

SYSTEMS APPROACHES TO HUMAN SETTLEMENTS

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## Preface

This paper is a critical survey of spatial development theories and policies in the light of evolving human settlements systems in the United States, Western Europe and Japan. It is intended as a background paper for the Human Settlement Systems: Development Processes and Strategies research task within IIASA's Human Settlements and Services Area. The issues raised are of widespread concern in Socialist countries as well as in nations with mixed economies.

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### Other Papers in the IIASA Series on Human Settlement Systems: Development Processes and Strategies

1. Peter Hall, Niles Hansen and Harry Swain, Urban Systems: A Comparative Analysis of Structure, Change and Public Policy, RM-75-35, July, 1975.
2. Niles Hansen, A Critique of Economic Regionalizations of the United States, RR-75-32, September, 1975.
3. Niles Hansen, International Cooperation and Regional Policies Within Nations, RM-75-48, September, 1975.
4. Peter Hall, Niles Hansen and Harry Swain, Status and Future Directions of the Comparative Urban Region Study: A Summary of Workshop Conclusions, RM-75-59, November, 1975.
5. Allan Pred, The Interurban Transmission of Growth in Advanced Economies: Empirical Findings Versus Regional Planning Assumptions, (to be published).



### Abstract

Regional and urban policies always have consequences for the whole of the national territory, whether or not they were intended to do so. Thus policy makers should have a reasonably good grasp of the structure of human settlement systems and of the nature of the processes that underlie evolving settlement patterns.

A number of traditional approaches to urban systems are critically evaluated, and more recent contributions with respect to hierarchical diffusion models and the relationship between business organization and spatial organization are examined. Then recent changes in actual human settlements patterns in developed countries are discussed in some detail. It is argued that although various theories have provided partial insights into these processes, none has proven adequate. The concluding section outlines an analytic framework for improving policy-related research on settlement system development processes.



## Systems Approaches to Human Settlements

Niles Hansen

### Introduction

In the past two decades governments increasingly have attempted to influence patterns of spatial resource allocation and population distribution. These efforts usually have been prompted by two concerns. First, there is a widespread feeling in many countries that one or more of the largest cities is too big, in the sense that the social costs of further growth exceed the social benefits. It is also widely felt that assistance should be given to promote the growth of lagging regions. These regions are usually rural and tend to have a relatively high proportion of their employment in the primary sector, but in some instances they are old industrial areas that need modernization. Obviously the problems of big cities, lagging regions, and other parts of any given country are not independent of one another because the various areas are linked by flows of goods and services, migration, information, etc. Regional and urban policies always have consequences for the whole of the national territory, whether or not they were intended to do so. Thus policy makers should have a reasonably good grasp of the structure of human settlement systems and of the nature of the processes that underlie evolving settlement patterns. This paper presents a brief critical summary of the state of the art of social science contributions in these regards and indicates promising directions for future major research efforts.

When numerous governments first became interested in human settlements policies there was surprisingly little guidance available from the social sciences. In the early 1960s it could still be said that "the conceptual structure

necessary for intelligent making of policy is in its infancy. The social sciences, principally economics and sociology, have been laggard in taking notice of space; while geography, which has always dealt with space, has lacked analytic power" (Friedmann and Alonso, 1964, p.1).

Today the situation is quite different, especially in the economics and geography disciplines. With respect to economics there has been a remarkable international expansion of university programs, books and journals dealing with urban and regional problems. This has been due in large measure to the fact that significant amounts of governmental funds have become available to support such activities. Moreover, geography has undergone a quantitative-theoretical revolution; indeed, one of its most brilliant leaders has suggested, in a recent private communication, that the movement has already "run its course and may even be spinning its wheels."

Even after these major recent developments it is not uncommon to find older approaches to human settlements still being used despite their limitations. Examples include central place theory, export base theory and input-output analysis. Because of their staying power they will be examined briefly in the following section. Then attention will be turned to a model which attempts to explain spatial-temporal growth processes in urban systems by synthesizing a number of strands developed for the most part in economic and geographic analyses made in the 1960s. Next the adequacy of this model is questioned in the light of empirical evidence and recent changes in human settlement patterns. The remainder of the paper is devoted to current spatial policy issues and to a research strategy for dealing with them.

### Traditional Approaches to Urban Systems

#### Central Place Theory

A major characteristic of human settlements is the presence of many separate nodes or centers of concentrated



activity. From historical case studies we learn that cities have grown because of a wide variety of initial advantages. For example, some have had military or political advantages, some have had good natural harbors and productive hinterlands, and some have benefited from location at the intersection of major transportation routes. In many instances the original reason has ceased being the main basis for continuing growth because the functions of the city have become highly diversified.

A complementary approach has attempted to explain the spatial distribution of cities in terms of their size and functions, rather than concentrating on individual cities and their peculiarities. This systems approach, generally termed central place theory, was pioneered by Christaller (1933) and Lösch (1940) and has subsequently been developed by numerous economists and geographers, most notably Berry (1964) and Beckmann (1968).

The "range" of a good and a "threshold" population (or purchasing power size) are the key concepts in central-place theory. The range of a good denotes the zone around the central place from which persons travel to the center to purchase the good or service offered at the place. In theory, the upper limit of this range is the maximum possible sales radius. Beyond this limit, the price of the good is too high because the distance involved makes it so or because of the closer proximity of consumers to alternative centers. The lower limit of the range is the radius that encloses the minimum number of consumers necessary to provide a sales volume adequate for the good to be supplied profitably from the central place. This lower limit is the threshold population. The lowest level of center performs certain functions or provides certain goods that are constrained in number and kind by the limited population within usual range of the center. The center of the next highest order performs all the functions of the lower-order center, plus a group of additional functions.

The next highest order of center will offer all the goods offered by the first two levels but will be differentiated from the order just beneath by a group of goods with greater ranges than those possessed by any of the goods of the next smaller center. In this manner a hierarchy of centers is determined.

It should be pointed out that population by itself is not necessarily a good measure of centrality. A large, specialized-function center may have only a small hinterland area and little influence on it. Thus, centrality is better considered in terms of centralized services, including administration, culture, health and social services, organization of economic and social life, finance, trade, service industries, the labor market, and traffic.

In the central place literature one frequently encounters market area maps that resemble honeycombs. The reason is that of all the systems of regular market areas that will completely cover a plane, the hexagonal one is most efficient in terms of minimizing the distance to be covered between supplier and demander per unit area when demand is given (see Table 1). The advantage of the hexagonal market area system

Table 1: Average Distance Between Supply and Demand

Type of Market Area	Equal Radii	Equal Areas
Circular	$\frac{2}{3} R$	$\frac{2}{3} r$
Hexagonal	$\left(\frac{1}{3} + \frac{1}{4} \log 3\right) R \approx 0.6079 R$	0.6685 r
Square	$\left(\frac{\sqrt{2}}{3} + \frac{1}{3} \log \tan \frac{3\pi}{8}\right) R \approx 0.5407 R$	0.6776 r
Triangular	$\left(\frac{1}{3} + \frac{1}{6\sqrt{3}} \log \tan \frac{5\pi}{12}\right) R \approx 0.4600 R$	0.7154 r

is actually understated in Table 1 because a more efficient market system permits prices to be lower, consumption to be higher and the density of firms to be larger, so that average distances would differ by even more than indicated.

Despite elegant modifications that have been made to earlier central place schemes in order to explain better the typical spacing, size and hierarchy of settlements, the usefulness of central place theory for human settlements policy is severely limited. The assumptions of the theory have some relevance to spatial patterns of mercantile centers but they are not applicable to most kinds of manufacturing activity. Moreover, the theory is essentially static; it provides little insight into processes of spatial economic development. Because it explains and evaluates localization from the perspective of the private firm it also is not a very useful tool for coming to grips with the external diseconomies and social costs of agglomeration, a major concern of human settlements policy.

As mentioned earlier, the urban hierarchy developed by Christaller and Lösch was based on function not population size. These are not synonymous but they are closely related. In the 1940s Zipf (1949) noted that if the cities of a given country are ordered by the integers 1,2,3..., then there exists a rank-size relationship which may be stated as follows:

$$P_r = \frac{P_1}{r^q} \quad .$$

In words this simply says that the population of any city of rank  $r$  is equal to the population of the largest city divided by the rank of the city in question raised to an exponent  $q$ . When the log of population size is plotted

against the log of rank,  $q$  generally has a value close to unity. Although Zipf derived the relationship empirically he went on to make the normative judgement that a value close to unity is desirable because it indicates national political and economic unity. Empirical evidence in this regard is not conclusive, but von Böventer (1973) has convincingly argued on theoretical grounds that satisfactory economic growth and the personal well-being of a country's citizens are compatible with a wide range of differences in the degree of spatial concentration of population and economic activity; particular rank-size distribution parameters are no help in national planning decision processes.

