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# GEOGRAPHIA POLONICA



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# **GEOGRAPHIA POLONICA**

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**URBANIZATION AND SETTLEMENT  
PROCEEDINGS  
OF THE SECOND SOVIET-POLISH GEOGRAPHICAL SEMINAR**

**Moscow and Leningrad, June 1974**

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## REPORT OF THE MEETING

The Second Soviet-Polish Geographical Seminar on problems of urbanization took place in Moscow and Leningrad between June 24-30, 1974. The participants of the Seminar (16 on the Polish side and about 50 from the Soviet Union) represented several disciplines, mainly geography, economics, and architecture, as well as a number of institutions, which included Academies of Sciences of the Soviet Union and Poland, universities, branch research institutes and planning offices. Over twenty papers were presented and discussed, dealing with contemporary questions of urbanization and the research needs in the field of urban studies. The programme of the Seminar included study-excursions in Moscow and the Moscow region, Leningrad together with its suburban zone, the new town of Pushchino, and the city of Novgorod — one of the oldest in Russia.

It is recognized that during the period which has elapsed since the First Polish-Soviet Seminar held in 1971, significant progress has been achieved in both countries in the study of urbanization. Research on planning future settlement patterns on the national scale has been carried on; the spectrum of research has been substantially broadened, a number of publications have appeared; progress in methodology has been recorded. The discussion during the Seminar followed three main lines: (a) General problems of urbanization; (b) Development and planning of national and regional settlement systems; (c) Development and planning of urban agglomerations.

The studies presented were aimed at providing inputs for social and economic planning at the national level. The further work on urbanization, taking into account the questions of relevancy, should proceed in the following directions:

(1) Urbanization as a world-wide phenomenon, extending to all countries of the globe (with few exceptions); characteristic features of urbanization in countries of different socio-economic systems. In particular, the study should allow to evaluate the state of urbanization in the developed capitalist countries, as well as in the developing nations and to critically appraise the research concepts developed in those countries. The appraisal should lead towards important research and planning generalizations concerning socialist countries.

(2) Settlement patterns and the territorial structure of national economy, as well as the formation of settlement systems at different spatial level. Interrelations between settlement structure and economic regionalization should be more intensively studied.

(3) Scientific bases of control and management of settlement systems.

(4) Urbanization and the protection of natural environment, including ecological aspects of urban development, questions of the rational use of land, etc. It is postulated that in the study on impact of urbanization on natural environment physical geographers should take an active part.

(5) The development of the system of large urban centres and urban agglom-

merations as nodal points in the spatial organization of settlement.

The development of urban research calls for comprehensive projects, the collaboration of specialists in various fields, and for the orientation towards theory formulations to be applied in the management of settlement systems and leading to the improvement of methods. It is a crucial task to concentrate the research effort on the study of geographical aspects of urbanization processes in order to identify urban growth mechanisms under different socio-economic conditions; to develop research pertaining to different levels of territorial scale.

The participants in the Second Soviet-Polish Seminar on Urbanization emphasize that:

(1) At the 23rd International Geographical Congress much attention will be devoted to the questions of urbanization, the fact to be taken into account when planning future research activity in the field;

(2) The results of this Seminar should be presented, in a join paper by Soviet and Polish authors, at the scientific symposium during the Congress;

(3) The materials from the Seminar should be published in Russian by the Institute of Geography, Academy of Sciences of the USSR; in Polish — by the Institute of Geography and Spatial Organization, Polish Academy of Sciences, and, selectively, in English, also by the Institute of Geography and Spatial Organization, Polish Academy of Sciences;

(4) Reports on the Seminar and its scientific results should be published in geographical periodicals in both countries.

It is recognized that it would be very useful to hold the next Polish-Soviet seminar on urbanization within 3–4 years, and also to present the materials from the present Seminar to the Commission on Building of the CMEA. It is postulated that scientists from other socialist countries — CMEA members — take part in the research programmes which have been discussed at the Seminar.

The Second Soviet-Polish Seminar on Urbanization has enabled to strengthen the scientific contacts between Polish and Soviet geographers, as well as representatives of other disciplines concerned with the study of urbanization.

The participants in the Seminar acknowledge their gratitude to the organizers and all the institutions which actively took part in the preparation and the completion of the Seminar, first of all to the Institute of Geography of the USSR Academy of Sciences, the Centre of Population Studies at the Moscow State University, and the Geographical Society of the USSR.

## CHARACTERISTICS OF WORLD URBANIZATION AND ITS FEATURES IN INDIVIDUAL COUNTRIES

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AND YAKOV G. MASHBITS

The world is becoming increasingly urbanized. The present epoch is marked by rapid growth of urban population (its growth rate being double that of the population as a whole), proliferation of cities, with sharply increased role of large cities (population over 100,000) and especially major metropolitan centres (including cities with a population in excess of 1,000,000), emergence of conurbations, increased cityward migration from rural areas and extensive commuting within metropolitan areas. The forming and accelerated development of increasingly complex urban systems and the turning of large cities into complex systems determines many aspects of modern urbanization, in particular its spatial aspect.

Table 1 gives some idea about the scope of urbanization. The process of urbanization is nearly universal and global in character. However, intensive urbanization is confined to relatively small areas which perform the role of focuses in which urbanization and associated processes are generated.

TABLE 1. Growth of Urban and Large-City Population in the World (1800-1970)

Years	Urban population (in millions)		Urban to total population ratio (in per cent)		Percentage of urban population living in large cities
	5000 and more	100,000 and more	5000 and more	100,000 and more	
1800	27.2	15.6	3.0	1.7	56.3
1850	74.9	27.5	6.0	2.3	38.3
1900	218.7	88.6	13.6	5.5	40.3
1950	716.7	313.7	29.8	13.1	43.6
1970	1354.3	690.0	37.3	19.0	51.0

Urbanization gives rise to an urban way of life by increasing human contacts, drastically changing the population's occupational structure and increasing its social mobility. The process creates an urban environment as found in major cities and urban agglomerations which are its physical result, the main arena and the exponents of its main features.<sup>1</sup>

<sup>1</sup> Large cities and conurbations are a distinct environment for the life of the population, the pursuit of industry and many other types of human activities, and the interaction between society and nature which is here particularly intensive and interpenetrative.

In geographical terms, the appearance and development of this distinct environment forms the main content of the urbanization process. It exercises a profound impact on all the aspects of society's material and cultural life and the entire system of "man — nature".

A highly urbanized environment covers a territory which offers the possibility to meet virtually all of man's labour, welfare and recreation needs. Although a key element in the process of urbanization, the large city does not afford a sufficiently diverse environment to meet all the various demands of the present-day society. In particular, it cannot satisfy the dramatically increased and still increasing need of the urban dweller for recreation, for a weekend in the countryside which has become a necessity for him.

The territory considered need not be excessively large, its size being usually determined by the radius of mass population movement (daily commuting to work and the movement of large masses to the surrounding recreation belts). It will be seen, then, that the main taxonomic unit, or cell of urbanized environment to be studied is not just a city, but a metropolitan area.

The merger of such cells into larger entities (e.g., megalopolises) does not mean that these original cells lose their identity and cease to exist as basic units of urbanistic taxonomy. A megalopolis is a vast territory affected by the process of urbanization. However, as distinct from a metropolitan area, it is not a whole entity where the daily and weekly cycles of the population's life take place.

Contemporary urbanization is closely linked with the scientific and technological revolution (STR). It is based on growing concentration of industry and research and development (RD), with the spatial form of this concentration changed from "spot" to "areal", as well as on the development of the infrastructure, notably the basic (or production) infrastructure. The link between urbanization and the development of infrastructure is constantly increasing. In the context of the STR, concentration becomes much fuller and more effective, involving, as it does, cooperation and specialization, and proceeding in conditions when improved infrastructure gives a boost to socialization of production in space.

Concentration in the epoch of the scientific-technical revolution proceeds on a polyfunctional basis involving intensive interfunctional interaction of an unprecedented scope and level. Science, design and planning, management, gathering and processing of information, personnel training, etc., are playing an ever more important role in urbanization and the development of the cities' polyfunctional basis. However, modern large-scale machine production (notably its new "science-intensive" branches) retain, at least at the present stage of world urbanization, a major and often decisive role. This is most manifest in industrialized countries, where industry is the cornerstone of the polyfunctional basis of cities, in the first place of large centres and conurbations.

Industry is still the focus of many pressing urban construction problems, as well as such adverse aspects of urbanization as environmental pollution, incommensurately large amounts of time spent in transit, etc.

Although urbanization is universal in character, it is manifested in different forms in different environments. Being a very complex process, urbanization is influenced by the most diverse factors, whose character and relative importance vary substantially in countries with differing types and levels of socio-economic development (including the modes of settlement, use of natural reso-

urces and development of the territory). This leads to sharp differences as to the degree and forms of urbanization between different countries and areas.<sup>2</sup>

Geographical study of urbanization thus involves the development of a typology of countries depending on the character of urbanization.

Because so many factors are involved in urbanization, its typology presents a great challenge. Taking as a basis one leading factor of urban development in a particular area, the following types of urbanization can be singled out: (1) industrial, (2) complex (based on an integration of functions), (3) "pseudo-urbanization" (disproportion in the growth rate of the urban population and the urban economic base, notably industry), (4) "service-type" urbanization (when the services are over-inflated).

Urbanization is an inherently geographic process its manifestations in space being highly selective. Intensively urbanized areas are tied to certain parts of the earth surface, revealing distinct geographic patterns. Even in highly developed and densely populated countries urban areas are unevenly distributed. The close link between urbanization and geographical difference of factors and conditions is apparent. Urbanization, in its turn, by responding to differences from place to place, tends to increase geographical differentiation of economy and settlement.

The development of large centres is the realization of the considerable (and in the case of major cities, outstanding) economic potential inherent in various "spots" of the territorial structure. In this process, geographical factors, notably the economico-geographic location, play perhaps a decisive role.

A geographical study of urbanization involves investigation both of its geographical conditions and geographical manifestations, and of its dialectical interaction with the natural environment and the economic "substance", the character of development and settlement, and prospects for growth.

A highly promising area of research for geographers is the study of urbanization, in geographical and material terms, as part of the territorial economic structure of a particular country in as much as that territorial structure provides pointers for urban development in space.

Urbanization, for its part, selectively contributes to the development of certain elements of the territorial structure, thereby substantially changing it. Urbanization transforms the settlement pattern by focusing it in major centres capable of influencing the structure of the system and its elements.

The selectivity of urbanization and its spatial discreteness which are very important geographically, lead to the formation of individual urbanized cells. Explaining the distribution pattern of these cells and, to an even greater degree, its long-term forecasting is a task which calls for geographical approach, an analysis of the process of urbanization in space and the factors and conditions of its development which vary from place to place. The differentiation of conditions, to which urbanization is exceedingly sensitive, is manifested in the territorial structure, i.e. the mutual spatial position of elements.

The geographer studying the present stage of urbanization singles out large polyfunctional dynamic centres which form a developing law-governed agglomeration. The geographer's main concern is the geographical course of urbanization, the sequence in the growth of major centres which draw within their spheres of influence new areas previously low-urbanized, predominantly rural

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<sup>2</sup> In most regions of the world urbanization has changed the environment to such an extent that traditional objects of geographical study—nature, population and economics—can no longer be considered without revealing and taking into account their links with urbanization.

or even totally undeveloped. Of crucial importance for the geographer are changes in the mutual position of cities forming hierarchic systems, the merger of agglomerations into still larger entities, the distribution pattern of urbanization's bridgeheads, cells (nuclei), fronts, networks, etc. Drawing a distinction between expansion and deepening<sup>8</sup> of urbanization, the geographer is called upon to establish the presence and level of the former and the latter, and the relationship between them for each country and area, which is essential in determining the specific character of urbanization and the level of urbanization of a particular territory.

Among the basic concepts that are useful in a geographical study of urbanization, two should be singled out. They are the urbanistic and the territorial-urbanistic structure.

Urbanistic structure is the ratio of various-sized urban settlements, with the share of large cities (large-city population) playing a particularly important role. Territorial-urbanistic structure enables one to judge the extent to which the country's territory is covered by large cities, and the contrasts of urbanization. The key factors involved are the ratio and mutual positioning of territories with varying degrees of urbanization and differing trends (character), and rate of urbanization; the scale and distribution patterns of highly urbanized entities. Territorial-urbanistic structure reflects the main features of territorial economic structure, and reveals many aspects of economic organization by district, especially in the industrialized countries.

A study of the dynamics of these processes reveals trends and the relationship between the expansion and deepening of urbanization. It is essential to identify the focus of urbanization and its role in the subsequent stages, and to assess the potential for further urbanization, viz.,

- (a) availability of territory beyond the economically active space,
- (b) and of space between cities.

On a tentative basis, one can submit the following classification of territorial-urbanistic structures:

(1) The largest focus of urbanization is in the central part of a country's territory. Situated along the perimeter is a system of regional subcentres among which the most important are ports and major raw materials centres (notably mining centres).

(2) Same as above, with the main metropolitan area situated away from the interior of the country.

(3) A focus of urbanization (located centrally or otherwise) is surrounded by low-urbanized periphery.

(4) The urban agglomeration has the form of a strip along the linear elements of the territorial structure.

(5) Territory sharply divided into an economically active part, with a developed network of highly-urbanized environments, and a part selectively developed.

The process of urbanization which leads to the emergence of highly-urbanized areas capable of exerting decisive influence on the country's economic and cultural development, is a historical process. It has a beginning and an end. Embarking on urbanization already presupposes a hotbed of urbanization and material, and other stimulating factors.

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<sup>8</sup> The former refers to emergence of urbanization cells in new territories, the latter to the increasingly complex forms and settlement patterns within an urbanized territory, i.e. the deepening of an urbanized environment structure.

Urbanization can be considered complete when the influence of highly urbanized environments covers virtually the whole of a country's territory (or at least its economically active part) while nearly all the inhabitants live in major cities or metropolitan areas or in the zones under their direct influence. Beyond that stage, of course, major cities and metropolitan areas continue to develop, the settlement forms grow more complex, and urban life acquires new features, both positive and negative. However, it would hardly be logical to refer to that process as further urbanization.<sup>4</sup>

#### FEATURES OF URBANIZATION IN VARIOUS TYPES OF COUNTRIES

Urbanization as a global process has a number of general features and laws. However, it is a highly complex, multi-faceted and inherently contradictory process involving a multitude of factors found in various combinations in various parts of the globe. Hence, one can only speak about urbanization as a global process governed by general laws at a fairly high level of generalization and abstraction.

In the first place, there exist fundamental differences in the socio-economic content of urbanization in countries with differing social systems, which has, among other things, geographical implications. The general laws of urbanization assume a specific character for every group of countries with similar socio-economic systems. Against that common background, more specific features of a given type are revealed in each given country. Each of the three main groups of countries — the socialist, industrialized capitalist and developing — reveals characteristic features of urbanization as manifested in the urbanistic and territorial-urbanistic structure of these countries. These are overlaid by features due to factors of a lower order. Thus, there are features common to countries at approximately the same level of economic development. Other appreciable factors are size of territory, degree and character of its development, population density, geographical (including economic-geographical) position, natural features (i.e. the presence of territories with extreme climates, high mountains, etc.). A multi-level typology of countries and areas in terms of urbanization must take account of all these factors.

The investigation of typological features (i.e. features revealed by groups of countries of similar type, levels and socio-economic trends) and concrete different-level peculiarities and problems of urbanization offers new insights into and facilitates analysis of that universal process. Such an approach reveals the underlying structural interconnection between urbanization and socio-economic development and its typological and regional features.

#### USSR AND THE SOCIALIST COUNTRIES OF EUROPE

Urbanization in socialist countries is a complex process that is not entirely devoid of contradictions. However, the origin and nature of these contradictions is different from those in the capitalist countries. Under socialism, the course of

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<sup>4</sup> Similarly, not all industrial development represents industrialization. Industrialization turns an agrarian country into an industrial-agrarian or industrial one, as reflected in the country's economic structure. Further development of industry is not thought of as industrialization. Thus, one does not speak of industrialization of industrially advanced countries.

urbanization is not distorted by class antagonisms, social and racial inequality, monopoly competition which in a different context are conducive to urban crisis. Settlement — a substantive result of urbanization — does not assume abnormal forms which run counter to the needs of economic and social progress.

The benefits of urbanization can only be maximized and the concomitant negative phenomena eliminated (or forestalled) when the multi-component urbanization processes are controlled by an advanced socialist society, by the state and its planning bodies. In the socialist countries, objective prerequisites exist for controlling the process of urbanization, and the growth of cities and the patterns of settlement are controlled through a system of measures. The task of controlling urbanization flows from the proclaimed goals of socialist society which stands committed to ensuring favourable conditions for full realization of man's spiritual and physical potential.

Socialism harnesses urbanization to high economic and social effect. The socialist society, using the levers of planned economy, directs the factors conducive to the growth of all types of cities, and determines their development proceeding from the national economic priorities and in keeping with the interests of all the citizens. In the socialist countries the course of urbanization is commensurate with economic development. Urbanization there is primarily the consequence of the development of productive forces and the growing complexity of their territorial organization. Socialist urbanization achieves consistent development of a harmonious settlement system that is hierarchically structured and corresponds to territorial economic structure and the task of raising the material welfare and cultural standards of the people. The diversity of settlement forms reflects, not only the geographical diversity of conditions but also the diversity of demands, traditions, tastes and interests of various strata and groups of the population. Large cities and metropolitan areas, being key elements in the sectoral and territorial structure of the socialist countries' economies, perform the role of economically and socially effective settlement forms. Their development is geared to the task of achieving high economic effect within ecologically admissible limits. The increased significance of large cities and metropolitan areas contributes towards a more rational overall settlement pattern, with large cities and metropolitan areas stimulating the life of small and medium cities. Measures to ensure an economic and social upsurge of small and medium cities, implemented in all the socialist countries, have yielded substantial results.

Realization of national economic plans, new community developments and master plans of cities contributes a healthier urban environment and better living conditions. The cities in the socialist countries have none of the negative phenomena such as ghettos, shanty-towns, and progressive deterioration of the environment.

The briefly outlined features of socialist urbanization are subject to modification depending on the specific conditions of particular countries. These are mostly determined geographically.

The Soviet Union, owing to its vast territory and great diversity of natural, economic and national conditions, differs markedly from the European socialist countries, which are small, long-settled, relatively densely populated, with an old pattern of cities and mosaic economic landscapes. Its size, the presence of vast territories, some long economically developed and others just being opened up, and low population density in many areas, reflecting low economic density of the territory, all tend to give added significance to large cities and their

metropolitan areas as centres of territorial structure which cement economically differentiated parts of the country into a single whole.

The history of the USSR, which has been marked by reliance on internal resources, has determined the underlying territorial economic patterns in which most of the more complex settlement systems occur in the interior of the country. By the same token, the burgeoning national borderlands, the development of resources and the Soviet Union's growing international economic links, notably the process of economic integration of the socialist countries, tend to accelerate the development of cities in the peripheral parts of the USSR territory.

A salient feature of urbanization in the USSR, which is a multi-national state committed to the Leninist policy of friendship and fraternal mutual assistance of peoples, is the development of national economic and cultural consolidation centres. The national republics and areas are parts of the all-Union economic organism. The Soviet example shows that the process of socialist urbanization brings nations closer together in a process of mutual enrichment and assistance in economic and cultural development.

New cities spring up in all the socialist countries. However, in the Soviet Union their share relative to the total number of cities and role in settlement patterns is much higher. The appearance of new cities in the USSR is the result both of the deepening of urbanization (the emergence of metropolitan areas, a process more characteristic of the country's European part) and its expansion, chiefly due to the development of mineral, hydro-power, timber and land resources, etc.

The territorial structure of settlement in the USSR bears clear marks of natural climatic zones. The zonal character of economic development is seen in the "cluster-like" forms of settlement prevalent in the Far North and in the desert areas, and in the presence of the main settlement belt which coincides with the economically active territory and reveals a particular variety of settlement forms. The opening up of vast resource zones has prompted the emergence of a front of bridgeheads represented by large cities strategically situated on the approaches to the resource-rich zones.

Urbanization in the European socialist countries reveals many common geographic features. However, substantial differences exist in the territorial structure of settlement, the role and distribution of large cities, and the relative location and composition of zones and districts with varying degrees of urbanization.

In the GDR and Czechoslovakia, dispersed forms of urbanization are more prevalent. In Poland and Romania, the network of large cities stands out in bolder relief. The system of large centres in Yugoslavia reflects its multi-national federated structure. The role of capital cities is particularly pronounced in Hungary, Romania and Bulgaria. Urban agglomeration is found to be at varying stages of development. It is most advanced in the GDR and Poland, and to a lesser degree in Czechoslovakia. In Hungary such an agglomeration only exists around Budapest. In Romania, Bulgaria and Yugoslavia urban agglomerations are in the early stages of development.

All the European socialist countries are carrying out planned territorial settlement programmes aimed at modifying existing patterns. Geographically, these processes and trends reflect the specific conditions of countries and vary accordingly. Thus, Poland links its present-day and future development with the formation of large metropolitan areas connected by urbanized strips. Out-

side these, relatively autonomous settlement centres in the shape of large cities will be situated.

The GDR is tackling the problem of making more effective use of the advantages of concentrated settlement by developing territory surrounding metropolitan agglomerations. Hungary plans a sustained effort at developing a network of major regional centres as a counterbalance to the capital, which is called upon to bring down the excessive share of Budapest in industry, the services, and population.

## INDUSTRIALIZED CAPITALIST COUNTRIES

Present-day urbanization in the advanced capitalist countries reveals some traits which essentially distinguish it from the analogous processes in the socialist countries. Under capitalism urbanization bears a spontaneous character, reflecting the spontaneous nature of capitalist economy. Attempts at regulating the growth and structure of cities are limited in scope and, as a rule, meet with little success. Its ungoverned nature makes more pronounced the negative aspects of urbanization — the main cause of the aggravating crisis of capitalist cities which is itself one of the more vivid manifestations of the sharpened general crisis of the capitalist system.

Urbanization tends to exacerbate all the inherent contradictions of the capitalist society, including class, racial, and national contradictions which are particularly intense in cities, assuming distinct spatial forms. Advanced capitalist countries are highly urbanized, with most of the population living in the cities (over 80 per cent in some countries). The high ratio of city population means that the main mass of the residents live in an urban environment.

A highly-urbanized large-city environment is a major present-day feature. The urbanistic structure in advanced capitalist countries is marked by the commanding influence of large cities, with gigantic polyfunctional centres playing an outstanding role, and the prevalence of urban agglomerations as the main settlement pattern. The territorial-urbanistic structure of these countries is stable and mature. The established settlement pattern changes but little, the hierarchy of cities is stable and pronounced, and few new cities appear.

Urbanization mainly develops in depth. This is true even of countries possessing vast undeveloped territories (such as Canada and Australia), not to speak of the economically developed and densely populated small countries of Western Europe which have a dense network of cities and where the possibilities for urban growth by annexation have been virtually exhausted.

In these countries (as well as in the more densely populated and economically developed parts of large countries, e.g., in the north-eastern United States) contiguous urban agglomerations tend increasingly to merge into larger entities, the suburban zones of neighbouring agglomerations partially overlap, with vast highly-urbanized areas formed as a result.

All this goes to show that the process of urbanization in the most advanced and populous capitalist countries is nearing completion.<sup>5</sup> This is also borne out by the noticeable slow-down in the growth of the urban population ratio in these countries (in some there is a zero growth rate).

In an increasing number of countries numerical growth of the urban population is almost entirely due to natural causes. Rural population has shrunk to

<sup>5</sup> The term urbanization is here used in the sense explained above.

such a level that migration from country to town is no longer a significant factor of urban population growth. The biggest migrations of people are now between cities.

The low natural population growth rate, both in urban and rural areas (which tends to drop still further), results in a slowed-down growth of the total urban population in capitalist countries compared with the developing countries.

In the capitalist countries the historically evolved network of cities forms an interconnected system that performs "urban functions" for the entire territory. The growing significance of higher-order functions, concentrated largely in the major urban agglomerations, brings structural changes to that system as reflected in the growing number of agglomerations and their increased share relative to the total and urban population. In the capitalist context, that often leads to "hyperurbanization", the sprawling gigantic agglomerations are inhabited by millions of people. Environmental factors hostile to man which are a feature of the modern urban scene under capitalism, are particularly pronounced in these super-agglomerations, radically changing the local natural conditions which had contributed to the development of the agglomeration in the first place. Los Angeles is a vivid example in point.

The internal spatial organization of a large capitalist city reflects its social and production functions, class essence and the level of technical development. That is seen in the character of building and the means of transport. Thus, the present stage is marked by the wide-spread phenomenon of private car ownership which makes heavy inroads on mass transit systems.

The class contradictions of capitalism, with its contrast between wealth and poverty, are most apparent in large cities. These contrasts are further aggravated by unemployment. These contrasts are manifest in the distribution of the population in physical space. Racial and ethnic segregation is widespread. Important elements of social-spatial stratification of the population in a large capitalist city are ghettoization of the central part and the development of the suburban form of settlement ("suburbia") as residence for the privileged strata of bourgeois society. These phenomena are most apparent in the main capitalist country today, the United States of America, where the contrast between the black ghettos of Harlem in New York, Watts in Los Angeles and Brunsville in Chicago and the "lily-white" bourgeois suburbs is a distinctive feature of urban agglomerations.

Marked spatial forms of social distinctions within large urban agglomerations mean that all the social conflicts and contradictions of capitalist society get territorial expression, determining, for example, voting patterns in various parts of the cities. These are also manifest in municipal problems proper, such as transport, education, health, construction and redevelopment of cities, land use in various parts of the agglomeration, etc. They account largely for the administrative and political divisions of the metropolitan areas (as most readily observed in the USA) which impedes implementation of a single municipal policy and rational development of transport and the infrastructure in general.

The above-mentioned traits, which warrant consideration of cities in advanced capitalist cities as a distinct type, provide a background against which one can single out several subtypes differing among themselves in the manifest-ness and combinations of these traits. Thus, one can draw meaningful distinctions between West European, North American and Japanese cities. These could be further elaborated by contrasting, say, eastern and western cities: within the USA.

## DEVELOPING COUNTRIES

For all the bewildering variety of socio-geographic conditions in each of the hundred or so Afro-Asian and Latin American states referred to as developing states, they reveal many common structural traits. The most relevant factors determining the scope and character of urbanization are as follows: the economy is geared to the production of a single crop or raw material and the infrastructure is inadequate; territory is mostly developed to primary export-oriented industries; the national economic space is poorly integrated, with foreign economic relationships prevailing over inter-sectoral or inter-district ones; a much higher territorial concentration of population and urbanizing factors (including the manufacturing industry) as compared with industrialized countries.

An overwhelming majority of the developing, notably Afro-Asian, countries have not yet been affected by widespread urbanization. However, the processes of urbanization tend to intensify. According to UN figures, about 20 per cent of the people in the developing countries lived in cities in the mid-sixties. The figure for Latin America was about 45 per cent, for Africa and South Asia 13 per cent, for East Asia 23 per cent. Before 2000 the UN forecasts say, 41 per cent of the population in developing countries will live in cities.

In most developing countries spatial patterns of urban settlement are just beginning to emerge. A distinguishing feature of urbanization there is that the urban population is growing at a rate 2-3 times higher than the total population. The snowballing growth of urban population is in stark contrast with the limited urbanizing basis, in which the services predominate.

In the developed countries, especially in Asia and Africa, "the urban gap", which is part of the "demographic explosion", belongs rather in the category of economic growth, as distinct from economic development (which implies qualitative as well as quantitative change).

The term "underdeveloped city", which has gained some currency, refers primarily to the discrepancy between the size of the city's population and its city-forming basis.<sup>6</sup> An "underdeveloped city", which may be of medium and even large size, more often than not has an inadequate functional-production base, with administrative and trade-distribution functions prevailing and strong links with the rural surroundings preserved.

The radius from which a city draws its migrants tends to increase as the city becomes more populous and develops its city-forming and district-forming base. Major national centres attract migrants from all parts of the country.

An "underdeveloped city" has a constantly growing zone of temporary buildings deprived of elementary sanitation facilities which provide residence for rural migrants. This "marginal" population is growing at an annual rate of 12-15 per cent in some Afro-Asian and Latin American cities.

Migrants account for 40-50 per cent of the population growth in an "underdeveloped city". For this reason, young age-groups predominate in these cities, with the ratio of female population gradually increasing, particularly in Latin America (in 1960 there were 93 males per every 100 females in Latin American cities the figures for Africa and Asia being 110 and 114 respectively).

<sup>6</sup> One can hardly go along with the assertion made in some countries that cities with a population varying between 20,000 and 100,000 cannot, in the context of the developing countries, be considered to be cities in the full sense of the word because they lack certain essential features. In developed areas in some major Latin American countries, e.g., communities with 5000 people and more are considered cities.

Typically, two or three large centres, which play an outstanding role in all the spheres, attract up to 80 per cent of all the migrants. Some of the major cities in developing countries sometimes are home of as much as half of the burgeoning population.

The concentration of the manufacturing industry and foreign investment in physical space is even higher. In Colombia, for example, the three main centres (Bogota, Medellin and Cali) account for 70 per cent of the national manufactured goods output and 66 per cent of foreign investment. Montevideo (Uruguay) concentrates 49 per cent of the population and 75 per cent of all manufacturing industry.

The concentration of population and economy in major centres is especially high in smaller developing countries (3-5 million people). Economic forecasts for certain Third World countries show that in the largest and most developed of them territorial concentration of population and industry will reach a ceiling by the early or mid-1980's. This is due to the existence in such countries of inter-regional centres and the implementation of regional policies, including an effort to decentralize population and the processing industries. In some countries, however, notably in Africa and Asia, where the level of urbanization is generally lower than in Latin America, a growth of such concentration can be projected well beyond that date.

The concentration of population and business activity in one or several leading cities often takes on an excessive character. It impedes the progress of vast areas beyond the most economically developed regions and exacerbates the consequences of regional disproportions in socio-economic development. The growing concentration of business activity in a few centres in developing countries is due, among other things, to the fact that these cities possess a relatively developed and improving infrastructure, towards which the government actively contributes. In Chile, for example, the capital metropolitan area absorbed 42 per cent of all infrastructure investment in 1965-1968.

The hypertrophy of one or several centres retards the development of systems of cities covering the whole of the settled territory as well as regional subsystems in "old" and newly-developed areas. Only some of the more advanced Third World countries can claim the presence of systems of cities covering all the settled territory. In most cases, however, such systems are yet to be formed, or have been formed in the most advanced areas only.

Nor do most developing countries have a "normal" hierarchy of cities. As a rule, the largest centre concentrates about half or more than half of the urban population, having 8-15 times more residents than the second largest centre. Along with several main centres ("focuses of growth") there exists a large number of small towns closely linked with the surrounding rural environs. The city hierarchy reveals an almost total absence of medium-sized cities, which indicates a poor state of division of labour within the nation. For example, out of 249 cities in Iran in 1966 there were 220 small and only 15 medium-sized ones.

Urban agglomeration is well-advanced only in Latin America and India, where multi-million urban areas often form entities approaching megalopolises in character. By the early 1970's Latin America had 32 agglomerations. By the late 1970's about 15-16 per cent of all Latin Americans will be living in the major metropolitan areas, while Mexico-City (13 million by 1980), Sao-Paulo and Buenos Aires (12 million each) and Rio de Janeiro (9 million) will be among the world's 12 largest urban agglomerations. The largest agglomerations are actively absorbing not only contiguous, but also relatively remote communities.

The internal structural evolution of the agglomerations involves the growth of fringe areas and the decreasing ratio of the central cities in the population and manufacturing industry output. Thus, the Buenos Aires metropolitan area has increased its population by 4 million, while the central city's population has not increased at all.

Occasionally, linear "development corridors" are formed between major agglomerations. They attract new industries and alter somewhat the urban settlement patterns.

Urbanization, notably the priority growth of large and largest centres, along with positive effects, tends to further aggravate socio-economic problems in developing countries (employment, education, food and medical supplies, environment, housing and sanitary conditions, etc.). According to UN data, at least 900 million new jobs will have to be created in the developing countries in the last third of the 20th century (60 per cent of them in the cities). The socio-economic and technical programmes are limited in scope and impact and unable to avert the negative consequences of urbanization in the developing countries.

Urbanization in multi-sectoral developing countries increases the pluralism (including spatial pluralism) of their socio-economic development. Many indexes of such pluralism in the major and largest centres exceed by a factor of ten or more the analogous indexes for other parts of the country. Such cities attract foreign investment and are also scenes of the activity of local monopolies which are intimately linked with the multi-national companies. Because of their close ties with the industrialized countries such centres are often described as "imperialist enclaves" and strongholds of "internal colonialism" (i.e. subjugation of backward areas by several leading centres). By the same token national patriotic forces (the working class, students, progressive middle classes, etc.) tend to be concentrated in the major and largest cities. All this increases the political role of the urban population, including recent immigrants. Sociological surveys reveal an increase in their political involvement in accordance with the length of their urban life period.

Cities are powerful catalysts of ethnic processes, the emergence and consolidation of nations. The process of acculturation and ethnic assimilation is much more intensive in cities, with the result that the old and young generations of rural migrants often seem to belong to different ethnoses.<sup>7</sup> In the future the socio-economic impact of urbanization in developing countries can be expected to increase dramatically.

\*

Cities have at all times formed a framework of economic and political life of countries and regions, being their "command personnel", to borrow a phrase from N. N. Baranskiy. In the epoch of the scientific and technical revolution, marked by the growing significance of science-intensive sectors and research and development, the powerful territorial concentration of productive and non-productive activity, the systems of cities and their regional subsystems increasingly determine the main trends of economic development, which is true of large regions as well.

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<sup>7</sup> See: Averkieva, Y. P., Arutunian, S. A., and Bromley, Y. V.: Eighth International Congress of Anthropological and Ethnographic Sciences, in: *Sovetskaya Etnografiya*, 1969, 1. p. 7.

## WORLD POPULATION CHANGE: 1950-1970

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The World Population Conference\* which took place in Bucarest in 1974 has precipitated the studies on world population trends over the past two decades. The research carried out under the auspices of the United Nations Social and Economic Council has brought a number of interesting and sometimes unexpected results. They allow now to build population predictions of a short range, as well as of intermediate and long range, and these predictions also differ rather markedly from the views previously held by demographers.

TABLE 1. Population of the World 1750-1950 and 1900-1970

Year	Population (in millions)			Annual growth rate, comparing to the previous date (%), based on an exponential function		
	world	developed countries	developing countries	world	developed countries	developing countries
(a) every 50 years						
1750	791	201	590	---	---	---
1800	978	248	730	0.4	0.4	0.4
1850	1,262	347	950	0.5	0.7	0.5
1900	1,650	573	1,077	0.5	1.0	0.3
1950	2,486	858	1,628	0.8	0.8	0,8
(b) every decade						
1900	1,650	573	1,077	---	---	---
1910	1,775	650	1,125	0.7	1.3	0.4
1920	1,857	682	1,155	0.3	0.3	0.3
1930	2,044	759	1,285	1.1	1.1	1.1
1940	2,267	821	1,446	1.0	0.8	1.2
1950	2,486	858	1,628	0.9	0.4	1.2
1960	2,982	976	2,006	1.8	1.3	2.1
1970	3,635	1,090	2,545	2.0	1.1	2.4

Source: United Nations, Economic and Social Council, Doc. E/Conf. 60/BP/p. 10.

