as an illustration aid and a conceptual summary tool. It is, therefore, imperative to study and constantly refer to the diagrams for a thorough understanding of the concepts proposed.

Application of Models to Urban Planning

We have described the models and techniques that can be used to analyze, project, or test various problems that are a part of the planning process or directly related or applicable to it. The models will incorporate and use the data described in the previous chapters to the problem at hand, namely the generation of alternative spatial patterns for the region.

Alternative patterns for this purpose are defined as structural outcomes which are the result of controlled structural strategies and uncontrollable factors. The structural strategies are stated sets of structural policies that are based on criteria prepared to satisfy the "needs framework". The states of natures are uncontrollable variables that should be considered as exerting a strong influence on the outcomes.

The "growth" model will be the tool that can help project the effects of alternative structural (design) plans made up of controllable parameters, on the alternative states of nature which are uncontrollable. The growth model can perform this operation by reducing the variables to dependent and independent variables and then systematically solving the equations through a regression process similar to the model described for the Baltimore Land Use Study.

The outcomes that we will obtain from the model can be evaluated against performance criteria specifications that are in turn derived to satisfy the goal framework. The decision maker can choose the structural outcome or a combination of outcomes that can satisfy the already agreed upon specifications. This process is illustrated in Figures 24, 25, and 26.

SUMMARY

The title of this paper suggests that we are going to consider and evaluate new concepts and techniques in the generation, analysis, and choice of alternative spatial patterns for the urban region. This objective was achieved through the proposal of three main concepts and a number of sub concepts that are considered of great importance at least to the development of this paper.

The concepts include: (1) The Needs-Goals Framework, (2) The Decision Framework for analysis choice and future implementation, and (3) techniques which would facilitate the generation, analysis and evaluation of the alternative patterns.

Each of the major concepts included numerous sub-concepts, categories and techniques which will be summarized with major emphasis placed on the subject of alternative patterns. First, the "needs framework" is the basis of all human decisions and choice. In this context it is made up of the following components. The basic biological human needs for survival, the additional needs that are not essential for survival yet are important in the biological development of the human being and are reflections of the human cultural surroundings, these are classified as "wants";and the "desires" that are usually personal and might be independent of the human cultural surroundings. The sum total of these needs, wants, and desires are goals to be attained if the development of the human being is to