#### Export Base Analysis

Policies with respect to human settlements must take into account the nature of growth processes in the economies of cities and regions. One of the most widely used tools of spatial economic analysis is the export base method, which emphasizes the importance of events outside a given area in determining the area's levels of income, employment and output.

Two economic sectors are identified: the basic sector, which sells to markets located outside the given area; and the service sector, which sells to markets within the given area. The major premise of the analysis is that exports play the most important role in the economic growth and well-being of a region, because basic employment generates income for local residents that is spent on goods and services that in turn generate service employment. The ratio between basic and service activities, usually measured in terms of employment or income, represents a multiplier. Thus, if basic employment is 10,000 and service employment 20,000, any change in basic employment will result (though not instantaneously)

in a readjustment so that the 1:2 ratio is maintained. For example, if basic employment doubles to 20,000, service employment will double in response to 40,000.

The export base approach involves many theoretical and practical problems. For example, along with normal difficulties in obtaining reliable data there are questions of the proper delineation of the area involved, the definition and measurement of the economic base, the assumptions that the marginal propensity to export is stable and that the marginal and average propensities to export are the same, and the assumption that exports are independently and autonomously determined. In addition, the economic base approach has been shown empirically to be a poor predictor of urban growth. It has even been argued that long-run urban growth is more a function of the service sector than of basic activities; because the economic base changes over time, a competitive service sector is necessary to replace stagnating basic activities with vigorous new ones.

The economic base of the larger metropolitan area is, then, the creativity of its universities and research parks, the sophistication of its engineering firms and financial institutions, the persuasiveness of its public relations and advertising agencies, the flexibility of its transportation networks and utility systems, and all the other dimensions of infrastructure that facilitate the quick and orderly transfer from old dying bases to new growing ones. A diversified set of current exports--"breadth"--softens the shock of exogenous change, while a rich infrastructure--"depth"--facilitates the adjustment to change by providing the socioeconomic institutions and physical facilities needed to initiate new enterprises, transfer capital from old to new forms, and retrain labour (Thompson, 1968, p.53).

Whether one wishes to maintain that service activities in the broadest sense are induced or inducing, or that basic and service activities are mutually interdependent and co-equal in importance, it is still clear that analyses based

on a distinction between basic and other activities or between service and other activities have not provided general explanations of why cities have grown the way they have. The determinants of urban growth are too complex to be handled within a framework which merely examines functional relationships between "basic" and "service" activities.

#### Regional Input-Output Analysis

Input-output (I-O) analysis represents a considerably more sophisticated approach to regional and urban growth than the simple export base method. Formal presentation of I-O techniques is beyond the scope of this paper but several good sources are available (Isard, 1975; Miernyk, 1965; Richardson, 1972). The popularity of regional I-O analysis is due largely to the fact that it is the only general equilibrium approach that provides a practical means for examining interregional trade flows empirically. It also is possible to take distance into account in the form of transportation costs. Moreover, although Eastern and Western countries may make different uses of I-O for planning purposes, the method is essentially neutral from a policy viewpoint.

The most commonly expressed objection to I-O as a means of specifying city-system interdependencies and growth transmission channels is simply its impracticality. It has been argued, for example, that

Input-output studies of the variety carried out for the Philadelphia, Seattle-Tacoma, and Stockholm metropolitan complexes are expensive and extremely time-consuming. Furthermore, such studies provide little locational information, only describing the relationships of an urban complex with "the rest of the world" or, at best, "the rest of the state." Thus, in order to secure details sufficient enough to outline growth transmission channels at a large scale, i.e., in order to specify sectoral input-output relationships between several urban regions of a national city-system, it would be necessary to undertake a project of unprecedented dimensions. And, even if it were feasible to

carry out such a gargantuan project, its results and utility would still be open to the criticisms--concerning changing input and production coefficients and other matters--often directed toward much more modest input-output analyses (Pred, 1975, p.8-9).

There also is another fundamental problem when I-O is used to explain regional and urban growth. In practice I-O, like export base analysis, traces the effects of changes in final demand backward to the intermediate and primary supply sectors. In location terms this implies that market orientation and backward linkages are all that matter; no attention is given to input orientation or to forward and complementary linkage effects. Yet the symmetry of an I-O table means that in principle it is neutral with respect to whether the initiating causes of regional growth are to be found in changes in final demand, in primary supply (e.g. changes in the quality of the labor force) or within the intermediate sector (e.g. technological changes that alter technical coefficients). Thus, in place of the usual demand-driven model one could just as well use a supply-driven model of regional growth that takes demand for granted and makes regional activity dependent on the availability of resources to put into production. The source of change now becomes primary supply rather than final demand and availability of labor, capital, imported inputs, and public infrastructure makes possible--through forward linkages--certain intermediate activities oriented to these inputs. Conceptually, the supply-driven process is very much like the demand-driven process, but in practice there is a critical operational difference. Usually there is not much flexibility in the kind and amount of input required for a given output. In contrast, if one has, say, an extra pound of copper it is difficult to tell whether it will be used to produce wire, cooking utensils, roofs, or something else. This is the reason why purely technical coefficients are referred to as input coefficients (demand-driven model)

rather than output coefficients (supply-driven model) even though the symmetry is complete. The demand-driven and supply-driven models are each one-sided; they need to be combined to gain an adequate understanding of real growth processes. Unfortunately, no existing analytic model adequately combines these complementary approaches.

### Growth Centers and Human Settlements

During the past two decades there has been a phenomenal expansion of spatial theory literature concerning growth centers. Detailed consideration of the history, nature, and significance of growth center theory is not appropriate here, but such studies are available elsewhere (Hansen, 1972, 1975; Kuklinski, 1972, Moseley, 1974). At the same time growth center policies intended to influence human settlement patterns have been adopted by countries throughout the world, although the extent to which they have been influenced by growth center theory has varied considerably.

In many respects growth center theory began as a reaction to approaches such as those discussed in the previous section because of their inadequacy in coming to grips with the dynamics of change. The emphasis given in classical location theory to minimizing transportation costs, for example, may be contrasted to the decline in importance of shipping costs of heavy and cumbersome goods. Long-distance transfer costs have been significantly reduced, while the rapid movement of relatively light but highly elaborated products has increased in importance, as has the need to communicate information and intangible services. Moreover, whereas industrial location in the past was heavily influenced by factors such as energy sources, water, and transportation facilities, entrepreneurs today tend to be more attracted by "external economies of agglomeration" of the kind that will be discussed shortly. Economic activity



also has become increasingly footloose. It has been estimated that today only about seven per cent of the labor force needs to be located close to natural resources, whereas only several decades ago thirty per cent were resource-bound. The trend is for the labor force to be potentially footloose and to locate in proximity to consumers, who themselves are relatively footloose. Economic opportunity, therefore, is increasingly associated with capital and human skills and not with land and natural resources (Spengler, 1967). Finally, a number of studies of the relative importance of various plant location factors from the viewpoint of industry have indicated the importance of markets. This does not deny the importance of tertiary activities because market and tertiary factors are mutually reinforcing. Because they deal with such functions as communications, construction, trade, finance, government, the professions, and recreation, tertiary activities are, by and large, closely tied to markets.

Urban markets thus serve and are served by large numbers of persons and firms located in close proximity. It is the great proximity in cities that generates so many external economies of agglomeration. The term "externalities" implies relationships other than those between buyer and seller. The term "external economies of agglomeration" refers to economies of operation that are external to the firm (or household) but result from the previous presence of other firms (households) and social infrastructure such as roads, schools, and utilities. Richardson (1973) has made a useful distinction among business, household, and social external economies of agglomeration. Business-agglomeration economies include access to specialized business services; sources of capital; labor-market economies in the form of more varied skills, greater elasticity of labor supplies, superior training, and better-organized worker-placement services; a larger stock of managerial and professional talent; good public services; cultural amenities; opportunities for specialization because of

the large market (product specialization, technical externalities, transport cost savings); economies of information and communication, especially where face-to-face contact is involved; greater adaptability and flexibility in the use of fixed capital; and the presence of a variety of business-entertainment facilities.