\* The article was written on the basis of the following materials prepared by the U.N. Secretariat in connection with the World Population Conference of 1974: (1) United Nations, Economic and Social Council: *Demographic trends in the World and its major regions, 1950-1970*, E/Conf. 60/BP/1, 3rd of May 1973, (2) *World and regional population prospects*, E/Conf. 60/BP/3, 31st of March 1973, (3) *World population prospects beyond the year 2000*, E/Conf. 60/BF/3 (Table 1), 16th of May 1973.

As a starting point in the analysis the estimated number of population of the globe has been compiled (see Table 1), showing the trends separately for the developed and developing countries over the past two hundred years. The data show that while during the first half of the present century the total population increased by about 50 per cent, the last two decades evidenced much more rapid growth resulting in also nearly 50 per cent increase over that so much shorter time span. In addition, since the outbreak of World War II the population growth of the less developed countries has been quicker (by hundred per cent now) than in the case of the developed countries. The rate of growth, in fact, has increased from 0.9 per cent in 1950 to 1.8 per cent in 1960 and 2.0 per cent in 1970.

The 1950–1970 increase was spatially distributed quite unevenly over space. When the total increase equalled 46 per cent, the respective rate for the developed countries was 27 per cent on the average and 56 per cent for the developing countries. Higher than average rate of growth occurred in Oceania (54 per cent), Southern Asia (61 per cent) and Latin America (74 per cent). As a result, one can notice a shift in population distribution to the South. While in 1950 about 43.9 per cent of people lived south of the tropic of Cancer, their percentage increased to 48.8 in 1970, and by now it has probably passed the 50 per cent mark.

On a more fine spatial scale the differences are still more pronounced. While the population of Europe has increased by 12 per cent only, that of Latin America has expanded by 90 per cent. A number of nations have doubled their population over the 1950–1970 period. They include, among others, Costa Rica, Dominicana, Hongkong, Kuwait, Singapore and Venezuela. The combined addition to the population of China, India, Pakistan and Bangladesh was twice as large as the total increase in the developed countries, i.e., the nations of Europe, the Soviet Union, Japan, North America, Australia, New Zealand and the temperate climatic zone in South America.

Population density which is a rather good measure of population concentration has increased from 18.3 persons per sq. km. in 1950 to 26.8 persons per sq. km. in 1970. On a regional scale the change was even more marked, in the case of Western Europe it amounted from 123.0 to 149.3 persons per sq. km.; in Eastern Europe — from 89.4 to 105.1; in the central part of Southern Asia — from 103.1 to 166.3; in Japan from 224.1 to 279.7; on islands in the Caribbean — from 71.2 to 109.2 persons per sq. km. At the same time numerous countries still remain rather sparsely populated; e.g., the whole continent of Africa (7.2 and 11.4 persons per sq. km. in 1950 and 1970, respectively), the Soviet Union (8.0 and 13.0), or Australia and New Zealand (1.3 and 1.9).

The large-scale population growth of the globe has been also reflected in a change in the percentage of non-agricultural population which increased from 906 to 1,773 million (i.e. 96 per cent) over the two decades. At the same time the agricultural population grew only by 18 per cent (from 1,580 to 1,802 million). Rural population densities, however, have practically remained constant, since the area under cultivation was extended (see Table 2). Regional variations are more spectacular; while in the developed countries the average agricultural population density dropped from 46 to 31 persons per one sq. km. of cultivated area, it grew somewhat (from 221 to 226 persons) in the developing countries. It is worth while to mention here that agricultural densities in Asia remain extremely high (235 persons per 1 sq. km. in Southern Asia, 453 in Eastern Asia) and have been subject to little change recently.

TABLE 2. Agricultural population, agricultural land, density of agricultural population 1950-1970

Area	Agricultural population (in millions)		Agricultural land (,000 sq. km.)		Density of agricultural population (per 1 sq. km of agricultural land)	
	1950	1970	1950	1970	1950	1970
World total	1,579.8	1,862.1	12,290	14,010	129	132
Developed countries	299.2	205.9	6,500	6,690	46	31
Developing countries	1,280.7	1,656.2	5,790	7,320	221	226
South Asia	544.6	763.2	2,400	3,250	227	235
East Asia	523.1	561.2	1,060	1,240	493	453
Europe	127.9	89.0	1,470	1,480	87	60
Africa	171.3	239.3	1,870	2,040	92	117
Soviet Union	100.5	77.3	2,250	2,330	45	33
North America	21.7	10.0	2,210	2,200	10	5
Latin America	87.1	117.9	840	1,230	104	96
Oceania	3.6	4.3	190	240 <sup>a</sup>	19	18

Source: United Nations, Economic and Social Council, Doc. E/Conf. 60/BP/ p. 10.

<sup>a</sup> Excluding arable area of steppe in Australia.

The shifts in the spatial distribution of population that occurred during the 1950-1970 period were caused in part by migrations. According to U.N. estimates, due to migrations Western Europe gained 9.3 million inhabitants while Southern Europe lost 6.1 million. In total, Europe gained 1.7 million inhabitants. It shows a substantial difference when compared to the more distant past when Europe was the main out-migration region. The more recently settled regions, i.e., the United States, Canada and Australia gained, owing to migrations, 6.7, 1.8, and 1.7 million inhabitants respectively between 1950-1970. To estimate the size and directions of migrations in the remaining parts of the world is quite a different task; it seems certain, however, that Latin America had a negative migration balance as a whole.

As far as the natural increase is concerned, the most marked change affected death rates. In the developed countries these rates declined from about 15 promille in 1935-1939 to about 10‰ in 1950-1955 and 9‰ during 1965-1970. One can assume that the value of the coefficient is now stabilized and should not be subject to a major change in the near future.

In most of the developing countries the death rates were at the level of 30-35 promille during 1935-1939 (perhaps 20-25‰ in Latin America); by 1950-1955 they declined to 24‰ (15‰ in Latin America). It is estimated that by 1965-1970 the index values continued to decline and reached the level of 16‰ (in Latin America — 10‰). When comparing those data one should keep in mind, however, that the percentage of people in old-age classes has greatly increased which makes it unrealistic to expect a further drop in death rates. On the contrary, this rate is likely to increase somewhat in the future.

On the other hand, in the case of some developing countries, due to the age composition the death-rate may be further maintained at the very low levels indeed. The age structure of population along with a high level of medical services are factors responsible for the very low death rates which are observed in the Soviet Union and Japan (7.7 and 7.0‰ respectively in 1970). In several

small countries, such as Fiji, Hongkong and Singapore the numbers of deaths per 1000 population are still smaller, and range between 5.0 to 5.9.

Infant mortality rates of 200 per 1000 live births were quite common at the end of the 19th century. By 1970, in those countries with high health protection and medical care development, the rates dropped to 10–15, and in some of the small countries in less developed regions they reached 20–30; nevertheless, the average infant mortality rate for the developing countries is now estimated at 140 per 1000. The global average is 120 and the average for the developed regions — 27 per 1000. The latter regions experience higher progress in reducing infant mortality, thus interregional variations in the index values tend to increase (opposite to the death rate trends). At the same time, this indicates a further potential source of population increase in the less developed countries.

Mortality is also measured as life expectancy. This is an interesting index, independent of age composition for the total population. In the developed countries its value increased from 56 years in 1935–1939 to about 70 years or even 72 years in 1965–1970. The earlier differences between Eastern Europe and the Soviet Union, on the one hand, and Western Europe on the other, have virtually disappeared. At present those values tend to stabilize. At the same time the relevant figures for the developing countries are estimated to be 32 years in 1935–1939, and about 50 years in 1970. Interregional variations are still pronounced; the life expectancy indices range from about 40 in Central and West Africa to approximately 60 in Latin America.

Unlike the mortality rates, which tend to become of similar magnitude in different regions and countries of the world, the birth rate distribution is still characterized by basic disproportions. In the developed countries the number of births per 1000 inhabitants was 24.9 in 1935–1939, 22.9 in 1950–1955 and 18.6 in 1965–1970. The post-World War II increase in birth rates (of a compensatory character) vanished in some countries during the sixties, while in some others it lasted longer; nevertheless, the secular downward trend is now fully evident with variations between individual nations tending to disappear (at present those variations are in the range of 17.3–20.2). In the case of developing countries the number of births per 1000 population is estimated to be as high as 40–45 in 1935–1939 (some authors believe that those estimates are low for Southern Asia and Africa, but high for China and the Caribbeans). Tradition, social factors and sanitary conditions were responsible for a high dispersion of index values, ranging between 35–48.8 per 1000 inhabitants. The post-war data indicate that average birth rates declined only slightly — from 43.9‰ in 1950–1955 to 40.6‰ in 1965–1970. Only in China the drop was probably more pronounced (from 40 to 33‰). One can see that birth rates in the less developed regions are twice as high as in the developed countries. According to U.N. experts it is birth-rate differences that determine basic divergencies in the demographic situation between the developed and the developing countries.

However, in some smaller countries, peripherally situated with respect to the less developed regions of the globe, the trends towards birth-rate decline (from 40 to about 25–30‰) have recently appeared. This foretells perhaps the future direction of change to be expected to occur in the remaining countries.

Similar differences pertain to gross reproduction rates which are independent with respect to the age composition of population. For the developed countries those rates equalled 1.3 on the average between 1965–1970, while in the developing countries they equalled 2.7. The relevant estimates were 1.2 for the Soviet Union, 1.3 for Europe, 1.4 for North America, 1.7 for Oceania, 2.0 for East Asia, 2.7 for Latin America, 3.0 for South Asia and 3.1 for Africa. In Japan

the gross reproduction was as low as 1.0, while in West and Central Africa it was as high as 3.2. It should be kept in mind that while the index value of 1.0 does not assure the constant population size in the long-run, the increasing life expectancy can bring about some population expansion over quite a long period.

During 1930-1939 both in the case of developed and the less developed regions the natural increase rates were at the level of 10 to 15 persons per 1000 inhabitants. Since World War II, however, the differences started to grow. Already in 1950-1955 the rates were as 1:2 (i.e., 10 and 20 promille) while in 1961-1970 the difference reached 1:2.5 (i.e., below 10 and nearly 25 promille). One can expect this divergency to become still deeper in the face of declining death rates in the developing countries followed by an only slight decline in birth rates. Only towards the end of the twentieth century the developing regions may experience a more radical drop in the number of births per 1000 population, while the general levelling-off in birth rates on the global scale is not likely to occur before about two hundred years from now.

The trends in basic demographic variables over the past two decades, as well as present population predictions, based on trend extrapolation, allow to draw several conclusions. One of the findings pertain to changes in death rates versus birth rates change. One can speak of great accomplishments in improving sanitary conditions in the less developed regions which has resulted in a dramatic decline of mortality. At the same time, attempts to check birth rates have proved to be largely unsuccessful (except for Japan and perhaps China). There is, however, a clear interdependence between birth rate decline, on the one hand, and the economic development and the elimination of substandard living conditions. It is only through the equalization of living standards as brought about by industrialization and urbanization that one can expect the equalization of basic natural increase parameters among the different regions of the globe.

The present pattern, structure, and variations in natural increase lead to basic shifts in the share of individual countries and regions in the world's population totals. In the developed countries the number of births has been, since about 1937, at the level of slightly less than 20 million annually; they now show even a certain decline. At the same time, in the developing regions the average number of births increased from 60 million in 1937 to 70 million in 1950 and 100 million in 1970. In the developed countries the number of deaths per year went down from 12 million in 1937 to 9 million in 1950 and went up again to 10 million by 1970. On the other hand, in the developing countries the number of deaths has been on a decline — from 46 million in 1937 to 41 million in 1950 and 38 million in 1970. This resulted in a four-fold growth of natural increase — from 16 million in 1937 to nearly 64 million in 1970.

A few remarks are now in order on structural transformations. One of the crucial aspects of population structure is age composition. In 1970 the percentage of children (below 15 years of age) was 37.0 (world total); including 26.8 in the developed countries and 41.4 in the Third World. Since 1950, in the former group of countries the relevant percentage experienced a decline, in the latter group — an increase. The percentage of persons of 64 years and over was 5.2 in 1970 (world total), but in the developed regions it was much higher (9.6) and in the Third World — substantially lower (3.3). Again in the case of the former group the 1950-1970 period marked an increase in the percentage value (by 2.1) and a drop in the latter (by 0.2). The remaining age categories, i.e., the population in the productive age (15 to 64) accounted for 64 per cent of all inhabitants in the developed, and only 55 per cent — in the developing coun-

TABLE 3. Ratio of population within 0-15 and 65 and over age group to the 15-64 age group

Area	1950	1970	Change, 1950-1970
World total	69	73	+4
Developed countries	55	57	+2
Developing countries	79	81	+2
South Asia	78	86	+8
East Asia	75	67	-8
Europe	54	57	+3
Africa	86	87	+1
Soviet Union	57	57	0
North America	55	63	+8
Latin America	80	86	+6
Oceania	59	65	+6

Source: United Nations, Economic and Social Council, Doc. E/Conf. 60/BP/ p. 10.

tries. In both cases there has been some decline in the percentage since 1950 (by 1.0 and 0.7, respectively). One can see that the existing structure favours the economy of the developed regions. Table 3 shows the relevant proportions, i.e., relations between the population in productive age to the non-productive age population. The highest index value (and the consequent burden on the economy) was present in Africa, Southern Asia and Latin America; the lowest — in Europe and the Soviet Union. The improvement of index values in Eastern Asia is a consequence of birth rates decline, mainly in Japan. The U.N. sources give also data on the percentage of young people (15 to 24) among the productive age population. These proportions did not change markedly, except for the Soviet Union, the United States, and Oceania where some increase did occur. The developed — developing countries differences are quite substantial

TABLE 4. Proportion of people within 15-24 age group to the total number of persons between 15-64: 1950-1970 (%)

Area	1950	1970
World total	31.7	31.7
Developed countries	26.7	26.3
Developing countries	34.7	34.4
South Asia	35.6	34.8
East Asia	33.3	32.4
Europe	24.5	24.4
Africa	35.1	35.3
Soviet Union	32.4	26.5
North America	22.8	28.8
Latin America	34.1	34.9
Oceania	24.7	29.3

Source: United Nations, Economic and Social Council, Doc. E/Conf. 60/BP/ p.27.

in this respect, too. Incidentally, the data do not show the effects of the post-war baby boom which was a local phenomenon even on the European scale.

Table 5 gives proportions of the economically active population. The ascendancy of the developed countries is also noticeable in this respect. The growth of percentage of women employed is quite strong, since it was accompanied by an overall decline in index values, however small. High proportion of economically active women is particularly noticeable in the Soviet Union while in Latin America it is strikingly low. The figures pertaining to the percentage of agricultural population were presented earlier. According to U.N. experts those figures, along with birth rates, are most clearly reflecting the differences in the level of economic development among individual countries and regions. There exists a clear-cut positive correlation between the two indices, for instance, in 1970 all regions where birth rates were less than 30 per 1000 had also less than one third of their population in agriculture. The agricultural population should not be identified with rural population, since the increase in numbers of non-agricultural population within rural areas is a universal phenomenon; at the same time, the criteria of identifying rural and urban population vary from country to country.

TABLE 5. Economically active population, 1950-1970

Area	Economically active population (in millions)		Percentage of economically active population (among all population)		Percentage of women within the economically active population	
	1950	1970	1950	1970	1970	1970
	World total	1,006.8	1,500.8	42.9	41.3	32.0
Developed countries	392.2	487.8	45.7	44.7	36.5	38.3
Developing countries	674.6	1,013.0	41.4	39.8	29.4	32.8
South Asia	303.2	428.6	43.4	38.1	30.8	30.0
East Asia	268.0	427.9	40.8	46.0	30.0	39.3
Europe	181.4	202.6	46.3	43.8	32.9	34.1
Africa	92.4	132.5	42.5	38.5	32.3	31.1
Soviet Union	93.8	123.3	52.1	50.8	51.8	49.9
North America	66.3	89.7	39.9	39.4	26.9	34.3
Latin America	56.4	88.2	34.7	31.1	18.2	19.5
Oceania	5.4	8.0	43.0	41.3	25.9	29.7

Source: United Nations, Economic and Social Council, Doc. E/Conf. 60/BP/1. p. 28.

The growth of urban population (keeping in mind the definitional differences mentioned above) was very noticeable between 1950-1970. The relevant percentage for the globe increased from 28 to 37. By 1970 about 64 per cent of the population of the developed countries, and 26 per cent of the Third World population lived in urban areas. An additional index showing the extension of urbanization is the increase of the number of people living in millionaire cities (Table 6). Their number grew from 75 in 1950 to 162 in 1970 and their combined population — from 174 to 416 million. It may be of interest that by 1970 the earlier differences in this respect, between the developed and the less develop-

TABLE 6. Cities of one million inhabitants and above, 1950-1970

Area	The number of millionaire cities		The combined population of millionaire cities (in millions)		The percentage of urban populations living in millionaire cities	
	1950	1970	1950	1970	1950	1970
World total	75	162	173.9	416.2	25	31
Developed countries	51	83	126.2	223.5	29	32
Developing countries	24	79	47.6	192.8	19	29
South Asia	8	27	15.0	63.1	13	26
East Asia	13	36	31.4	100.9	31	37
Europe	28	36	60.2	86.3	29	30
Africa	2	8	3.4	15.6	11	20
Soviet Union	2	10	7.5	21.1	10	15
North America	14	27	38.1	71.2	36	42
Latin America	6	16	15.3	52.9	23	33
Oceania	2	2	3.0	5.1	38	39

*Source:* United Nations, Economic and Social Council, Doc. E/Conf. 60/BP/1. p. 34.

ed regions ceased practically to exist. This gives evidence to a faster concentration of population in large urban agglomerations in the Third World. More detailed data support the hypothesis on an extraordinary acceleration of urbanization processes in the developing nations in the case of which the natural increase rates for urban and rural areas are virtually similar, a phenomenon alien to the developed countries in general.

As far as the structure of rural-urban migrations is concerned, one can speak of substantial differences between Africa and South Asia on the one hand, and the rest of the globe on the other. In the former case most of migrants are men, in the latter the majority consists of women. As a result, migration mechanisms are quite different, with the phenomenon of return migrations being characteristic of the first case discussed.

The U.N. data have been used to build population forecasts up to the end of the present century and also for the long term of 200 years from now. The latter prognosis allows to determine the periods when, assuming present trends to continue, one can expect the state of zero-population growth for the world as a whole and its individual regions.

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## THE DEVELOPMENT AND CONTROL OF THE SETTLEMENT SYSTEM

VLADIMIR G. DAVIDOVICH

In the development of the unified system of production and settlement (urban as well as rural) extending over the entire territory of a country, it is the production that leads the way; simultaneously there occurs an important "feedback" effect — the influence of the settlement upon the production. Moreover, a considerable role is also to be attributed to social and demographic processes.

The development of this huge system and its components — the territorial subsystems of production and settlement — is interrelated with the natural environment, which, however, acts only indirectly and whose influence varies with changes in the level of the forces of production.

The unified system of settlement, being a part of a larger system of production and settlement, can be and, in fact, is subject to control and regulation. In order to organize properly the management, forecasting, and planning of the system of settlement, it is necessary to find out what are the quantitative regularities inherent in actual phenomena, what are the trends in the processes of urbanization and in the remodelling of the rural settlement, and eventually what are their regional characteristics. To this end a great variety of research methods can be recommended: cartographic, analytic, and diagrammatic models, methods deriving from the theory of management, mathematical statistics, etc.

Of all these methods there is one that seems to be of particular interest. Its aim is to determine functional relationship linking up main quantitative indicators characteristic of urban and rural settlement, and to establish their dynamics.

Let's introduce the following symbols:

(1) Indicators characteristic of settlement

$N_g$  — total number of the district's urban population;<sup>1</sup>

$N_s$  — total number of the rural population;

$N_r$  — total number of the population;

$U$  — basic index of the urbanization level: the percentage of the urban population in the total population;

$N_c$  — number of population in the district's centre;

$N_d$  — number of population in all the other urban settlements in the district;

<sup>1</sup> The indicators and formulae can also be applied to analyze the features of settlement and its dynamics when dealing with the whole country as well as when studying economic regions, Union and Autonomous Republics, *oblasts*, urban agglomerations, and smaller groupings of towns and villages. For the sake of convenience we will use a conventional term "district" below.

$C$  — percentage of the population of the district's centre in the total urban population;

$K$  — number of all urban settlements in the district (including the centre);

$p$  — mean size of an urban settlement (in thousands of inhabitants, excluding district's centre);

$S$  — number of the rural population (in thousands of inhabitants) per one urban settlement.

(2) Indicators of settlement process dynamics for the period under study

$P_g$  — increase in the number of the urban population;

$P_c$  — increase in the number of the population of the district's centre;

$P_d$  — increase in the number of the population in the other urban settlements that existed at the beginning of the period;

$P_n$  — number of the population in the new urban settlements at the end of the period (i.e. the increase due to the creation of new urban settlements);

$p_n$  — mean size of a new urban settlement (in thousands of inhabitants at the end of the period);

$K_n$  — number of the new urban settlements;

$P_s$  — increase (+ $P_s$ ) or decrease (− $P_s$ ) in the number of the rural population.

(3) In order to analyse the changes in the character of settlement in the period under consideration the following supplementary indicators are introduced:

$o$  — at the beginning of the period;

$t$  — at the end of the period,

hence  $N_{go}$ ,  $N_{so}$ ,  $N_{co}$ ,  $N_{do}$ ;  $U_o$  and  $U_t$ ;  $C_o$  and  $C_t$ ;  $K_o$  and  $K_t$ ;  $p_o$  and  $p_t$ ;  $S_o$  and  $S_t$ .

Taking into account actual functional relations among the said indicators, the author proposes the following system of mathematical formulae:

$$U_o = \frac{100}{1 + \frac{N_{so}}{N_{go}}} \% \quad (1)$$

$$U_t = \frac{100}{1 + \frac{N_{so} + P_s}{N_{go} + P_g}} = \frac{100}{1 + \frac{N_{so} + P_s}{N_{co} + N_{do} + P_c + P_d + p_n K_n}} \% \quad (2)$$

$$C_o = \frac{100}{1 + \frac{N_{do}}{N_{co}}} \% \quad (3)$$

$$C_t = \frac{100}{1 + \frac{N_{do} + P_d + P_n}{N_{co} + P_c}} = \frac{100}{1 + \frac{N_{do} + P_d + p_n K_n}{N_{co} + P_c}} \% \quad (4)$$

$$p_o = \frac{N_{do}}{K_o - 1} \quad (5)$$

$$p_t = \frac{N_{do} + P_d + P_n}{K_t - 1} = \frac{N_{do} + P_d + p_n K_n}{K_o + K_n - 1} \quad (6)$$

$$S_o = \frac{N_{so}}{K_o}, \quad (7)$$

$$S_t = \frac{N_{so} + P_s}{K_o + K_n}. \quad (8)$$

To make the dynamics of interrelations among the indicators of settlement more clearly perceptible, the author proposes a graphic analytical model under the heading "Dynamics and Remodelling of Urban and Rural Settlement", based upon the data from the Kaluga and the Pavlodar oblasts (Fig. 1). It consists of two nomograms, each of which includes two quadrants: 1 and 2 on the left hand side, 3 and 4 on the right hand side. The vertical "discontinuity zone" between the left and right nomograms makes it possible to confront the district's total population with that of its centre: the values for  $N_g$  and  $N_c$  (corresponding to every given date, e.g., 1959 and 1970) have been drawn so as to join within the limits of the zone; the same holds true in the case of the values of the total number of urban settlements in the district ( $K$ ) and the number of all the urban settlements minus the district's centre ( $K-1$ ).

From 1959 to 1970 in the Kaluga oblast the growth of manufacturing industry and, consequently, of the number of the urban population was considerable ( $P_g = 166,000$  persons, the growth coefficient—almost 1.5 times), the mechanical increase being the dominant factor and the natural one of a rather small significance. In the same period the rural population decreased by 110,000 persons (19%) due to migrants moving into district's urban settlements and partly leaving the district's territory altogether. In the first quadrant in the Fig. 1 one can see the vectors of the increase of the urban population and of the decrease of the rural one, and the vector of the sum total as well. Eventually, the proportion of the urban population ( $U$ ) rose from 37.3% to 51.8%, that is by 14.5%, the latter figure being the result of the increase in the urban population by 9.4% and of the simultaneous decrease of the rural population by 5.1%.

The second quadrant shows the vectors of the decrease in the number of the rural population per one urban settlement ( $S$ ). The decrease was primarily due to the lowering of the total number of the rural population and partly to the fact of four new settlements of the urban type having been established in the meantime.

In the third quadrant one can see that the share of the centre in the district's total urban population would have increased from 38.3% to almost 50% but for the "braking up" influence exerted by the growth of other old urban settlements and the formation of new ones; this is why the share of the centre increased only up to 40.9%.

The fourth quadrant shows the growth in the size of the district's urban settlements (excluding the centre). The average size of the old (i.e. existing already in 1959) urban settlements grew from 8,300 to 11,100 inhabitants; simultaneously four new small settlements came into being, each having 4,300 inhabitants. Consequently, the average size of the urban settlements, both old and new, amounted to 12,000 persons.

In the Pavlodar oblast of the Kazakh SSR we find an example of a different type of dynamic changes in urban and rural settlement in the period of 1959–1970 (cf. Fig. 1). Rapid development of mining and manufacturing resulted in high rates of increase of the urban population which grew almost 2.6 times (at  $P_g = 208,000$  persons), both the natural and the mechanical increase being much greater than the average for the whole of the USSR. Not only did the

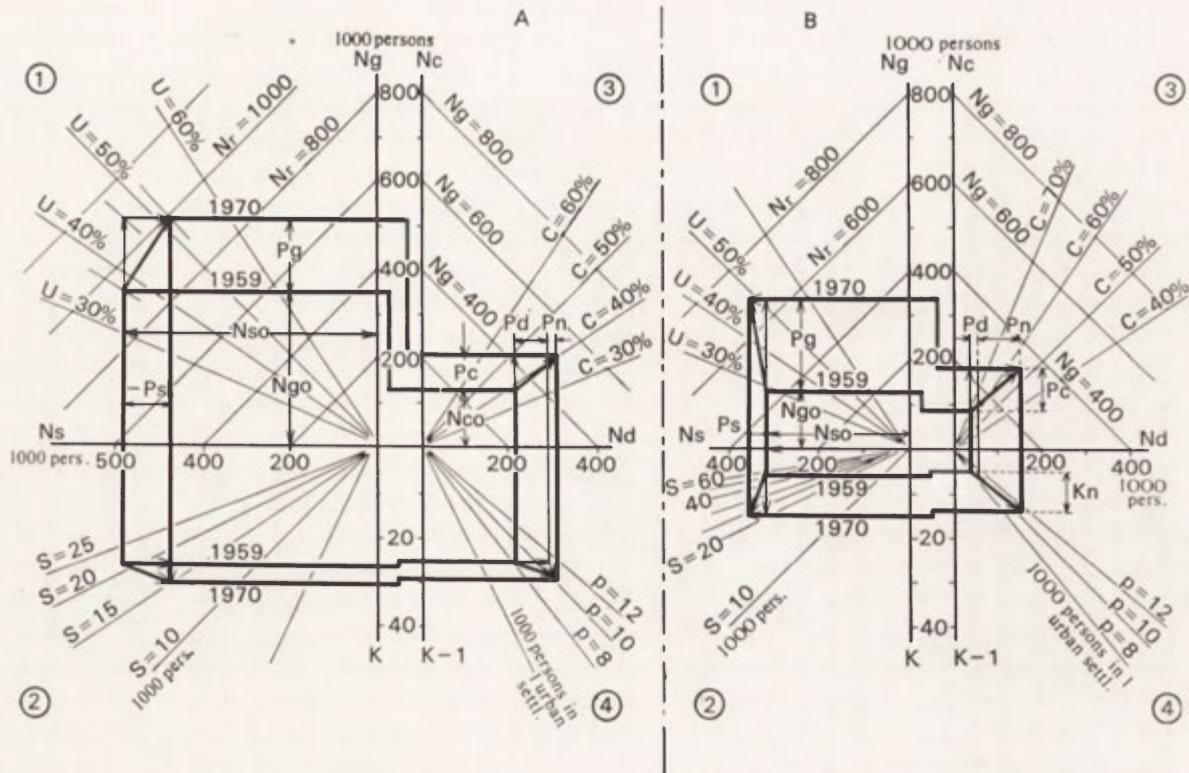


Fig. 1. Dynamics of urban and rural settlement  
 A — the Kaluga oblast, B — the Pavlodar oblast

$N_g$  — number of the urban population (in ,000);  $N_c$  — number of population of the oblast's centre (in ,000);  $N_s$  — number of the rural population (in ,000);  $N_{s0}$  — number of the rural population at the beginning of the period (1959), in ,000;  $N_{g0}$  — number of the urban population at the beginning of the period (1959), in ,000;  $N_{c0}$  — number of population in the oblast's centre at the beginning of the period (1959), in ,000;  $U$  — basic index of the urbanization level: the percentage of the urban population in the total population;  $S$  — number of the rural population (in ,000) per one urban settlement;  $P_g$  — increase in the number of the urban population;  $P_s$  — increase (+ $P_s$ ) or decrease (− $P_s$ ) in the number of the rural population;  $P_c$  — increase in the number of the population of the oblast's centre;  $P_d$  — increase in the number of the population in the other urban settlements that existed at the beginning of the period;  $P_n$  — number of the population in the new urban settlements at the end of the period;  $C$  — percentage of the population of the oblast's centre in the total urban population;  $p$  — mean size of an urban settlement (in ,000), excluding the oblast's centre;  $K$  — number of all the urban settlements in the oblast's (including its centre);  $K-1$  — number of the oblast's urban settlements, its

urban population increase but the rural one as well, although the latter by no more than 35,000 persons, which means 1.14 times. This slowed somewhat the growth of the share of the urban population (*U*): by 1970 it should have been 51.3%, the vector of growth of the rural population, however, lowered it to 48.7%.

The share of the district's centre in the urban population (*C*) dropped from 68% to 55%, owing mainly to the formation of new urban settlements. Their population amounted to 62% of that of all the urban settlements, the district's centre excepted. The mean size of the urban settlements (also without the centre) grew from 8,400 to 10,900 inhabitants, whereas that of the new ones reached 10,500: it means that by 1970 the new towns became bigger than the old ones in 1959.

The number of the rural population per one urban settlement (*S*) manifested a significant decrease (from 54,000 to 24,000 persons) in consequence of a sharp increase in the number of urban settlements: from 6 to 15, nine urban settlements having been newly created. All this happened regardless of the "slowing down" role played by some increase in the total number of the rural population.

In the period of 1959-1970 urban and rural settlement processes displayed a great variety of types; this was due to the dynamics of urban and rural population (decrease or increase) or the rates of growth of the old and new urban settlements interfering with one another in many ways. To get a general idea of the characteristic differences between the western and the eastern (i.e. east of the Ural Mts.) regions of the USSR it may be useful to take a look at the results of an analysis of the settlement processes in 1959-1970; the study related to 168 administrative territorial units: 5 Union Republics that are not subdivided into *oblasts*, *rayons* directly subordinated to the central governments of the five Union Republics, 20 autonomous republics, 8 autonomous *oblasts*, 120 *krais* and *oblasts*, 10 national districts, all these being the administrative territorial subdivisions taken into consideration by the All-Union Population Census 1970. From among these territorial units 100 lay in the western and 68 in the eastern part of the Union (cf. Tables 1 and 2).<sup>2</sup>

TABLE 1. Types of urban and rural settlement processes in the western regions of the USSR, 1959-1970

Urban population growth rates in the <i>oblast</i> (its centre excluded) are conditioned mostly by the growth of:	Number of administrative-territorial units within which:				Total number of administrative territorial units	of which those, where the share of the <i>oblast's</i> centre diminished
	total population		rural population			
	decreased	increased	decreased	increased		
old urban settlements	8	13	50	13	71	27
new urban settlements	5	10	14	10	29	15
Total number of administrative-territorial units	13	23	64	23	100	42

<sup>2</sup> The tables are based on the data of Central Statistical Agency of the USSR: *Itogi vsesoyuznoy perepisi naseleniya 1970 g., Tom I. Chislennost naseleniya SSSR* (The Results of the All-Union Population Census 1970, Vol. I. Population Numbers of the USSR), Statistika, Moscow 1972, pp. 10-133.

TABLE 2. Types of urban and rural settlement processes in the eastern regions of the USSR, 1959-1970

Urban population growth rates in the <i>oblast</i> (its centre excluded) are conditioned mostly by the growth of:	Number of administrative-territorial units within which:				Total number of administrative territorial units	of which those, where the share of the <i>oblast's</i> centre diminished
	total population		rural population			
	decreased	increased	decreased	increased		
old urban settlements	—	30	4	30	34	14
new urban settlements	2	24	8	24	34	14
Total number of administrative-territorial units:	2	54	12	54	68	28

Table 3, which is based upon the findings of Tables 1 and 2, shows that, whereas in the prevalent number of the administrative territorial units in the western part of the country the rural population decreased, in the western part it increased. The drop in the rural population to a greater extent than the rise in the urban one occurred very seldom in the eastern and more often in the western regions. The part played by new urban settlements in the growth of the urban population was significantly greater in the eastern regions.

In the period from 1959 to 1970, of all types of urban and rural settlement processes occurring in the western regions (cf. Table. 1) the most widespread was the one that brought about an increase of the urban population in a greater measure than a decrease of the rural population; this was primarily due to the

TABLE 3. A comparison of urban and rural settlement processes in the western and eastern regions of the USSR, 1959-1970

The percentage* of the number of the administrative-territorial units in which various kinds of urban and rural settlement processes occurred:				
Regions	Total rural population decreased	out of which those where the total population decreased	District's (its centre excluded) urban population growth rates conditioned more by the growth of the new urban settlements than by that of the old ones	The share of the district's centre in the total urban population decreased
Western	77	13	29	42
Eastern	21	3	50	41
USSR	54	9	37.5	41.7

\* In the first horizontal row the number of administrative-territorial units in the western regions has been considered as equal to 100%; in the second row the same is valid for the eastern regions; in the third — for the whole of the USSR. In the vertical columns of the Table the regions are compared as to the different characteristic features of settlement dynamics. As those features occur in different combinations, the indicators in each one row cannot be added up — they are not supposed to make a total of 100%.

growth of old urban settlements (50% of all the administrative territorial units in the western regions). In the eastern regions (cf. Table 2) two types of processes stood out: in the simultaneous increase of both the rural and urban population the leading part was played either by the old urban settlements (44% of the administrative territorial units in the eastern regions) or by the new ones (35%).

Our country has at its disposal powerful instruments in the form of economic planning for controlling and managing the development and spatial distribution of the great unified systems of production — provided we know the objective laws that govern socio-economic processes.

Within the framework of this great and dynamic system the policy of managing and regulating settlement processes strives to achieve the following main goals:<sup>3</sup>

I. In accordance with the tenets of planned growth and localization of production, to develop and remodel the unified system of urban and rural settlement in order to raise the material and cultural standard of living.

II. In the domain of socio-demographic policy: to stimulate the natural increase of the population, to regulate the migrations in the *oblasts* and between the *rayons*, to establish interdependent settlement networks in the form of areal groupings of towns, hamlets, and villages.