FIGURE 22

THE DECISION FRAMEWORK AND ALTERNATIVE SPATIAL OUTCOMES DERIVATION

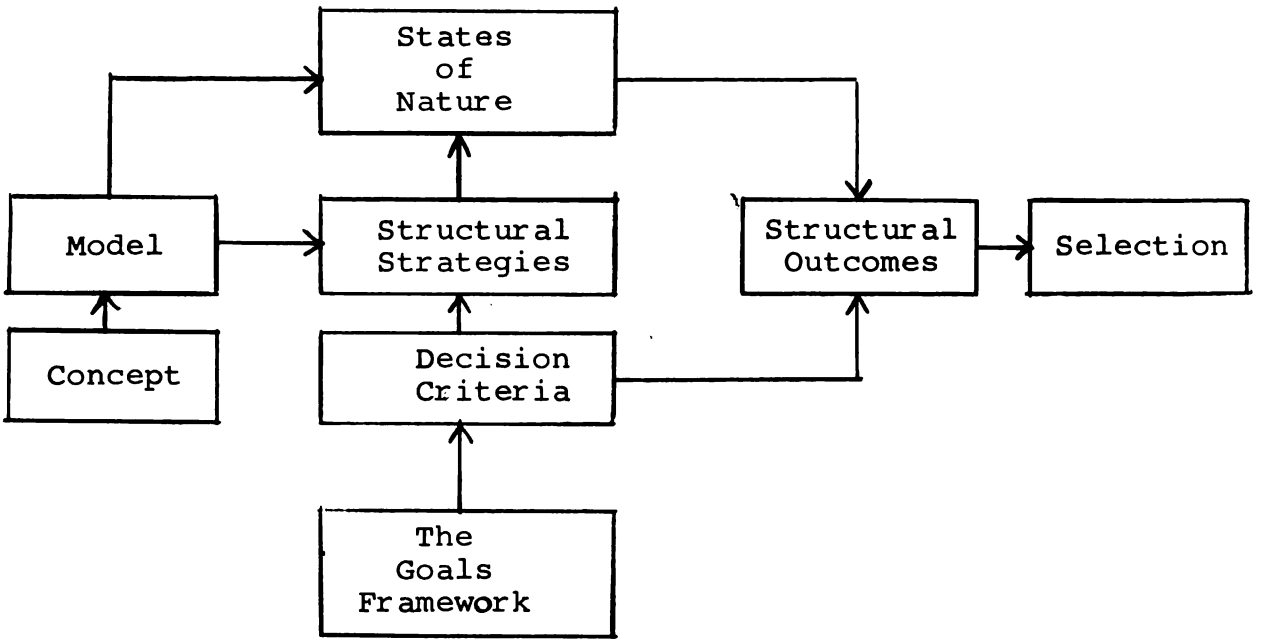


FIGURE 23

THE ROLE OF THE GROWTH MODEL

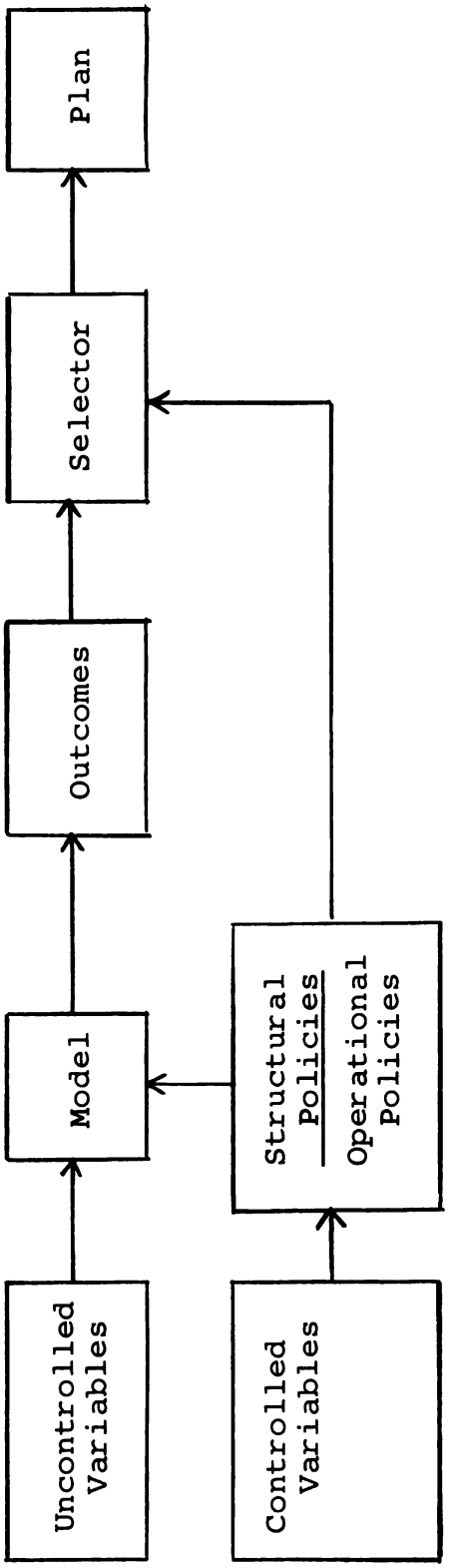
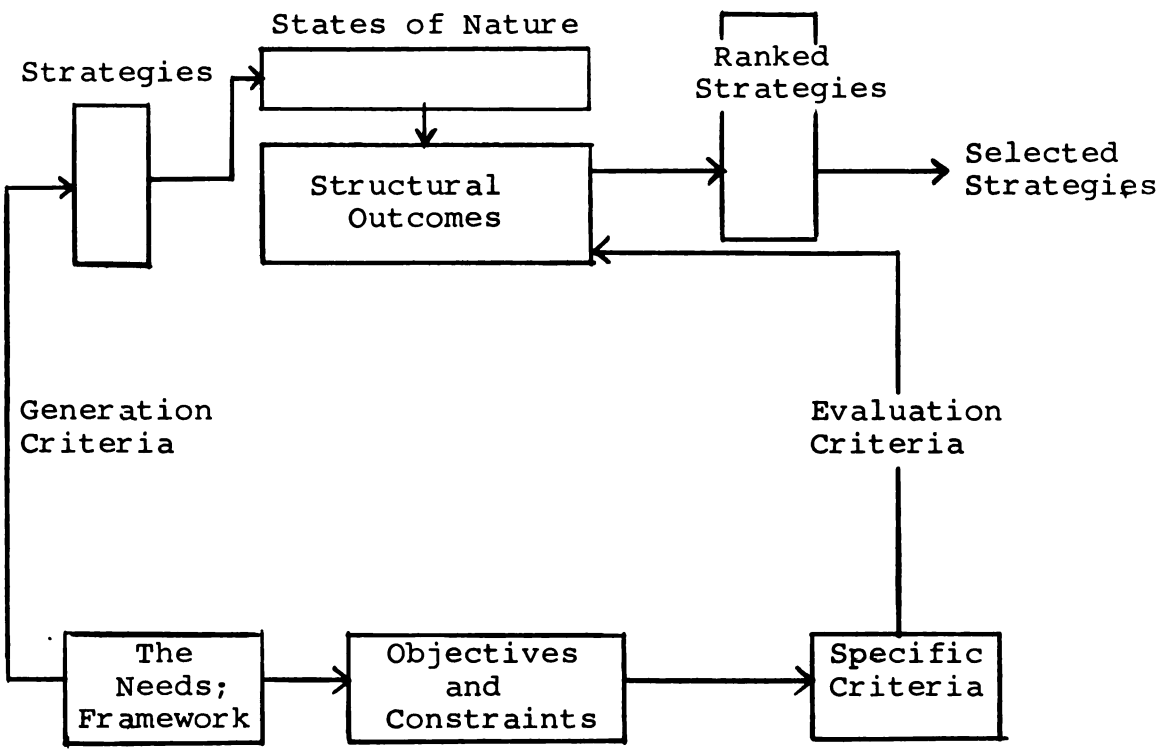