Household-agglomeration economies would include opportunities for earning higher incomes, and a wide variety of jobs, shopping facilities, public services, leisure and cultural amenities, and housing. The efficient provision of major educational facilities, public transportation, hospitals, entertainment facilities, and other types of social infrastructure usually requires some minimum population-size threshold, though there may be a levelling off in many benefits in the medium size range.

Then there are the more nebulous social-agglomeration economies. This refers to the functions performed by cities as centers of innovation, and the role of cities in transmitting innovation through the urban hierarchy and to urban hinterlands.

In a sense, then, it is the prevalence of these externalities that make a city what it is. However, the external economies that attract people and firms to cities often are accompanied by their negative counterpart, external diseconomies, that are reflected in traffic congestion, air, water and noise pollution, social disorder, physical blight, and similar phenomena. If firms are able to slough off on society the social costs that their presence generates the market system will be biased in favor of large urban areas. Because of this problem some persons have advocated policies to reduce the size of large cities; others have argued that it is not feasible to attempt to reduce large city sizes and that it would be more efficient to correct negative externalities by prohibitions of noxious activities, taxes, or subsidies for investment in abatement. The latter position

may be theoretically sound but in practice it is often impossible to measure all of the social costs of adding a given firm or plant to a city. Perhaps it is this practical difficulty that has led so many countries to adopt another alternative, namely the growth center strategy.

Growth centers that are the object of public policy are not simply urban places that already are growing rapidly, i.e. spontaneous growth centers. Indeed, one of the principal arguments for investments in induced growth centers is that population can thereby be diverted away from allegedly overcrowded metropolitan areas toward smaller cities. This approach has another policy advantage because most governments also wish to promote growth in economically lagging regions. Growth center theory and policy maintain that the most efficient way to generate development in lagging regions is to concentrate projects in a relatively few places with growth potential; the growth center approach quite explicitly recognizes the existence of external economies of agglomeration. If the policy worked ideally, public investments in induced growth centers would initiate a kind of chain reaction of mutually induced public and private investment. Moreover, the benefits would not be limited to a few select centers; in theory the economic expansion would spread from the growth centers to their hinterlands, thereby achieving truly regional development.

How well have growth center strategies worked in practice? With some exceptions in small countries they have not been very successful. In particular, they have suffered from a tendency toward proliferation of a large number of relatively small centers incapable of effectively performing the role attributed to them. There is increasing realization that viable growth center strategies require greater selectivity in choice of centers and of activities. However, it still is uncertain whether spread effects from induced growth centers can really raise income and employment opportunities

in lagging or declining regions to levels comparable to those in more advanced regions. In some cases it is possible that the economic infrastructure bias that has accompanied growth center policies has done a disservice by shifting attention away from the critical health, education, and social problems that plague less developed regions. Preoccupation with spread effects also has hindered efforts to explore the role of induced growth centers as migration centers. In many of the countries considered here the fastest growing urban areas are neither the largest metropolitan areas nor the small towns and cities, but rather intermediate-size cities. In the last, I would suggest, public funds could be integrated with existing or potential external economies to produce more rapid growth with a minimum of diseconomies of congestion. Although such places do not "need" growth center subsidies, it may be easier to accelerate their growth than it would be to accelerate growth in a lagging region. However, the accelerated growth of intermediate growth centers should be made conditional on the granting of newly created employment opportunities to a significant number of workers from lagging areas who could either commute or migrate. This approach would serve to keep workers from areas with poor growth prospects at least relatively close to their original homes. Moreover, if the government knows what places are going to grow it can provide public facilities in advance of demand. In other words, a growth center strategy could be integrated with rational physical planning to the greater benefit of both. It is evident that a successful growth center strategy would have to be based on careful analyses of data on employment growth prospects, commuting, migration, and the location preferences of people in the context of actual opportunities available in alternative locations. Even so, however, political realities may make it impossible to implement a development strategy based on only a relatively few urban centers.

Hierarchical Diffusion: A Spatial-Temporal Dynamic Model

In the late 1960s several major geographic and economic analytic strands of thought were synthesized in a general model of hierarchical diffusion of innovation. As described by Berry (1970), this urban-oriented framework of economic activities in space has two major elements: (1) a system of cities arranged in a functional hierarchy and (2) corresponding areas of urban influence surrounding each of the cities in the system. Given this framework, the spatial extent of developmental spread effects radiating from a given urban-center are proportional to the center's size and functions. "Impulses of economic change" are transmitted from higher to lower centers in the hierarchy so that continuing innovation in large cities is critical for the development of the whole system. Areas of economic backwardness are found in the most inaccessible areas, that is, between the least accessible lower-level towns in the urban hierarchy. Finally, the growth potential of an area located between any two cities is a function of the intensity of interactions between the cities.

One would conclude from this that, if metropolitan development is sustained at high levels, differences between centre and periphery should be eliminated and the space-economy should be integrated by outward flows of growth impulses through the urban hierarchy, and inward migration of labour to cities. Troughs of economic backwardness at the intermetropolitan periphery should, thereby, be eroded, and each area should find itself within the influence fields of a variety of urban centres of a variety of sizes. Continued urban-industrial expansion in major central cities should lead to catalytic impacts on surrounding regions. Growth impulses and economic advancement should 'trickle down' to smaller places and ultimately infuse dynamism into even the most tradition-bound peripheries (Berry, 1970, p.45-46).

It was pointed out earlier that static central place and urban hierarchy schemes are not in themselves adequate for analyzing growth and change. The synthesis just described

takes the central place framework as a kind of locational matrix or landscape within which dynamic processes take place. Growth center concepts also fit well within the general synthesis. One merely has to view induced growth centers as means for linking lagging regions more closely with the national system of hierarchical filtering and spread effects from urban centers to their hinterlands. Clearly, the synthesis has a great deal of inherent intellectual appeal and it has had some demonstrated applicability, especially in explaining industrial decentralization processes and the spatial-temporal diffusion of certain product innovations, e.g. television sets.

Having looked at the positive side, it must also be said that the model is not adequate for dealing with many important human settlements issues, even in Western urban-industrial countries. The failure of growth center policies to generate significant spread effects to lagging region hinterlands already has been pointed out. Although these policies may not have provided an adequate test of the theory--because they used too many small centers--the burden of proof nonetheless still rests with the believers in spread effects.

An equally fundamental problem with the model is that it does not deal adequately with an increasingly crucial aspect of the complex interaction between economic growth and spatial organization, namely, the interplay between business organization and the transmission of growth within systems of cities.

#### Business Organization and Spatial Organization

At least in Western nations, there is a pronounced tendency for economic theory to lag behind changes in economic reality. Spatial theorists do not gladly give up the convenience of assuming that the world is composed of single-product firms operating under competitive market conditions, though there has been some willingness to explore the spatial implications of oligopolistic markets. However,

the consequences for human settlement patterns of the size of the multi-product, multi-locational firm--which has reached gargantuan dimensions in the multi-national corporations-- have just begun to be investigated by economists and geographers.

From the economic side the major contribution has been made by J.R. Lasuén (1973), who has attempted to re-establish growth pole theory by giving it more of a systems orientation with respect to both economic organization and spatial-temporal development processes. It is not possible to do justice to the complexity of his arguments here, but essentially he maintains that economic development results from the adoption of successive packages of innovation in clusters of establishments linked to a regional export activity. These clustered sectoral sets are also clustered geographically. The diffusion and adoption of successive sets of innovation follow similar patterns, resulting in a fairly stable system of poles. Over time, successive innovations demand greater scales of operation and larger markets; they also come at shorter intervals. Large cities are the earliest adoptees of innovations, which then diffuse to the rest of the urban system. As a consequence of this process, the system of growth poles become increasingly hierarchic in nature. Lasuén also places great emphasis on the international generation of innovations and he argues that if innovation diffusion is delayed because of inadequate organizational arrangements then changes need to be made in order to minimize the costs and risks inherent in the learning process. This implies that development policies should put less emphasis on production promotion and more emphasis on marketing and technical know-how. Moreover, permanent and long run integrated activities (multi-city conglomerates or large single-city firms) are deemed to be better development organization solutions than the short run integration of activities through contracting arrangements.