III. To conserve and transform Nature and improve the environment, making sure that living conditions of the population are wholesome and comfortable.

A suitable method of forecasting the future development of urban and rural settlements should be the outcome of the following investigations:

(a) to study the trends inherent in the dynamics of settlement, in particular for the period 1959–1970–1973 and according to individual *oblasts* and economic regions;

(b) to get a better understanding of what causes these trends: to what an extent they are dependent on the development and localization of production and cultural centres as well as what is their relationship to the socio-demographic processes;

(c) to study with the aid of mathematics the laws governing the dynamics of urban and rural settlement;

(d) to work out a prognosis of changes in the settlement, making use of the long-range plans for the development of the national economy of the USSR in the years 1980 and 1990 (and for longer periods); to prepare prognoses of the growth of the country's population, natural resources, scientific and technological progress, etc., due regard being paid to the factor of managing and regulating the settlement processes.

The method of accounting is, therefore, by no means a simple extrapolation, but a prognosis that rests upon a better knowledge of objective laws and on the feasibility of planfully influencing the processes of urban and rural settlement.

To analyze trends, to figure out prognoses for a foreseeable period and to subject the obtained forecasts to control, the author has proposed an analytic-graphic model "The Remodelling of Urban and Rural Settlement in the USSR" (cf. Fig. 2). It is analogous to that in Fig. 1, but supplemented by some new in-

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<sup>3</sup> For more detailed treatment see: V. G. Davidovich, *Protsesi urbanizatsii i ikh regulirovaniye* (Urbanization Processes and their Regulation), in: *Voprosy geografii*, 96, 1974.

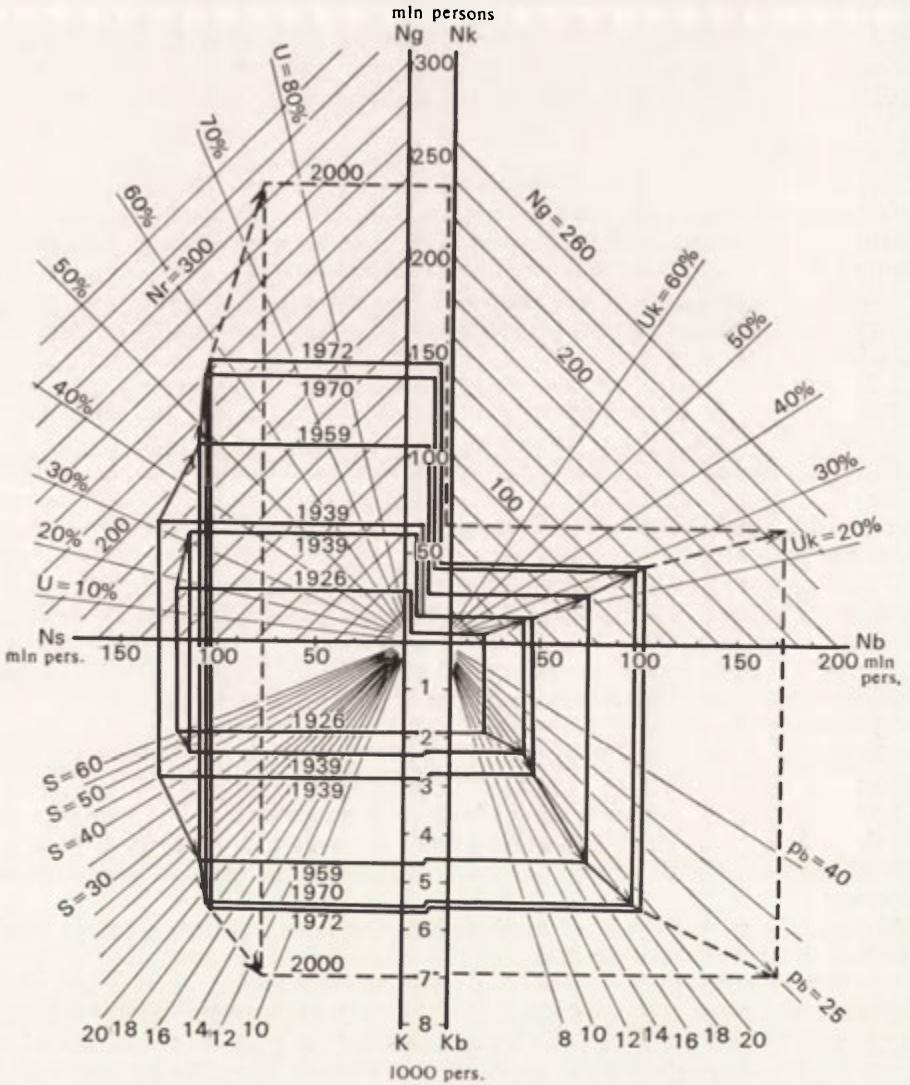


Fig. 2. Dynamics of urban and rural settlement population in the USSR

$N_g$  — number of the urban population (in  $10^6$ );  $N_k$  — number of the population of all the bigger towns (in  $10^6$ );  $N_b$  — number of the urban population (in  $10^6$ ), the bigger towns excluded;  $N_s$  — number of the rural population (in  $10^6$ );  $p_b$  — mean size of a single urban settlement (in 1000), the bigger towns excluded;  $S$  — number of the rural population (in ,000) per one urban settlement;  $K$  — number of all the urban settlements (in ,000);  $K_b$  — number of urban settlements (in ,000) the bigger towns excluded;  $U$  — the percentage of the urban population in the total population;  $U_k$  — the share of the population of all the bigger towns in the total of the urban population (in %)

dicators, referring to the entire USSR considered as a single economic region. These indicators are:

$N_k$  — number of the population of all the bigger towns (of more than 500,000 inhabitants each);

- $U_k$  — the share of the population of all the bigger towns in the total of the urban population (in %);
- $N_b$  — number of the urban population, the bigger towns excluded;
- $p_b$  — mean size of a single urban settlement (in thousands of inhabitants), the bigger towns excluded;
- $K_b$  — number of urban settlements, the bigger towns excluded.

Figure 2 shows the dominant trends in the processes of the urban and rural settlement formation within the limits of the entire country (cf. Table 3) as resulting from the prevalent spread of various types of these processes — the “resultant of the development vectors” of different *oblasts*.

According to the author's computation,<sup>4</sup> the characteristic features of the dominant trends in the years 1926–1939 and 1939–1959–1970–1972 as well as of the prognosis till the year 2000 seem to be the following (cf. Fig. 2):

(1) The growth of the urban population in the USSR (both as to its dimension and pace), associated with the decrease in the rural population, has been unprecedented in the whole history of mankind. Consequently, in 1926–1972 the share of the urban population increased very rapidly (from 18% to 58%).<sup>5</sup> In the future the growth of the urban population will proceed at a somewhat slower pace, for, owing to the progress in science and technology and to the improved organization of production, the efficiency of labour will be greater, and also because the natural increase of the population will still continue, though at a smaller rate. Nevertheless, by the end of the century the total increase in the urban population will have proved to be considerable, thanks to the development of manufacturing and transportation (in the eastern regions in particular) and, also, to the fast accretion in the number of the personnel employed in scientific research and public services. The number of the rural population will have dropped as a result of increased efficiency of labour in agriculture, which will be intensified, and also because many villages will have grown up to reach the rank of a town.

(2) The number of the rural population per one urban settlement (this figure may be regarded as a conventional index of improvement in serving village inhabitants with cultural and primary life necessities by institutions and enterprises located in urban centres) decreased sharply between 1926 and 1972. It resulted through creating numerous new towns and town-like settlements as well as because of the decrease in the number of the rural population. It is a tendency which will no doubt keep continuing.

(3) The share of the biggest towns (of more than 500,000 inhabitants each) in the total of the USSR's urban population increased in 1926–1939 from 15.6 to 21.1% that is by 5.5%, in 1939–1959 by 3.1%, and in 1959–1970 by 3.2%. If we disregard the lowering in the share of Moscow and Leningrad, the main cause of this process is to be seen in the growth of many other towns which, having crossed over the threshold of 500,000, had entered the category of big towns; however, their share, though still growing, slowed down, especially in the last three years (1970–1973), when it increased by 0.5%. In the future the share of

<sup>4</sup> See a collective work: V pomoshch proyektirovshchiku-gradostroitel'nykh (To Assist Urban Designers), in: *Problemy gradostroitel'stva*, 1, 1970, p. 33.

<sup>5</sup> Up to 59% till 1973 and apparently to 60% by 1974. See: TSU SSSR, *Statisticheskii Yezhegodnik Narodnoye Khozyaistvo SSSR v 1972 g.* (Statistical Yearbook “National Economy of the USSR in 1972”), Moscow 1973, p. 7.

the bigger towns is bound to go down, for the policy is firmly to apply brakes to their growth.<sup>6</sup>

(4) The bigger towns excepted, the mean size of urban settlements increased from 11,500 to 18,300 inhabitants in the period of 1926–1939, by 1959 it went down to 16,400, by 1970 increased again to 18,000, and by 1972 to 18,600 (in 1973 it was 18,800). The period of decline in the mean size (1939–1959) coincided with the time when numerous small town-like settlements were created (cf. Fig. 2). However, regardless of the tide-and-ebb character of the changes in the mean size of urban settlements, the general trend was toward the urban settlements growing bigger and bigger. In the future this trend will gain momentum owing to a dominant growth of many a small and medium town as well as to the policy of renouncing the narrowly bureaucratic, “artificial” localization of new industrial plants and the creation of undersized settlements.

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<sup>6</sup> Directives of the 24th Congress of the Communist Party of the Soviet Union for the Five-years Plan of the Development of the National Economy of the USSR in the Years 1971–1975.

## URBANIZATION PROCESSES IN POLAND, 1960-1970

STANISŁAW HERMAN

**ABSTRACT:**<sup>1</sup> In the introductory part of the paper some terminological questions are raised. In particular, distinction is made between two alternative notions of urbanization. The first notion, according to the author, is quite broad in scope and encompasses numerous aspects of urban growth. The second notion is that relating to the percentage of population living in towns, i.e. the statistical definition of urbanization.

The 1960-1970 changes in urbanization are then briefly presented for different parts of the World and, more detailedly, for the CMEA countries. The next sections are devoted to urbanization processes in Poland during the sixties. Interregional differences are outlined, followed by discussion on the growth of population in urban agglomerations, as well as in selected middle-size cities which are often identified as growth centers. The final sections report on the growth of nonagricultural population and on some policy implications of urban growth.

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<sup>1</sup> The full version of the paper has been published by the Committee for Space Economy and Regional Planning, Polish Academy of Sciences. Cf.: *Biuletyn KPZK PAN*, 94, 1977, pp. 105-150.



## URBANIZATION PROCESSES AND CHANGES IN THE DEMOGRAPHIC REGIONALIZATION OF POLAND

ADAM JELONEK

The circumstance that in Poland population changes, especially in natural increase rates and migrations but also the population structures, disclose a highly differentiated spatial distribution is primarily due to the sweeping migration processes both in the past and now. Professor Kazimierz Dziewoński (1974) suggests that the population structures have developed to their present spatial form under the decisive impact of three such processes: "These, in their historical order, are the following:

(1) the economic and partly political foreign emigration at the end of the 19th and the beginning of the 20th centuries,

(2) the resettlement actions in connection with the outcomes of the two world wars and the delineation of state boundaries,

(3) the processes of industrialization and urbanization, which have reached their apex only now, in People's Poland, during the forming of a centrally planned socialist economy."

Continuing in the line of K. Dziewoński's reasoning let us emphasize that in the latter half of the 19th and at the turn of the 20th centuries the population developments commonly known in Europe as the demographic revolution were taking place on Polish lands too. Natural increase rates were then very great, as a high birth rate was accompanied by a declining mortality. The political situation, with Poland's territory partitioned by the three neighbouring powers — Russia, Prussia and Austria — did not secure an economic development sufficient to match up with the rising population pressure. The political persecution to which Poles were exposed especially in the Prussian partition and the stagnation and economic and social backwardness in the Russian and Austrian partitions encouraged people to emigrate, with the most favoured migration route leading to North and South America. Yet the huge emigration, which it is now hard to fix in quantitative terms, neither prevented a considerable population growth in absolute figures nor produced any major changes in the population structure. The emigrants were mostly from rural areas, as urbanization was but in a nucleus, with any noticeable scope only in the Upper Silesian coal district, around the textile industry centres of Łódź and Białystok, and in Warsaw.

One consequence of World War I was a new delineation of Poland's state boundaries. The hostilities caused huge population shifts, and later, within the framework of large-scale repatriation and re-emigration actions, about 1,265,000 Poles dispersed in the previous partitioning powers and in other countries, including the old emigrants-for-earnings from toward the end of the 19th century, returned to reborn Poland. Still during the hostilities the partition-

ing powers had evacuated their population groups that had been engaged in public service or in the police as well as their military personnel. They were followed by a considerable number of civilians. Nevertheless Poland remained a country with a significant percentage of national minorities. Some of the more persistent consequences of the hostilities were primarily the direct and indirect war casualties, which cut deep dents in some age groups of the population. Strong compensation processes as well as a steep rise in population number (from 27.4 million in 1921 to 35.1 million in 1939) were recorded for the period between the two world wars, and the (incidentally declining) emigration, especially in the 1920's, did not prevent them. The integration of areas that had formerly belonged to three different economic organisms and, additionally, the worldwide economic crisis anything but facilitated a full-fledged urbanization and industrialization. The need to reconstruct what had been ruined in the war and, moreover, to meet foreign obligations demanded a lot of effort. The share of urban in total population grew from about 24% in 1921 to some 29% in 1939. The urban population concentrated especially in medium-sized towns and in the big cities.

Poland's demographic situation today is largely the outcome of the enormous losses during World War II and the huge population shifts in connection with the new delineation of Poland's state boundaries. The wartime population losses are estimated to have exceeded 6 million. In addition to these direct losses, there were indirect losses in connection with the declined natural increase estimated at about 1.2 million people. Moreover, 590,000 people were crippled and many died prematurely of illnesses or exhaustion after the war. Not all groups of Poland's population suffered equally from wartime losses: these were especially high among the urban population both because of the great number of casualties in Warsaw, the more extreme terror in towns, and also because nearly all of the killed Jews had lived mostly in towns. Acute losses were also recorded for other areas of Poland, such as the Zamość district, parts of the Kielce voivodship and a number of others that put up particularly strong resistance. It must be emphasized that Poland's population losses during World War II were the result of a deliberate policy of biological extermination that the Nazis waged against the Polish nation. The first targets of that extermination were the nation's political leaders and its intellectuals. Hence the extremely high casualties among lawyers, physicians, researchers from higher schools, and among the Catholic clergy. While the Nazis did not spare anyone, the casualties included predominantly males, and in particular young men.

The outbreak of the war triggered a sweep of migrations on Polish territory at an unprecedented scale which, in percentages, are among the greatest recorded in world history. The wartime migrations began already during the Nazi attack on Poland in 1939 with the evacuation of some population groups and the escape of civilians from the approaching enemy lines. Some of those people as well as whole military groups crossed the boundaries to set out on a pilgrimage through Europe from which some did not return to stay in emigration. Others returned to their homes after the hostilities known as the September campaign or after the war. As soon as in the autumn of 1939 the Germans started removing the resident Polish population from areas incorporated into the German Reich to make room for Germans who had by that time lived in eastern or southern Europe. Large-scale resettlement actions were later also carried through in other areas of Poland. Altogether about 2.5 million people were included in forceful resettlement actions. In 1940/41, the Nazis resettled some Ukrainians, Byelorussians and Lithuanians from Polish territories to the

Soviet Union. German administrative personnel began to arrive into the German-occupied territories together with their families. Germans from areas that were likely air-raid targets were resettled to what are now Poland's Western and Northern Territories. Many people in those areas were prisoners and forced labourers. Toward the end of the war refugees from territories won by the Soviet Army began swarming in. The last months of the war saw mass-scale evacuations and a rush of German refugees from the occupied areas and from the territories previously in the boundaries of the German Reich that were to be incorporated into Poland. Those huge population shifts were estimated to have comprised about 14 million people. At the end of the hostilities there were still about 2 million Germans in Poland, mainly in Lower Silesia, Pomerania and in Masuria. The census of 1946 provided for those people to be recorded as a separate category and subsequently almost all of them left Poland. After verification by commissions specially created for that purpose Polish citizenship was restored to about 1.1 million autochthons in the Northern and Western Territories who had belonged to the former Polish national minority in Germany.

The end of the war saw the onset of new migrations caused by the return of POWs, refugees, people removed to Germany as forced labourers, etc. Territorial alterations were followed by the repatriation of Poles from areas that had been incorporated into the Soviet Union. Poland agreed to the principle of a two-way exchange of population groups with the Soviet Union: within the framework of an organized repatriation in 1944–49, 1,507,000 people came to Poland and 518,000 Ukrainians, Byelorussians and Lithuanians emigrated to the Soviet Union. 1,482,000 people came in from other chiefly West-European countries, most of them forced labourers, veterans from military units fighting the Germans in the West, as well as former emigrants.

On the ground of the decisions made by the victorious powers and in accordance with appropriate international agreements the German population was resettled from Poland to the Soviet and British occupation zones in Germany. Within the resettlement action of 1946 to 1949, which was organized and carried through according to plan, 2,275 million people left Poland.

The great wartime migration movements ceased toward the end of 1949. As evidenced in records, they comprised a total of 5.8 million people, but it is estimated that together with the uncontrolled migration waves during the last months of the war and the first months after it the total number reached about 8 million.

At the outbreak of the war Poland's population was 35 million (within her boundaries as on 31 March, 1938), while at the end of the war in her new boundaries there were only 24 million. In 1946/47 this latter figure declined still further in connection with the continuing migration movements of non-Polish population groups. But from the end of 1949, when the migration movements ceased, the population number showed a steady growth due almost exclusively to natural factors. A period of several migration-free years ensued. But in 1956, with the return of Poles from the Soviet Union who wished to repatriate, a new wave of migrations began. At the same time, on the grounds of agreements with the German Democratic Republic, the action of "bringing together families" separated through the war was launched thus providing for emigration from Poland to Germany. Emigration of people of Jewish descentance to Israel was another significant factor. Altogether, 346,000 people left Poland and 257,000 came to settle here in 1956–59. The resulting adverse net balance amounted to about 90,000 people. In the early sixties inter-country migration

stabilized with an average of about 22,000 people a year leaving Poland and 2,400 coming in. This gave an adverse balance of foreign migration that persisted for years on much the same level. In the seventies both emigration and immigration have been markedly declining, with the adverse net balance reduced to a mere 10,000 a year.

The altered state boundaries caused mass-scale domestic migrations too. The regained Northern and Western Territories left by the Germans had to be populated anew. As settlement reserve areas those territories were utilized to settle repatriates and reemigrants as well as people from the most war-damaged areas and from areas with an agricultural excess population.

The 1950 population census furnished detailed data on the territorial origin of the population of the Northern and Western Territories. Most of them were settlers from Poland's stock territory (49.1%); repatriates from areas now belonging to the Soviet Union were the next biggest group (26.9%), and autochthons (19.6%) and reemigrants from the West (a mere 2.6%) were the next recorded groups. The autochthonous population concentrated and was a majority in Upper Silesia and in the Opole region, whereas in Varmia and Masuria it accounted for a considerable percentage of the local population. Repatriates from the Soviet Union and reemigrants dominated especially in the Wrocław and Zielona Góra voivodships, where they often accounted for more than half the total numbers of settlers. They were also often the dominant group in Western Pomerania. But in most cases the majority of settlers in the regained territories came from Poland's stock territory. More homogeneous groups of settlers could be found in the areas close to the border which were chosen by people from the neighbouring voivodships (L. Kosiński, 1960).

After the great domestic and foreign migrations had ceased, that is since 1950, there ensued a period during which the nationwide population growth in Poland became principally determined by natural increase.

Wartime losses and postwar resettlements induced by the hostilities and the subsequent redelineation of state boundaries resulted in a spatial differentiation of the population structures. Industrialization and urbanization processes that evolved in that context attained their highest intensity during the construction of a planned economy. If the period of 1945-49 is to be considered as decisive for mass-scale population shifts all over Poland's territory, the analogous interval for the national economy was that of postwar reconstruction.

In 1950-72 Poland's population grew from 25 to 34 million, population density from 80 to 108 persons per 1 km<sup>2</sup>, and the share of urban in total population from 39% to 55%. The growth rate of Poland's population in 1950-60 was very high totalling about 0.5 million a year; toward the end of the sixties it slightly fell to about 270,000 to rise again in the seventies reaching 340,000 a year in 1974. Total urban population grew from 9.0 million in 1950 to 18.3 million in 1974. The particularly high growth rate for 1950 to 1960 accounted for an increase almost equal to the total natural increase. Over this decade alone the urban population grew by 5.1 million. In the sixties that rate declined somewhat to an average of 250,000 people. Urban population equalized rural population in 1966 and in the ensuing years it has continued to grow.

The increment of urban population was composed of three factors: natural increase, inflow of rural population, and changes in administrative-legal status. An upsurge in the share of urban population was recorded in 1951, when the legal status of many urbanized areas was submitted to revision in result of which new administrative boundaries were laid down and town status was granted to a number of industrial, mining and suburban settlements and to

several health resorts. The changes brought about by that action were most conspicuous in Upper Silesia, where 15 new towns of *poviat* status directly neighbouring to one another were created, and in the Warsaw agglomeration (with the capital city's area significantly extended and several suburban settlements granted town status). But ultimately it was the very high natural increase that was the most pronounced factor in the growth of urban population in Poland in the 1950–60 decade. This is what specifically distinguishes the postwar from the prewar urbanization processes. Village-to-town migration was another significant factor; its net values were, respectively, almost 820,000 for 1951–60, and 1,889,000 for 1961–74.

L. Kosiński's study (1960) on the typology of population changes in Poland in 1951–60 showed that only few *poviats* recorded population increases. These included primarily *poviats* in western Poland, those around the Upper Silesian Industrial District, *poviats* in the Bieszczady Mts. (an area of intensive economic reactivation that had earlier been harassed by Ukrainian nationalist bands and hence had had much of its population evacuated), as well as towns with *poviat* status. A circular pattern of population inflow zones began to form around the biggest cities. The high rate of growth of the big cities and medium-sized towns continued through the sixties with migration-induced increments exceeding natural increase. The surrounding *poviats* also recorded population increases but predominantly due to natural causes. But as a new process observed there was also a marked reduction in population number in absolute terms in connection with emigration exceeding natural increase. This was especially so in a major part of the Kielce and Lublin voivodships and, to a smaller extent, in the voivodships of Białystok and Łódź. All of these processes reflect the continuing urbanization which resulted in concentrating more and more people in the towns. At about a time when natural increase kept rather small over considerable areas of Poland, further population growth in towns could be effected at the expense of depopulating the most neglected agricultural areas which are left by people moving to get a better living standard.

The present author's studies on the demographic regionalization of Poland show that the spatial differences in population structures vary with time. Different methods and a varying number of features were employed in the regionalization procedure. The regionalization for 1950 was based on the age and sex structures, their mutual relations and the rate of changes over 1946–50. That for 1960 was based on eight features, of which three related to age and the remaining five to sex structure, births, deaths, and migration. The regions were delimited by the border frequency method and the spatial distribution of the mutual relations of the three age groups. The attempt to delimit Poland's demographic regions for the year 1970 was made by means of multi-factor analysis on the ground of 26 population features.

Poland's demographic picture for 1950 represented a tripartite spatial structure, with a well-marked dividing line between the stock territory and the Northern and Western Territories. Within these latter two smaller regions — those of the Opole district and Masuria — distinguished themselves against their contexts. This specific spatial structure was a consequence of migration processes connected with the settling of Polish population in the Northern and Western Territories. The population of those areas was typically immigrant. The two distinctive subareas, the Opole region and Masuria, had a significantly smaller share of immigrant population. The autochthonous population predominant there had suffered heavy wartime casualties and lost many of their males who were evacuated by the Nazis in the final phase of the war.

The demographic picture for 1960 discloses again the basic groundwork resulting from the new boundaries and the resettlement and settlement processes but also betokens new developmental trends. The region of Western and Northern Territories underwent a definite differentiation. The Sudetes subregion emerged as a more urbanized area. The autochthonous region of Masuria shrank remarkably. The Opole region disclosed features similar to those of Upper Silesia and to the western part of the Cracow voivodship. The stock territories were no longer uniform. Eleven subregions could be distinguished in it. Except for the Bieszczady subregion, which betrayed features typical of immigrant areas, the other subregions were a result of the differentiation of industrialized and agricultural areas. This was especially true of the Warsaw, Łódź, and the Upper-Silesian-Cracow subregions. We can say that the spatial differentiation of demographic structures of that period was a result of the previously commenced and intensifying processes of large-scale industrialization and urbanization.

The demographic regions delimited for 1970 again disclosed a spatial structure composed of three parts but whose extents were definitely different from the previous ones. The North-Western region comprised no longer merely the regained Northern and Western Territories but also the neighbouring voivodship of Gdańsk, almost all of the Bydgoszcz voivodship and part of the Poznań voivodship. Areas that were basically agricultural in the Northern and Western Territories integrated with areas of a similar structure situated in the stock territory. The Silesian-Cracow region retained its boundaries unchanged but its internal structure underwent a number of modifications. The Warsaw, Sudetes, Łódź and Gdańsk subregions increased. A new subregion, that of Szczecin, emerged. All of these subregions appeared in connection with big urban agglomerations or with urbanized areas (the Sudetes subregion). Several subregions in the eastern and central areas which — except for the Bieszczady region — used to be agricultural emigration areas before, now underwent definite transformations.

The regionalization of the demographic structures in Poland for 1970 disclosed a gradual disappearance of the differences generated by the settling process in the Regained Territories. There was a more and more pronounced general distinction between strongly urbanized and industrialized areas with typically immigrant population structures both in the stock territory and in the Northern and Western Territories on the one hand, and the agricultural emigration areas with excessive population outflow that may have adverse effects on both the structure and the rate of population development, on the other.

The previously prevalent division into the Northern and Western Territories on the one hand and the stock territory on the other, is expected to further attenuate in the future. The areas of big urban agglomerations attracting population groups with definite demographic features are certainly going to gain in importance. The areas alimentary to those agglomerations will extend and may occasionally overlap. Some adverse effects of excessive population outflow that are visible already now, such as excessive ageing, deficit of women in definite age groups, disturbances in the process of reproduction, and eventually even the depopulation of some areas, must all be neutralized through appropriate population policies. It seems that the control of demographic processes with a view to securing the optimal population number and the most desirable population structure for any given area is possible and, moreover, will soon be a necessity. Instruments of population policies must be sought in the control

of migration movements, in investment policies not only for industry but also for agriculture and for the services in the broad sense, and eventually in the sphere of living and social conditions.

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## THE ROLE OF PERMANENT MIGRATION AND COMMUTING IN URBAN GROWTH

ANDRZEJ GAWRYSZEWSKI

Migration movements are inevitably concomitant to socio-economic change. The mass population shifts that began 30 years ago followed a distinct rise in the intensity of socio-economic processes at that time. How enormous the migration movements in Poland were at that time is seen, for instance, in the fact that over the period of 1951 to 1973 a total of 25,587,000 changes in permanent residence were registered, and these do not include movements within the administrative boundaries of the same town or rural community (or the *gromada* before 1972).

The documentation of changes in residence kept on a regular basis since 1951/52 onwards shows that except for 1951-55 most common in Poland was migration from one village to another; migration from rural to urban areas ranked only second considering the number of people involved (Table 1).

TABLE 1. Domestic migrations by their principal flows

Years	Total population (in ,000)	Direction of migration				
		town-to- town	village- to-town	town-to- village	village- to-village	
		annual averages (in ,000)				
1951-1973	25,586.8	1,112.5	268.5	298.2	180.0	365.8
1951-1955	6,904.7	1,380.9	390.1	368.5	250.0	372.3
1956-1960	6,717.7	1,343.5	311.6	322.1	238.1	471.7
1961-1965	5,030.7	1,006.2	225.7	260.8	160.2	359.5
1966-1970	4,324.3	864.9	189.4	253.1	113.6	308.8
1971-1973	2,609.4	869.8	196.9	278.4	110.4	284.1

From the early sixties onwards, the main trend in total migration has been a characteristic shift toward movements from the countryside to the towns, while town-to-village migration has been declining and the other types of migration (town-to-town, village-to-village) have been stagnating.

The considerable volume of village-to-village migration has up to now not been regarded as a problem, presumably because it has been obviously underrated as a factor in urbanization and industrialization processes. Before I phrase a hypothesis concerning these migration movements let me point out that village-to-town and village-to-village migration movements are more extensi-

vely intraregional in character than town-to-village or town-to-town migration; in 1973, only 46% of people leaving one town for another stayed in the same region (within the administrative boundaries of the same voivodship) and 67% did so in moving from a town to a village, while the analogous percentages for the two types of emigration from villages were 74% in each case. Only

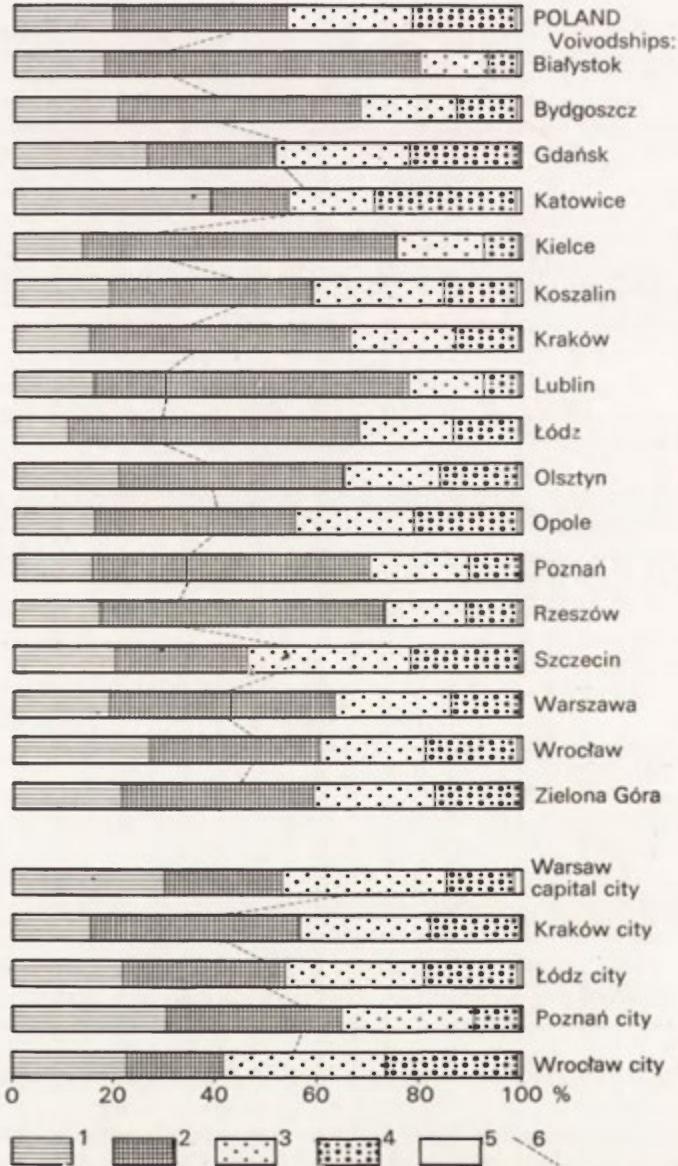


Fig. 1. Structure of immigrant population in towns in 1961-70 by previous residence 1 — people from towns of the same voivodship (in case of the 5 city-voivodships — of the surrounding voivodship), 2 — from rural areas of the same voivodship (in case of the 5 city-voivodships — of the surrounding voivodship), 3 — from towns of other voivodships, 4 — from rural areas of other voivodships, 5 — from abroad, 6 — total from towns

Source: Data of the National Census of 8 Dec. 1970

town-to-town migration turned out to have been predominantly interregional: 54%. The spatial patterns of village-to-town migration as disclosed in the National Census of 8 December 1970 are shown in Fig. 1.

If we look at migration from the angle of socio-economic development, movements from the countryside to the towns appear to be most significant, as they involve a shift of manpower from agriculture to the nonagricultural sectors and from areas where manpower at productive age is in excess to those where it is in deficit.

Among the migration-generating factors, industrialization together with the ensuing urbanization processes are no doubt those most powerful: as much as about 90% of the total industrial potential is localized in the towns.

Over the period of 1946-73, urban population grew from 7.5 to 18.1 million, or more than doubled (Table 2). Three factors contributed to that increase: natural increase, immigration (both domestic and from abroad<sup>1</sup>), and administrative growth (following alterations in administrative boundaries). Migration from the countryside to towns was commonly thought to have been the dominant factor of urban population growth, but actually it was different. To be true, the data on the contributions of each such factor are not fully reliable; some flaws of the system of population registration have only recently been overcome (practically since 1 January 1975), and, moreover, there were alterations in the administrative division almost every year. But it can be said that official data from the Central Statistical Office point to natural increase as the decisive factor in urban population growth (it accounts for 46% of the total growth). Immigration came next with 36%, and increase due to administrative alterations accounted for 18%. This latter factor played the decisive role in 1951-55 with the two general reforms of the nationwide administrative division. From 1951 to 1966 natural increase dominated, and the year 1967 marks the

TABLE 2. Changes in urban population<sup>a</sup>

Years	Population in first year of period	Population increment				Population at end of period
		real	natural	net migration	due to admini- strative changes	
millions						
1946-1950	7.5	1.7	0.7	0.9	0.1	9.2
1951-1955	9.2	2.9	1.1	0.7	1.1	12.1
1956-1960	12.1	1.9	1.1	0.3	0.5	14.4
1961-1965	14.4	1.3	0.7	0.5	0.1	15.7
1966-1970	15.7	1.2	0.6	0.6	0.0	17.1
1971-1973	17.1	1.0	0.4	0.6	0.0	18.1
1946-1973	7.5	10.0	4.6	3.6	1.8	18.1

<sup>a</sup> Population estimates for the terminal year of each period are based on census data for 1950, 1960, and 1970; hence the imprecise balances of the figures in the table.

Source: Central Statistical Office, Demographic Yearbooks.

<sup>1</sup> The yearly urban population loss due to emigration abroad in 1946-73 averaged 18,500 persons.

beginning of the rising of immigration in the net population increase in towns. The mean yearly values of natural increase and migration-caused increase have been seen to rise over the recent years. This is a consequence of the numerous pre-1956 generation entering procreative age. Moreover, people born in the birth-rich years are reaching productive age which intensifies migration, especially from the countryside to towns (cf. Table 1). If it is considered that fertility maxima are normally recorded for the age group of 20-25 years the share of natural increase in total urban population growth is likely to decline toward the end of the present decade in proportion to the growing importance of migration-caused increase.

The structure of indigenous vs. immigrant urban population as on 8 December 1970 is shown in Fig. 2 which corresponds to Table 1.