FIGURE 24

THE SELECTION PROCESS



be attained. The goals are then the reflections of the problems that require solutions. These problems can exist on an individual basis or on a community basis. The community problems that require solutions at the institutional level (government) are described as issues, which in turn can be translated into policies. We have finally arrived at a critical "building block" in the generation of alternative spatial patterns for the urban region. The policies are required to activate future development outcomes. The decision maker chooses among alternative sets of policies in order to find the "package" that can best solve the problems and by the same token meet the established goals and objectives for the region.

The "Decision Framework" facilitates the process of making a rational, objective decision by intentionally considering all the factors. These factors are called variables which in turn consist of controllable and uncontrollable variables. The controllable variables are called strategies. The strategies when compared to the existing planner framework will consist of sets of policies, a policy "package" or plan. The uncontrollable variables are called states of nature and comprise all the elements that are either known but beyond human control or unknown and likely to materialize at some future date. The "states of nature" are comparable to the present planning assumptions that so far have not been actively used in the present decision making process. The framework will project the controllable

and uncontrollable variables in order to obtain alternative outcomes. The outcomes desired in this are structural outcomes rather than functional outcomes since these outcomes can in turn become the components of alternative spatial patterns.

Finally, the techniques covered will be visualized as "tools" which can facilitate arriving at solutions otherwise not considered due to the complexity of the problem. The tools consist of mathematical techniques that, with the help of computers, analyze, project, or test the variables. The "model" suggested in the decision framework will project the controllable variables and test them against the uncontrollable variables on a conceptual level. The solution "outcomes" can, however, be applicable to "real life" by testing them against known data and criteria developed as a result of the "goal framework". The application of the tools described can contribute towards the generation of alternative patterns by projecting the structural outcomes that make up these patterns. The decision maker can either choose the desirable outcomes directly or can choose the combination of the outcomes in the form of a "strategy".