According to Lasuén, most innovations in the western world today originate in four megalopolises: the eastern and western American seaboards, the Ruhr-Rhine valleys, and the London-Midland plain. In the future he expects that:

large towns will grow relatively larger than middle-sized ones; and these latter larger than the smaller ones, with the obvious exception of urban centres absorbed by others and cities created in new open areas; but all of them will tend to grow maintaining their relative places in the urban system, because more and more the whole system will participate in the adoption of new techniques. This trend will accelerate naturally if organisational policies of the type indicated are applied to geographical clusters at all levels, in order to integrate them tightly in the national innovation adoption process (Lasuén, 1973, p.187).

There are several problems with Lasuén's arguments from a human settlements viewpoint. First, what is to sustain the increase in population in the larger cities? Will small towns and rural areas decline or will there be high rates of national population growth? As will be shown subsequently, both of these alternatives are difficult to reconcile with current demographic tendencies. Second, it is by no means obvious that London is today a major western center of innovation. Great Britain is widely held to be the sick man of Europe, in large part because of lack of innovation. How does one account for this in Lasuén's theory? Finally, Lasuén's model is essentially a highly sophisticated version of the hierarchical filtering theory. Some of the shortcomings of this approach have been noted. However, there is more general evidence that national systems of cities are more complex than hierarchical filtering models would indicate.

The influence of organizational decision-making linkages on growth processes within urban systems has recently received considerable attention from a number of geographers (Goddard, 1975; Pred, 1973, 1975; Törnqvist, 1973). Pred, in particular, has systematically explored the role of large private and public organizations in the diffusion of growth-inducing



innovations that affect city-system development. He finds that:

the cities chosen for innovation implementation, regardless of size, most frequently are identical either with those cities where the large organization is already operating or those cities with which it has strong inter-organizational linkages. This is so because existing office, sales, and production facilities represent immobile, fixed capital, because of limited search behavior, and because the manifold uncertainties that surround growth-inducing innovations can be reduced by working in familiar environments. The selection of already familiar centers, of course, contributes to large-city rank stability within systems of cities and their regional subsystems.

The asymmetrical hierarchical spatial structure of organizations portrayed here is synonymous with the large-city specialization and complex metropolitan interdependencies that are probably the most important structural characteristics of systems of cities in advanced economies (Pred, 1975, p.256).

However, the diffusion implications of this asymmetrical structure are not consistent with the trickle-down in the strict hierarchical diffusion model discussed earlier. Pred (1975, 1976) in fact presents empirical evidence that growth-inducing innovation linkages run from large cities to even larger cities, from smaller to larger cities, and even between cities of comparable size.

A highly simplified synoptic view of the process of growth transmission is presented for heuristic purposes in Figure 1. At time T, the totality of linkages existing within and among organizations creates a goods and services interaction matrix, or growth transmission matrix, among cities. (Subprocesses by which self-sustained growth is maintained in metropolitan areas are ignored here.) Each of the economic linkages in the goods and services matrix involves an exchange of information, that is, each economic transaction has a dual over which some specialized information flows. The network of contact linkages may be viewed as a matrix of probabilities influencing both the cities to which growth-inducing innovations diffuse and the

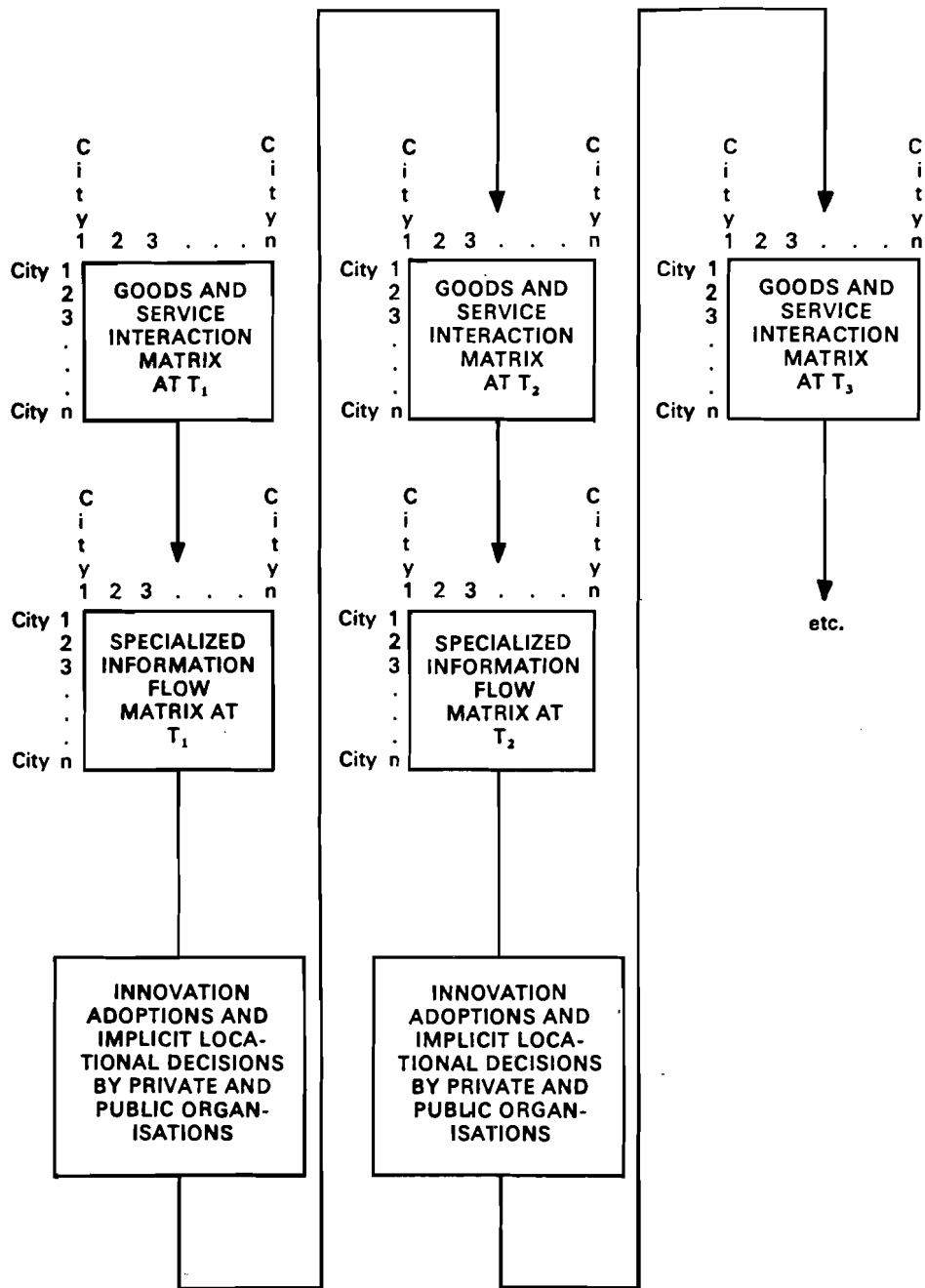


Figure 1. The Process of Growth Transmission Within a National System of Cities.

Source: A.R. Pred, "Growth Transmissions Within the Australian System of Cities--Observations and Recommendations," in The Australian System of Cities: Need for Research. Canberra, Australian Government Publishing Service, July, 1975, p. 42.

the cities identified for the implementation of new implicit location decisions. Each innovation adoption and implicit location decision either creates new growth transmission linkages within and between organizations or reinforces existing linkages. Thus by time  $T_2$  a new modified goods and services interaction matrix has emerged, giving rise to a corresponding information flow matrix which influences subsequent explicit and implicit location decisions. At time  $T_3$  another goods and services interaction matrix has evolved, and so the process continues.

Pred does not claim that the evidence conclusively supports this conceptual model. His empirical findings rest heavily on data for the amount of employment in other metropolitan areas "controlled" by major industrial organizations from the metropolitan areas where the respective organizational headquarters are located. It is assumed that the number of growth-inducing innovations steered to a city from headquarters is roughly proportional to the number of employees in the organization in the given city. Clearly this assumption needs closer investigation, particularly by detailed case studies of the amount and kinds of investments made in various dispersed organizational units.