Areas of village-to-town migration were most frequent in the voivodships of Białystok, Kielce, Cracow, Lublin, Łódź, Olsztyn and Rzeszów. The terminal

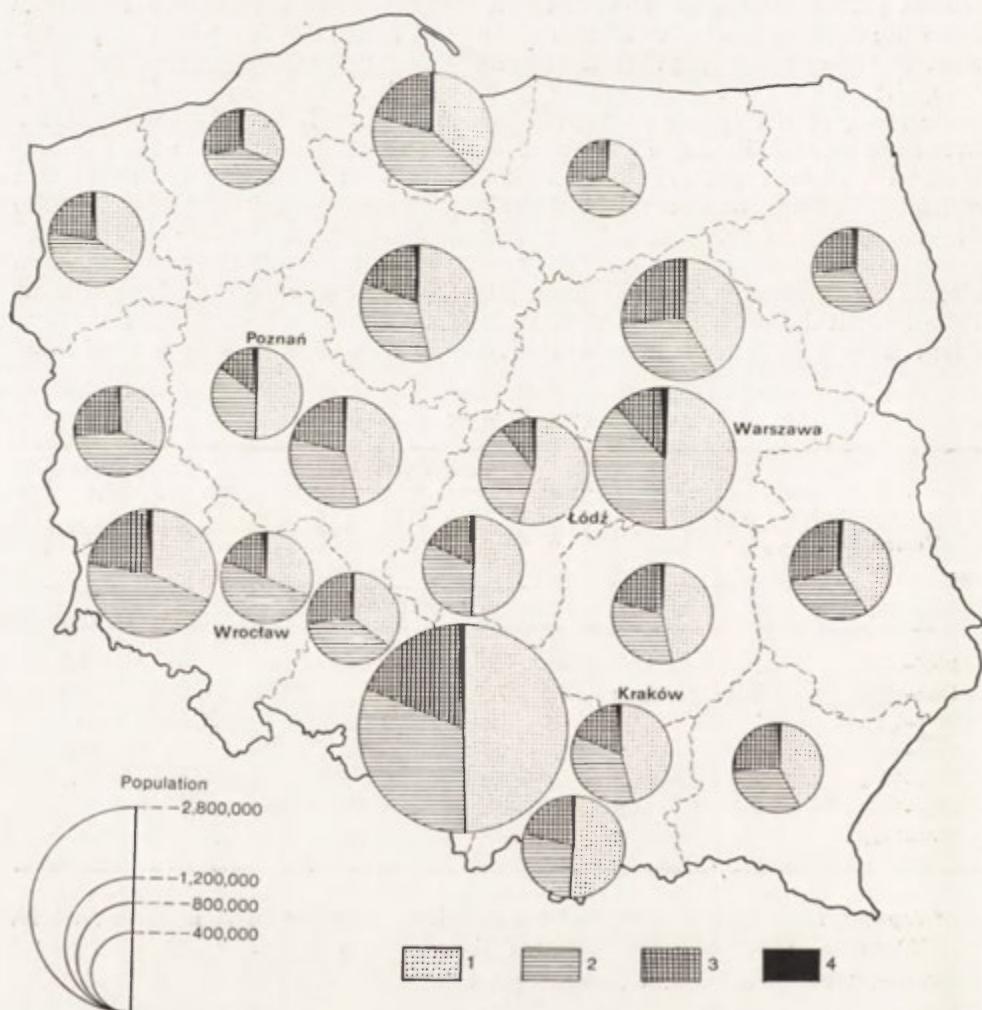


Fig. 2. Structure of population living in towns on 8 Dec. 1970  
 People living in the towns: 1 — since birth, 2 — since immigration in 1960 or earlier, 3 — since immigration in 1961-70, 4 — unidentified

towns were mostly situated in the same voivodship but also in others (though predominantly in those closest to the emigration area and in those most advanced and urbanized). Most immigrants from the rural areas were absorbed by the five city-voivodships: Warsaw, Cracow, Łódź, Poznań and Wrocław, as well as by the industrial towns of the Katowice and Cracow voivodships and in the big seaports (Gdańsk, Gdynia, Szczecin). Migration from rural areas to towns in the remaining voivodships was as a rule much smaller than intra-voivodship village-to-town migration. The highest migration-caused population increases were noted for the big cities, medium-sized towns, for urban and rural *poviats* situated close to such cities or towns, and for areas of new investment projects.

In absolute figures, population increase was biggest in the biggest cities. But the highest population growth rates were noted for the 20-50-thousand group of towns (Table 3). Towns of less than 10,000 population have been suffering from a population decline for quite some time now.

TABLE 3. Towns by population

Years	Total	Size groups of towns					
		less than 5,000	5-10,000	10-20,000	20-50,000	50-100,000	100,000 and more
Number of towns							
1946	732	466	135	69	41	10	11
1965	891	369	245	151	78	25	23
1970	889	359	220	162	97	27	24
1973	836	302	201	170	108	30	25
Urban population (in ,000)							
1946	7,425	1,152	947	944	1,187	784	2,411
1965	15,680.7	1,122.7	1,740.7	2,089.1	2,329.7	1,633.3	6,765.2
1970	17,088.0	1,099.3	1,570.8	2,243.1	2,915.8	1,870.9	7,388.1
1973	18,148.3	937.1	1,445.1	2,381.7	3,333.7	2,120.8	7,929.9

Source: Central Statistical Office, Statistical Yearbooks.

Questionnaire researches carried out by the Section of Geographic Economy of Poland of the Central School of Planning and Statistics show that limited employment possibilities are the main cause of instability of the population of small towns (up to 10,000) and that the demand for jobs in the smallest towns (up to 5,000) is not fully met. These results can be confronted with the distributions of migration balances over the recent two years thus allowing for a more comprehensive estimate of urban growth (Table 4).

The Table shows that each group of towns recorded a surplus in migration between urban and rural areas. That surpluses are high for the big cities and for the 20-50 and 10-20-thousand population groups of towns. These bigger urban centres are at first much more attractive to immigrants from the countryside than the more numerous and accessible small towns which generally offer a style of life much similar to that predominant in the rural areas. As regards town-to-town migration balances, each group of towns has a surplus over urban units with less population and a deficit with groups of urban units with larger populations. Moreover, the share of migration-caused increase related to the larger urban units declines with growing town size. The smallest towns

TABLE 4. Balance of domestic migration by town size in 1972-1973

Present residence	Previous residence								Rural areas	
	Total	Towns	Towns with population					100,000 and more		
			less than 5,000	5-10,000	10-20,000	20-50,000	50-100,000			
thousands										
Towns with population:										
less than 5,000	+11.1	-14.2	x	-1,0	-2.3	-4.2	-2.3	-4.4	+25.3	
5-10,000	+27.4	-14.1	+1.0	x	-0.6	-4.7	-2.2	-7.6	+41.5	
10-20,000	+39.8	-21.9	+2.3	+0.6	x	-5.8	-3.5	-15.5	+61.7	
20-50,000	+80.4	+4.9	+4.2	+4.7	+5.8	x	-0.4	-9.4	+75.5	
50-100,000	+40.0	+4.0	+2.3	+2.2	+3.5	+0.4	x	-4.4	+36.0	
100,000 and more	+134.1	+41.3	+4.4	+7.6	+15.5	+9.4	+4.4	x	+92.8	
Rural areas	-332.8	-332.8	-25.3	-41.5	-61.7	-75.5	-36.0	-92.8	x	

Source: Central Statistical Office, Demographic Yearbooks.

with up to 5,000 population recorded a total migration-caused increase of 25,300 people, of which they lost 56% to the larger towns. The analogous percentages for the other towns were, respectively, 36, 40, 13, and 12. This and other facts indicate that small towns fulfill an intermediary role on the move toward a big city or an agglomeration.

Though the proportion of originally rural population in migration from smaller to bigger towns is not known exactly, most migrants from villages probably tend not to settle permanently in small urban centres.

So far, in analysing the factors of urban growth I focused my attention on natural increase and migration-caused growth. Now it is necessary to turn to another factor: commuting to work. This factor is intermediate between the two others, and its influence on urban growth is indirect.<sup>2</sup>

In recent years several authors suggested that commuting to work has been turning into permanent migration. For instance, M. Olędzki's studies (1967) of the industrializing region of Płock indicate that commuting to work strongly tends to transform into permanent migration. He found that trend to be equally strong among commuters from towns and from rural areas (57 and 51% of all commuters, respectively). In 1971, Professor A. Rajkiewicz found the same trend in the industrializing regions (Płock, Puławy, Tarnobrzeg, Lubin, Konin) to be still stronger: as many as 66-75% of all commuters in those regions pledged their willingness to move to the town of their workplace.

Because of insufficient statistics it is impossible to demonstrate beyond doubt that a substantial proportion of commuting to work transforms into permanent migration (as measured against the total of all migrants). But analyses of correlation between the flows of daily commuting and the corresponding permanent migration movements (for 108 *poviats*, including 30 town-*poviats*) disclose — though without taking account of the time sequence of the movements — a highly significant correlation, especially for urban centres at a high level of socio-economic development.

Further investigations showed that in addition to the labour market, which is a direct migration-generating factor differences in living standard have an analogous effect. It modifies the decisions of potential migrants whose primary motivation might be to secure employment possibilities. The volumes of migration and commuting to work clearly correlate with such elements of living standard as retail trade turnover, consumption of electric energy by households, or housing construction. When the migrant sees few possibilities of permanently settling in the town he may give up his decision to move or, in the case of a highly attractive urban centre, he may opt for commuting. Because of the deficit in dwellings, which is still growing, the housing situation fulfills a special role in determining the volume of migration and commuting and their mutual relations. At present 1,236,000 people are waiting to get their dwellings from cooperative building firms. The deficit in dwellings is expected to decline after 1980, though not below 500,000 dwellings.

A gravitation-model analysis of the extent of migration for inter-*poviat* migration flows in five voivodships (Białystok, Gdańsk, Katowice, Olsztyn, Opole) and an analogous analysis of village-to-town immigration in the Kielce voivodship by A. Żurek (1975) both suggest that migration conforms to certain spatial mechanisms. The extent of migration and of commuting to work to urban centres turned out to be smaller than to their hinterland. A. Żurek also

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<sup>2</sup> In 1973, the number of commuters to work in the towns reached 2,420,000; the total of commuting was 2,895,000 persons.

found that the rate of immigration from rural areas decreased with growing town size (Fig. 3).

The smaller extent of the migration inflow to urban centres represents a situation of these latter draining most intensively the closest neighbourhood from its population and only little the more distant areas. Thus the direct hinterland is, in a sense, a migration reserve of the urban areas. It is also this hinterland which furnishes a much bigger area for population inflow: due to administrative barriers to direct immigration to the urban centres proper the hinterland tends to take over much of the given town's own attractiveness. Thus the pattern of the migrant's road to the urban centre constitutes a "migration ladder" every rung of which corresponds to a different extent.

Similar differences occur in the case of extents of commuting to work. The extent of any of such areas depends on factors such as demand for nonlocal labour, the attractiveness of the jobs offered, or the possibility to meet the demand in the closest surroundings. The hinterland area, which gives a large proportion of its own labour force to the town, must in its turn draw from the manpower reserves of more remote areas.

The scheme of individual migration decision suggests that the potentially mobile part of the population dissatisfied with the opportunities their place of residence offers, tend to consider the attractiveness of alternative places of residence. The prospective migrant weighs the new opportunities against each other and using the information at his disposal he picks those that promise the possibly greatest improvement of conditions. But decisions to migrate and the choice of residence are modified in at least three aspects: (a) the possibility to move to the selected destination, difficulties to get a dwelling and residence

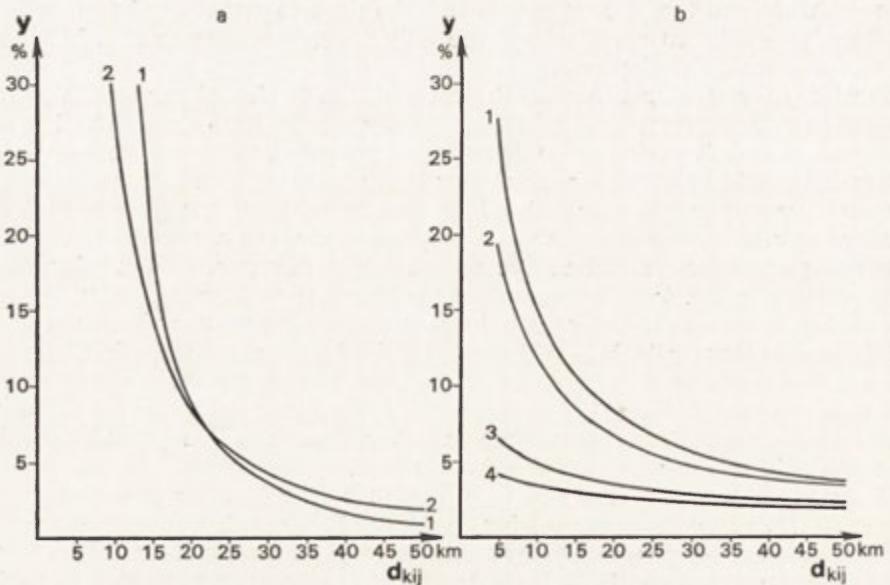


Fig. 3. Examples of migration distributions in function of distance (a) for the surrounding *poviat* and for town-*poviats* (A. Gawryszewski, 1974): 1 — *poviat* town Brzeg, 2 — *poviat* surrounding the *poviat* town Brzeg; (b) for towns of the Kielce voivodship (A. Zurek, 1975): 1 — more than 100,00 (Kielce, Radom), 2 — about 50,000 (Ostrowiec Świętokrzyski, Starachowice, Skarżysko-Kamienna), 3 — 10-20,000 (Sandomierz, Pionki, Opoczno, Końskie, Jędrzejów, Busko), 4 — the remaining 26 towns of less than 10,000 population in 1968

permits, (b) distance, and (c) the closeness of the cultural, social and family ties in the previous place of residence. This produces three main streams of migration:

(1) Permanent, terminal migration directly from previous places of residence *A* to the selected destination *B*. Normally, this type of migration fits the simplest mechanism and as a rule involves migration movement at small distances.

(2) Commuting from *A* to *B*; this form of migration is a substitute of permanent migration to *B* if this latter is not too far off *A*. It is to be regarded as a two-phase migration which is naturally limited by distance.

(3) Permanent migration from *A* to some destination *C* which is situated close to the terminal place *B* and commuting from *C* to *B* while waiting for the moment at which *B* will be accessible. This three-phase form of movement is also a substitute of permanent migration to *B* (unless it is too far off the place of residence *A*).

This mechanism of the three-phase form of movement seems to govern a lot of the village-to-village migration movements (see Table 1). This type of movements terminate largely in rural areas surrounding highly industrialized urban centres which have a high growth rate of employment but with housing construction lagging behind, which makes settling in the city itself impossible. Apart from the housing situation, the large proportion of village-to-village migration flows is partly due to administrative restrictions (especially on granting residence permits) in a number of urban centres including Warsaw, Cracow, Łódź, Poznań and the Gdańsk agglomeration. For instance, according to police estimates in 1961 about 80,000 people registered for permanent stay in places around Warsaw were actually working and living in the city itself. If this estimate is correct, then a large proportion of village-to-village migration shifts should be taken into account in analyses of the effect of migration on urban growth and on urbanization processes in suburban areas. Migrants participating in types 2 and 3 of migration may eventually reconsider their original decisions and either change them or else to settle permanently in *C*. Such changes of destination of migration are, however, unlikely to become very frequent, especially as on the whole it is not a small town but a big urban centre or agglomeration that is the final destination. This finds an indirect confirmation in the above-mentioned balances of inter-town migration which show that every size group of towns has an adverse migration balance with the group of more populated towns and a positive balance with those of smaller population. As regards emigration from rural areas, the nearest town is the first intended final destination, but if it is a small centre which fails to fulfill the migrant's expectations then after some time it becomes a transitory phase on his move to some bigger town.

In addition to the phase of commuting to work, one more form of migration must be distinguished within each of the above three variants of the migrant's way to the town: migration for a temporary stay of more than 2 months which includes registrations of stay in employee hotels, boarding schools and students' hostels, but also stays in private dwellings. According to data supplied by the Central Statistical Office, in 1967 almost 700,000 persons were registered in towns for a temporary stay of more than 2 months (with 62% of the migrants permanently registered in villages), and by 1972 this number rose to 930,000 (with the proportion of migrants from villages unchanged).

The processes of urban growth depend also strongly on the migrants' demographic characteristics (age, sex), occupational status, and level of education. Long-run observations of village-to-town migration balances have shown

that about 30% of the migrants are at pre-productive age, slightly more than 60% are at productive age, and the remaining 10% at post-productive age. The distribution of the age of the migrants from rural to urban areas in 1973 is shown in Fig. 4.

As to the sex structure, the mobility of males had been observed to recede as compared to that of women till 1963. In the mid-fifties there were 114 male per hundred female migrants. Since 1964 onwards there have been more females than males among migrants: the respective proportion rose from 102 (in 1964) to 108 (in 1972) females per 100 males.

Females predominate in village-to-town migration too. At present, that is in the former half of the seventies, they account for 54% of all migrants from rural to urban areas (they claim a share of 62% in the 18-24 age group, 41% in that of 25-44, and 67% in that of 45 and more). Moreover, if we consider village-to-town migration depending on town size, women again tend to claim a slightly rising proportion of the total migration volume: from 52% in the case of the smallest towns to 56% for towns of more than 100,000 population (against 54% in 1966-70). The proportion of women in village-to-village migration is slightly smaller (51%).

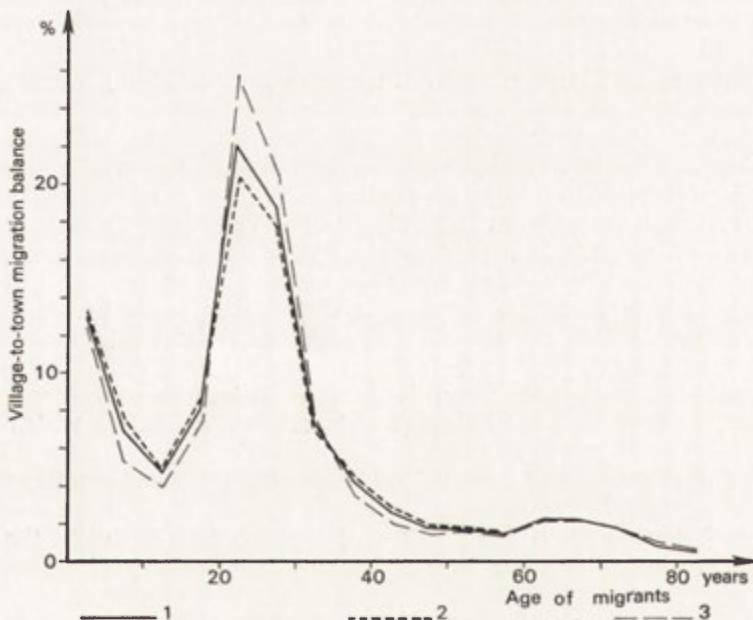


Fig. 4. Distribution of village-to-town migration volumes by the migrants' age in 1973  
Balance of migration shifts: 1 — total, 2 — intraregional, 3 — interregional

K. Dzięwoński and A. Gawryszewski (1975) suggest that this situation may be due to the male's better opportunities to get a nonagricultural job in rural areas than those offered to women. Moreover, the spatial pattern of demand for female labour is entirely different from that for men. Consequently, the migration patterns for women and men differ remarkably. Women, both those who have adequate vocational qualifications and those that have not, are mostly employed in the services sector, while men, especially if they have poor vocational qualifications, find their first jobs in construction and then switch over

to the industrial sector, especially to mining and to the heavy industries. Thus women tend to settle in the central areas of towns, especially of the bigger ones, while male migrants tend to do so on the peripheries of the bigger towns and the agglomerations and in highly developed mining and industrial districts.

On the whole it can be said that economically active persons predominate among village-to-town male migrants, while the opposite is true of the female migrants, for whom migration generally means taking the first job in life.

The published results of the National Census carried out on 8 December, 1970, suggest that the population aged 15 or more (who arrived from villages to the town of their current residence during 1961-70) were dominated by persons with elementary education (46%) and with secondary and incomplete secondary education (34%), whereas persons with higher or incomplete higher education accounted for a mere 5% of all immigrants from rural areas. The remaining 12% of migrants had an incomplete elementary education or had no school education (no data were found for 3% of the immigrants). In comparison to this, the structure of the town-to-town migration presents an interesting picture. Migrants with incomplete secondary and secondary education (44%) and elementary education (31%) constituted the biggest groups. There was a sizeable proportion of immigrants with higher and incomplete higher education (18%). Migrants with incomplete elementary education or without any education at all were a small minority (5%).

To conclude these remarks, let us turn to the spatial structures of migration and the migration-based interregional differences. At present three types of such structures can be distinguished: local, regional, and interregional. Local patterns are among the most traditional structures for they depict the historical and still extant distinction opposition between town and village. To find a job migrants tend to move to the nearest town.

Regional migration movements to bigger urban centres are more complex. They occur in one, two, or three phases. The indexes of migration flows are much higher although the area of the inflow of migrants is limited (sometimes even smaller than in the case of small towns). But such an area is itself backed with another field outside it from which people arrive to it.

Interregional migration movements occur in the rare cases when the local and regional reserves of manpower are not big enough to meet the demand for new labour. In such cases there are no distinct well-developed structures of migration that would have spatial continuity and require planning, organization and management on the part of the government. Migration patterns are reflected in specific structures in the major urban centres. Central areas and the ring of outer suburbs are easy to identify. There is a clear quantitative domination of women in central areas, and occasionally high natural increase rates are recorded in them. The outer zone is characteristically dominated by males and sometimes has lower indexes of natural increase. Migration from the outer to the inner zone occurs often in connection with marriage; this is especially characteristic of the bigger towns in the eastern regions (Białystok, Lublin).

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Forecast studies sponsored by the Central Statistical Office in collaboration with the Planning Commission at the Council of Ministers suggest that the volume of village-to-town migration will grow considerably and that natural increase in towns will decline. The expected figures are as follows (in thousands):

	Village-to-town migration	Natural increase in towns
1973-1975	614	441
1976-1980	1,190	812
1981-1985	1,250	696
1986-1990	1,250	423

Emigration from rural areas will not only neutralize the already declining natural increase in villages but also sweep away part of the economically active agricultural population. In the future, it is expected, the rural areas may no longer be capable of meeting the towns' demand for labour.

Are the above-described mechanisms of migration going to persist in the future? Plans assume that the urban-industrial agglomerations will continue to record the greatest additions of new jobs in absolute figures in the coming years, and this will make them more and more dependent on the inflow of migrants. Hence the mechanism of migration in those areas will be expected to persist: presumably all three types of migration (the one-phase migration from the nearest areas, two-phase from farther-off areas, and three-phase migration from the farthest areas) will continue. One-phase migration of qualified personnel from agglomeration to agglomeration will go on uninterruptedly. In a more distant future, owing to the gradual improvement of the housing situation the volumes of two- and three-phase migration are expected to decline. This in particular may be connected with the declining rate of commuting to work by people having two occupations — the group termed "peasant-workers" in Poland. The ageing of individual farmers may considerably speed up these processes.

Whether or not the mechanisms of migration to medium-sized and especially small towns will persist depends on the functions those towns fulfill now and are planned to fulfill in the future. Their growth and migration to the smallest towns are largely dependent on the development and progress in the organization of small settlement groupings which combine agricultural settling with small towns and on their integration and concentration. These processes are strongly associated with the development of socialist economic relations in agriculture.

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## THE OBJECTIVES OF AN INTEGRATED DEVELOPMENT OF A SYSTEM OF HUMAN SETTLEMENTS IN THE USSR

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The development of human settlements in the USSR with regard to size, position in the system of settlements, type of economic activity and territorial expansion is effected on the basis of a vast body of research, including generalizations of theoretical studies in the field of regional economics, town planning, and economic geography, and including also statistical data, special computations, and results of analytical research into alternative settlement patterns in the future. Special attention is devoted to the attainment of unity and interdependence between the development of settlements and that of the national economy as a whole as well as to the attainment of balance between social, economic, and town planning aspects of settlement.

The integrated approach to the solution of the proposed questions is called for by the need to take account of the multi-faceted impact that the various directions of national economic development may exert upon the patterns of settlement and, at the same time, to provide for the possibility to use new forms of settlements as a lever in actively influencing the industrial location. This enhances the importance of various inter-industry alternatives of growth in making decisions regarding the location of productive forces over the territory of the country. Such an approach should allow to avoid many undesirable economic, socio-demographic, and ecological consequences that may necessarily follow in its absence or in those cases where the development of production and settlement is not sufficiently interdependent.

The realization of the integrated approach is connected with the employment of the systems approach which implies the following main stages in solving the problems of settlement: (1) determination of the major objectives sought in improving and transforming the settlement systems; (2) analysis of the main factors which will govern the development of a system of human settlements for a long term; (3) formulation of main recommendations and complex programs for solving the chief problems of settlement; (4) identification of factors and conditions bearing upon the realization of the recommendations and the complex programs and representing them in the form of a system of measures in the economic, social and organizational fields.

### OBJECTIVES OF THE INTEGRATED DEVELOPMENT OF A HUMAN SETTLEMENTS NETWORK

dations and the complex programs and representing them in the form of a system of measures in the economic, social and organizational fields.

The first one consists in creating an urban milieu which would promote an all-round development of human personality, the maximum satisfaction of material and cultural requirements of the population as the highest goal of social production under socialism and also in creating objective pre-requisites for overcoming the essential differences between town and country through the formation of a single system of settlements.

What is necessary for the attainment of this objective is to provide for the population, both urban and rural, living in different natural-climatic conditions and in localities of various size, equally favourable conditions with respect to both the choice of occupation, and the provision of cultural and welfare facilities and communal services as well as recreation facilities and those for use in leisure time; to provide for such location of industrial construction and that of housing and community facilities as would preserve and effectively utilize the interests of man's natural environment and, in particular, landscapes of unique value; to provide for the rational utilization of the existing stock of housing and civic buildings and for a gradual improvement in the level of amenities in smaller-size localities.

The second objective lies in the formation of town-creating factors which would promote a further rational location of productive forces with a view to constantly increasing the effectiveness of social production on the basis of the maximum utilization of the achievements of science and technology.

It should be noted here that the formation of a system of human settlements has a pronounced effect in the following respect: it increases the concentration and specialization of production and improves its management as a result of the attendant formation of the production-territorial complexes and production combines; promotes a better supply of labour resources; promotes localization of labour in newly developed areas; ensures full employment of the entire population in the productive age and a more equitable location of productive forces which should achieve equalization of the levels of the socio-economic development of various regions, preserve valuable tracts of agricultural land, utilize rationally natural and mineral resources, especially fuel and energy resources, as well as the infrastructure in the production, engineering and transport fields and also the construction base.

#### FACTORS OF DECISIVE IMPORTANCE IN THE DEVELOPMENT OF HUMAN SETTLEMENTS

The determination of the main directions in the development of a system of human settlements is based on the analysis of factors which play a crucial role in the formation of such system. This should be the analysis of not only the preceding stage of development, especially of changes in the number and size of, and in the type of activity in, towns and urban and rural settlements and of changes in the formation of urban agglomerations but also of those trends of national economic growth which, while connected with the new scale of national economic development, the technological and scientific revolution and the intensification of the economy, actively influence settlement patterns.

In the period between the All-Union Censuses of Population in 1959 and 1970, the policy of locating productive forces on a planned basis achieved a relatively balanced development of settlement networks in the USSR. There was also achieved some restriction of growth of the largest cities. There was

created a network of urban nuclei-cities with population of over 100,000 inhabitants (their number increased from 158 in 1959 to 221 in 1970 and to 238 in 1974). A fresh impetus for development was given to a large number of small-sized and medium-sized towns which already possessed the necessary economic and town-creating pre-requisites. Of the total increase of urban population, 31 per cent fell to the share of large-sized towns and cities (with population of between 100,000 and 500,000), 30 per cent — to the share of small-sized and medium-sized towns (with population of between 20,000 and 100,000), 24 per cent — to the share of the largest cities (with over 500,000 inhabitants) and 15 per cent — to the share of small-sized urban settlements (with less than 20,000 inhabitants). The share of urban population increased in the country from 48 to 56 per cent, while that of rural population dropped from 52 to 44 per cent. As a result of this development, the Soviet Union has become intensely urbanized, with a high degree of concentration of urban population. As of the beginning of 1974, the urban population made up 60 per cent of the total population of the country of which 34 per cent resided in cities with over 100,000 inhabitants.

It should be noted here that the preceding stage of development of the network of human settlements exhibited certain negative phenomena which, in the future, are yet to be overcome.

There still persists an excessively high rate of growth of some of the largest cities. Out of the total increase of the urban population in the country of the order of 30.4 million in the 1959–1970 period (according to the 1959 census), 25 such cities accounted for 7.4 million while new urban settlements for 5.6 million. This raises certain complications in solving town planning problems in such largest cities and hinders the establishment of new centres of settlement and location of productive forces.

There has taken place an excessive expansion of the network of small-sized urban settlements where it is difficult and, in practical terms, almost impossible to provide a high level of amenities and cultural and welfare services for the population. In the 1959–1970 period, the number of such urban settlements increased by 650.

The process of enlarging rural localities goes on at a low rate. Though their number has fallen from 704 to 469 thousand 75 per cent of them are too small to make it economically feasible to adopt measures aimed at considerably raising their level of amenities.

There are still many shortcomings in the development of urban agglomerations. 68 large urban agglomerations which contain 45 per cent of the urban population of the country exhibit growing imbalances in the pattern of living places and work-places, a growing scale of irrational commuting and also the process of building up valuable natural landscapes despite the fact that, on the whole, the suburban territories are not used effectively. The low degree of concentration of urban population in the peripheral zones of large urban agglomerations which stood at the level of 13.6 per cent in 1959 and remained at the same level in 1970 leads to an under-utilization of the socio-economic potential of large-sized and the largest cities — centres of agglomerations, and does not contribute at all to restricting their excessive growth.

There still persist regional imbalances with regard to the development of urban settlement patterns, which slows down the process of equalization of the levels of the socio-economic development of individual areas of the country. Thus, the lowest deviations from the all-Union proportions of the urban population as exhibited by regions and large cities in 1959 and 1970 were, in respect of

the former, 26 and 24 per cent and, in respect of the latter, 16 and 16 per cent, which goes to show that the level of the deviations, for the period in question, has, practically, remained unchanged.

The towns in the newly developed areas, in the Siberia, Kazakhstan, the North and the Far East are lagging behind in their socio-economic development, which results in an irrational inter-regional migration.

Territorially, human settlements show, to a considerable extent, an extensive growth. Urban land is utilized for urban purposes proper only to the extent of no more than 50 per cent while the towns expand annually by one third at the expense of agricultural land.

The majority of the shortcomings mentioned above has been an objective result of the accelerated tempo of the economic growth and also of the structural shifts in the field of material production which take place so rapidly that town planning finds itself unable to react properly to them. Some of the negative phenomena are caused by shortcomings in planning and designing human settlements and, more importantly, by the absence of an integrated approach to the solution of questions pertaining to their development.

The study of national economic trends called forth, in particular, by the technological and scientific revolution and the intensification of the economy, from the point of view of their possible impact on the settlement patterns indicates that in the future the inter-relationships between the various forms of organization of settlements and production should grow as should the role of socio-economic factors in the development and location of the productive forces.

One should note the existence of a close relationship between the size structure of the networks of human settlements and the territorial-industrial structure of production. The conclusion to this effect has been made on the basis of

TABLE 1. The distribution of the labour force employed in various industries among towns of various size (in the Russian Federation)

Industries	Distribution, in per cent, of the industrial labour force among towns of various size (in ,000)							total
	under 20	20-50	50-100	100-250	250-500	500-1,000	over 1,000	
Energy	5.7	16.6	11.7	24.8	17.1	14.3	9.8	100
Extractive	6.9	25.2	28.0	19.6	12.0	8.2	0.1	100
Ferrous and non-ferrous metallurgy	3.4	11.0	12.3	20.6	11.4	21.0	20.3	100
Machine-building and metal processing	1.9	6.5	7.8	18.0	18.5	16.2	31.0	100
Chemical, oil and gas	1.6	7.5	9.1	26.7	15.5	25.7	13.9	100
Forest, wood-working, pulp and paper	19.9	22.3	8.8	13.6	12.8	10.2	13.0	100
Building materials	5.7	14.2	15.4	18.6	16.9	12.8	16.4	100
Light	7.8	16.7	18.9	13.7	13.5	8.5	20.9	100
Food	9.4	17.9	8.8	15.6	21.9	8.9	17.5	100

data pertaining to the structure of employment of the industrial labour force in 675 cities of various size in the Russian Federation.

As is evident from Table 1, the extractive industry and the "primary" branches of the manufacturing industry (forest, light) gravitate towards cities with population of less than 100,000 inhabitants while the "final demand" branches of the manufacturing industry, especially machine-building and metal-processing predominate in large-sized and the largest cities.

The objective trend towards a lower increment in the supply of labour resources points to the need to sharply improve the quality of substantiation of proposals regarding the distribution of the increase of the total population by the settlements of various size. Small-sized and medium-sized towns and urban settlements which are located autonomously and have a poorly developed social, scientific and educational infrastructures can, in fact, no longer meet the requirements imposed by the imperatives of location of modern production. But new projects of national economic importance can be located in the old established largest cities only to a very limited extent because of the increasing restrictions, territorial, economic and demographic, put in the way of growth of such cities.

In the future, both production and social factors will be of decisive importance in developing a system of human settlements. The modern production which becomes increasingly "science-intensive" and shows a trend towards concentration provides the objective stimuli for enlarging the forms of urban settlement. The requirements of a higher concentration of agricultural production which takes on increasingly the agro-industrial aspect sped up the process of enlargement of rural settlements. The growing social requirements of the population call for a radical improvement in the quality of urban milieu and, above all, in the level of amenities and in the provision of cultural and welfare services in the small-sized and medium-sized towns and also rural settlements. A task of special importance is to satisfy the social requirements of the population in the newly developed industrial and agricultural areas as an important condition for localization of the labour force.

The long-established, predominantly autonomous network of human settlements where town-planning problems and those of production are solved separately for each settlement significantly limits the possibilities for raising the economic and social effectiveness of the modern settlement patterns.

#### THE MAIN RECOMMENDATIONS FOR, AND PROGRAMS OF AN INTEGRATED DEVELOPMENT OF A SYSTEM OF HUMAN SETTLEMENTS

The requirements of a planned regulation and a qualitative improvement of a system of human settlements call, in the prospect, for a transition from the autonomous to an interdependent development of both town and urban settlements. This approach should activate the positive trends in the field of settlement and overcome those which are negative and facilitate the realization of a comprehensive program of integrated development of a system of human settlements.

What is most important in this respect is to pool on a planned basis settlements of various sizes and engaged in different activities into group systems of human settlements. Thus, the emphasis in solving settlement problems is shifted from the level of autonomous towns to that of regions. The primary significance is assumed in this process by the following problems: the identification

and systematization of the entire complex of relationships common to all human settlements of a sufficiently large region or of the country as a whole, including those relating to production, production and social infrastructure and population; identification of regularities characteristic of the formation of a territorial structure of a system of human settlements and of the ways of regulating its development with the aid of economic and town planning methods; forecasting the prospects of development of human settlements of various size and engaged in different activities with due consideration given to the general trends of the social and technological and scientific progress and to the influence of local conditions.

The principle of interdependent development of a system of human settlements, based on the unity of planning, designing and control, can be realized at various levels: the country as a whole, economic regions and Union Republics, administrative regions and districts, provided they approximate the prospective zones of influence of large-sized towns and cities and, to a certain extent, of medium-sized towns.