In conclusion, the alternative patterns that are generated by using the three principal frameworks suggested will more truly reflect the basic goals of the people and since they are derived from alternative outcomes rather than conceptual images they can be tested according to their

performance rather than their reflection of imaginative proposals.

FIGURE 25

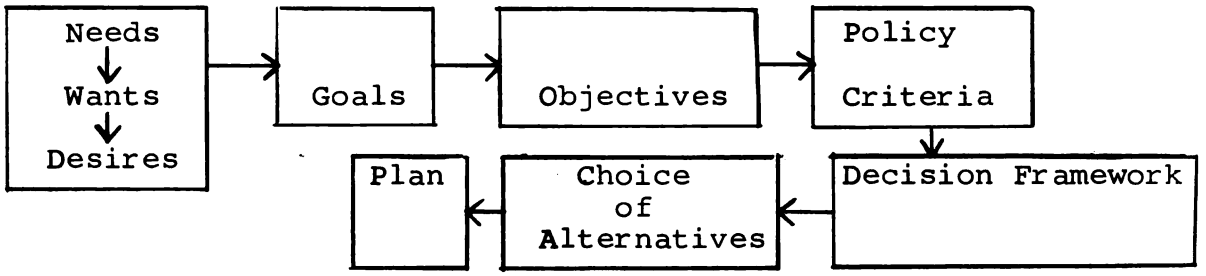
SUMMARY OF CONTENT AND CONCEPTS COVERED IN THESIS

Chapter	Content	Relationship to Patterns	Major Concept
I	The needs framework	Concept	
	Systems	Analysis	"The Goals Framework"
	The Decision Framework	Choice	
	Alternative Patterns		
II	Needs and Goals		
	Problems and Issues	Policies	"The Goals Framework"
	Policies		
III	Historical Problems		Conceptual Background
	Patterns Defined	Concept	of Alternative Patterns
IV	Present Planning	Planning Process	"The Goal Framework"
	Policies	Policies	"The Decision Framework"
	Use of Patterns		(Present techniques)
V	Models		
	Techniques	Technical Aids	Techniques for solutions
	Applications		