Nevertheless, from a policy perspective, the literature on information flows already makes it apparent that "no regional-planning policy is likely to be either goal consistent or as successful as anticipated unless its formulation is preceded by studies establishing the peculiar underlying structure of growth-transmission interdependencies within the concerned regional and national system of cities (Pred, 1976, p.40)." But how precisely can knowledge about information flows be used to restructure human settlement patterns? It will be recalled that the objectives of most human settlements policies usually involve some form of concentrated decentralization. Pred suggests that if this is what policy makers want, then they should

create new interdependencies between selected small metropolitan areas, regardless of whether or not they are located in the same broadly defined region. In particular, if the policy is to increase its probability of long-run success through circular and cumulative feedbacks, some high-level organizational administrative activities--with their characteristically high local multipliers--should be among the activities located at the decentralized foci. The artificially created interdependencies associated with such a policy would, in turn, require improved air connections between the selected "intermediately-sized" cities so as to facilitate the non-local face-to-face exchange of non-routine specialized information (Pred, 1973, p.62).

This is about as specific as the relevant literature gets with respect to policy recommendations. What obviously is missing is careful consideration of the costs and benefits of such schemes. Recent investigations by geographers of the nature and significance of information flows in an urban systems context have opened promising vistas for policy-oriented research on human settlements; however, future extensions of this research should attempt to incorporate more economic analysis.

#### Recent Changes in Human Settlement Patterns

Up to this point primary attention has been devoted to various theoretical approaches to the structure and development of human settlement systems. In contrast, this section examines actual changes in human settlement patterns in a number of industrially-advanced countries. It will be seen that these changes represent rather dramatic shifts from patterns that prevailed even in the recent past. Theoretical models which had difficulty in explaining past settlement structures and growth are even less likely to give adequate understanding--much less policy guidance--in the newly-emerging settlement context.

#### The United States

Earlier in this paper it was pointed out that cities have grown primarily because of the external economics of

agglomeration they have provided for interdependent specialists who have needed to interact with one another frequently or intensively. On the other hand, proximity also gives rise to pollution, congestion and other undesirable external diseconomies that make cities unattractive. In addition, modern transportation and communications technologies have reduced the need for spatial concentration of many kinds of economic activities and household amenities.

The implications of these and related phenomena for human settlement patterns in the United States between 1950 and 1970 are illustrated by the data in Table 2 and by Figure 2. During the 1950s metropolitan areas increased in population by 26.4 per cent while nonmetropolitan areas grew by only 5.3 per cent. The growth of the suburbs of central cities was a remarkable 45.9 per cent. During the 1960s the growth rate of metropolitan areas declined to 16.6 per cent, but this still exceeded the corresponding national rate of 13.3 per cent. As in the previous decade, the growth rate in the suburbs was four times that in central cities. The growth rate in nonmetropolitan areas increased to 6.8 per cent.

Figure 2 shows the extension over time of commuting distances around metropolitan areas. Absorption into the commuting field has brought significant increases first in income, and then in population. Within these commuting fields the size of a city or town has not been as important for residential and employment growth as distance to the metropolis and the presence of environmental and recreational amenities. Beyond metropolitan commuting fields population and economic activity have continued to centralize into larger urban centers. "Low-wage, 'trickle down,' industries soak up excess labour supply with minimal welfare impacts. The higher order centers are islands of prosperity in a sea of stagnation. The one significant exception to this historical pattern...is the accelerated growth of retirement or recreation communities drawn to amenity-rich sites (Lamb, 1975, p.186)."

Table 2. Population of the United States by Place of Residence 1950 to 1970 (in thousands, except for per cent)

Residence	Population			Per Cent Change			Average Annual Change		
	1950	1960	1970 Total	1950-60	1960-70	1950-60	1950-60	1960-70	1960-70
Total	151,326	179,323	203,212	100.0	13.3	18.5	1.7	1.7	1.3
Standard metropolitan statistical areas	94,579	119,595	139,419	68.6	16.6	26.4	2.3	2.3	1.5
Central cities	53,696	59,947	63,797	31.4	6.4	11.6	1.1	1.1	0.6
Outside central cities	40,883	59,648	75,622	37.2	26.8	45.9	3.8	3.8	2.4
Nonmetropolitan areas	56,747	59,728	63,793	31.4	6.8	5.3	0.5	0.5	0.7

Note: All figures as of April. Covers 243 SMSAs as defined in 1970.

Source: U.S. Bureau of the Census, Statistical Abstract of the United States: 1972 (Washington, D.C.: U.S. Government Printing Office, 1972), p.16.

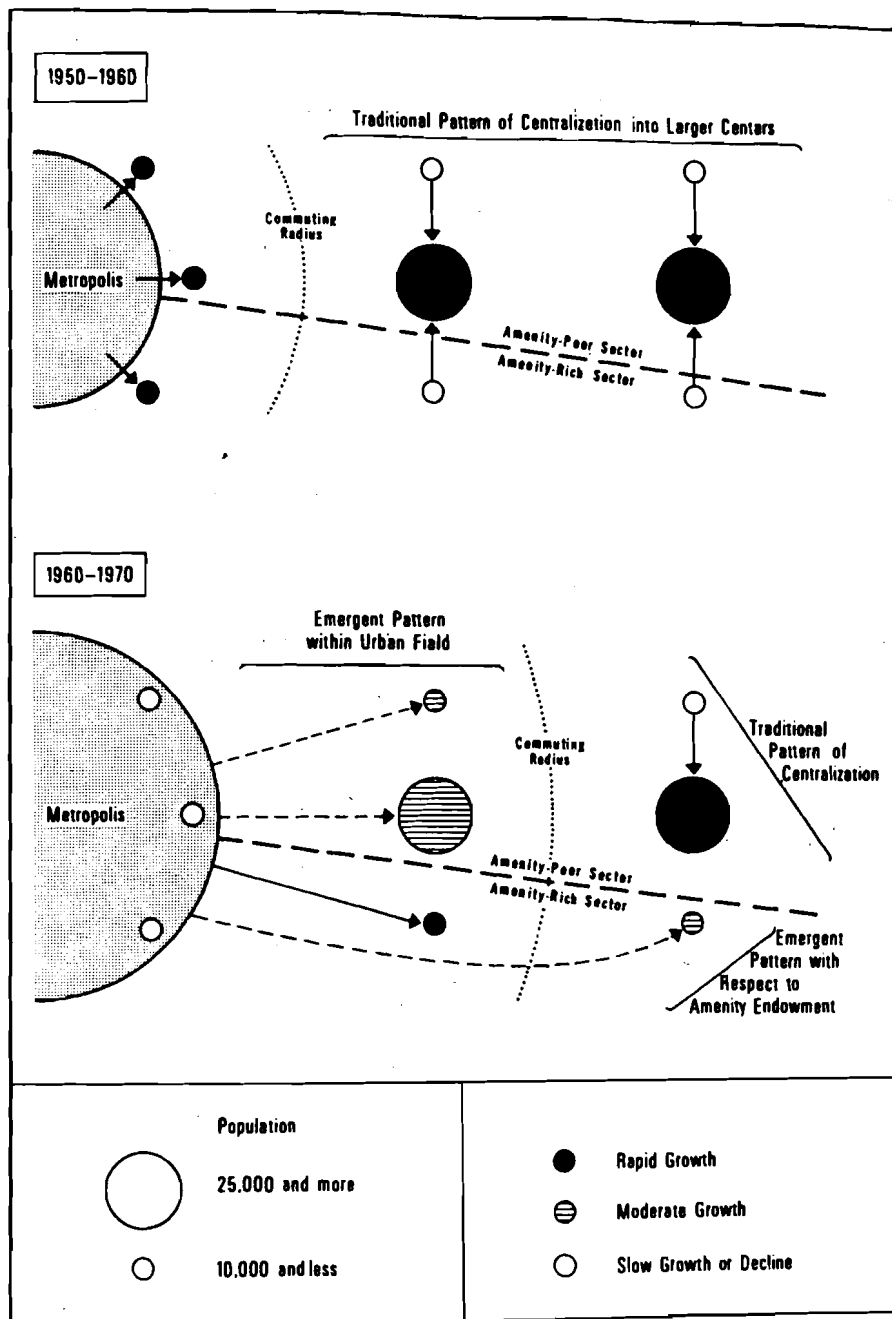


Figure 2. Graphic Summary of Recent Non-Metropolitan Growth Trends.

Source: R. Lamb, Metropolitan Impacts on Rural America. Chicago, University of Chicago, Department of Geography, Research Paper No. 162, 1975, p. 187.