A single national economic complex of the USSR will have its counterpart in a single all-Union system of human settlements which will reflect inter-regional proportions of population and be based on centres of regional systems. This all-Union system of human settlements is to be based in the sphere of production on the constantly growing specialization and industrial co-operation; in the sphere of infrastructure, on a system of inter-regional high-speed arteries for transportation; in the sphere of interdependent settlement, on a growth of socio-cultural mobility of the population to be realized as more and more free time will be available to the working people and their material well-being will increase.

Regional systems of human settlements are formed on the basis of economic complexes of Union Republics and large economic regions of the country. For example, the functioning of the regional system of human settlements in the Central Economic Region is related to a task of crucial importance for this region — that of restricting the growth of the capital of the USSR, Moscow. The zone of influence of Moscow alone which, in the main, coincides with the boundaries of the Moscow Region, offers a scope too narrow for solving this task.

It would seem reasonable to form at the distance of 150 to 500 km from Moscow plan-regulated group systems of human settlements within the zones of influence of all the eleven centres of modern regions contiguous with Moscow. These could act as a sort of "counter-balances" to Moscow for they will represent new concentrations of workplaces and population, the latter gravitating to Moscow by virtue of their location.

The group systems of human settlements identified within the regional systems can, in their turn, be differentiated depending on size and level of development.

The group systems of human settlements represent the main link in the prospective development of a system of human settlements of the entire country. They will consist of groups of urban and rural settlements of various sizes and types of activity and will complement each other in the socio-economic and cultural respects. Their territorial base will be represented by zones located within a two-hour journey from the parent city and within which there are to be developed territorial-production, specialized labour and socio-cultural ties, the general transport and engineering infrastructure, and a single system of social centres for provision of cultural and welfare services and also places for recreation.

The formation of plan-regulated group systems of human settlements represents a national economic task of great importance whose solution is intended to ensure a complex territorial organization and a balanced development of production and settlement; to increase the level of concentration of production and, at the same time, to avoid an excessive concentration of enterprises in the largest cities and building up of valuable agricultural land; to encourage, as a measure aimed at the restriction of the growth of the largest centres, the establishment in small-sized and medium-sized towns which are part of the given system, of branches of those enterprises, scientific-and-production institutions and educational establishments which are located in the largest cities in question; to improve the demographic structure of the population in the largest cities through the creation of the conditions for their freer redistribution within the given system; to increase the effectiveness of utilization of the capital-intensive transport, engineering and socio-cultural infrastructure through its greater concentration and a considerable enlargement; to increase the spectrum of choice with regard to places of work, places for spending leisure time, and places for recreation by maintaining, to a reasonable extent, the inter-locality labour and socio-cultural mobility of the population; to ensure for the population of small-sized settlements wider opportunities for raising their level of education and improving their qualification; to better preserve and utilize the natural environment by regulating pressures upon the landscape.

The formation of group systems of settlements facilitates the achievement of an urban milieu in each of them which is the same in quality and equally favourable for living.

The realization of the principle of the integrated development of systems of human settlements implies the formation of three types of such systems; large (mainly on the basis of the largest cities), medium (mainly on the basis of large-sized towns and cities) and small (mainly on the basis of small-sized and medium-sized towns). They are to mutually complement each other and will embrace the entire settled territory of the country.

The gradual inclusion of all urban and rural settlements into the group systems of human settlements of the above-mentioned types should gradually simplify the established multi-stage hierarchy of settlements and establish direct ties between them and the centres of the systems. The general scheme of settlement of the population over the territory of the USSR provides for the formation within the target period of 60 to 65 large, up to 200 medium and about 350 small group systems of human settlements.

Priority is given to the formation of large group systems mainly on the basis of growth of towns and settlements in the peripheral zone of the parent city and of extending the boundaries of modern agglomerations. This should make wide use of the socio-economic potential of the centre-cities. At the same time, the zonal principle of development should make it possible to ensure within the target period the restriction of growth of the parent cities in absolute terms, on the average, by 15 per cent as against the rates of growth which were observed in the 1959-1970 period.

The creation of large group systems of settlements makes it easier to replace the traditional compact form of town development with the regional form in which case the advantages offered by the largest city begin to operate on the regional scale and those shortcomings of the given form of settlement which are connected with physical planning and ecology are neutralized and overcome within the same region.

Medium and small group systems should be formed in those areas which, within the target period, will remain outside the boundaries of large group systems of human settlements.

The fact that large group systems are able to provide the widest diversity of workplaces and services makes it expedient to expand their territory. This progressive process can be realized in two ways.

One of them consists in building up the industrial, scientific and socio-cultural potential of the parent cities of medium and small groups systems as a pre-requisite for forming large systems on this basis. This is the way of development in time.

The other way is based on the development of the transport infrastructure of large group systems, which should lead to the inclusion within their boundaries of the contiguous medium and small systems. This is the way of development in space.

The formation of medium and small group systems of human settlements should proceed both on the basis of growth of the parent cities when they perform the function of nucleus cities and through improving the transportation links between the settlements that are to be included in the given system. Pre-dominance in the development of medium and small systems will be given to the nucleus approach. The establishment and development of group systems is viewed as a dynamic process in the course of which some of them become more important while others lose their status of independent entities and become subsystems of larger and territorially expanding systems.

The group systems are to become the predominant form of settlement in the main populated area of the USSR.

As for the North Zone of the country, the scheme applied there should be different for the specific conditions of development of this zone require a three-tier structure of the network of human settlements which is to include large nucleus cities, small-sized towns with a high level of amenities and mobile complexes at the sites of mineral deposits whose conditions allow them to be worked only for a short term. The elements of such a structure should possess a greater degree of autonomy, compared to those in the more populated part of the country. The above-mentioned structure provides better conditions for improving the quality of urban milieu in the North Zone and corresponds to

TABLE 2. An approximate estimate of the distribution of the population of the USSR among the group systems of human settlements

Group systems	Proportion of population, in per cent	
	1975	target
Large	41	47
Medium	31	27
Small	24	21
Outside the group systems	4	5
Total for the USSR	100	100

*Note:* Figures for the year 1975 refer to the totality of those urban and rural settlements which, during the target period, may be included into group systems of human settlements.

TABLE 3. An approximate estimate of the distribution of the population of the USSR, with due consideration given to the zonal and nucleus approaches in the development of group systems

Group systems and population	Proportion of population, in per cent					
	1975			target		
	Total for group systems	of which		Total for group systems	of which	
	in centre-cities	in other settlements		in centre-cities	in other settlements	
Large						
total	100	51	49	100	45	55
of which:						
urban	88	—	—	90	—	—
rural	12	—	—	10	—	—
Medium						
total	100	34	66	100	51	49
of which:						
urban	53	—	—	59	—	—
rural	47	—	—	41	—	—
Small						
total	100	15	85	100	25	75
of which:						
urban	26	—	—	33	—	—
rural	74	—	—	67	—	—
Outside the systems, total	100	—	100	100	—	100
of which:						
urban	70	—	—	87	—	—
rural	30	—	—	13	—	—
Total for the USSR	100	35	65	100	40	60
of which:						
urban	61	—	—	70	—	—
rural	39	—	—	30	—	—

a greater extent to the specific conditions of production in this area and the latter's natural environment. A transition to the formation of group systems in the North Zone which will be based on large nucleus cities may become feasible only in a distant future when it will be possible to solve the transport problem on a radically new technological basis.

The quality of rural milieu is to be improved through the formation of a network of enlarged rural settlements with a high level of amenities for which the provision has been made in the Program of a Further Development of Agriculture in the Non-Black Earth Zone of the RSFSR adopted for a fifteen-year period in the year 1974. Such enlarged rural settlements will be gradually included into the group systems of all types.

Computations of a possible scale of interdependent settlement to be achieved in the future within the framework of the group systems of human settlements are presented in Tables 2 and 3.

The development of the system of human settlements will result in a growing proportion of the country's population living in large group systems within the zones of influence of centres possessing the highest socio-economic potential. At the same time, there will take place a lowering of concentration of population in the centre-cities of large group systems (from 51 to 45 per cent).

The nucleus approach will predominate in medium group systems; the proportion of population living in the centre-cities or nucleus cities of these systems may increase from 34 to 51 per cent.

A point should be made of the fact that the formation of the group systems will allow an overwhelming majority of the rural population to live in surroundings which will be, qualitatively considerably improved.

#### THE CONDITIONS FOR REALIZATION OF THE PROGRAM OF AN INTEGRATED DEVELOPMENT OF A SYSTEM OF HUMAN SETTLEMENTS

An integrated development of a system of human settlements and the formation of the group systems cannot be possible unless there are certain conditions necessary for realization of the above-mentioned program. This is connected with the need to take account of the socio-economic, demographic, technical-scientific and ecological processes which defy an exact quantitative forecasting. What is necessary are special measures taken to ensure the formation of settlement systems in case some of the decisive factors of their development undergo a change. The possibility of variation between the real processes and those forecast will be less in case of the availability of necessary resources and the adoption of a system of measures elaborated with a view to decreasing the negative consequences of such variation. Such measures are aimed, in the first place, at actively restricting the growth of the largest cities, preventing the dispersal of urban settlement, accelerating the process of enlargement of rural settlements, overcoming regional imbalances in the development of human settlements and encouraging the growth of towns in newly developed areas.

The national economic planning, schemes of development and location of productive forces, settlement schemes, physical plans, realization designs and projects should contain provisions with regard to the following: the creation of conditions necessary to effect the transition from the autonomous to the inter-related development of human settlements with due consideration given to the definite directions regarding the location of productive forces and the elaboration of industrial development plans, which should help overcome the narrow departmental approach and prevent an excessive concentration of production in certain areas and towns of the country; the formulation of itemized lists of enterprises with a view to their location predominantly in the towns lying in the peripheral areas of large group systems as well as in the centre-cities and subcentres of medium and small group systems; an accelerated development of a single transport infrastructure for the group systems as a most important condition for forming and functioning of the latter; the encouragement of the creation in the peripheral zone of large and medium group systems of branches of large-scale enterprises located in the old established cities and also of shifting away into this zone of town-creating factors from such cities; an accelerated reconstruction and modernization of industrial enterprises and reduction in the number of workplaces; an accelerated rate of development of

the social, especially scientific-educational, infrastructure in the centres of group systems of human settlements in newly developed areas; the creation of a centralized construction base in the group systems of human settlements.

The inner conditions for realization of the program of the formation of a single all-Union settlement system and for the transition from the autonomous to an inter-related development of human settlements consist in a timely elaboration of scientific and design proposals regarding the formation of group systems in the first place, on the basis of the established agglomerations and new production-territorial complexes.

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## URBAN SYSTEM OF POLAND: ITS DEVELOPMENT AND FUNCTIONAL ORGANIZATION

MAREK JERCZYNSKI

### SIZE STRUCTURE AND DEVELOPMENT OF THE COMPONENTS OF THE NATIONAL URBAN SYSTEM

In 1973 Poland's urban network was composed of 836 units which, in this preliminary phase of the analysis, can be treated as formal components of the system. The statistical distribution of those components according to the rank-size rule for 1950, 1960, 1970, and 1973, indicates high regularity (the polycentric character of the settlement network) and significant time-stability (Fig. 1). One significant property of the system of towns is not only the relatively uniform development of the whole but also the concurrently rising level of internal organization. This is seen in the increasingly regular course of the successive distribution curves (starting with that for 1950) each of which illustrates the state of the system at a definite moment.

The fact that the curve for 1950 is most disturbed seems to be due not only to traces of the wartime losses in urban population but also to the occurrence in the newly developing system (established after the formation of new state boundaries) of urban settlements that had previously not belonged to it. The processes of adaptation and subsequently of rapid growth stimulated mainly by the quick-paced industrial development in the ensuing years raise the degree of organization (ordering). The corresponding "smoothing" of the distributions in the curves for the later years is fairly conspicuous, especially in the upper segments of the curves. Warsaw is a special case here: having lost its capital-city function due to the nearly total destruction during the war the city regained its leading rank and restored the status of which it had been deprived.

The change from a formal pattern of administrative units to networks that are: (a) aggregations of towns and urban settlements (units with common administrative boundaries) as well as towns situated outside such aggregations, (b) urban agglomerations and towns outside them, seems to disclose a higher degree of ordering and concentration for the distributions found for these latter aggregations (Fig. 2). Should this conjecture find its final confirmation, this would also imply — though in a different form — that towns within administrative boundaries especially the largest cities, do not coincide with the actual functional-spatial structures. This might, moreover, vindicate the hypothesis that the efficiency of the organization of the system as a whole is higher in the case of functional components. But the answer to whether or not that is really so was suspended until after completing the statistical analysis.

The otherwise uniform distribution of town sizes in the system shows a considerable break about the 5,000 population limit (considering the ordering of urban agglomerations and of towns outside their boundaries, Fig. 2). It is also below that value (especially from 1960 onwards) that the most significant changes in distribution between the individual periods of time take place. Hence it follows that this category of units is very unstable as functional components of the system. Formally, this is reflected in the loss of urban status by many of them or in that some are incorporated into big agglomerations or to major towns and neighbouring communities.

Because some of the smaller towns with positive absolute increases climb up the ladder of ranks and in consequence of administrative alterations, the overall number of this class of units and their share in the system decline. Although the size of the smallest town grows, the difference between the smallest and largest components of the system gradually grows too.

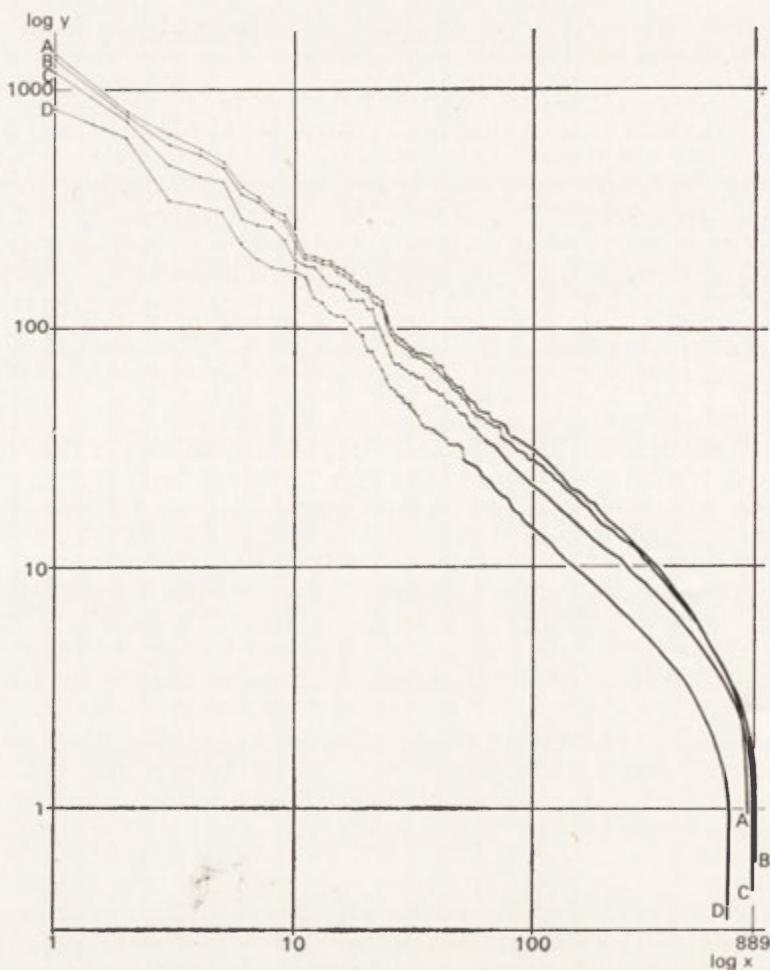


Fig. 1. Statistical distribution of cities and towns by rank and size in 1950, 1960, 1970, 1973 (cities and towns within the administrative boundaries)

x — rank, y — size (inhabitants in thousands), A — 1973, B — 1970, C — 1960, D — 1950

The regularity of distribution of size and rank and the shift in distribution over a unit of time may be used to identify the basic trends in the development of the national system of towns. A comparative analysis carried out showed that:

(a) curve shifts for the ten-year period between 1950 and 1960 were greater than for 1960-70 (a lower rate of urban growth in the latter decade),

(b) the shift over 1960-70 was more regular than the preceding one (the rate of urban growth for units of different size was more regular), though it had a slightly smaller deviation in the upper segment of the distribution (a rel-

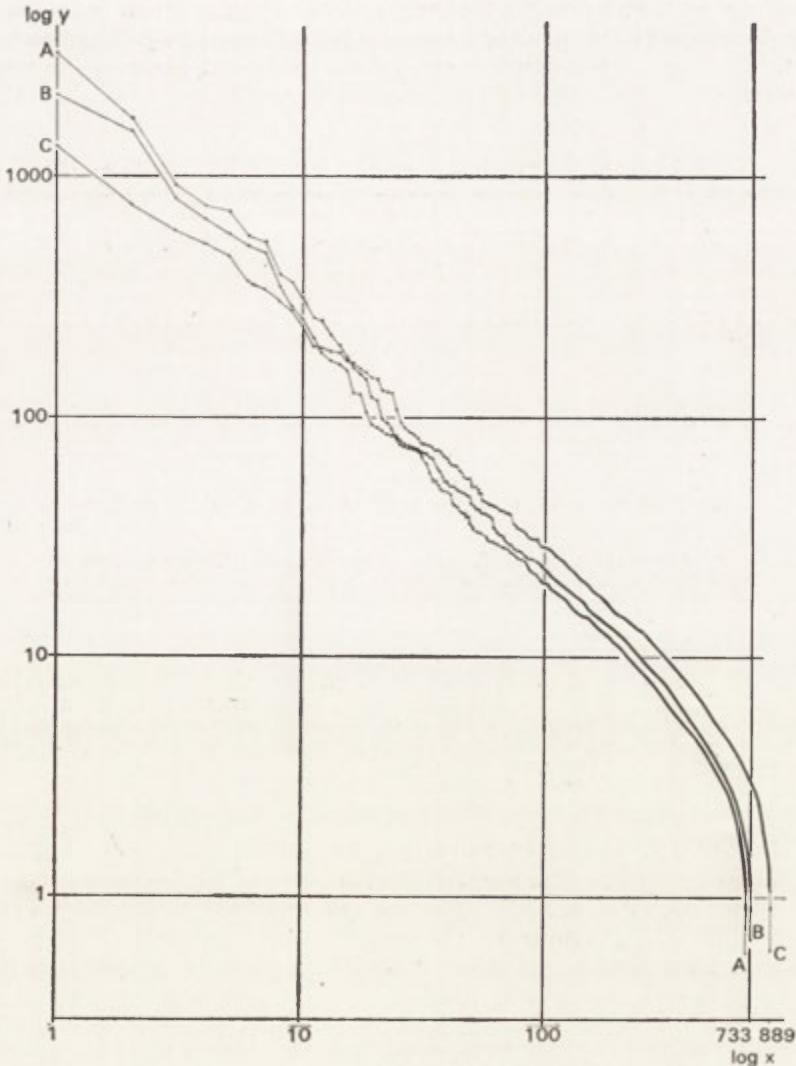


Fig. 2. Statistical distribution of urban units in 1970 by rank and size in different spatial aggregations

x — rank, y — size (inhabitants in thousands), A — metropolitan areas and other towns and cities, B — complexes of cities and towns and other towns and cities, C — cities and towns within administrative boundaries

ative decline in the growth rate of the largest cities) and a more pronounced fall in the lower segment of the distribution for 1973 (the liquidation of a number of towns and urban settlements by their incorporation into neighbouring agglomerations).

The above trends are illustrated in Table 1 (homogeneous set of towns, division into size classes for 1960). From Table 1 it follows that whereas in 1950–60 the highest growth rates were recorded for towns of 20–100 thousand of population, and while the growth rates of the largest cities and those for the smallest towns were much the same, in 1960–70 the highest growth rates were recorded for small towns up to 20,000 population, the growth dynamics of medium-sized towns (20–100 thousand) did not differ much and the growth rates for the largest cities declined considerably. It must be pointed out, though, that in this case, too, the calculations relate to formal rather than functional urban units.

TABLE 1. Growth of urban population in 1950–1960 and 1960–1970

Size of towns (in ,000)	Increase of urban population (in %)	
	1950–1960* (1950 = 100%)	1960–1970** (1960 = 100%)
Below 20	136	123
20–100	146	122
Over 100	134	117
Poland	137	120

\* Settlements having the rank of the town in 1950–1960 were included in the analysis.

\*\* Settlements having the rank of the town in 1970 were included in the analysis. Division of cities and towns by size in 1960 was taken as a base of reference for the comparative analysis of urban growth.

Sources: for 1950–1960 estimates made by B. Welpa, in: K. Dziewoński (1962). For 1960–1970 author's estimations on the base: *Struktura demograficzna i zawodowa ludności. Gospodarstwa domowe. Tom Polska. NSP 8 XII 1970. Wyniki ostateczne* (Demographic and Occupational Structure of Population. Households, Vol. Poland, National Population Census, 8 Dec. 1970, Final Results), GUS 1972.

The observed regularity of behaviour of the national system of towns in the development process (the similarity of distributions) produces the problem whether or not the relative stability of the system of towns as a whole is matched by a stabilized behaviour of its individual components. This problem is illustrated in Figs. 3 and 4 which show shifts in rank of urban units (by their population number) over the studied period. For comparison they are represented in two bases of reference. In the first case 50 of the largest units in the administrative boundaries for 1950, 1960, and 1970 were included in the analysis (Fig. 3). The second case includes 60 units composed of aggregations of towns and urban settlements as well as of towns outside them over the period of 1960–70 (Fig. 4).

Both distributions disclose significant shifts of individual components in different directions and of different intensity (growth, decline, stability, inclu-

sion of new components into the "system" or their exclusion). The movements of the individual components account for the system's dynamic equilibrium though the impulses from outside affect the components with various intensities. One result of these is that the individual distributions are definitely irregular.

The picture of shifts in rank by the individual components shows stability in the upper part of the distribution (for the largest cities) and remarkable fluctuation in the lower part (the smallest towns). A more clear-cut foundation for analysis is furnished by the shifts of units that belong to urban aggregations. Those exceeding the 200,000 population limit appeared to be stable and showed little change in size rank (the one exception in this case was the city Wrocław which in the period of 1960-70 outpaced Poznań). Upward shifts in the hierarchy were primarily recorded for the cities that are voivodship centres (this reflects the impact of the system's environment, in this case of a definite socio-economic policy giving priority to a rapid development of those centres), and medium-sized and smaller towns owing their advance to the dynamic development of industry (mainly on the basis of natural resources).

The instability of the position (rank) of individual towns and the "closed" character of the upper part of the distribution seems to indicate that the phenomenon of the system's equilibrium is a result of a stochastic process. Because of the complexity of this process and as no definitive calculations are available,

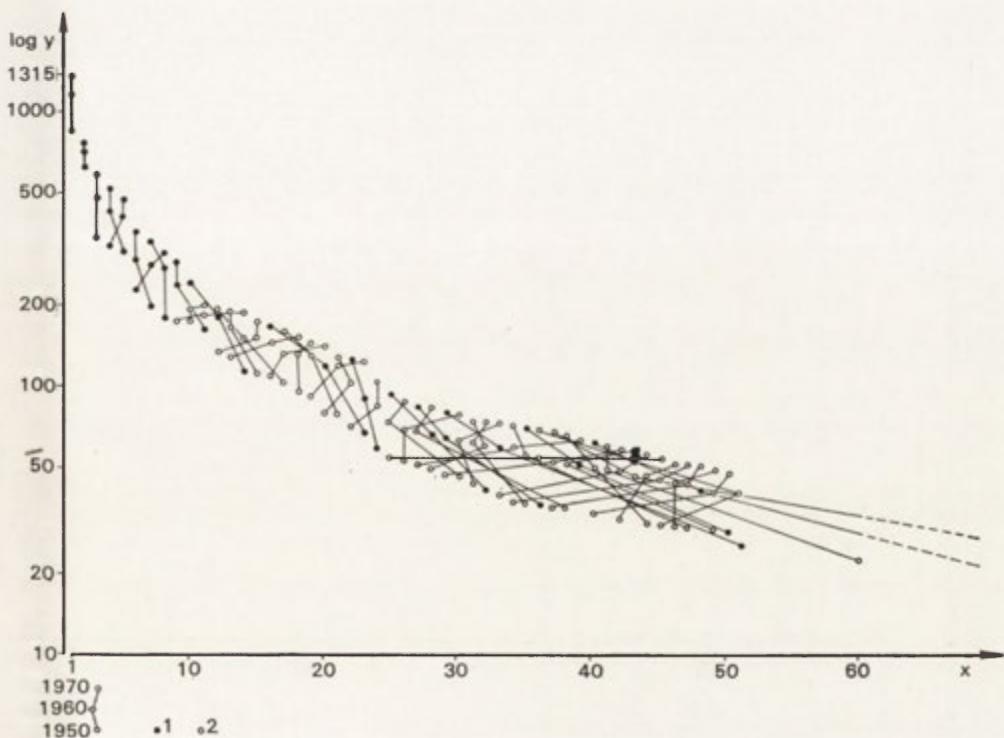


Fig. 3. Shifts in rank of 50 largest cities in years 1950, 1960, 1970 (cities within administrative boundaries)

x — rank, y — size (inhabitants in thousands), 1 — voivodship cities, 2 — other cities

any more penetrating analysis is impossible at this place. It is undisputable though, that the behaviour of the system of towns cannot be described except in terms of likelihood. Although we regard the development of the system in its whole as a purposeful process, the position of individual components in time is not ultimately fixed. The likelihood for any change (a shift in hierarchy) to occur is higher in smaller than in larger urban units.

The growth of urban population is more and more often a product of exogenous factors. Migration-caused urban increase accounted for no more than 30% of the actual increase in urban population in 1951-70 (43% natural increase and 27% population increase resulting from administrative changes), but since 1967 onwards this factor has been steadily gaining at the expense of the two others. In 1970-73, migration accounted for 60% and natural increase for 40% of the absolute population increase in towns. These proportions varied depending on the size of towns. In 1966-72, towns of more than 100,000 population absorbed more than 42% of the total migration-caused increase in urban population. In this class size migration-caused population increase was twice as large as that due to natural factors (in 1966-71, 65% of the total population increase in those towns was due to immigration, and 34% to natural increase).

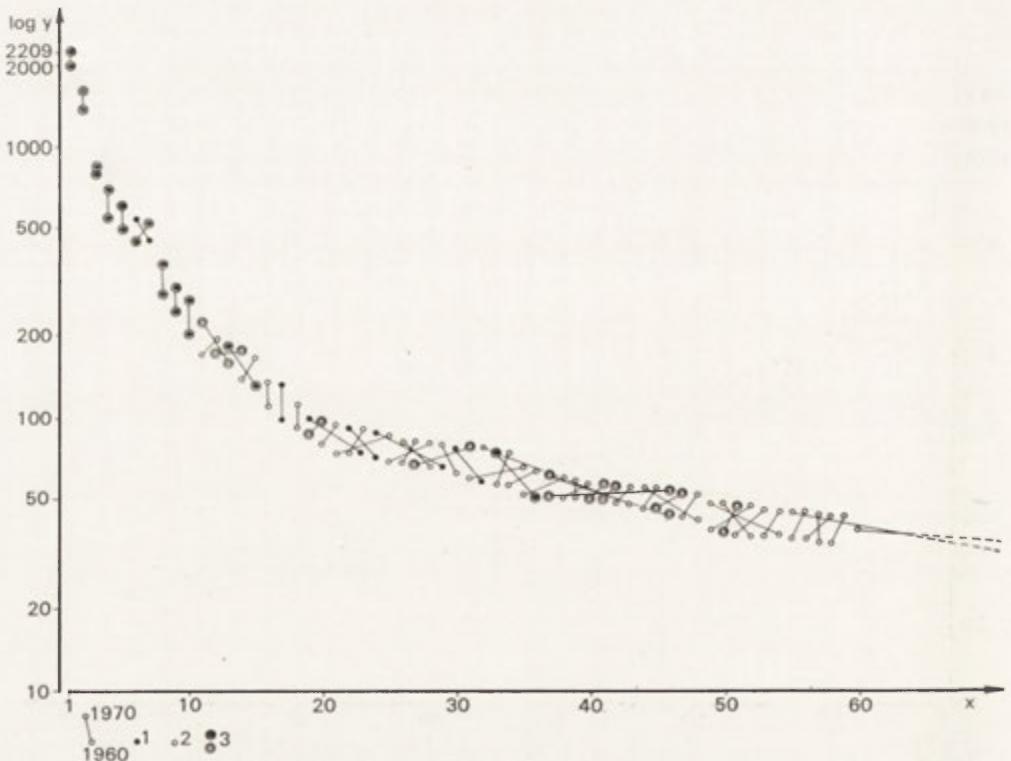


Fig. 4. Shifts in rank of 60 largest functional complexes of cities and towns and other urban units in years 1960 and 1970

x — rank, y — size (inhabitants in thousands), 1 — voivodship cities, 2 — other cities, 3 — functional complexes of cities and towns

## THE SPATIAL STRUCTURE OF THE NATIONAL URBAN SYSTEM (OF THE SETTLEMENT SYSTEM)

The disclosed trends in the growth rates of urban population find their reflection in certain transformations of the spatial structure of the settlement system. Of essential significance here is the observation that the spatial concentration of urban population grew significantly during the period of 1950-60, whereas in 1960-70 a slight deconcentration was observed (A. Muszyńska, 1973).

A more penetrating analysis of changes in the spatial concentration of the total population basing on a lattice of squares of 100 km<sup>2</sup> area each casts additional light on the character of those changes. The process of spatial concentration of population turns out to have taken place in both of the two decades, though in the former it was much more pronounced than in the latter. The higher spatial concentration recorded for 1970 than for 1960 was primarily due to population concentrating more strongly in the smaller and medium-sized settlement units (higher growth rates); the curve for the largest population aggregations in 1970 for the first time disclosed some traces of spatial deconcentration.

The above results vindicate the view that the spatial structure of the settlement system developed basically in a steady nation-wide process of spatial concentration and, in the largest urban agglomerations, in one of spatial deconcentration which started in the decade between 1960 and 1970.

This latter trend was a resultant of many interdependent factors. These in turn derived both from the properties of the system's components themselves (the size, character and differentiation of the economic base, geographical situation) and from definite impulses from the environment. These latter included, for instance, deliberate deconcentration policies for attenuating the growth of the largest cities through certain immigration restrictions and the deglomeration of industry. The immigration restrictions reinforced the ageing of the population thus contributing to a decline in natural increase and in the rate of development. Parallel to this, urban settlements situated in the immediate vicinity of the cities comprised by the immigration restrictions but maintaining efficient traffic connections to the city cores began to show high rates of growth. The other factor, that is deglomeration policies, was partly responsible for reducing the effectiveness of urban growth stimulating mechanisms.

The spatial deconcentration of population in the largest cities was further stimulated by changes in their internal structure induced by the modernization and redevelopment of the central service and shopping centres. Population censuses in 1960 and 1970 disclosed a decline or stagnation of population in mid-city quarters but an accelerated increase in the more peripheral city districts (where most of the new housing developments are located) in such cities as Łódź, Cracow, Warsaw, and, to a lesser extent, in Poznań or Wrocław.

The evolution of the national settlement system in its spatial structure can be given a general and considerably simplified picture on maps of changes of the population potential. A model of population potential can be approached and interpreted as an indirect (as it neglects actual functional links) and highly probable measure of social interaction in space and thus a simplest indirect measure of the system's integration.

The results obtained by applying the above method are basically in accordance with what has been stated so far. Thus, whereas the twenty-year period between 1950 and 1970 was marked by a steady growth in potential, its rate

and spatial distribution in the first of the two decades differed significantly from those in the second.

Over the fifties there was a rapid growth of the potential together with a strict location in space. On a map this was shown in the form of clearly visible "peaks" in the form of concentric equipotential lines which represent the highest values of the potential corresponding to the largest urban concentrations. The definitive location of this process in space and the considerable differences in indices between the "peaks" and the areas surrounding them with uniform potential values (at a 6-degree growth scale) illustrate in another form the way in which the process of spatial concentration of population affected that distribution.<sup>1</sup>

In the next decade the potential grew at a much lower rate and was much more uniform in its spatial distribution. The differences between the "peaks" and the equalized potential values for the whole country are less pronounced (a 3-degree growth scale).<sup>2</sup>

But the above factors did not significantly affect the general picture of distribution of the population potential over the studied period. A comparison of the maps of potential for a long-run again discloses the high inertness of spatial settlement structures and the relatively time-invariant pattern of gravitations in space.

The statical picture of distribution of potential is composed of three outer concentric equipotential zones whose values grow with decreasing distance to the centre. Within the second zone, but especially within the third, there are enclaves of higher values, among them 3 of the most extensive "peaks" which correspond to the Upper-Silesian-Cracow conurbation, and to the cities of Łódź and Warsaw.

The growth and changes in time of the potential take the form of centripetally extending and spatially continuous equipotential areas; the main source of new "waves" of higher potential are the above-mentioned three largest concentrations of urban population. The evolution in space of that phenomenon is as follows:

- in the first phase, each of the above agglomerations creates three concentric mutually isolated zones whose potentials are higher than the extensive equipotential zone within which all of them are situated,

- in the second phase, together with the growth of population, these zones integrate into one spatially continuous equipotential area in the form of a broad "edge" whose overall bearing is determined by the locations of the change-generating population concentrations,

- in the third phase, that expansive equipotential area continues to spread centripetally and, while assuming an increasingly regular form, it gradually expands over the whole country.

In each phase some areas are not affected by the highest potential values (the basic pattern of gravitation forces): these are areas situated peripherally with respect to the largest population concentrations in the north-east and in the north-west as well as strips along the eastern and western borders. The only potential "peaks" in the north of the country were observed in the agglomeration along the Bay of Gdańsk (with a well-marked pattern of gravitation forces to the central and southern parts of Poland; the vertex of the "triangle

<sup>1</sup> Cf.: K. Dziewoński, P. Eberhardt, J. Gaździcki, E. Iwanicka-Lyra, J. Krolski and M. Żeniewska, The population potential of Poland between 1950 and 1970, *Geogr. Pol.* 31, 1975, p. 21 (Fig. 8d).

<sup>2</sup> Cf.: K. Dziewoński *et al.* (1975), p. 22 (Fig. 8e).

of concentration of the population potential"; the main point of "input" into the system) and, to a much lesser degree, in Szczecin (the effect of considerable distance).

The irregular course of equipotential lines, the "peaks" and "corridors" of highest population potential all together furnish a complex picture of interaction in space which is characteristic of the most mature settlement structures, especially the south of the country. These characteristics are in striking contrast to the rather uniformly low-potential character of the remaining areas.

It can be expected that the growth and distribution of the population potential corresponds actually to the higher intensity of interactions between the components of the population and to the rising internal coherence of the country's settlement system.