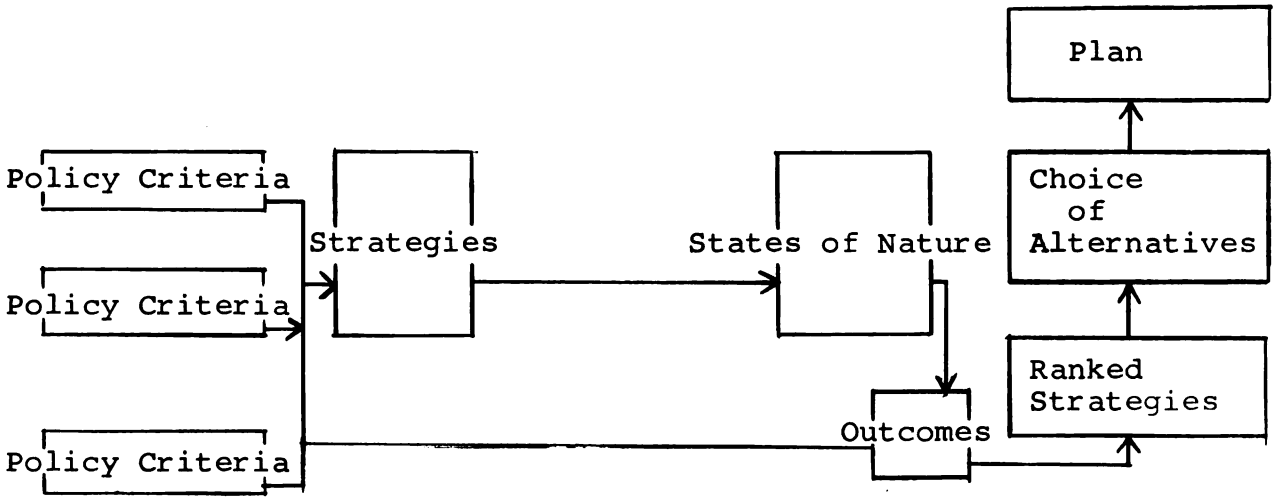
FIGURE 26

OUTLINE OF CONCEPTS AND PROCESS OF ALTERNATIVE GENERATION

The Goals Framework



The Decision Framework



The Tools for Decision

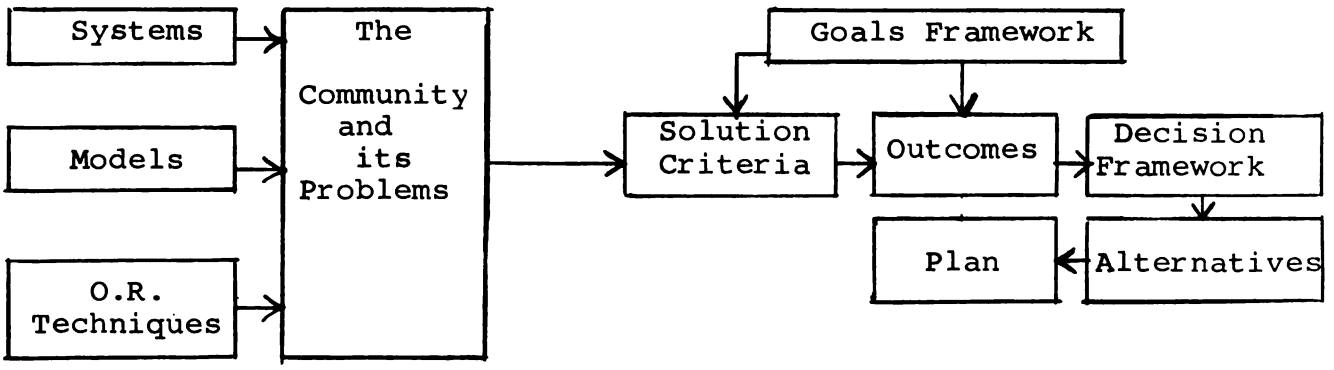
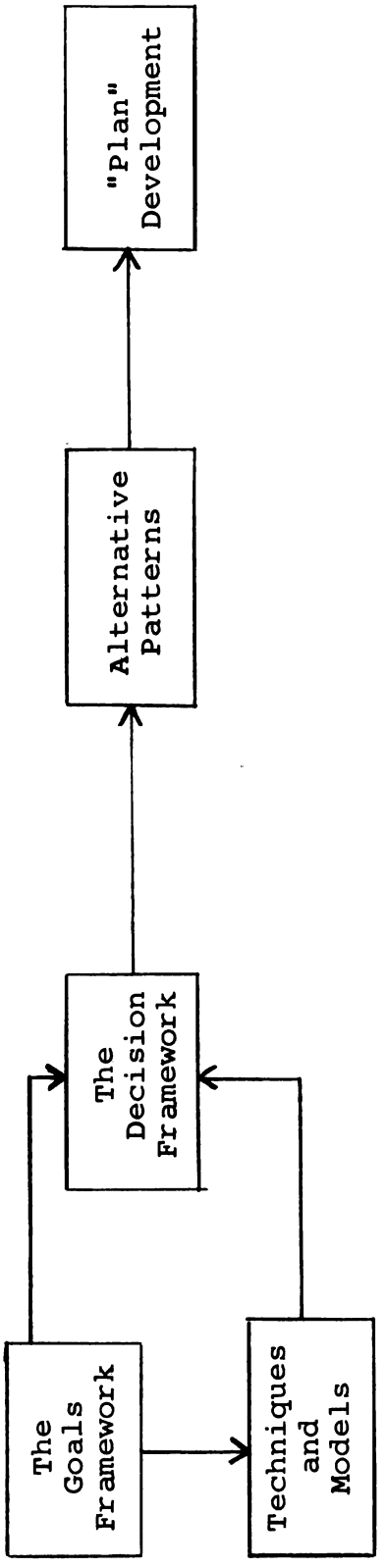


FIGURE 27

SUMMARY OF RELATIONSHIPS OF CONCEPTS



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