The importance of decentralizing forces, and particularly of nonmetropolitan amenities, no doubt accounts for the fact that by the early 1970s there was positive net migration from metropolitan to nonmetropolitan areas. Despite the movement from central cities to their suburbs and sometimes beyond, only Pittsburgh among the nation's twenty-five largest metropolitan areas lost population during the 1960s. By 1974, ten of these areas--including New York, Chicago, Los Angeles, Philadelphia, and Detroit--were declining absolutely. One in every three metropolitan residents now lives in a declining area.

The data in Table 3 show that whereas in the 1960s the annual average growth rate in metropolitan areas led the corresponding nonmetropolitan rate by 1.6 per cent to 0.4 per cent, there was a reversal between 1970 and 1973 (0.9 per cent versus 1.3 per cent, respectively). This unprecedented reversal is not simply the latest manifestation of urban sprawl around metropolitan areas. Referring to the data in Table 3, a leading demographer points out that the most dramatic net migration changes have taken place "in those counties with the least commuting to metropolitan areas and in those classified rural nonadjacent. That component of change, in those two categories of counties, carries the clearest message: the more remote kinds of places--those that as a group used to be regarded as 'nowhere'--have today become 'somewhere' in the minds of many migrants (Morrison, 1975, p.12)."

Regional employment change data lend further support to this position. The locus of fastest employment growth shifted from suburban counties prior to the 1969 national economic downturn to nonmetropolitan counties throughout the 1969-72 business cycle. Moreover, nonmetropolitan growth rates were highest in less-developed regions, indicating that employment decentralization was more than mere metropolitan spillover (Nelson and Patrick, 1975).



Table 3. Population Change for Groups of Metropolitan and Nonmetropolitan Counties, 1960-1970 and 1970-1973.

Population Category	Provisional 1973 Population (000's)	Annual Population Growth Rate	
		1970-1973	1960-1970
United States	209,851	1.0	1.3
Inside SMSAs <sup>a</sup> (Metropolitan)	153,350	0.9	1.6
Outside SMSAs (Nonmetropolitan)	56,500	1.3	0.4
<i>In countries from which:</i>			
≥ 20% commute to SMSAs	4,099	1.9	1.0
10%-19% commute to SMSAs	9,683	1.4	0.7
< 10% commute to SMSAs	42,719	1.2	0.3
<i>Entirely rural counties not adjacent to an SMSA<sup>b</sup></i>	4,401	0.9	-0.4

Source: P.A. Morrison, The Current Demographic Context of National Growth and Development. Santa Monica, Calif., Rand Corporation, September, 1975, p.10. Data are from Richard L. Forstall, "Trends in Metropolitan and Nonmetropolitan Population Growth Since 1970," forthcoming; and Calvin L. Beale, *The Revival of Population Growth in Nonmetropolitan America*, ERS-605 Economic Development Division, Economic Research Service, U.S. Department of Agriculture, June 1975.

<sup>a</sup> SMSAs defined as of December 31, 1974, except in New England, where definitions in terms of entire counties have been substituted.

<sup>b</sup> "Entirely rural" means the counties contain no town of 2500 or more inhabitants.

### Great Britain

Tables 4 and 5 present data on employment and population by urban zone in Great Britain. The zone categories refer to basic spatial units of analysis that are now in common use there. In brief, the urban core and metropolitan ring comprise the Standard Metropolitan Labour Area (SMLA), which together with the outer metropolitan ring makes up the Metropolitan Economic Labour Area (MELA).

Table 4 compares population and employment proportions by spatial zone in 1971. Employment is more concentrated in urban core areas than is population. The reverse situation holds for metropolitan ring areas, though it is not so pronounced in the outer ring areas. Commuting is the major factor behind the differences shown in Table 4, though there are some differences in labor force participation rates. Even more interesting, however, are the comparisons over time shown in Table 5.

The 1951-1961 period was marked by a small but increasing concentration of employment into SMLAs at the expense both of outer metropolitan ring and unclassified areas. There was little difference between metropolitan core and ring employment growth rates. The general picture was one of urban concentration and rural depopulation related to declines in agricultural employment. In the 1961-1971 period a more basic process of change was superimposed on the previous pattern. Decentralization of employment from core areas to metropolitan rings (and to a lesser extent, outer metropolitan rings) became significant. Total employment growth in the ring areas amounted to about 700,000 jobs; and in the outer ring areas to 130,000 jobs. This took place during a period of relative national stagnation in employment growth. The data in Table 5 also indicate that decentralization of employment lagged the decentralization of population to metropolitan rings and outer metropolitan ring areas.

Table 4. Great Britain: Proportions of Employment and Population by Urban Zone, 1971.

	<u>Population</u>	<u>Employment</u>
1. Urban Core Areas	47.42	58.56
2. Metropolitan Ring Areas	31.86	22.87
3. Standard Metropolitan Labour Areas (1)	79.28	81.44
4. Outer Metropolitan Ring Areas	16.42	14.91
5. Metropolitan Economic Labour Areas (2)	95.70	95.44
6. Unclassified Areas	4.30	4.06
7. Great Britain	100.00	100.00

(1) Row 3 = Row 1 + Row 2

(2) Row 5 = Row 3 + Row 4

Source: R. Drewett, et al., Employment Change in the Urban System. London, London School of Economics and Political Science, Department of Geography, Urban Change in Britain: 1961-1971 Project, Working Report No. 15, June, 1975, p.5.

Table 5. Great Britain. Growth Rates of Population and Employment by Urban Zone.

	1951-1961		1961-1971	
	Population	Employment	Population	Employment
1. Urban Core Areas	1.88	6.72	-2.77	-3.06
2. Metropolitan Ring Areas	13.33	6.63	17.17	15.04
3. Standard Metropolitan Labour Areas	5.71	6.70	4.36	1.42
4. Outer Metropolitan Ring Areas	3.13	-0.43	9.76	3.91
5. Metropolitan Economic Labour Areas	5.27	5.57	5.25	1.79
6. Unclassified Areas	-0.92	-5.53	-1.36	-0.70
7. Great Britain	4.97	5.06	4.95	1.69

Source: R. Drewett, et al., Employment Change in the Urban System. London, London School of Economics and Political Science, Department of Geography, Urban Change in Britain: 1961-1971 Project, Working Project No. 15, June, 1975, p.6.

If one examines the structure of Great Britain's entire urban system over time it is apparent that there has been a pronounced flattening out of the rank-size distribution as population has shifted away from the largest cities to medium-size cities and as new urban areas with high rates of population growth have been added to the lower rungs of the urban hierarchy. These changes, together with the decentralization processes within SMLAs and MELAs, have led British scholars who have studied these developments closely to pose "the question of the meaningfulness of the centrally focused definition of urban areas as a basis for understanding urban growth in the future (Drewett, et al., 1974, p.13)."

#### Sweden

Data on population increase in urban regions of Sweden between 1960 and 1970 are presented in Table 6. During this period the urban population--defined to be people living in places with 200 or more inhabitants--increased from 72.7 per cent to 81.4 per cent. In the three largest urban regions--Stockholm, Göteborg, and Malmö--population expanded much more rapidly in outlying satellites than in the more narrowly defined central urbanized areas. But then this was also the case for most urban regions with more than 30,000 inhabitants. The rural population decreased by 26.5 per cent during the 1960s; almost all communities experienced rural population declines, usually close to the national average. Thus, Sweden had a decentralization of its urban population on two levels: first, from the central urbanized areas of large- and middle-size urban regions to outer suburbs or satellites; and second, from the two largest urban regions to other urbanized areas of the country. The Stockholm central urbanized area, it will be noted, had zero population growth during the 1960s.

In the early 1970s the entire urban regions of Stockholm and Göteborg were experiencing zero population growth.

Table 6. Population Increase of Urban Regions \* in the 1960s in Sweden.