Viewed thus, the results of changes in the population potential in 1950-70 acquire a special meaning (Fig. 5). They indicate the process of development of "corridors" of higher potential between the largest agglomerations (most of

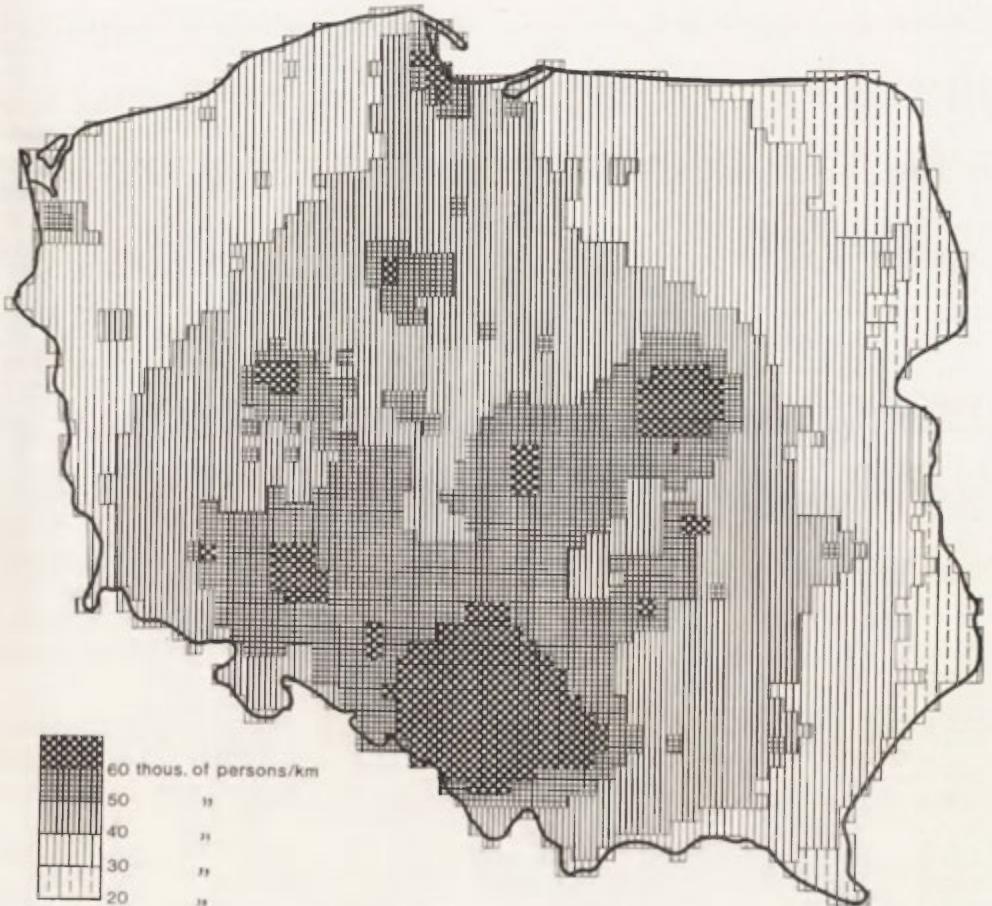


Fig. 5. Changes in the population potential between 1950 and 1970 (by squares, 100 sq. km in area) according to K. Dziewoński *et al.* (1974), p. 23.\*

\* Note: The particular graphic possibilities of the computer used here have led to a certain insignificant distortion of the shape of Poland, while preserving accurate representation of areas. This deformation is not relevant to the question at hand (Ed.).

them have their source in the Upper-Silesian-Cracow conurbation). The emergence of "corridors" of high interaction which connect the "peaks" of the urban agglomerations (whose potential exceeds those of the "strips" connecting them to one another) is perhaps an indicator of the high degree of coherence of that category of urban organisms in the settlement system (a functional subsystem) and suggests that the network of links between settlements is undergoing a process of differentiation and a new system of a higher order is emerging in its stead.

## THE FUNCTIONAL-SPATIAL ORGANIZATION OF THE NATIONAL URBAN SYSTEM

### THE FUNCTIONAL STRUCTURE OF THE COMPONENTS OF THE URBAN SYSTEM

During the past twenty years urban growth was stimulated and controlled mainly by means of economic factors. In this sense there was a close connection between economic growth and urban growth.

In 1950 to 1970 intensive industrialization was the principal driving force of urban development. This process finds its reflection in the functional characteristics of urban settlements. In 1960, nearly 60% of the 241 towns of more than 10,000 population were industrial centres (employment in industry and construction accounted for more than 50% of the total employment in urban settlements). Eighty-four of this latter group (which was composed of 140 urban units) were towns with a narrow homogeneous production profile (employment in one type of production accounted for more than 50% of total industrial employment). On the whole the smaller urban units were dominated by service activities. Of the cities of more than 100,000 population, only four seem to have been dominated by this type of economic activity (Warsaw, Szczecin, Lublin, Gdynia). The domination of the industrial sector was disclosed in all categories of town size.

During the 1960-70 decade urbanization processes were gaining in importance in shaping the functional structure of towns. The overall bearing of these changes in the employment structure can be found out from an analysis of the set of 79 towns having the rank of *poviats* or voivodships all of which occupy the upper rungs on the hierarchical ladder of the settlement system.

Notwithstanding the considerable size of this class of towns, it was industry that clearly dominated the employment structure in most of them (employment in industry and construction accounted for more than 55% of total employment). Just as in the case of stability of the system of towns which was considered in terms of population growth, the general functional features of the studied set of towns (viewed as a whole) showed considerable stability over the ten-year period between 1960 and 1970 (with a growth of the services by 1.8%). But significant changes were noted for individual towns. If we consider the changes in the proportions of employment in the three main sectors of the national economy (industry with construction, material services, and non-material services), the following results are obtained. Forty-two towns recorded in that period a rise in the proportion of the services in total employment, industry grew in 23 towns, whereas 14 urban settlements disclosed no significant (less than 1%) changes.

These results as well as the data cited in earlier studies show that whereas in 1950-60 industrial production showed a higher relative rate of development,

in the next decade the service developed quicker (Table 2). This circumstance reflects the growing impact of urbanization processes on this category of urban settlements, which acquires additional significance if it is pointed out that nonmaterial services increased more quickly than material services.

All towns that were residence of voivodship authorities in the less advanced voivodships or those located peripherally with respect to the greatest concentrations of population developed differently than the above-described class of towns. From the remaining voivodship towns they clearly differ both by their higher growth rates of industry than of services (in contrast to voivodship towns of more than 200,000 population) and, accordingly, by their higher population dynamics.

TABLE 2. Growth of population and employment in voivodship-cities in 1960-70

Voivodships-cities by size (in ,000)	Increase in 1960-70 (1960 = 100%)					
	population	employment				
		total	industry and construction	services		
				total	material	non-material
Below 100	135.0	152.1	164.5	142.7	149.1	137.2
100-200	137.4	160.8	161.9	159.7	155.9	162.9
Over 200	117.7	123.3	118.7	129.0	122.9	133.6
Total	119.6	126.7	122.8	131.3	126.6	135.0

Source: Author's estimates based on *Roczniki Statystyczne Województw* (Statistical Yearbooks of Voivodships), 1972.

It is also remarkable that voivodship cities in the 100-200 thousand size class (Białystok and Kielce) recorded both a higher population increase and a higher rate of total employment than voivodship towns of less than 100,000 population. These latter had higher development rates of industrial activities but lower dynamics of development of the services than Białystok and Kielce (Table 2). Over the 1960-70 decade both categories of towns (50-100 and 100-200 thousand population) increased their population by more than 35% and their industrial employment by more than 60%. Particularly high industrial growth rates in that period were recorded for Koszalin and Olsztyn (227.2% and 164.5% greater in 1970 than in 1960, respectively, 1960 = 100%).

But a town's actual functions can better be assessed on the basis of the functional structure than on that of the employment structure. A town's function in the settlement system is to be assessed less by that socio-economic activity which is to meet the demands of the town's own population but primarily by the activity it performs for the external world. It is the export-oriented activities that basically constitute the urban economic base and thus are the basic fundamental source of growth for the town. They enable the town to acquire the goods that it does not produce itself. No urban organism could function without this type of exchange in the form of flows of goods and people to the place of fulfilling the given function.

Viewed thus, the town can be regarded as a specific type of economic region (nodal region), as a partly open, partly closed subsystem within the system of national economy. This division is the foundation of the concept of an economic base in which the degree of mutual openness (or closure) of a town's economy

reflects the mutual proportion of the exogenous and endogenous sectors. For the lack of more adequate data on flows, this proportion is commonly estimated on detailed materials concerning employment structure.

The calculations have disclosed the share of the endogenous group to correlate positively with the size of the given town, which points to a higher self-containness of the larger urban organisms. The endogenous sector also turned out to be related to geographic location and functional type of towns (industrial towns had, on the whole, smaller shares of the endogenous group than service towns). The endogenous group betrayed high internal differentiation and low town-to-town variation. The economic base, on the other hand, appeared to be highly homogeneous while varying widely from town to town. The industrial sector was the main component of the economic base of most urban settlements. Where industry was in strong domination the town had a more homogeneous exports sector. The smallest of the analyzed units were at the same time the most homogeneous ones.

#### FORMS OF FUNCTIONAL-SPATIAL ORGANIZATION OF THE NATIONAL URBAN SYSTEM

Social and economic activities need to be organized in space. This organization is ensured by functional links between settlement units of various rank, type and spatial extent. Depending on the character of those links, an urban organism is attributed various competences and roles in the social and territorial division of labour.

For the determination of a given town's role in spatial organization it is essential to identify:

(a) the extent to which the town fulfills certain functions to the benefit of the regional market (i.e., the area in the zone of gravitation of that town),

(b) the extent to which such functions exceed that market to contribute to the national (international) division of labour. The first type of functions are specific for central places, functions of the latter type for specialized places. In reality, however, urban units combine functions of both the first and second types.

A separate study and a statistical analysis of this issue disclosed that the supraregional sector distinctly predominated in the economic base of most *poviat*-towns and voivodship-cities (M. Jerczyński, 1973). In 1960, the exogenous sector of supraregional character was noted to be lowest for voivodship cities of the 50–70 thousand size class and highest in industrial towns (smaller than 50,000 population) with a homogeneous economic base. Analyses of the functional importance of towns showed, moreover, how strongly the administrative functions of voivodship level reinforce the given town's rank as a central place. This group of cities occupied the upper rungs of the hierarchical ladder. Only smaller towns of this type (in peripheral locations) ranked below the voivodship cities that exceeded them in size considerably. But as regards specialized (supraregional) functions, voivodship towns played — except for the largest of them — a much less important role and occupied lower positions in the hierarchy.

In 1960–65 the supraregional sector of the economic base of urban settlements was characteristically gaining in importance. While this was the predominant trend, there were developments in other directions too. In towns with a highly homogeneous economic base (for instance, in Upper-Silesian towns and in those of the Łódź agglomeration) the exports sector diversified over that period and central functions were strengthened.

The above confirmation that the supraregional sector predominates in the economies of most of the studied urban units and that with time that predominance is being reinforced points to the continuing process of functional integration on a nationwide scale. Though the data that were used for the study do not enable us to pinpoint this process in space, the fact that specialized functions do play a more and more important role in the towns' economies seems to indicate that they are rendered for the benefit of other urban units. It is now fairly safe to say that in the process of socio-economic development the environment of a town is composed more and more of other towns and that the advancing specialization between them makes them more and more interdependent on one another which is reflected in the higher integration of the national settlement system.

Urban functions of different rank and spatial character furnish the foundation for different models of spatial organization of settlement units.

Central (regional) functions are closely related to the size of urban settlements. Such activities have the character of spatially continuous functions whose impact attenuates with growing distance from the given town (the extent of the zone of influence). If it is based on central functions a spatial organization assumes the form of a hierarchical model. In contrast to these, specialized (supraregional) functions seem not to correlate with town size and are spatially noncontinuous (discrete). Hence, if it is based on this type of functions a spatial organization assumes the form of a model in which the system's components are interconnected by links of non-hierarchical character.

The above dichotomic distinction is paralleled in the now current theories of settlement networks. These relate to either the one or the other type of functional categories without attempting to treat them together. Thus central-type functions are the foundation for the theory of central places both in its classical formulation (W. Christaller, 1933), and in its modifications (A. Lösch, 1940; W. Isard, 1956; D. L. Huff, 1963; Curry, 1964; B. J. L. Berry, 1967; J. U. Marschall, 1969). Functions of the second type find their fullest expression in Soviet theories that are based on N. Kolosovskiy's theory of territorial-production complexes (Y. G. Saushkin, 1960; N. I. Blazhko, S. M. Voskoboinikova, B. L. Gurevich, 1967).

In its classical form, the theory of central places has two major flaws: (1) in the model it presents it neglects the horizontal functional links between urban places of the second or lower orders whenever they are not components of one subsystem (location in different regions), and (2) it neglects the horizontal functional links between urban places of the same order within one subsystem (towns of equal size within the same region). This model establishes functional interdependencies between individual hierarchical levels only, and not within the system as a whole (A. Pred, 1973).

Much more correct are the provisions of the Lösch model (which takes account of the second of the above requirements) but it also fails to reflect the full range of interdependencies in the system.

The models based on the analysis of territorial-production complexes, which are most consistent in materializing the requirements of systems analysis, focus almost exclusively on production links and transport-communication connections while taking less account of the services sector.

In view of the fact that towns represent the functions of both types (regional and supraregional) it seems that at present the most realistic articulated model of spatial organization of the national settlement system can be obtained by integrating (a) the hierarchical model with (b) some elements of functional

links of non-hierarchical character both between centres of the highest order and between towns of lower size classes (Fig. 6).

Such a model is a dynamic category. It seems that when submitted to certain impulses from the environment (say, the location of an industrial plant) the components of the settlement system undergo definite transformations which in the model of spatial organization show as a given town's shift in rank within the system of horizontal (geographical) and vertical (hierarchical) links. Less prone to all of these types of change are, of course, the largest units (the generally straight correlation between functional rank and size). In this context it is understandable that every single voivodship city in the less developed regions of peripheral location have had higher indices of industrial development. For location and the rapid development of industry in those areas can be interpreted not only as a factor stimulating further integration with the national system of towns and contributing to the activation of the area on the regional scale. The occurrence of industrial activities in the urban economy is also an element of dynamic growth, one which secures a shift upward onto a higher level of functional hierarchy and thus reinforcing the stability of the hierarchical structure of the system of towns, especially on its uppermost level. The target in this case is to secure the identity of the formal hierarchy (the legal status of the voivodship cities) with the real hierarchy (the functional rank within the system).

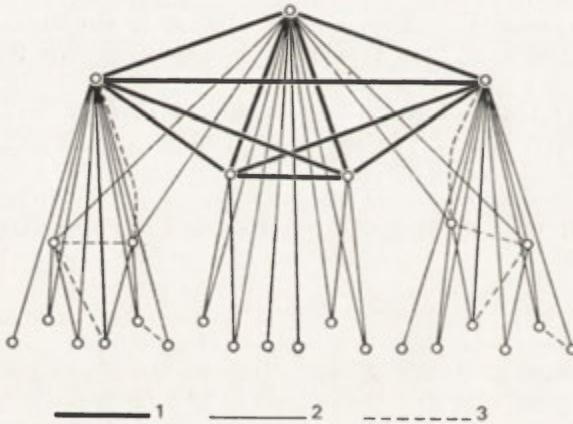


Fig. 6. Model of a national settlement system organization with some links of non-hierarchical nature (according to A. Pred, 1973)

1 — functional interactions among the largest urban units, 2 — functional interactions of Christaller's type, 3 — functional interactions of Losch's type

The rising functional specialization of urban units and the growing degree of functional differentiation on the national scale reinforce interdependence and interaction in space. The development process of the functional-spatial structure of the national economy consists in the growth of small isolated and functionally undifferentiated units into strongly interdependent functional urban regions.

The bigger population concentrations the more complex should the forms of social organization be in order to ensure certain improvements in social and political mechanisms that would provide for certain forms of exchange between an ever-growing size of various specialists in various fields.

The growth of transports and the appearance of new means of transportation constitute the most powerful change-inducing factor in the development of forms of organization of geographic space. Spatial mobility is one of its aspects, and population migrations (whether permanent, like village-to-town or town-to-town migrations, or seasonal, like recreational and tourist migrations) illustrate well its impact. The results of studies completed by now seem to indicate that in the case of a simple regular settlement network in areas of unintensive industrialization and urbanization and with an underdeveloped transport network, rural people wishing to migrate to larger urban units tend to do so through the intermediate settlements, thus yielding a model of hierarchical migration. In areas with advanced industrialization and urbanization and with an efficient transport network interconnecting the settlements into one system, migration movements are so fluid and so independent of a town's size that the hierarchical model becomes pointless. Hence changes in the hierarchical model of spatial organization and the growing importance of non-hierarchical links appear to be two expressions of the present evolution of the national settlement system.

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## REGIONALIZATION AND SETTLEMENT

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The division of the country into economic districts is the underlying principle of the territorial organization of productive forces under socialism. The effectiveness of centralized planning and management in a socialist state, especially in such a large one as the USSR, depends to a large extent on the character of territorial division, its hierarchy and the rigorous scientific basis on which such division rests. The question of division into districts (elsewhere referred to as regionalization) has attracted numerous works whose authors include Academicians: G. M. Krzhizhanovskiy, I. G. Alexandrov, Corresponding Member of the USSR Academy of Sciences N. N. Baranskiy, Professors N. N. Kolosovskiy, V. M. Chetirkin and others. The theory of economic regionalization in the USSR has become essential to the science of economic geography.

The processes of urbanization and settlement cannot be correctly interpreted or understood without the concept of territorial organization of the country's productive forces, and the tasks of directing these processes cannot be solved without economic regionalization used for constructive purposes. This highlights the link between regionalization and settlement.

Economic regionalization must meet three general criteria: systemic character, effectiveness and manageability. The first of these views the country as a hierarchic and complete system of districts of varying ranks covering the whole country, and demands not random, but strictly patterned inter-district relationships which make sound social and economic sense. Effectiveness presupposes that such relationships within the system and within every district lead to maximum economic efficiency. Finally, the criterion of manageability is the main requirement in the cybernation of various systems (including districts), with cybernetics providing the recipes for turning unmanageable systems into manageable ones. This criterion demands that territorial economic systems be territorial management systems, i.e. presupposes the ultimate unity of economic and administrative regionalization at all levels.

It must be stressed that territorial structures of settlement can only be formed within the framework of territorial economic structures (economic districts of various ranks) in as much as the concept of territorial settlement structure assumes its subordination to a certain production-territorial complex. It is desirable in principle that territorial settlement structures could be considered as ecological systems, which would promote research into the triple problem "production — settlement — environment". Ultimately such territorial structures must be territorial structures of integrated management of social processes. That would enhance the possibility for conducting a policy of harmonious settlement in keeping with the demand of preservation and improve-

ment of the environment. Solution of such problems depends on social conditions, which in this country are determined by the nature of the socialist system and the tasks of communist construction.

The key problem of the whole urban theme is the place and significance of cities in the development and distribution of productive forces because in them are concentrated the functions in the system of territorial division of labour. That problem is largely tackled through regional economic planning, i.e. in close connection with the distribution of productive forces and production zoning at various levels. This is the solely correct approach in tackling the complex problems of urbanization which is a multi-faceted socio-economic and geographic process depending on the territorial division of labour and predominantly on economic factors. This prompts the need to develop regional socio-economic policies in the union republics and economic districts in the USSR, including the concepts of urbanization and migration within a given territory. This puts a high premium on providing the longterm plans of the development and distribution of the productive forces in the union republics and economic districts of the USSR with well-elaborated regional concepts that form a basis for drawing up comprehensive district plans for given territories.

Regional research should be concluded by regional (district) planning, which in the USSR has a long-standing tradition and no small achievements. As of the beginning of 1970, 271 district layouts have been drawn up, not to speak of rural planning materials which use a different method. Among the schemes and plans 99 cover *oblast*, *kray* (territory), autonomous and union republics and 172 are for industrial, health resort and other planning units — intra-district economic-geographic areas (*okrugs*). An all-Union schedule has been drawn up of work to develop new concepts for district planning, the building and layout of cities and villages approved by the State Committee for Civil Construction and Architecture. And yet a good deal more has still to be done to promote district planning which to date has been largely focused on the development of certain large or new industrial districts. Proceeding on the basis that about 500–600 areas (*okrugs*) can be singled out in the USSR (on the data of intra-oblast economic-geographic zoning), one arrives at the conclusion that district plans have only been drawn up for about one-third of all the areas. It is necessary to link district planning with long-term territorial planning of the national economy and with the country's economic zoning. The order of priorities is as follows: large economic district — a republic or *oblast* (plans for development and distribution of productive forces) — planning district (district planning) — industrial hub (hub planning).

It is essential that regional economic planning be more comprehensive in character when it deals with such multi-sectoral and integrated objects as cities, and that along with pre-planning schemes and district plans integrated economic plans be compiled for regions and individual cities, including not only production but infrastructure as well. So-called social planning of districts and cities is increasingly geared to that task.

Social planning should be regarded as one element in the development of a comprehensive economic plan. This is the most common form of social planning, which accompanies economic planning. Thus the system of economic indices is supplemented with social infrastructure indices.

When one passes on to territorial objects such as a city or district, the situation changes. At present we have no system of comprehensive economic planning for cities and districts. In order not to be divorced from sectoral economic planning, social planning at that level adjusts its functions and con-

tent to take on a new form (this is one of the reasons why we now speak about social-economic planning at city and district level). However, in the absence of a single comprehensive national economic plan that would bring together all the sectors within a certain area (city, district) social planning, which embraces specific functions, is extremely difficult. Thus, the comprehensive plans developed for Moscow, Leningrad and Sverdlovsk are just general economic development plans.

Although economic-geographical investigations are being pursued on a fairly broad front, not enough effort has to date been concentrated on the main directions, viz., the development of scientific principles of regionalization, singling out production-territorial complexes, organizing integrated transport systems, and elaborating a new concept of a comprehensive settlement plan. These spearhead methodological directions (to which one must add the problem of anthropoecosystems) have a direct bearing on the task of rationalizing territorial centralized management of the economy and improving territorial systemic organization of social processes in general. Economic-geographical studies should not be pursued as an end in themselves but should be geared to the major constructive task of territorial development of society. An attempt should be made to give these studies inter-disciplinary relevance and to introduce them into public consciousness and social practice. They must be linked with the theory of production management which is of more recent growth than the zoning theory.<sup>1</sup> We should eliminate the inconsistency that crept in for a time when we abandoned the principle of unity of economic and administrative regionalization, which was in fact the rationale of the Soviet regionalization theory when it was first proposed in the 1920's, and ceased to consider it necessary to introduce scientific regionalization principles in the management of social processes, including administrative division. At the stage of advanced socialism and scientific and technological revolution, inadequacies of administrative division and the weakness of its lower levels are a serious brake on social development, being at least partly responsible for a number of drawbacks (unbalanced development of cities and districts, lag in road construction and services).

One may quote N. N. Kolosovskiy's wonderful words: "To achieve full mutual coordination, comprehensiveness and combination between various sectors at economic district level (energetics, transport, water supply, municipal services, metallurgy, chemistry, and agriculture) means to accomplish a new unprecedented increase in labour productivity nationwide and to score a final victory on the economic front".<sup>2</sup>

The past decades have seen accelerated processes of differentiation as well as of integration of scientific disciplines. New comprehensive trends of research are emerging which sometimes cannot be accommodated within traditional disciplines — economics, geography, etc. — and break their traditional structure. New trends (usually of a comprehensive-problem character) often emerge on the basis of a traditional discipline while not being confined to it (or changing the subject matter of the given discipline). The existence of a comprehensive problem of territorial organization of productive forces can hardly be gainsaid. Its scientific development can only be tackled by a number of contiguous sciences, although economic geography has a natural claim to leadership. Recently,

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<sup>1</sup> See the works by G. Kh. Popov and his research team at the Social Production Management Problems Centre at Moscow University, and *Problems of territorial management of social production*, Moscow 1973.

<sup>2</sup> N. N. Kolosovskiy, *The Fundamentals of economic zoning*, Moscow 1958, p. 96.

however, a serious rival emerged in the shape of regional economics which grew out of territorial economic research within the bosom of economic science but is often erroneously treated as a new regional science, a comprehensive discipline about spatial distribution of production which unites and therefore supplants all the other scientific disciplines in the field. Naturally, as the doctrine of territorial organization of productive forces as a system of knowledge evolves, the role of traditional economic geography in the study of this problem is bound to change. However, this does not mean that it will give way to a new "regional science".

Geography is a science of spatial combinations and interrelationships in human and physical phenomena.<sup>3</sup> Accordingly, the subject matter of economic geography is spatial-social processes as manifested in concrete combinations and interaction (including the interaction between society and nature). Philosophers have recently introduced a new distinction between the subject matter and object of science. As distinct from the subject matter, spatial organization of the productive forces and social processes in general, including, of course, regionalization form the object of investigation by economic geography. This is also the object of regional economics, whose subject matter is territorial proportions in the development of production. Economic geography is here interpreted in the broad sense, including population geography. The latter reveals its specific character to a greater extent when included in another field of knowledge — population study whose object is population in all its forms and manifestations.

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<sup>3</sup> See B. S. Khorev, *Problems of cities*, Moscow 1971, p. 79.

## FORMATION OF SYSTEMS OF SETTLEMENT

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The areal-branch structure of production (ABSP) is a totality of the functionally interrelated branch and areal economic subsystems.<sup>1</sup> The spatial skeleton of any regional ABSP is formed by a historically conditioned, in a given region, unified system of settlement (USS).<sup>2</sup> In the dialectical binary unity of "ABSP-USS" the first element is not only the leading component, but also the more dynamic one. In fact, any substantial changes in the ABSP require, and result in, corresponding changes in the settlement pattern. Thus, an ABSP may be considered an argument and the system of settlement a function.

The settlement is prone to inertia and, therefore, is not sufficiently a dynamic system. As its development is lagging behind that of the ABSP, the settlement pattern (or its particular components) may find itself at odds with the most important, at a given stage, objective conditions and requirements of production. In a socialist society such contradictions are submitted to planned elimination in accordance with objective economic laws. In order to avoid errors in the process of such planned activities, it is indispensable to acquire deep knowledge of the mechanics that govern the interrelationships between the ABSP and USS, due consideration being given, among others, to their regional subdivisions of all taxonomic ranks; among the latter, the regions of an *oblast* rank (*oblasts, krays, autonomous socialist soviet republics*) are of particular importance, for it is they that make a substratum upon which the planning and administration of the economy are mainly realized.

Inside the limits of so huge a country as the USSR, regional ABSP differ considerably in many aspects, such as the levels and rates of socio-economic development, the proportions of their branch and areal build-up, the number, composition, and dynamic trends of their population, etc. All these characteristics and inter-regional differences influence the settlement patterns both directly and indirectly. Of all the traits characteristic of the ABSP the level of areal concentration (i.e. of agglomeration) of production and the organization of the transport network are those that influence the settlement most forcefully.

<sup>1</sup> Consequently, in this kind of ranking, a system is tantamount to the entire economy (ABSP) of the Soviet Union, a Union republic or an economic region (including regions of an *oblast* or *intra-oblast* rank).

<sup>2</sup> The authors fully accept the essence of the notion of the USS, as it has been developed by B. S. Khorev (Khorev, 1971), and are of the opinion that further elaboration and concretization of this notion constitutes one of the most important tasks confronting the students of settlement in the Soviet Union.

Under the influence of the law of production agglomeration, big economic centres are formed in which industry plays the leading role. They grow into big cities — central points and agglomeration factors in settlement — surrounded by suburban zones. After having reached definite dimensions such cities become the “cores” of industrial and, consequently, urban agglomerations.<sup>3</sup> As yet, the knowledge of these processes has not attained a level high enough to permit us to formalize them objectively and to find a reliable mathematical expression for them. Nevertheless, we have already accumulated rich empirical material, from which a number of conclusions can be drawn.

And so, it is beyond any doubt that the biggest industrial centres are exceptionally strong factors in production and settlement. Agglomerating not only industries but also other kinds of socio-economic activities of the society, they are the bases on which the biggest towns are formed, with the tendency to reaching “one million mark” in the number of their population; in some cases this limit has already been left far behind. Most of these cities perform similar socio-economic functions; their agglomerative role stands out sufficiently clearly and can be relatively easily prognosticated. Besides those centres, we can isolate another class of towns, already very numerous, which have risen above the “one hundred thousand mark”, but have still not come near to that of one million.<sup>4</sup> As a rule, their agglomerative role shows a similarity to that of the biggest towns, but finds a much weaker and less definite expression. Industrial centres, on the basis of which towns of from 100 to 200 thousand inhabitants are formed (perhaps the upper limit in this class is nearer to 300 thousand inhabitants), may be conventionally called indeterminate agglomerators. Their influence upon the localization of production and settlement finds relatively weak expression and can be substantially and quickly changed by means of a comparatively small redistribution of capital investments.

Finally, the overwhelming majority of middle and small towns exert only a very limited agglomerational influence. Their influence on the localization of production is dependent not so much on their own socio-economic potential as on transport conditions. The dimensions of their centripetal zones, too, are related to the level of development of the local transport network and to the branch structure of the town economy (primarily in the sphere of industry and services) as it exists at a given period of time. Of a very great importance is also their distance from an *oblast* centre: in its proximity the middle and small towns mainly “inscribe” themselves into a “local settlement district”,<sup>5</sup> or perhaps into an agglomeration which may be forming around the *oblast* centre.

The entire organization of the regional transport network brings a strong influence to bear upon the character and forms of settlement. It is particularly perceptible in the areas of rural settlement, where railways and motorways often become “axes of settlement”.

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<sup>3</sup> It should be noted that the term “urban agglomeration”, as it is currently used, expresses merely the most striking features of the phenomenon and inadequately reflects its essence. In many a case agglomerations, as forms of settlement and patterns of production organization, include not solely urban settlements but also numerous rural ones, among the latter those based on agriculture. In particular, these rural settlements are the “starting points” of pendulum-like migrations.

<sup>4</sup> Many of them have even no chance of reaching this mark in a foreseeable future (we are merely stating a fact, leaving alone the problem whether or not such town growth is desirable).

<sup>5</sup> The notion of the “local settlement district” is dealt with in detail in an article by M. O. Afonskaya, E. V. Knobelsdorf, and M. A. Novikov (cf. Afonskaya, M. O. and others, 1973).

Now, we are going to consider these general statements in the light of concrete data referring mainly to the *oblasts* of Gorkiy, Kaliningrad, Novgorod, and Pskov.

The fast development of Gorkiy as a major industrial centre has resulted in its becoming a powerful agglomeration centre of production and settlement. Besides Gorkiy itself, within the radius of 50 km, seven towns and more than twenty settlements of the urban kind have come into existence. They are all functionally linked up with Gorkiy and form an agglomeration whose population is already approaching two million inhabitants. Within the framework of the agglomeration a unified areal-production complex has formed. In the small and medium towns and in the small town-like settlements that make parts of the complex, there have appeared numerous subsidiary and auxiliary production establishments; all these settlements have developed stabilized transport links centered upon Gorkiy (including a considerable commuter movement of up to 70,000 persons).

The agglomerative effect of the biggest town manifests itself also in that the local settlement district of Gorkiy is, by its area, much larger than the agglomeration of the same name. In the district all the three zones appear with sufficient clarity: (1) the zone of direct gravitation (as to its extension, it is essentially identical with the agglomeration area); (2) the zone of indirect gravitation (along the transport lines the outer limits of the zone reach from 80 to 100 km from the city of Gorkiy); (3) the peripheral zone embracing, practically speaking, all the remaining territory of the *oblast* and at places even reaching beyond it.

Kaliningrad can be used as an example of an industrial centre of the second type. At present its population has grown up to 328,000 inhabitants; thus, according to a generally accepted classification, it has entered in the category of big cities. As it is in the case of Gorkiy, also around Kaliningrad a local settlement district has formed with analogous three zones. The industry in it, however, has developed on a smaller scale and the level of specialization (and, correspondingly, that of co-operation) is lower, too. Even the biggest enterprises have almost no "daughter" plants and the number of plants, whose production activities overlap in any way is, in Kaliningrad itself or its vicinity, rather small. Therefore, the agglomeration effect of the city's industry is also small and the term the "Kaliningrad urban agglomeration" can be used only with reservations. Commuting (on the scale of 15-20,000 persons) is linked up with the nearest rural settlements and, mainly, with towns outside the core of the agglomeration. The zone of direct gravitation is very neatly defined (it falls within the radius of 20-25 km from Kaliningrad); practically, it extends as far as the zone of suburban agricultural activity and its settlement network is very dense (it includes a strip of summer and health resorts). The zone of indirect gravitation reaches as far as 40-45 km from the *oblast's* centre, and eastward of it even to 70 km. It is relatively well defined and includes two thirds of the *oblast's* settled localities. The peripheral zone embraces almost all the remaining territory of the *oblast*, with the exception of its north-eastern part.

The Gorkiy and Kaliningrad local settlement districts extend over an area of, correspondingly, 80,000 and 10,000 sq. km. The basic difference between them amounts to the fact that, whereas in the former a big agglomeration has formed, in the latter no agglomeration has, as yet, come into existence.

Industrial centres, which, according to our foregoing classification, fall into the category of indeterminate agglomerators, are characterized by a mot-

ley specialization, first of all in the branches of manufacturing industry. As typical examples of such centres Novgorod and Pskov can be considered, both growing rapidly and belonging to the class of 100,000, or so, inhabitants. The characteristic feature of their industry is that the links between different plants within each city are tenuous and that the plants co-operate with very remote "customers" (Leningrad, Moscow, Lvov, Novosibirsk, etc.). Therefore the agglomerative effect of both the cities has been, and still is, rather weak: inside their local settlement districts (about 6,000 sq. km. in each case) they primarily perform organizational-economic and administrative functions. In the zones of direct gravitation (the radius of which is about 20 km.) cultural and everyday life links are predominant, as well as links connected with commerce and distribution. In the indirect gravitation zones (and it is still more valid with reference to the peripheral ones) the links of the latter category play the leading role.

Their agglomerative influence being weak, the cities of the Novgorod and Pskov type affect only slightly the forming of the settlement systems in the surrounding territory. During the periods of accelerated growth they actively participate in the redistribution of the population of their "own" *oblast* by becoming the centres of attraction for the intra-*oblast* migrations. In the periods of stabilization a considerable part of migration flow, originating in the *oblasts*, bypasses these cities.<sup>6</sup> Thus, the agglomerative influence of the towns in the "one hundred thousand" category is visible mainly in the dynamics of the rural settlement. Many towns belonging to this class lack any extraordinary attributes that would facilitate the localization of new kinds of production within their precincts, and the very size of them is yet insufficient to attract industries. It is, in fact, the category of towns that objectively presents the best conditions for regulating their growth.

The study of the differences in the nature and degree of the influence that industrial centres of different rank exert upon the whole area of every intra-*oblast* system of settlement seems to be particularly meaningful.

Practically speaking, any bigger town plays an important role in the formation of the transportation network of its *oblast*; under the modern conditions, with the growing concentration and specialization of all the remaining spheres of the national economy, this network becomes a decisive factor in the development of the intra-*oblast* settlement systems. It manifests itself, first of all, in the occurrence of three tendencies: (1) in the concentration of the rural population in suburban zones and along improved roads; (2) in the accelerated development of middle and small towns enjoying an advantageous localization (in evaluating the localization it is important to take into account its situation towards the *oblast* centre); (3) in the stabilization or even regress of small and medium towns whose transport situation does not adequately respond to the requirements and conditions of modern production. Under the influence of the biggest cities these trends lead to the formation of unified *oblast* settlement systems, within which subsystems and monostructures are born, characterized by different development and different relationship to the system as a whole (such is, in particular, the Gorkiy *oblast* settlement system).