Urban Region	Urbanized Areas and Satellites			Urbanized area		Satellites	
	Inhabitants 000, 1970	Increase 1960-70	per cent per annum	Inhabitants 000, 1970	Increase per cent 1960-70	Inhabitants 000, 1970	Increase per cent 1960-70
Stockholm	1 384	19	1.8	973	0	411	113
Göteborg	600	20	1.9	486	9	114	110
Malmö**	434	27	2.4	265	14	169	53
Västerås	135	33	2.9	99	30	36	42
Uppsala	112	37	3.2	93	27	19	116
Norrköping	114	13	1.2	91	6	23	53
Örebro	125	22	2.0	87	20	38	28
Helsingborg	179	19	1.8	82	8	97	29
Jönköping	102	20	1.9	81	13	21	57
Linköping	92	25	2.3	77	17	15	85
Borås	100	17	1.6	73	10	27	40
Eskilstuna	95	27	2.4	69	21	26	46
Gävle	112	15	1.4	65	11	47	22
Sundsvall	89	23	2.1	54	22	35	24
Karlstad	92	22	2.0	52	22	39	22
Halmstad	67	23	2.1	50	19	17	34
Umeå	58	44	3.7	48	47	10	32
Trollhättan	75	25	2.3	41	31	34	18
Växjö	58	49	4.1	39	58	19	34
Karlskoga	70	12	1.1	37	18	33	6
Luleå	49	40	3.4	37	23	12	141
Uddevalla	45	12	1.1	35	8	9	29
Borlänge	80	15	1.4	35	18	45	14
Kalmar	48	20	1.9	35	14	13	41
Karlskrona	64	19	1.8	34	1	30	49
Nyköping	53	41	3.5	31	30	22	61
All urban places of 200 inhabitants	6 575	21	1.9				

\*) For the three largest cities all urbanized areas within a radius of 40 km were included, for other urban places with more than 30 000 inhabitants the radius was 25 km.

\*\*\*) Malmö, excluding Landskrona with satellites, which was included in Helsingborg.

Source: G. Alexandersson and T. Falk, "Changes in the Urban Pattern of Sweden, 1960-1970: The Beginning of a Return to Small Urban Places," *Geoforum*, 4 (1974), p.91.

Although this surprised many members of the planning community, it should have been apparent from trends in the 1960s that a small change in place preferences could easily lead to no growth in Sweden's two largest urban regions. Meanwhile, many small urban places in southern Sweden have had rapid population growth, especially where schools and easy access to sports and recreation are available. In both southern and central Sweden high standards of private transportation have made it quite feasible to separate residences and work places. Decentralization also has been encouraged by an increase in effective demand for single-family homes as compared with apartment dwellings. In the 1960s ambitious plans were formulated for big- and medium-sized city regions all over the country; ample space was provided for apartments and industrial uses. Because land near these cities was often not available for single-family units many persons moved to small places a considerable distance away. Traditionally about 80 per cent of the people in Swedish cities have lived in apartments. In 1965 apartments accounted for 71 per cent of new dwelling units; by 1972 this figure was down to 64 per cent. In general, then, "Journey-to-work distances of 40-50 kilometers are becoming rather common in the early 1970s even for medium-sized cities. The green wave in Sweden is a move back to the small urban places, where land for homes is abundant and cheap, but so far it has not been a move back to the countryside, which held 80 percent of the population in 1880 but only 19 percent in 1970 (Alexandersson and Falk, 1974, p.92)."

### Japan

Although this paper is primarily concerned with Western urban-industrial nations, it is appropriate to give due consideration to Japan because in many respects it has equalled-- and in some cases even surpassed--the economic performance of some nations in this category.

The pace of urbanization in postwar Japan has been quite remarkable. In 1950 only about two in every six Japanese lived in urban areas; by 1970 the corresponding figure was five in every six. Glickman (1975) has analyzed population and employment growth in the Japanese urban system for the four quinquennia from 1950 to 1970. The spatial units of observation used were Regional Economic Clusters (RECs), which are analogous to American Standard Metropolitan Statistical Areas. Two-thirds of the 1970 population lived in 80 RECs and half lived in eight large Standard Consolidated Areas. The system of cities tended to centralize between 1950 and 1970. There was relatively rapid growth in a few large population centers--many of which had an important manufacturing base--near Tokyo and Osaka.

Central cities accounted for 55.0 per cent of the total REC population in 1950, 58.5 per cent in 1960, and 54.8 per cent in 1970. Thus there was increasing centralization within metropolitan areas between 1950 and 1960, but some decentralization in the 1960-70 period. No employment data were available for 1950. However, between 1960 and 1970 the proportion of employees living in central cities of RECs declined from 58.0 per cent to 54.3 per cent, indicating that employment decentralized along with population but not nearly to the extent that was observed in the countries discussed previously in this section.

Among major metropolitan centers, Tokyo's population growth rate declined in each quinquennium, from 23.7 per cent in 1950-55 to 13.7 per cent in 1965-70. In contrast, Tokyo's outlying suburban areas had increasing growth rates over this period. The employment growth rate in Tokyo fell from 25.4 per cent in 1960-65 to 13.4 per cent in 1965-70, but the growth rate in many outlying areas increased. Osaka's population growth rate declined from 20.4 per cent in 1950-55 to 14.8 per cent in 1965-70. Growth rates in outlying suburbs increased over time but not as much as in those of Tokyo.



With respect to employment growth, Osaka went from a 31.2 per cent increase in 1960-65 to a 14.4 per cent increase in 1965-70, though growth in outlying areas increased in the late 1960s.

In terms of employment, then, the rapid growth of Japanese manufacturing regions appears to be similar to what happened in the United States and the United Kingdom in the first half of this century. In terms of population (and to some extent employment) the cities that grew the fastest during the 1950-1970 era grew less rapidly during 1965-70; conversely, cities that grew the slowest seemed to grow less slowly (or have less negative growth) during the 1965-70 period. This suggests that at present decentralization effects may be becoming more apparent in the Japanese urban system.

#### From Nodal Cities to Megaregions

Various theories have provided partial insights into the organization and development of human settlements. None-- either by itself or in combination with other theories--has proven really satisfactory in explaining human settlement processes or in giving specific guidance to public policy. In the preceding section it was shown that recent decentralization of population and economic activity has made the very notion of a system of nodal cities (and their hinterlands) questionable. Although evidence was presented for only four countries, there are indications that decentralization is a widespread phenomenon in Western Europe (Alexandersson and Falk, 1974).

The changing nature of human settlements patterns was anticipated ten years ago in a well known article by Friedmann and Miller.

Looking ahead to the next generation, we foresee a new scale of urban living that will extend far beyond existing metropolitan cores and penetrate deeply into the

periphery. Relations of dominance and dependency will be transcended. The older established centers, together with the intermetropolitan peripheries that envelop them, will constitute the new ecological unit of America's post-industrial society that will replace traditional concepts of the city and metropolis. This basic element of the emerging spatial order we shall call the "urban field (Friedmann and Miller, 1965, p.313)."

The urban field, in this view, represents a fusion of metropolitan areas and nonmetropolitan peripheries into areas with a minimum population of 300,000 persons and extending outward for approximately one hundred miles, that is, a driving distance of about two hours.

Similarly, Berry points out that:

Gradients of distance accretion are now beginning to replace those of core-centered distance-decay within the larger megalopolitan complexes as persons of greater wealth and leisure seek homes and work among the more remote environments of hills, water, and forest, while most aspire to such settings as an ideal. In consequence core-dominated concentration is on the wane; the multi-node multi-connection system is the rule. It is the spontaneous creation of new communities in zones of superior residential amenity, the flows that respond to new transportation arteries, the waves emanating from growth centers, the mutually-repulsive interactions of antagonistic social groups, the reverse commuting resulting from increasing segregation along city boundary lines as employment decentralizes, and all the other facets of social dynamics that today combine to constitute today's urban systems in America.

It is these dynamics that produced significantly different patterns of regional growth in the 1960s, and call for a different theory of regional development than has traditionally been used (Berry, 1973, p.40).

Berry correctly stresses that if regional growth processes are to be understood adequately it is necessary to have at the outset a precise functional definition of the nature of urban regions. In the context of the United States he has proposed using a set of 173 "daily urban systems" which exhaust the national territory. These regions were defined according to

the following criteria:

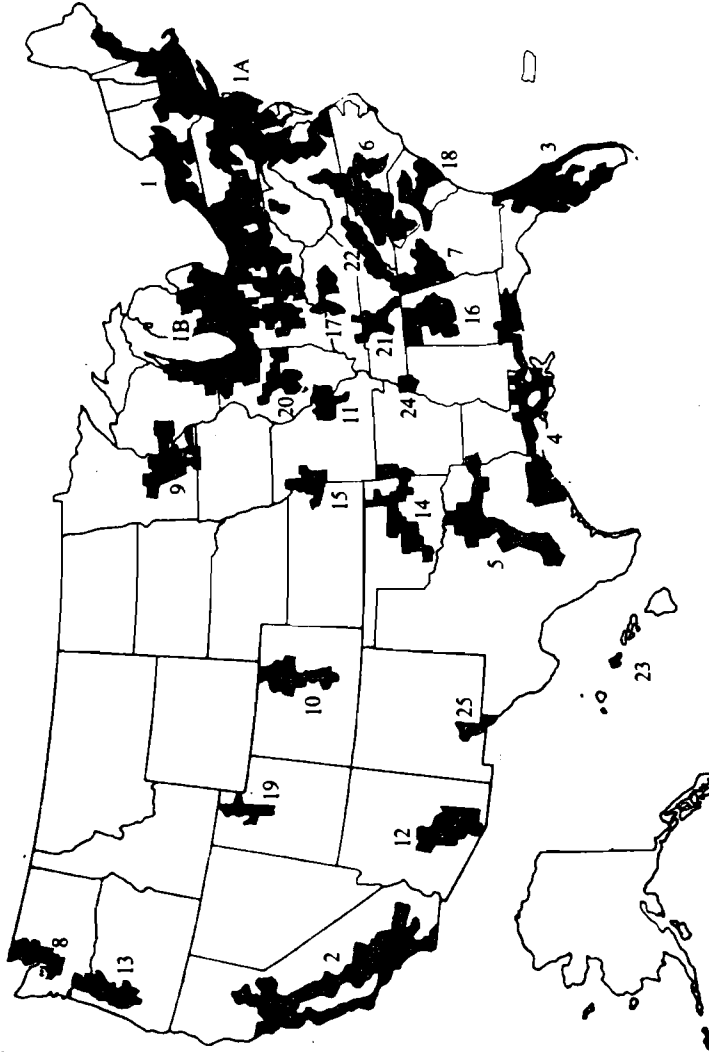
After identifying economic centers, intervening counties were allocated to the centers. The assignment was made primarily on the basis of the journey to work pattern around the economic centers. Comparative time and distance of travel to the economic centers, the interconnection between outlying counties because of the journey to work pattern, the road network, and the linkages of counties by such other economic ties as telephone traffic, bank deposits, television viewing, newspaper circulation, and topography were also used to determine placement of peripheral counties into the appropriate economic area. In places where the commuting pattern of adjacent economic sectors overlapped, counties were included in the economic area containing the center with which there was the greatest commuting interconnection. In the case of cities where the commuting pattern overlapped to a great degree, no attempt was made to separate the two cities; instead, both were included in the same economic area (Berry, 1973, p.11-15).

The areas thus defined have in fact been adopted for purposes of regional analysis by the Bureau of Economic Analysis, U.S. Department of Commerce. Ideally they have a high degree of "closure" with respect to employment and housing markets, as well as tertiary activities. A problem arises when there is increasing cross-commuting between areas; this suggests that in the future adjacent daily urban systems should be merged as their employment and housing markets coalesce. What might this new pattern of American megaregions look like? Figure 3 shows one of the most frequently cited projections of the American urban landscape at the end of the twentieth century, that made by Pickard for the U.S. Commission on Population Growth and American Future.

In Western Europe the history of economic development has also produced a megaregion system running from the south of Great Britain to the north of Italy. In this landscape the Rhine occupies a central position. Here are found most of the population, industrial activity and services of Western Europe. Around this axis, the south of Italy, Spain, the west and southwest of France, Ireland, Scotland,

Based on 2-child family projection

1. Metropolitan Belt
  - 1.a. Atlantic Seabord
  - 1.b. Lower Great Lakes
2. California Region
3. Florida Peninsula
4. Gulf Coast
5. East Central Texas—Red River
6. Southern Piedmont
7. North Georgia—South East Tennessee
8. Puget Sound
9. Twin Cities Region
10. Colorado Piedmont
11. Saint Louis
12. Metropolitan Arizona
13. Willamette Valley
14. Central Oklahoma—Arkansas Valley
15. Missouri—Kaw Valley
16. North Alabama
17. Blue Grass
18. Southern Coastal Plain
19. Salt Lake Valley
20. Central Illinois
21. Nashville Region
22. East Tennessee
23. Oahu Island
24. Memphis
25. El Paso—Ciudad Juarez



Source: U.S. Commission on Population Growth and the American Future, *Population Distribution and Policy*, Sara Mills Mazie, ed., vol. 5 of Commission research reports (Washington, D.C.: U.S. Government Printing Office, 1972), p. 143.

Figure 3. Projected Megaregions in the Year 2000.

and the north of Scandinavia constitute a relatively underdeveloped and lightly-populated periphery. It is noteworthy that the Netherlands, Belgium and West Germany are situated almost entirely within the industrial corridor. England is linked to it by London and Italy by the industrial centers of the north, though not without an alpine impediment. On the other hand, the Paris region is not well linked to the ensemble. The second most important French region--Rhône-Alps--is somewhat better situated in this regard (Délégation, 1974).

Obviously the megaregions of Europe, the United States and Japan are not political units. It also is misleading to regard them as mere configurations of population densities. Within megaregions there are of course very densely-settled areas, but these by no means necessarily typify the regions shown, for example, on Figure 3. Even within the Atlantic Seaboard Metropolitan Belt (megalopolis) the amount of built-up area accounts for only six per cent of the total area. Thus, the megaregion is not so much a physical entity as a pattern of localizations and connecting flows of people, information, goods, and services.

In sum then, the nineteenth-century nodal city has given way, in varying degree, to the metropolitan area, the urban field, and the megaregion. Yet spatial-temporal development processes are still very imperfectly understood. This in itself explains why even though nearly all of the countries considered feel a need for some form of human settlements policy, few are able to elucidate clearly what the problems really are.

#### A Framework for the Analysis of Human Settlement Systems

Any major effort to gain better understanding of spatial-temporal development processes should have at the outset a framework of functional economic areas. It should reflect the

fact that these processes are increasingly international in character. It also should be flexible enough to take into account differences in degree of development among national (and even sub-national) economies as well as differences in degree of national economic planning.

Such a study is now being undertaken within the Urban and Regional Project of the International Institute for Applied Systems Analysis, in collaboration with the University of Reading, England. The research covers the United States, Canada, Japan, and most of Western and Eastern Europe. The basic units of analysis are urban regions, which essentially are functional labor market areas corresponding to the daily urban systems of the United States and the Metropolitan Economic Labour Areas of Great Britain (Hall, Hansen, and Swain, 1975a, 1975b).

The initial phase of this study is attempting to define the hinterlands of urban core areas and to delineate the boundaries of functional urban areas. However, as discussed earlier, it may not be possible to make core-hinterland distinctions when dealing with urban fields and megaregions, though in the latter it may be possible to identify multiple cores, e.g. in the Ruhr and in the Atlantic Seaboard Metropolitan Belt of the United States.

Given this context it should be possible to test the theory that, at least in some settings, innovation and economic growth have a two-fold spatial-temporal character, that is, they trickle down through the urban hierarchy and also spread from urban cores to their respective hinterlands. But the hierarchy may include urban fields, megaregion cores and perhaps even megaregions rather than just the traditionally defined cities or metropolitan areas.

It also should be possible to test the theory that urban system development is a function of contact systems and information flows--which frequently must be viewed in an international setting--and that economic growth and innovation

diffusion patterns may not correspond to the predictions of the theory of hierarchical filtering and hinterland spread. Thus, for analytic purposes mappings of information flows can be superimposed on urban region mappings.

Throughout most of this paper primary attention has been given to growth processes but it also was pointed out that many entire urban regions are experiencing--and still others will experience--population loss as national birth rates decline. It is not likely that the process of growth and decline are symmetrical but as yet there is not much systematic knowledge about the potential problems and opportunities that may accompany population stability or decline. Even if a nation reached a no-growth situation the selectivity of migration flows would produce different regional consequences. Clearly any meaningful systems approach to human settlements must be informed by knowledge about the nature and significance of human migration. This important issue has not been dealt with in detail here because it is being examined within the Urban and Regional Project in a major closely-linked research effort on migration and settlement.

Finally, problems common to "natural" regions cut by political boundaries--disparities in growth rates, customs barriers, limitations on labor mobility, lack of coherence in infrastructure and industrial location policy, etc.--have in the past been slighted because of economic and political nationalism. Today the development of the Common Market is drawing attention to these issues; and in the United States there has been sharply-increased interest recently in the special problems of regions along the frontier with Mexico. Hopefully, the research effort just outlined will be able to contribute not only to a better understanding of the problems of border regions, but also to their resolution to the benefit of all of the populations concerned.

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