Speaking about subsystems, one should first of all mention urban settlement districts in which, though the towns are visibly grouped together, no manifestly dominant centre exists among them, and the intensity of their mutual links

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<sup>6</sup> This problem is treated in more detail in a paper by A. A. Anokhin (cf. Anokhin, A. A., 1973).

is insufficient for creating an agglomeration. By way of examples one can point out the Pavlovo-Vacha (metal-working and machinery construction) and the Vyxa-Kulebaki (metallurgy and machinery industries) districts. The former includes three towns and three small settlements of urban kind, the latter — three towns and five settlements of urban kind. Besides the towns both regions include also rural localities, a considerable part of the population of which commute. The formation of the urban settlement districts is objectively founded upon the law of the agglomeration of production that leads to the areal concentration of industry and the development of production and shipping-receiving interrelationships. Besides, both districts are subject to the influence of the Gorkiy agglomeration which, though it fosters the socio-economic effects of the subsystems, simultaneously slows down the pace of their quantitative growth.

Another kind of subsystems growing up inside the *oblast* systems of settlement is represented by “dual” structures made of pairs of towns situated not very far from one another. Here are the examples of such pairs: settlements of the urban kind Vetluzhskiy and Krasniye Baki, Vakhtan and Syava. The members of the pairs may have originated on different production bases; usually, however, with the course of time they become linked up by stable production and social relations.

Finally, inside the framework of the *oblast* settlement systems, in most cases at their peripheries, one can often meet single urban settlements, as a rule belonging to the category of the smallest ones. Their relations with the *oblast* centre consist mainly in selling goods; the links among such peripheral settlements themselves are of no consequence. As parts of the unified settlement systems, however, they enter in close relationship with the surrounding rural settlements in relation to which they perform a region-forming role. The three zones of gravitation, formerly referred to, emerge also in those cases, but their scale is very modest, corresponding, as it is, to the socio-economic potential of such settlements.

All the components of the unified system of settlement that have been analysed above, are plainly visible (the “mature” agglomeration excepted) in the cases of the Kaliningrad, Novgorod, and Pskov *oblasts*; each of the *oblasts* has, however, some specific features that to a great extent reflect the scale of their *oblast* centres, as well as the pattern and general level of development of the transportation network.

So, in the western part of the Kaliningrad *oblast* a big urban settlement district has risen, gravitating strongly towards the *oblast* centre (it includes 13 towns and town-like settlements distributed within a distance of a 90 minute trip from Kaliningrad). Commuting, centered on Kaliningrad, is steadily increasing. A considerable number of the towns in the district have already become mass recreation resorts for Kaliningrad's inhabitants. If, in addition, a very high level of transportation facilities in this part of the *oblast* is taken into account, we can assert with a great degree of probability that here one has to do with a process of agglomeration formation, slowed down only by intentional, planned restrictions imposed on the rate of growth of the *oblast* centre.

At present this region of urban settlements (including also more than 400 rural localities) presents a subsystem in the condition of a not quite stabilized equilibrium. It would be enough to locate in Kaliningrad itself, or its vicinity, several bigger enterprises and they would become catalyzers of an accelerated development of agglomeration processes, resulting, among others, in the transformation of a number of rural settlements into urban ones. A new big agglomeration would then extend over about 5,000 sq. km; if some variants of its

development were accepted, it would absorb more than 30 urban settlements having a total population of a million or so.

Measured on the scale of socio-economic potential the cities of Pskov and Novgorod fall far behind not only Gorkiy but also Kaliningrad. Therefore, their role in the intra-oblast USSR formation is considerably smaller. The local settlement districts as organized by these two cities extend only over comparatively small parts of the relevant *oblasts*. The shape of the districts is closely linked up with the transportation networks: along the railway lines and improved motor-roads both districts extend by "tongues" or "ribbons" for 60-70 km, while in between the ribbons the outer limits of the districts are no more distant from the *oblast* centre than 20-35 km. In the case of these two local settlement districts, it is more plainly visible than in those of Gorkiy or Kaliningrad that the average population of rural settled localities decreases with their growing distance from the centre (these indicators are below the *oblast* average already in the zones of indirect gravitation). There are differences between the district that grows under the influence of Pskov and the one whose growth is affected by Novgorod. The branch composition of industry in Pskov being as it is, the city is more closely tied up with the economy of the surrounding area than is in the case of Novgorod, and therefore the local settlement district of the former city is characterized by a more easily definable zone of direct gravitation.

In the Pskov *oblast*, besides Pskov itself, there is yet another region-forming centre (Velikiye Luki), which by its dimensions stands rather close to Pskov. Moreover, within the *oblast* territory there are two well determined local settlement districts: the transition from them to the area that lies in between them is reflected not only in the population numbers of the rural settlements, but also in such important aspects as the concentration, specialization, and intensity of agriculture and the level of development of socio-economic and technico-economic infrastructure. As to the Novgorod *oblast*, there is only one big town over there and the peripheral zone of the local settlement district that has formed around the city of Novgorod, is still, in the light of the above mentioned characteristics, not clearly discernible from the surrounding area.

The foregoing considerations have been devoted to some more general aspects of the interrelations and interactions between the ABSP and USSR. The real range of pertinent problems is much wider. In particular, such problems as the study of gravitation (vide, e.g., Zastavniy, 1972), of commuting (Polskiy, ed., 1973, which is in fact the first well-founded book on the subject), of the influence of concentration on the localization of industrial production (Sazontov, 1971) and several others seem to raise great interest. At this instance, despite the fact that the fashion to "mathematize" is not yet quite over, the authors of this paper wish to emphasize their firm conviction that what is necessary is rather a further "eccnomization" of research. One can give as much consideration to the problems of applying mathematical and system approach methods as one may possibly wish, but if it is not preceded by serious economic elaboration, by the studies of the deep-set economic processes (be it, at least, in their basic approximations), the results of any mathematical analysis will stay within the limits of abstract mental exercises in logic that are far from practical needs and do not promote the development of theory.

Let us cite but one of those statements that are as abstract as they are abortive: "The society that aims at maximum production efficiency should be oriented towards the maximal development of big and biggest cities" (*Problemy ...*, 1972, p. 55). And farther on: "If the means were unlimited, the population capacities of big cities could have been extended practically without limitations"

(ibid., p. 62). In such a way — disregarding social conditions and taking as a starting point some abstract “unlimited means” — one of the most important problems of modern town-planning science is being dealt with. Thus, in a stride, both the objective economic regularities and the general policy line based upon them laid down by the 22nd and 23rd Congresses of the CPSU and aimed at stemming the growth of big cities, are ruled out. We have cited only one example — there are many more to quote — of the instances when the problems of town development and planning are considered from a subjective point of view and in disrespect of concrete economic realities.

And this is why we deem it necessary to emphasize once more the unequivocal ascendancy of economic research over anything else in solving any problems of settlement.

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## FOUNDATIONS OF THE MODEL OF SPATIAL SYSTEM OF TOWNS

ZBYSZKO CHOJNICKI

## INTRODUCTION

This study is to present the foundations of a model of the spatial system of towns. In order to accomplish this task, the model and the systems methodologies are integrated. In the model methodology, reality is idealized so as to identify the factors and relations that are significant and to cut out those of secondary importance. In following such a research procedure, which by way of abstraction, eliminates subsidiary effects on the studied object, and thus makes certain research assumptions, we are led to the construction of a model. The resulting models are idealized and hence abstract representations of reality formulated as sets of modelling assumptions. The objects thus characterized — spatial systems devoid of certain real features — are called ideal types or abstract phenomena.<sup>1</sup>

The proposed modelling strategy is to identify the fundamental features of the spatial system of towns through what is called the systems approach or the systems methodology. One important feature of this methodology is that the studied object, say a town or a set of towns, is treated as a specific system.

The systems methodology is not uniform in character. Its origin can be traced to several trends and concepts which were later integrated into an independent discipline tentatively called systems theory. But at present that theory is in fact scarcely more than a loose collection of notions and directives.<sup>2</sup>

Attempts to approach the town, or a collection of towns, as a system have been made before. Geographic literature gives ample evidence of comparisons of the town to the organism as a systematic analogy. It was L. Bertalanffy's general systems theory that most significantly promoted the systems approach to the problems of towns in western geographic literature.<sup>3</sup>

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Thus conceived, the model method is very realistic and is a consequence of the methodological directions employed by Marx. See the studies by J. Topolski, *Założenia metodologiczne "Kapitału" Marksa* (The methodological assumptions of Marx' "Capital"), Warszawa 1970; L. Nowak, *U podstaw marksistowskiej metodologii nauk* (Foundations of the Marxist methodology of science), 1971; and the collection of essays edited by J. Kmita, *Elementy marksistowskiej metodologii humanistyki* (Elements of the Marxist methodology of the human sciences), Poznań 1973.

<sup>1</sup> Cf. V. N. Sadovskiy, *Ogólna teoria systemów jako metateoria* (General systems theory as metatheory), *Prakseologia*, 2 (46) 1973, pp. 23-46, and A. I. Uyemov, *Systemy i badania systemowe* (Systems and systems research), in: *Problemy metodologii badań systemowych*, Warszawa 1973.

<sup>2</sup> L. von Bertalanffy, The theory of open systems in physics and biology, *Science*, 111, 1950, pp. 23-29; General system theory, *General Systems*, 1, 1956, pp. 1-10; General system theory: a critical review, *General Systems*, 7, 1962, pp. 1-20.

This is no place for a full discussion of the otherwise scanty geographic studies in this respect, but let us draw attention to certain fundamental difficulties and dangers that may turn up in adopting the systems approach to the study of distribution of towns in terms of Bertalanffy's conceptual framework. This latter is essentially organic in its character thus leading to a number of faulty analogies between the organic model of the system and the town, or the system of towns or settlement system.

The organic model of systems ignores a number of structural and developmental characteristics of towns, such as cultural systems, which, in reality, are concrete products of social activity and fulfill definite socio-economic functions. What is primarily meant here is the specific character of those systems as wholes which, rather than being organic, constitute conceptually isolated portions of reality of different degrees of differentiation and integration. Nor do those systems retain their structural interdependences, since the changes that take place in them are not cyclical in character and include radical transformations of the structures themselves and the appearance of new elements.<sup>4</sup>

Different in their consequences are attempts to employ cybernetic models in studies of settlement systems (and, more broadly, in economic geography). Such approaches operate with the conceptual framework of cybernetics and information theory (feedback, entropy etc.) and have already had a number of interesting applications which can be treated as attempts to develop new instruments for analytical purposes.<sup>5</sup> If systems methodology is to be more extensively applied in geographic-economic studies of towns, adequate conceptual system models must be developed first. These must be more than simple adaptations of system models in other domains. Rather, they must be sets of assumptions concerning the geographic-economic study of towns using the notions and methods of systems theory so as to conform fully with the specific requirements of the field of research, i.e. of economic geography.

The primary prerequisite for the construction of such models is the formulation of a basic model of a spatial system of towns thus defining the properties of towns as a system. Before we furnish such a basic theoretical foundation let us briefly discuss the meaning of the notion of system in its form and substance.

#### SYSTEM: ITS FORM AND SUBSTANCE

The term "system" is charged with much ambiguity, which is due to the many attempts to use it for the description of various types of objects.

To dodge this danger we must restrict ourselves to the formal features of the object designated by the term "system" only. In contrast to the various substance-oriented notions of system, this can be called a formal or relational system. The underlying idea of the definition of system is the existence of a set

<sup>4</sup> Cf. P. Haggett, *Locational analysis in human geography*, London 1965; D. R. Stodart, *Organism and ecosystem as geographical models*, in: R. G. Chorley, P. Haggett (eds.), *Models in Geography*, London 1967, pp. 511-548 and G. B. Mc Loughlin, *Urban and regional planning: a system approach*, London 1969.

<sup>5</sup> Tentative applications of this type are made in the following studies: B. J. L. Berry, *Cities as systems within systems of cities*, *Papers and Proceedings of the RSA*, 10, 1964, pp. 147-163; J. V. Medvedkow, *Concept of entropy in settlement pattern analysis*, *Papers and Proceedings of the RSA*, 18, 1967, pp. 165-168; O. Warneryd, *Interdependence in urban systems*, Goteborg 1968.

of elements and the relations between them; it is upon these that further conditions of substantial character are imposed.<sup>6</sup>

A system in the formal (set-theoretical) meaning is a certain pattern of elements of a definite set which are connected with one another and with elements that do not belong to that set by definite relations. Formally then it can be defined as follows:

$$S = \langle X_i, R_i, R_{ij} \rangle,$$

where

$X_i = \langle a_{i1}, a_{i2}, \dots, a_{in} \rangle$  is the set of elements or the subset of the system;  
 $R_i = \langle r_{i1}, r_{i2}, \dots, r_{in} \rangle$  is the set of relations in the broad sense — including both the functions and properties of the elements — which exist in the set  $X_i$ ;  
 $R_{ij} = \langle r_{ij0}, r_{ij1}, r_{ij2}, \dots, r_{ijn} \rangle$  is the set relations occurring between sets  $X_i$  and  $X_j$ , where  $X_j$  is the set of elements that do not belong to the system, that is,  
 $X_j = \langle a_{j1}, a_{j2}, \dots, a_{jn} \rangle, X_i = X_i$ .

The formal notion of the system is a convenient point of departure for constructing various substantial notions of system, such as the socio-economic system, the ecosystem and such like, for it is to this model that further substantial conditions concerning the specific properties of objects in view of their significance for the given research field or discipline are reduced.

Thus for the construction of substantial concepts of system it is necessary that a substantial interpretation of the formal notion of system is at hand.

In practice, however, in various sciences such a substantial interpretation is on the whole intuitive and rather imprecise. To be fully adequate, the substantial interpretation must comprise a definition of the formal notion of system: elements, internal relations, and external relations, all expressed as appropriate modelling assumptions.

The substantial description of the components is very diversified. Attempts made in different disciplines to utilize the formal notion of system show that incommensurate conditions are superimposed upon one another so that in effect different concepts of system are obtained and consequently also different research directives based on those concepts. The most precise and specific conceptual apparatus has so far been developed in cybernetics; it can also be utilized in geographic studies.

The postulates of systems methodology in socio-economic studies find their justification also in the fundamental tenets of ontological and methodological wholism, an idea that can be traced back to the postulates Marx made in the *Capital*.

Ontological wholism points to the integral character of social reality which is a system of operating elements (people and products of their activity) which are connected by various relations. The basic tenet of methodological wholism is that both in description and interpretation the researcher adopts as his point of departure a certain body of knowledge which is composed of knowledge of certain wholes. This brings to the fore the cognitive role of statements concerning objective wholes which constitute systems.<sup>7</sup> While leaving aside any closer considerations of this topic let us emphasize that the systems approach is an inseparable element of Marxist methodology.

<sup>6</sup> A. Rapaport, Zastosowanie izomorfizmów matematycznych w ogólnej teorii systemów (Uses of mathematical isomorphisms in general system theory), *Prakseologia*, 2 (46), 1973, p. 72.

<sup>7</sup> J. Topolski, *op.cit.*

These formal properties of systems and their substantial interpretation together constitute the foundation for constructing system models of towns. The strategy of such a procedure consists in using the modelling assumptions for a substantial interpretation of the notion of systems such as would conform to the theoretical requirements of economic geography and for presenting the methodological consequences of such an interpretation. The same assumptions imply also the fundamental directives of the systems-oriented methodology such as integrity, functionality, and dynamism.

#### THE BASIC MODEL OF THE SPATIAL SYSTEM OF TOWNS

Analyses of earlier studies employing the systems methodology yielded no elaborate definition of the spatial system of towns. But K. Dziewoński gave a tentative description of the settlement system, which is closely related to the system of towns.<sup>8</sup>

In its essence the concept of the fundamental model of the spatial system of towns is a substantial interpretation of the formal system expressed in a collection of assumptions which characterize the systemic properties of the spatial system of towns.

But this system of towns must not be treated autonomously. It is actually a subsystem of the overall geographic-economic (and social) system which is a spatially and historically defined system of operating elements, that is, territory, people, and the products of human activity.

Without discussing the model of the overall geographic-economic system let us emphasize here that it is multi-systemic and diversified in character.

It is multi-systemic in the sense that it is composed of several subsystems or system of lower order that are subordinate to it. Such subsystems are collections of interconnected elements simultaneously being sufficiently separable, and hence based on certain valid criteria of separation which differ from case to case in that they are selected so as to conform to the requirements of the concrete research problem to be tackled.

This system can be relativized in two different ways: regionally and generically, in either case producing complexes that are specific, hierarchic and highly complex subsystems such as industrial or settlement systems, which include urban, agricultural, transportation and other systems.

The diversity of the overall geographic-economic system derives both from the generic differences in the subsystems and in the specific system properties as well as from the role they fulfill in the general system.

Thus, for a tentative formulation of the basic fundamental model of the spatial system of towns it is necessary both to characterize the system properties of the system of towns and to relate it to the more comprehensive overall geographic-economic system. This model consists of the following assumptions: (1) the spatial integrity of the system, (2) the identification or spatial delimitation of its elements, (3) the interdependence of its components, and (4) the relative isolation of the system.

The postulate of the spatial integrity constitutes the foundation for distinguishing the spatial system of towns in the form of a highly closed geographic-economic region. The notion of system as a whole is connected with that of

<sup>8</sup> K. Dziewoński, *Theories of settlement network: a survey*, in: K. Secomski (Ed.), *Spatial planning and policy. Theoretical foundations*, Warszawa 1974, pp. 155–173.

element as its component. In this sense, the term "whole" is used here to denote something that is spatially extendable whereas a component is anything contained in it. Thus conceived, the term "whole" does not imply the condition of spatial continuity for the components; the set of towns is one example.

The following relations can occur between the components of a spatial whole: (a) inclusion, that is the occurrence of components, within the whole; (b) succession, that is the ordering of components by their spatial size; (c) position, that is the situation of components on the scale of spatial coordinates; (d) direction, that is the location of components with respect to a certain point of reference along at least one spatial coordinate; (e) size, that is the length or area occupied by any given component; (f) configuration, that is forms of spatial organization of the components.

The postulate of spatial integrity does not suffice to construct the model of spatial system of towns; if it is restricted to this postulate alone, it does take account of each component's spatial relations but fails to characterize the relations between them. This leads at best to a morphological concept of system. The postulate of spatial integrity for the system of towns is external in character because it bases that system upon the more complex and diversified general geographic-economic system.

The postulate of spatial identification of the elements make us view the town as a fundamental element of the system which, however, must be submitted to spatial delimitation, that is it must be distinguished from among the other components of the geographic-economic system. The delimitation methods necessitate further assumptions concerning certain features of the town which in turn are also specific systems taking different forms (e.g., urban agglomeration, concentration, urban centre, urbanized area and others) and maintaining relations with systems of other types, such as the industrial system. One example of the many difficulties involved is furnished by the attempts to define and delimit urban agglomerations.<sup>9</sup>

The next postulate, that of interdependence of the components, constitutes the foundation for characterizing the operation of the system rather than its spatial morphology. Generally, interdependence occurs when a change in the state of any of the system's elements enjoins a change in the state of the other elements, and conversely.<sup>10</sup> But the notion of interdependence does not predetermine the intensity of that dependence, which is variable. In order to give a more precise meaning to the term "dependence", assume  $S$  to be a system and  $K$  the class of properties  $P_1, \dots, P_n$  of the system, that is of its elements; assume, moreover, that the propositions about these properties have the form: "Property  $P_i$  of the system  $S$  has the value  $x$  at time  $t$ " or, briefly,  $P_i(S, t) = x$ . Using these symbols we should call interdependent properties such that each and any of them is dependent on the remaining properties of class  $K$ , or else when for every  $P_i$  and  $P_j$  in class  $K$  the following condition is fulfilled:

If  $P_i(S, t_1) = P_i(S, t_2)$  then  $P_j(S, t_1) = P_j(S, t_2)$ .

It is to be pointed out that the analysis of the interdependence of the components can be either partial or complete. In partial analyses the researcher focuses his attention on one selected element and on the one- and two-way rela-

<sup>9</sup> Cf. *Agglomeracje miejskie w Polsce. Pojęcie i terminologia* (Urban agglomerations in Poland. Concept and terminology), Biuletyn KPZK PAN, 79, Warszawa 1973.

<sup>10</sup> Cf. E. Nagel, Wholes, sums, and organic unities, in: D. Lerner (Ed.), *Parts and wholes*, New York 1963, p. 154. According to Nagel, a property  $P_1$  in class  $K$  can be called "dependent" on the remaining properties, in class  $K$  when the value of  $P_1$  has the same value at different times, if the remaining properties have equal values at those times.

tionships of dependence between that element and the remaining ones. Complete analyses involve an investigation of the dependences of the whole system, and the overall target is to define the state of the whole system, say its equilibrium.

The postulate of interdependence is the criterion of internal complexity of the spatial system of towns. A simple system emerges, when it occurs between all the elements of the spatial whole, but when interdependence occurs only in some parts of the spatial whole, there emerge spatial subsystems of towns and the system is consequently of a complex character.

In spite of its unambiguity, the concept of interdependence creates a number of interpretative difficulties and further particular assumptions may have to be made. The postulate of interdependence of the elements of the spatial system of towns may be interpreted either functionally or dynamically.

The functional interpretation assesses interdependence through definite types of activity of the elements, that is through the functions they fulfill in the system. In the spatial system of towns, those functions are involved in social and economic processes that concern the towns and are indispensable for the system.<sup>11</sup> In this sense, the functions of towns are interpreted as "the total of all social and economic activities that towns fulfill within the system of the national economy".<sup>12</sup>

Not all functions, however, are of a systemic character. Those that are not include exogenous functions, i.e. functions fulfilled by towns with respect to the population of the outside world, as contrasted to endogenous functions, which are fulfilled for the town's own population.

In further analysis of urban functions, two models of towns can be distinguished: (1) the model of isolated urban community due to the existence of central functions, and (2) the model of integrated urban community due to the existence of specialized and complementary functions. This latter model represents a functional interpretation of the spatial system of towns as a set of specialized urban centres with highly open urban economies, low self-sufficiency, and functional-spatial links to the other towns of the given system.

It must be pointed out, however, that spatial systems of towns contain properties of both models. This, on the one hand, caused the emergence of regional subsystems of towns due to the existence of central functions, and, on the other, of complex spatial systems of towns induced by specialized functions. Thus the interdependence of the elements of the spatial system of towns rises in proportion to the degree of specialization of the constituent urban centres. At the same time, parallel to the growing interdependence of the urban centres, their own dependence on the whole system grows too.

From the above, it follows that by bringing the tentative functional interpretation of the spatial system of towns a step further, we can perhaps integrate different theories of urban spatial patterns such as the theory of central places, that of the economic base, and the interaction theory.

The dynamic interpretation of the interdependence of towns is more complex and less advanced in both theory and method.

The most convenient point of departure for the dynamic interpretation is to define interdependence tentatively as different types of feedback relations with

<sup>11</sup> Cf. K. Dziewoński, *Baza ekonomiczna i struktura funkcjonalna miast* (Sum.: Economic base and functional structure of towns), *Prace Geogr. IG PAN*, 63, Warszawa 1967.

<sup>12</sup> M. Jerczyński, *Zagadnienie specjalizacji bazy ekonomicznej większych miast w Polsce* (Sum.: Problems of specialization of the urban economic base of major cities in Poland), *Prace Geogr. IG PAN*, 97, Warszawa 1973, p. 19.

time lags.<sup>13</sup> More involved models may be of a simulation-stochastic nature or in the form of Markov chains. This group of models includes also dynamic models of the analysis of principal components.

That models of this type are system models in their character is but a supposition, and it must be submitted to closer analysis in order to define its resulting consequences for the systems approach.

The final postulate, that of the system's relative isolation, concerns the relations of the system and its surroundings.<sup>14</sup> These relations find their expression in the interaction between the surrounding and the spatial system of towns which indicates the degree of the system's relative isolation. The systems' surroundings are generally defined as "the set of all objects not belonging to the system whose properties affect the system and are themselves affected by that system".<sup>15</sup> In the case of systems that are but conceptually (and not organically) isolated fragments of the real world, it is entirely up to the researcher himself to decide whether what constitutes the object of his study as viewed from the standpoint of the aim of research is treated as system or as its surroundings.

The surroundings of the spatial system of towns are composed of systems of different degrees of complexity and hierarchy. These include: the overall geographic-economic system and the geographic environment as an ecological system.

With respect to the spatial system of towns, the general geographic-economic system constitutes a subordinate system of regional (national) scope composed of a number of subsystems (of industries, settlements, transports, agricultural subsystems etc.) to which the system of towns belongs and with which it remains in one- and two-way dependences. When the spatial system of towns is not an element of the spatial whole of the overall socio-economic system, the surroundings are spatially external in character (other countries) and those relationships find their expression in the interaction taking place at definite places on the system's boundary.

The study of relations between the spatial system of towns and other subsystems reduces to one-way dependences, with the surroundings viewed as a set of input (independent) variables affecting the spatial system of towns but which themselves are not affected by that system. The way in which the system exercises its own impact may be more precisely described by further specification.

The geographic environment as the natural surroundings of the overall geographic-economic system establishes both the direct and indirect relationships through other geographic-economic subsystems. But, as a system, the geographic environment is governed by regularities of a different character and has a different spatial organization due to the integration of the spatial structure and the process. R. Chorley's and B. A. Kennedy's typology of physical-geographic systems (morphological, cascade, coupled, and controlled) each of which represents a higher level of organization and integration of structure and process contains also an element of human intervention and control as a one-way dependence on the social system.<sup>16</sup> But normally we have to do with essen-

<sup>13</sup> J. Langton, Potentialities and problems of adopting a systems approach to the study of change in human geography, *Progress in Geography*, 4, 1972, pp. 125-179.

<sup>14</sup> The concept of relatively isolated system has been introduced by H. Greniewski, *Cybernetyka niematematyczna* (Cybernetics without mathematics), Warszawa 1969, p. 21.

<sup>15</sup> A. D. Hall, R. E. Fagen, Definition of system, *General Systems*, 1, 1956, p. 18.

<sup>16</sup> Cf. R. J. Chorley, B. A. Kennedy, *Physical geography, a system approach*, London 1971.

tially two-way dependences, and hence the attempts to construct models of the metasystem: geographic environment — human society.<sup>17</sup>

The basic model of the spatial system of towns fulfills the set of general conditions defining the specific nature of systems methodology in geographic-economic studies. Its postulates, however, are general in their character and demand further specification in the form of particular assumptions. Accordingly, further models of higher degrees of specification would be formed as variants of the basic model of the spatial system of towns.

Adam Mickiewicz University, Poznań

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<sup>17</sup> Cf. Z. Chojnicki, A model of interaction between the socio-economic system and geographical environment, *Geogr. Pol.*, 22, Warszawa 1972, pp. 173–181.

## THE NATURE AND DYNAMICS OF REGIONAL SETTLEMENT SYSTEMS

ANN KH. MARKSOO AND SALME J. NYMMIK

The idea that settlement should be considered a kind of system is already implicit in the classic paper by N. N. Baranskiy "Some Remarks about the Economico-geographical Study of Towns",<sup>1</sup> in which he emphasizes the leading role played by towns in the system of settlement and in the spatial organization of the forces of production in general. Later on, a whole group of scientists applied their efforts to investigating theoretical problems and spatial systems of settlement in the USSR taken as a whole as well as in different Union republics and economic regions. While doing it, the researchers envisaged the settlement as falling into two big classes of settled localities, the urban and the rural ones, and accordingly they specialized in their investigations.

In the early 1970's an effort was made to consider settlement formation (both urban and rural) as a unified, consistent process. Since then, it has been assumed that, in the course of the spatial concentration of the forces of production and with the progress of the socio-areal division of labour, on the basis of given socio-economic relations there appear settlements of different quality as well as their regional systems performing various functions and organized hierarchically.<sup>2</sup> Below the reader will find the results of an attempt at bringing to light some basic aspects that determine the essence of the unified system of settlement; an endeavour will also be made to find out to what an extent its transformations and changes can be considered as proceeding regularly.

### THE ESSENCE OF THE REGIONAL SYSTEMS OF SETTLEMENT

In its general sense, settlement is, first of all, a form of spatial existence of a society; the contents of this form are the forces of production — people and objectivized labour — active under the conditions of the corresponding social relations. Settlement reflects in its own way what is regular, from the spatial point of view, in the life of the society, and the factors of change in a specific pattern of settlement should, first of all, be looked for in the socio-economic foundations.

The laws governing the formation of settlements and their spatial systems are primarily a reflection of the process of differentiation in the life of the so-

<sup>1</sup> N. N. Baranskiy, *Ob ekonomiko-geograficheskom izuchenii gorodov* (Some remarks about economico-geographical study of towns), *Voprosy Geografii*, 1946, 2, pp. 19-62.

<sup>2</sup> S. J. Nymmik, V. I. Muryel, *K izucheniyu sistemy rasseleniya (na primere Estonskoy SSR)* (Sum.: On the study of settlement system. On the example of the Estonian SSR), in: *Uchenye Zapiski Tartuskogo Gosudarstvennogo Universiteta*, 282, *Trudy po geografii*, 6, Tartu 1971, pp. 133-150.

ciety. At the present time, settlement embraces all sorts of inhabited localities, no matter what their genesis may be and at which stage they were born, beginning with purely rural settlements, sprung up under the agricultural conditions, and ending with giant cities, which owe their existence to almost anything except rural human activities. Between these two extreme stages of settlement formation all kinds of transitional forms are scattered, in which rural, semi-rural and non-rural kinds of human activities can be found in different proportions. The type of a given settlement and its position in the geographical division of labour depends just on what these proportions are.

Under the conditions of a very high articulation in the geographical division of labour, no settlement is born and develops isolated, but it always does it in a tight co-operation and with the "support" of the neighbouring inhabited localities. As an outcome of productive and non-productive symbiosis among the largest (in a given area) settlements and the surrounding, subordinated, lesser settlements, there comes into existence an integral regional system of settlement.

Regional systems of settlement partake in all general attributes proper to any kind of system. There are, however, some features specific only to the settlement systems. A regional system of settlement represents a unity of relatively independent components — individual settled localities. The latter are tied up to each other by functional, system-creating links. The internal organization of the regional systems of settlement is characterized by structurality, hierarchy and spatial discretion, integrality and autonomy.

Functional structurality as a basic feature of towns has been brought out already by N. N. Baranskiy, and since that time it has found a firm position in the methodology of the Soviet settlement research. The internal hierarchical aspect of the organization of the regional systems of settlement is an objective feature that reflects the hierarchical pattern of the way in which the society manages its affairs, provides for its needs, and produces.<sup>3</sup>

Spatial discretion in the organization of settlements within a regional system is an outcome of their objective spatial nature. Villages come into existence through labouring their lands. Towns always spread out to include a definite zone of convergence. Within the limits of a regional system the settlements are organized on a pattern of "zonal concentration" with reference to the biggest settlement in the system. One can easily observe that as the settlements are getting nearer to the outer limits of a regional system, they become smaller — it is a phenomenon often described by the method of demographic potential. All the regularities observed in the behaviour of the spatial organization of settlements within a regional system may sometimes be subject to changes due to the influence of external factors. Socio-economic (for instance, political administrative boundaries) and natural barriers (water courses and basins, marshes, mountain ridges) may deform both the outlines and the internal organization of a regional system of settlement.

The notions of structurality and hierarchic arrangement are dialectically inter-related characteristic features of the settlement system. A functional-hierarchic comprehension leads to the understanding of the vertical sequence of

<sup>3</sup> V. V. Pokshishevskiy, *Naselennyye punkty — mestnye centry i problemy ikh sopodchineniya* (Inhabited localities — local centres and the problems of their subordination), *Voprosy Geografii*, 1962, 56, pp. 30–53; T. Kaare, E. Lankots, U. Pragi, *Ekonomicheskiye svyazi promyshlennosti yugo-vostochnogo ekonomicheskogo rayona Estonskoy SSR* (Economic links of industry in the south-eastern region of the Estonian SSR), in: *Uchenye Zapiski Tartuskogo Gosudarstvennogo Universiteta*, 237, *Trudy po geografii*, 6, Tartu 1969, pp. 128–148.

the levels according to which settlements in a settlement system are subordinated to one another. However, since the components of the system possess some spatially discretionary traits, functional hierarchy reflects not only the vertical but also the regional (horizontal) structure of the settlement system.

The functional-hierarchical regional systems of settlement possess the attributes of integrality and autonomy. The integrality of a regional system of settlement is determined by the possibility of opposing this system to other systems (to the environment) and by the composition of its components. Autonomy of a system is a consequence of its integrality, which enables one regional settlement system to function to some extent independently of other systems.

#### ABOUT THE FUNCTIONAL-HIERARCHICAL STRUCTURE OF SETTLEMENT IN THE USSR

On the strength of the foregoing theoretical statements, in the USSR settlement one can discern eight functional-hierarchical regional systems. As the basic criteria for establishing the grades of the regional settlement systems the functional-hierarchical structures and convergence zones of the settlements have been considered.

The first grade — the village (*derevniya*), the original stage in the formation of an element of settlement; it is characterized by a most rudimentary functional structure. As a rule it is here that the rural people live by the side of individual, generally speaking, agricultural objects (a farm, a kiln, and the like). The convergence zone embraces the territory of the village itself.

The second grade — a centre of an agricultural enterprise — as a rule, a bigger rural settlement (*selo*). The agricultural functions, which are predominant by far, combine with the service functions; a specific trait is the existence of the organizational economic functions. The convergence zone embraces the territory of the agricultural enterprise.

The third grade — local centres — big rural settlements (*selo*) or smaller urban settlements, as lesser towns or “settlements of the urban type” (*gorodskoy poselok*). In the functional structure, besides the predominant non-agricultural functions, the proportion of the rural ones is still great. The convergence zone includes the territory of two or three communes (*selsoviet*) and several agricultural enterprises.

The fourth grade — a centre of a *rayon* (a low level administrative territorial unit) — an urban settlement with the functions of leadership. The productive (industrial) as well as service functions play already a greater role: besides the services of a periodic type, there occur also some kinds of services of a rather episodic type. The zone of convergence — the territory of the administrative unit of a lower level (*rayon*). However, in consequence of some big industrial plants, using raw materials brought from outside, being located in the *rayon* centre, the economic links of this type of settlement reach far beyond the boundaries of the *rayon* administrative unit, sometimes, being of importance for the whole republic or *oblast*, and even, though not so very often, for the entire USSR.

The fifth grade — a regional centre — a big town of a great productive (industrial) potential, important on the level of a republic or of the Soviet Union. It performs organizational economic functions, which go beyond the competence of individual *rayons* (the management of roads and construction works,

commercial bases). The convergence zone is the territory of a group of lower rank *rayons*.

The sixth grade — the capital city of a smaller republic or a centre of an *oblast* — a big city. Apart from having a large productive capacity of republican or Union significance, it is endowed with agencies of all ranks, first of all with the management boards of the most uncommon enterprises and institutions of episodic service. The zone of convergence — the territory of a smaller Union republic or of an *oblast*.

The seventh grade — inter-*oblast* (inter-republican in a group of lesser republics) centre — a big city with a large production and service potential applicable to a large part or the whole of the USSR (for instance: Leningrad, Kiev, Sverdlovsk and others).

The eighth grade — the capital city of the USSR — Moscow. The convergence zone is the entire Soviet Union.

All functional-hierarchical regional systems of a lower grade enter as subsystems into regional systems of a higher grade, while the latter are supersystems in relation to the systems of lower grade. Thus, a settlement system of a small republic (of the Estonian Republic, among others) or of an *oblast* of the RSFSR enters into the all-Union supersystems of a big part of the country and the Soviet Union as a whole.

#### ON THE DYNAMICS OF THE REGIONAL SYSTEMS OF SETTLEMENT

As the socio-economic foundation changes and develops, so do the regional systems of settlement that have grown out of it. The causative factors of the dynamics are, first of all, the mechanical and the natural movements of population, as well as the increase or decrease in the material capital funds. At this instance it is of importance to emphasize that according to the tenets of the dialectical teaching about the relationship of contents and form, the settlement as a spatial form always lags behind the development of its contents and reflects the changes that have occurred in the life of society only with some delay.

There are two aspects of the dynamics of the regional settlement system. Firstly, it finds an expression in the general increase or decrease of the population, of the capital funds, and of the territory the system embraces. In the case of the regional systems of a higher grade, for instance those of the Union republics, the two former values tend, as a rule, to grow, whereas the limits of the systems are relatively stabilized. It stands to reason, however, that these circumstances do not preclude either the contact zones coming into existence between different systems, or some settled localities entering simultaneously into the convergence zones of two neighbouring centres of the settlement systems.

All regional settlement systems of the Union republics are getting transformed under the influence of local (internal) as well as all-Union (external) factors of growth. The internal factors of growth are the natural increase of population and the extended reproduction of capital funds obtained owing to locally produced added value. To the external factors of growth belong the inflow of people (the positive balance of migration) from other regional systems and also the creation in the settlement system of various new productive plants that have an all-Union importance (and are supplied with funds from centralized sources). Because of such new enterprises some old settlements may grow

extensively and acquire a more diversified functional structure; for the same reasons new settlements, highly specialized, may be born. As a rule, new settlements are included into the neighbouring settlement system making an organic part of it. There may be, however, exception to this rule. Sometimes, their basic function being too specific, there may be new settlements that are only loosely tied up with the neighbouring area. If this is the case, those ties are dominant, by means of which the settlement is included, as a particular link, into some specialized decentralized system of settlements (e.g., into the all-Union hierarchical system of harbour towns).

The second aspect of the dynamics of the regional systems of settlement is related to internal changes in their structure. They are brought about by differences in the natural increase of population and in the balances of people immigrating and emigrating, and also by irregular accretion in capital funds. The structural changes can be divided into two groups: (1) changes in the specific weight of different grades in the hierarchy, and (2) changes inside the same particular hierarchical grade, that is changes in the specific weight of settlements, belonging to one or several functional types, brought about by differentiated rates of growth. Eventually such changes may cause shifts along the hierarchical scale: some settlement may go up, others step down.

At the present time, the process of urbanization gaining in strength and depth, the main shift among the hierarchical groups of settlements consists in the lowering of the specific weight of rural settlements and the corresponding heightening of that of urban settlements. Simultaneously changes occur also in relationships among particular hierarchical grades of towns — as a rule, in the direction of the medium and big towns growing in importance. In the rural areas the specific weight of bigger villages also tends to increase.

This general development trend, moving along the vertical lines, from low to high, is well reflected in the direction and numerical dimensions of migrational flows in settlement systems. By and large, the vertical migrational streams (movements of people between settlements of different levels of development) predominate over the horizontal ones (movements of people between settlements of equal level of development). Besides, the up-going migrational flows (from village to town, from a small town to a bigger one) are numerically greater than the opposite ones.<sup>4</sup> Investigations concerning the causes of migration prove that the main motive forces which make people move up on the hierarchical scale of settlement are the desire to get better educated in one's profession, the drive to climb the steps of one's vocational career, or the wish to settle where manifold cultural needs may be better satisfied. No wonder, for the higher links of the chain of social infrastructure, including specialized institutions of higher learning and higher echelons of authority, are to be found mostly in bigger towns. At the same time the currents of controlled migration, leaving the more developed towns, are increasingly being directed toward the rural areas and the less developed towns; it is over there that a number of school graduates or a part of skilled cadres from the higher ranked towns are induced to move. However, as to its dimensions, this movement does not compensate for the opposite flow having its source in the desire to learn and in the individual initiative.

What we have said before does not mean that regular proportional growth of those settlements that are higher up in the settlement hierarchy is an ubiqui-

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<sup>4</sup> A. Marksoo, On trends of intrarepublican migration in the Estonian SSR, *Estonia Geographical Studies*, Tallin 1972, pp. 123-135.

tous phenomenon. It should be kept in mind that at a given stage of development, depending what is the degree of the concentration of the forces of production and what is the organization of the administrative and economic authorities, the specific weight of particular grades in the hierarchy of settlement is by no means the same. For instance, in the Estonian SSR of today the capital city and the *rayon* centres are more firmly rooted in the ground and have better prospects of growth than the local and regional centres whose specific role is decreasing.

The analysis of the dynamics of concrete settlement systems discloses also that, when investigating changes within a single hierarchical group, it is necessary to reckon with the following circumstances. The settlements of a particular hierarchical group are characterized by definite terminal dimensions within the limits of which the settlements are capable of performing their functions, for instance those of the centre of an administrative district (*rayon*), of an *oblast*, etc. The terminal values are obviously dependent upon how large is, generally speaking, a given settlement system and what are its particular features: the number of inhabitants, the extension of its territory, its internal physical and economic differentiation, and the like. Settlements, which are at the lower grades of their functional hierarchical group, not infrequently develop at a quicker pace than the settlements that, although they belong to the same group, are at its upper grades. To transgress the terminal dimensions at the higher level of the scale is made difficult because the convergence zone of a given town is, in fact, limited, and any attempt at enlarging it intrudes, so to say, into the convergence zone of another town of a higher rank. One can notice, for instance, that the "ceiling" setting a limit to the development of a *rayon* centre depends on the influence of the nearest regional centre, and the development of the latter — on the influence emanating from the capital city of the republic, etc.

This paper has dealt with only some more general and essential features and regularities of the dynamics of the settlement systems. The conditions of the development of each system of settlement being different, each acquires some features that are peculiar to it. In one system some tendencies push more strongly to the fore, while in another the same may be true of different trends. Deviations from what may be considered as regular development are especially frequent in the settlements that are in the zones of transition between various neighbouring settlement systems, as well as in the settlements that fall into the above mentioned category of highly specialized systems. These are, however, exceptions that do not contradict the assertion that the dynamics of the settlement systems follow certain basic rules, which reflect still broader processes of the concentration of the forces of production and of ever growing urbanization.

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## ROLE OF NEW TOWNS IN THE DEVELOPMENT OF SETTLEMENT SYSTEM IN THE USSR

OLEG A. KONSTANTINOV

A change in the social structure entails essential alterations in the structure and territorial distribution of social production. These, in turn, bring about gradual changes in settlement, in particular in the network of town settlements. The geography of towns under capitalism is different from the feudal urban geography, not to mention that of the slave-owning system. Some cities (Rome, Athens, Istanbul, Alexandria, etc.) have existed for many centuries and even millennia. As a result of changing socio-economic conditions, they have changed their functions and their appearance. But many of them have fallen into decay or even vanished completely, and these have been replaced by new towns born of their own epoch.

The former Privilinsk territory, a region of Poland that was a part of the Russian Empire, is an example of this. Here a dense network of towns was historically established to meet the requirements of Polish feudal society. At the beginning of the 1860's 452 settlements were officially classified as towns here. As the capitalist relations of production developed, many of these towns began to lose their urban functions and fall into decline. In 1866, 280 of them were deprived of this title and only 172 were still called towns.<sup>1</sup> The process of decline continued; consequently the decline of towns of feudal origin also continued. According to the 1897 census only 121 of all the former towns had retained their status. And only a little more than half of them were economic centres of some significance. To make up for this, the period of capitalism has created new economic centres, which have grown largely around factories and works. These new industrial towns constituted two-thirds of all major economic centres of the Privilinsk territory.<sup>2</sup> Most of them were actually given the rights of a town later on. Changes in town structure inevitably occur in countries that have embarked upon socialist construction, too. This phenomenon can be observed in the countries that were populated and developed long ago. Such countries have a network of towns that has been taking shape for many centuries. In some of these countries the process of renovation of this network is sufficiently intensive. Thus, before the establishment of people's power in Bulgaria (i.e., before September 9, 1944) there were 104 towns. Tremendous successes in economic and social development have resulted in the foundation of 70 new towns<sup>3</sup> in Bulgaria by 1970.

<sup>1</sup> This should be regarded as a repressive measure against those who took part in the revolt of 1863.

<sup>2</sup> O. A. Konstantinov, *Ekonomicheskiye tsentry Privilinskogo Kraya na rubezhe XIX i XX stoletiy* (Economic centres of the Privilinsk territory at the turn of the century), *Izv. VGO*, 1973, 1, pp. 21-27.

<sup>3</sup> I. Penkov, *New towns in the People's Republic of Bulgaria* (in Bulgarian), Sofia 1971.

The renovation of towns is most marked in the Soviet Union. Before the Great October Socialist Revolution many settlements, having the rights of a town under the Administrative Reform at the end of the 18th century, lost their functions, but still continued to be considered as towns. On the contrary, many industrial centres that sprang up during the period of capitalism did not secure the rights of township from the tsarist government, because of the large proletariat population there. V. I. Lenin wrote: "Among the 'towns' of the provinces of Vladimir, Kostroma, and Nizhnii Novgorod there are quite a few of less than three, two, or even one thousand residents, whereas quite a number of 'villages' have two, three, or five thousand factory workers alone".<sup>4</sup>

As soon as the Soviet Government came to power the regulation of the urban network, inherited from the old regime, began. By the 1926 census, more than 100 of the former towns had been reduced to the rank of villages, while 180 non-town economic centres had been given urban rights.<sup>5</sup> After that only a few were deprived of this title, but to make up for this one thousand new towns were founded, which now constitute more than half of all the towns in the USSR.

The formation of the network of new towns, including those founded in the post-war years, has not yet been studied completely in this country.<sup>6</sup> The sources of information concerning all administrative reforms in this country are the Gazette of the Supreme Soviet of the USSR published since 1937 and the handbook "The USSR: Administrative and Territorial Division of the Union Republics".<sup>7</sup>

The formation of new towns since 1927 is presented in Table 1. From the table it can be seen first of all that the total number of new towns is now smaller than in the period since 1927. Some of them have merged with neighbouring towns and ceased to be independent units.<sup>8</sup>

In the years following the 1926 census the process that had been going on from 1918 to 1926 still continued. Urban rights were given to settlements that had previously been formed as economic centres (Rubtsovsk, Kamensk-Shakhtinskiy, Tulun, etc.) or as new administrative centres (Dzhalal-Abad, Naryn, Gorno-Altaysk, Karachayevsk). But in later years the results of the socialist industrialization of the country began to tell upon the process. Consequently, once insignificant workers' settlements which had become important industrial centres became towns (e.g., Kadiyevka, Gorlovka, Kramatorsk, Konstantinovka, etc., in the Donbass; Anzhero-Sudzhensk and Prokopyevsk in the Kuzbass; Dzerzhinsk near Gorkiy, and so on). New towns born of the first Five-Year Plan appeared (Magnitogorsk, Berezniki, Krasnouralsk, Novokuznetsk, Komsomolsk-on-Amur, and so on).

<sup>4</sup> V. I. Lenin, The development of capitalism in Russia (in Russian), Collected Works, vol. 3, p. 56.

<sup>5</sup> O. Konstantinov, Changes in the geography of towns in the USSR during the Soviet period (in Russian), *Problemy geografii*, 1947, 6.

<sup>6</sup> O. Konstantinov, *The study of the network of urban settlements in the USSR in Soviet economic and geographical literature*. Materials of the 1st Interdepartment Conference on the geography of population, 1965, 7.

<sup>7</sup> First published in 1937. Before that there had been similar publications under different titles.

<sup>8</sup> For example, Ivankovo, formed in 1958, was amalgamated with Dubna in 1960; Novo-Vilnya, given urban rights in 1950, was absorbed by Vilnius in 1957; Borovsk, a town since 1949, became part of Solikamsk in 1959; the last time that the boundaries of Moscow were extended (in 1960) they embraced, among other urban settlements, the town of Tushino (formed in 1938), and so on.

TABLE 1. New towns founded in the USSR between 1927 and 1973

Year	Number of towns	Year	Number of towns	Year	Number of towns
1927	9	1943	18	1959	14
1928	3	1944	24	1960	13
1929	3	1945	17	1961	39
1930	4	1946	27	1962	22
1931	12	1947	15	1963	43
1932	20	1948	9	1964	18
1933	10	1949	17	1965	38
1934	9	1950	28	1966	40
1935	10	1951	24	1967	32
1936	6	1952	20	1968	18
1937	15	1953	18	1969	12
1938	139	1954	28	1970	10
1939	22	1955	23	1971	21
1940	19	1956	56	1972	21
1941	15	1957	30	1973	22
1942	13	1958	21		

Subsequently, socialist industrialization has become the most important factor influencing the creation of new towns in the USSR.

The marked increase in the number of new towns in 1938 is noteworthy. By that time the country had completed the second Five-Year Plan; many new industrial centres had sprung up and a new population census had to be taken in January, 1939. Unlike the 1926 census, in which many settlements not classified as towns or urban settlements (but meeting the requirements of the census) were registered as urban settlements, in the 1939 census and the subsequent 1959 and 1970 censuses, only those settlements were registered as urban which were officially classed as towns or urban settlements. Therefore, those settlements had to be registered officially as urban that had actually become such as a result of socialist construction.

It is a striking fact that new towns were founded during the Great Patriotic War. In those extremely difficult years the network of urban settlements continued to expand and urban rights were given to 72 settlements. The formation of new towns was mainly linked with the relocation of the industrial centres and with the war-time reconstruction of the Soviet national economy.<sup>9</sup>

In the post-war period the formation of new towns was influenced by the rapid pace of the Soviet Union's all-round development.

The proportion of new towns differs greatly from one administrative and territorial unit to another (see Table 2). As might be expected, in old, long-settled localities with a historically established urban network, where there are new towns, their proportion is relatively small, as in many regions of the European RSFSR (Kaliningrad, Pskov, Smolensk, Orel, Kursk, etc.) and the Ukraine (Rovny, Tarnopol, Ivanovo-Frankovsk, Chernovtsy, Lvov, etc.), as well as in Estonia, Latvia, and the Sakhalin region. As mentioned previously, Lithuania sharply contrasts with them.

<sup>9</sup> O. Konstantinov, New urban settlements of the Great Patriotic war period (in Russian), *Transactions of the Leningrad Finance and Economics Institute*, 1956, 13.

On the opposite "pole" one sees the most backward "outlying areas" of the former Russian Empire, which were so underdeveloped that there was not a single town there (the Kalmyk ASSR; the Khakass, Gorno-Altai, Gorno-Badakhshan, and Karachay-Cherless Autonomous Regions; the Nenets, Komi-Permyak, Yamalo-Nenets, Khanty-Mansiysk, and Taymyr (Dolgano-Nenets) national districts; the Magadan, Dzhezkazgan, Turgay, Syr Daria, Kulyab, Naryn districts.

There is a high proportion of new towns in most of the eastern regions, which are being systematically developed and settled, and the same is true of most of the Union Republics. The proportion of new towns is as high as 74% in Kazakhstan, 73% in Kirgizia, 72% in Tadzhikistan, 86% in the Komi ASSR, 87% in the Karbardino-Balkarian ASSR, and 78% in Armenia. The consistent implementation of a national policy has led to a growing number of new towns as economic and cultural centres in the union and autonomous republics, autonomous regions and national districts.

TABLE 2. Distribution of administrative and territorial units of the USSR\* according to the proportion of new towns

Without new towns	10	51-60%	15
1-10%	7	61-70%	24
11-20%	6	71-80%	25
21-30%	13	81-90%	13
31-40%	19	100%	16
41-50%	13	Total:	161

\* According to the administrative and territorial divisions as of January 1, 1974.

The proportion of new towns in the country's main industrial areas is just as high: in the Donbass (Donetsk region 87%, Voroshilovgrad region 92%), in the Urals (Sverdlovsk region 77%, Perm region 74%, Chelyabinsk region 82%, the Bashkir ASSR 71%), in some areas of Siberia (Kemerovsk region 79%), the Soviet Far East (the Khabarovsk Territory 78%), and so forth.

In the European USSR, certain parts of the Volga region can be mentioned (Kuibyshev region 80%, Volgograd region 83%), and the Ukraina (Kirovograd region 82%, Kherson 88%, Zaporozhye 77%, Kiyev 80%, Nikolayev 67%).

In the central European territory new towns amount to only 38% (areas: North-Western 36%, South-Western 34%, and Central-Chernozem 29%), but in the Tula region this proportion is as high as 67% (the influence of the coal-mining basin near Moscow), while in the Moscow region it is 61% (due to the districts near Moscow).

The proportion of new towns is especially high in the "agglomerations" that have formed both around major cities (Moscow, Leningrad, Gorkiy, Kharkov, etc.), and in mineral extraction areas (in the Donetsk and Kuznetsk coal basins, in the Krivcrozhye iron-ore basin, etc.).

The Soviet specialist literature does to a certain extent deal with the origin of new towns, but not sufficiently. At present the origin of new towns is being studied on an all-country scale by A. A. Epikhin. According to his preliminary data, about 70% of all new towns have evolved from some prerevolutionary urbanistic embryos. Naturally, the overwhelming majority of them are situated in old, long settled parts of the country. But they are also found in certain

peripheral areas where industrial development started shortly before the revolution.

The most widespread type of new town is represented by the factory-and-works village settlements. Factories and works, situated in such villages, expanded; often new industrial enterprises sprang up. The settlement that had retained its originally rural appearance gradually lost it. Workman from the nearby villages moved closer to their place of work. Eventually, the former factory village became a well-built factory housing estate which, in turn, became a town.

There are quite a few towns of this type in the following regions between Volga and Oka rivers: Vladimir (Gus-Khrustalnyy, Kolchughino, Karabanovo, etc.), Moscow (Balashikha, Ivanteyevka, etc.), Ivanovo (Navoloki, Privolzhsk, etc.), around Gorkiy (Vyksa, Kulebaki, Dzerzhinsk, etc.), around Bryansk (Dyadkovo, Kirov, Lyudinovo, etc.), in the Urals, and in other regions of the USSR.

The new towns arising out of old mineral mining centres are of a similar type, for instance: Artemovskiy, Asbest; Berezovskiy, and others in the Sverdlovsk region; Gubakha in the Perm region; Kopeysk in the Chelyabinsk region, etc. — all in the Urals; Semiluki in the Voronezh region; Belaya Kalitva, Morozovsk in the Rostov region; Zmeinogorsk in the Altai Territory; Anzhero-Sudzhensk, Salair, etc. in the Kemerovo region; Artem and Suchan in the Primorye Territory, and so on.

Those new towns emerging from settlements around major railway stations and junctions are of a special genetic type. Such are Cheorghiu-Dezh (formerly Liski) and Povorino in the region of Voronezh, Ruzayevka in the Mordovian ASSR, Agryz in the Tatar ASSR, Asino in the Tomsk region, Volnovakha, Ilovaysk, and Krasnyy Liman in the Donetsk region, Lozovaya, Lubotin, and Merefa in the Kharkov region, and so on.

About a quarter of the new towns have grown from large villages, some of which had considerable trading, and sometimes even industrial functions, while remaining, nevertheless, predominantly agricultural settlements. The appearance in them of enterprises to rework agricultural produce among others, has led to a considerable reduction in agricultural production and to the strengthening of the role of industry and the other functions; this eventually resulted in their becoming town-type settlements and then towns. New towns in the Northern Caucasus, which now exist on the sites of former populous cossack *stanitsas* and large migration villages, are typical in this respect, for example, Abinsk, Belorechensk, Krymsk, Kurganinsk, Labinsk, Slavyansk-upon Kuban, Tumashevsk, and other towns in the Krasnodar Territory.

There are new towns of this type in the Ukraine, among them the towns created from former boroughs (for example, Bar, Bershad, Khmelnik in the region of Vinnitsa, Dunayevtsy, Polonnoye, Slavuta in the region of Khmel'nitsk, and so on), as well as from the large villages of the steppe zone (Tokmak, Gulyay Pole, etc. in Zaporozhe, Berezovka in the region of Odessa, Kakhovka in the region of Kherson, etc.).

New towns of this origin are to be found almost everywhere (Alekseyevka in the region of Belgorod, Uryupinsk, Nikol'yevsk, Leninsk in the region of Volgograd, Kalach in the region of Voronezh, etc.).

Thirty per cent of the new towns did not spring up from any urbanistic embryo and have, as the Soviet special publications say, grown on "blank" or "empty" places. These fall into two different genetic types: first, there are towns that have arisen on the sites of small agricultural settlements, i.e., in populated localities, for example, Naryan-Mar, Kudymkar, Ivdel, Kondopoda,

Medvezhyegorsk, Komsomolsk-on-Amur, etc. Second, there are towns on previously uninhabited sites. This genetic type includes many towns on mineral extraction sites, such as Kirovsk, Monchegorsk, Kovdor, and Olenegorsk in the region of Murmansk, Vorkuta and Ukhta in the Komi ASSR, Norilsk in the Krasnoyarsk Territory, Neftuyugansk and Urai in the region of Tyumen, and so on. Most of these towns are located in those parts of the USSR (especially in the north and east), where new mineral deposits are being developed.

A peculiar genetic type is that of the towns that have grown around hydroelectric power stations and other hydro-structures (Bratsk, Volgodonsk, Volzhskiy, Divnogorsk, Zavolzhije, Novaya Kakhovka, Togliatti, etc.).

This is a far from complete list of all the genetic types of new towns in the USSR, but it covers the most widespread among them. Special consideration should be given to detailed analysis of genetic types of new towns and their geographical distribution. New towns are one of the striking manifestations of urbanization. In the USSR this process is not all uniform. It has taken various forms, depending on the significance of a given area in the country's national economy and on all the local conditions. When new towns appear in a sufficiently urbanized area, their foundation is linked with the inward development of urbanization, with the intensification of the process itself. The Moscow region is a striking example of this. Before the Revolution, there were 19 towns (including Moscow) in this territory. The network of towns there was sufficiently dense for that time. Immediately after the Great October Socialist Revolution fourteen industrial centres that had formed earlier were given urban rights (Orehovo-Zuyevo, Mytishchi, Ramenskoye, etc.). By the 1926 census, the Moscow region (then a province) was among the most urbanized areas in the Soviet Union (the urban population here constituted 60% as against the average of 18% for the USSR). Nevertheless, during the pre-war Five-Year Plans 20 settlements were made into towns there and in the post-war period another twenty-three. As a result, three-fifths of the new towns are in the region of Moscow. A similar situation obtains in other regions between the Volga and the Oka, in the Urals, in the Donbass (though with their own modifications).

It is quite another matter when new towns spring up in places that are underdeveloped and thinly populated, where towns are being built for the first time. This is evidence of the outward development of urbanization, or its extensive process. For example, in the new Turgay region, Kazakh SSR, created in 1970, three towns and one urban-type settlement have been founded very recently. The regional centre Arkalyk became town in 1965 (urban settlement in 1956), Derzhavinsk — a town in 1966 (urban settlement in 1963), Esil — a town in 1963 (urban settlement in 1958), and the urban settlement Zhaksy was formed in 1960. The Gorno-Badakhshan Autonomous Region is also of this type for there is only one town, Khorog (founded in 1932), and no other urban settlements whatsoever. The administrative and territorial units just listed, where towns are completely new, are an illustration of urbanization development.

The creation of new towns is not the sole feature of urbanization, but, as can be seen, we are sufficiently justified in using it to establish the type of urbanization found in the USSR.

## RELATIONS BETWEEN LAND USE INTENSITY AND THE SIZE OF TOWNS IN POLAND

WITOLD KUSINSKI

Urbanization being the common and large-scale phenomenon it is, its problems draw the attention of specialists of different scientific disciplines. Both Polish and foreign scientists are concerned with its demographic and economic bearings.<sup>1</sup> The sociology of development of towns<sup>2</sup> is especially widely studied. Lawyers too have to devote their attention to the quick progress of urbanization,<sup>3</sup> not less than municipal services specialists.<sup>4</sup> Previously, however, the progress of urbanization has seldom been considered in terms of space. The space problem, or rather that of a town's spatial structure, is a vital question of urban geography. Indeed, any thorough study of a town or group of towns requires the investigation of their territorial development, the changes in land use, increasing or decreasing trends in its intensity, etc. The literature on the spatial structure of towns is rather abundant.<sup>5</sup> In references one can often find numerous papers on the spatial structure of particular towns as well as many

<sup>1</sup> K. Dziewoński, Procesy urbanizacyjne we współczesnej Polsce. Stopień poznania, próba syntezy (Sum.: Urbanization processes in contemporary Poland. An attempt at a synthesis), *Przegl. Geogr.*, 34 (1962), 3; Kusiński, W., Demographic and social aspects of urbanization in Poland, *Geogr. Pol.*, 27, 1973: *Problemy sovremionnoy urbanizatsii*. Ed. Pivarov, Moskva 1972; K. Davis, The Urbanization of the Human Population, *Scientific American*, 1965, 5.

<sup>2</sup> S. Nowakowski (Ed.), *Socjologiczne problemy miast polskich* (Sociological problems of Polish towns), Warszawa 1964; J. Ziółkowski, *Urbanizacja, miasto, osiedle* (Urbanization, town, settlement), Warszawa 1965; *Urbanizatsiya i rabochiy klas v usloviyakh nauchno-tekhnicheskoy revolyutsii* (Urbanization and the working class under the scientific-technical revolution conditions), Moskva 1970; P. Rybicki, *Spoleczeństwo miejskie* (Urban society), Warszawa 1972.

<sup>3</sup> J. Służewski, *Działalność organów państwowych na obszarze aglomeracji miejskich* (State organs in urban agglomerations), Warszawa 1965.

<sup>4</sup> A. Ginsbert, Małe miasta i przesłanki ich rozwoju (Small towns and the objectives of their development), *Gosp. Admin. Terenowa*, 1966, 5; A. Ginsbert, Miasta polskie i ich wyposażenie w urządzenia komunalne (Polish towns and their municipal facilities), *Biuletyn KPZK PAN*, 10 (29), Warszawa 1963; Z. Dziembowski, A. Ginsbert-Gebert, *Urządzenia komunalne jako element kosztów budowy miast* (Municipal services as part of towns' construction costs), *Studia KPZK PAN*, 43, Warszawa 1973.

<sup>5</sup> K. Dziewoński, Geografia osadnictwa i zaludnienia (Sum.: Geography of population and settlement), *Przegl. Geogr.*, 28 (1956), 4, pp. 721-762; A. Werwicki, *Struktura przestrzenna średnich miast ośrodków wojewódzkich w Polsce* (Sum.: Internal structure of Polish medium size towns, voivodships capitals), *Prace Geogr. IG PAN*, 101, Warszawa 1973; *Studia z geografii średnich miast w Polsce. Problematyka Tarnowa* (Studies in geography of medium-size cities. Problems of Tarnów), *Prace Geogr. IG PAN*, 82, Warszawa 1971.

general and theoretical ones.<sup>6</sup> Some of them have become the part and parcel of the relevant disciplines (e.g., those of W. Burgess, H. Hoyt, Ch. D. Harris and E. L. Ullman). However, the majority of elaborations on the spatial problems of towns, be they monographic or general-theoretical, can hardly be recognized as being concerned with the spatial problem of urbanization. Of course, they can be of use for the analysis of this question. But they are habitually confined to one concrete town only, its progress and the regularities of development of its spatial structure.

The importance of the study of urbanization in its spatial bearing, be it at the level of a region, country or continent, will become obvious as soon as we recall that every society has but a limited territory which for this very reason ought to be utilized as economically as possible. Such a study, however, involves serious difficulties, caused first of all by the lack of comprehensive statistic data on land use in towns. The information available usually concerns a town's territory, whereas nothing is said about its uses, what part of it is occupied by areas with investment (with the sort of investment specified) or agriculture, forests, waters, transport, waste land, etc. As for Polish towns, no material concerning all of them that would enable a wider comparative study has been gathered so far, even though data on land use in certain particular towns have been available. In Z. Galperyn's opinion,<sup>7</sup> this is due to the fact that "the information on urban areas is the most neglected and least elaborated branch of statistics". This remark is presumably true of other countries as well.

For the study of the progress of urbanization it is essential that comprehensive data on urban areas and land use (or uses) are gathered. Urbanization, which is the most significant process of modern times, is evidenced by intensified land use as well as economic and social changes. The land use intensity is expressed in fixed capital per unit area and by population density.<sup>8</sup> The land use intensity in towns can also be expressed by the extent to which the environment is transformed.

Assuming the above factors as the measure of urbanization one must bear in mind how difficult it is to carry out the relevant studies. The ministries of Agriculture and Municipal Economy have recommended that uniform land records in Poland should be kept.<sup>9</sup> This, together with the research financed by the Central Statistical Office (*GUS*)<sup>10</sup> and the Institute of Geography of the Polish Academy of Sciences,<sup>11</sup> makes it possible to analyse the various land uses in all Polish towns (and not only in individual cases) more thoroughly.

<sup>6</sup> The most important are: O. Schlüter, *Bemerkungen zur Siedlungsgeographie*, *Geogr. Z.* (Leipzig), 1899, 5; O. Schlüter, *Über die Grundrisse der Städte*, *Z. Gesell. Erdkunde*, 34, Berlin 1899; R. E. Park, W. Burgess, R. D. McKenzie, *The city*, Chicago 1925; Ch. D. Harris, E. L. Ullman, *The nature of cities*, *Ann. Amer. Acad. Polit. Soc. Sci.*, 242, Philadelphia 1945.

<sup>7</sup> Z. Galperyn, *Gospodarka terenami miejskimi w Polsce i jej przemiany po II wojnie światowej* (The economy of urban areas in Poland and its development after World War II), Warszawa 1972.

<sup>8</sup> Note that the land use intensity in towns is in no direct relation with the productivity of land, as land is seldom a basic factor of production in towns.

<sup>9</sup> Minister of Agriculture's decree of 2 Feb. 1955 concerning uniform land records, *Dziennik Ustaw* No. 6 of 15 Feb. 1955; Minister of Municipal Economy's instruction of 8 Sept. 1959, *Monitor Polski* No. 96 of 29 Sept. 1959; Minister's of Agriculture and Municipal Economy's regulation of 20 Feb. 1969, *Monitor Polski* No. 11 of 25 March 1969.

<sup>10</sup> *Tereny w miastach i osiedlach, 1968 r. Użytkowanie i władanie* (Areas in towns and settlements, 1968. Use and ownership), GUS, Warszawa 1969.

<sup>11</sup> Bilans użytkowania ziemi w Polsce (według stanu na 31 XII 1970) (Balance of land use in Poland as on Dec. 31, 1970), *Dok. Geogr.*, 2, Warszawa 1972.

Even though certain land uses are treated too briefly, the material as a whole is nonetheless much more abundant than previously available.

We deal with the land use intensity in all Polish towns (i.e., 889 towns and urban settlements in 1971) treated as a whole. The towns were divided into seven size groups according to the number of inhabitants. The first group includes towns of up to 5 thousand inhabitants, the next one, towns of 5-10 thousand inhabitants and the last and smallest (including 5 towns only), those having more than 500 thousand inhabitants.<sup>12</sup> The analysis takes into account the total area of towns as well as the areas of agriculture and with investment. The latter category includes transport (roads, squares, streets) and settlement areas with building developments. On the other hand, the settlement areas with no building developments, green areas and mining sites were neglected. Neither were forests and tree stands, waters, waste land areas and those classed as various areas analysed. This, however, seems reasonable, as land use intensity in areas without building developments is much lower than in those built over or with all sorts of traffic arteries. Moreover, green areas constitute a minor part of a town's territory.

Due to the lack of information of fixed assets accumulated in urban areas, the land use intensity in towns was established indirectly, by determining the share of areas with investment in a town's territory and the population density. As for the latter, two categories were distinguished — the general density of population (the number of inhabitants versus the whole area of the town) and the qualified density of population (the number of inhabitants versus the areas with investment).

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Since World War II, the economic and social structure of Poland has been thoroughly transformed. The changes in economy have altered the settlement network system essentially and enabled a quick progress of urbanization. Between the wars Poland was hardly urbanized, as the sparse urban network and the low percentage of urban population of that time indicate.

World War II inflicted serious losses on Polish towns. A great part of the urban population was murdered, and many buildings, factories, trade institutions and municipal services destroyed. It is hard to calculate the material losses of Polish towns. They can be gauged by the losses in urban population, which in 1946 was by 3.5 million less than in 1931. The first census carried out after the war showed that 7.5 million people lived in towns.

The development of industry and other non-agricultural branches of economy has caused a great part of the population to come to the towns, to the benefit of the latter. Thus in 1950 the urban population constituted 39.0% of Poland's entire population, in 1955 — 43.8%, in 1960 — 48.3%. In 1966 the urban population caught up with that of villages and exceeded it ever since. In 1972 17.6 million people, i.e., 53.1% of the country's population, lived in towns. Since the war's end Poland's population has increased by almost 10 million, i.e., over 40%. The urban population too has increased by nearly 10 million, i.e., 120%, while the village population has remained at the same level. Hence it follows that towns have absorbed the entire increase of population.

The rapid progress of urbanization is expressed by not only the increase of urban population and its share in the country's total population, but also by

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<sup>12</sup> The size group of towns of over 500,000 inhabitants includes five city-voivodships (Warsaw, Łódź, Cracow, Wrocław, Poznań) of which Poznań had not had a population bigger than 500,000 by the end of 1971.

the increased density of the urban network. In 1945 there were 751 settlements with town status in Poland. In view of war damage, depopulation and the fact that some of them did not really function as towns, 72 settlements were deprived of this status in 1945-1950, in which period 26 other settlements were given it. In the years to follow the number of towns systematically increased. In 1951-1955 the town status was given to 33 settlements, in 1956-1960 to 20, in 1961-1965 to 45, and finally in 1966-1970 to 4 settlements. Some others have simultaneously lost the status of towns, no matter how long their tradition was. From the end of World War II to 1972 this fell to the lot of as many as 88 settlements.

From 1954 to January 1, 1973 a specific form of settlement in Poland were urban settlements. In the years 1954-1963 very many settlements of this type were formed. In that period 160 settlements were established that in the years to follow were either given the status of a town or included in the neighbouring towns. Most new towns and urban settlements were formed in regions of highly developed industry, namely the Katowice and Wrocław voivodships, the Warsaw district and the western part of the Cracow voivodship.

The system of urban settlements that has evolved during the 28 years of development of administration includes 889 units.<sup>13</sup> The number of towns rela-

TABLE 1. Density of towns and settlements in Poland in 1971

Voivodship	Density of towns (number of towns per 10,000 km <sup>2</sup> )	Area per 1 town (km <sup>2</sup> )
Białystok	15.6	643
Bydgoszcz	27.8	361
Gdańsk	29.0	345
Katowice	95.3	105
Kielce	19.0	527
Koszalin	19.3	517
Kraków	34.0	294
Lublin	12.9	777
Łódź	24.1	427
Olsztyn	18.5	540
Opole	37.7	265
Poznań	38.0	265
Rzeszów	24.7	405
Szczecin	31.4	319
Warszawa	23.4	424
Wrocław	51.7	193
Zielona Góra	28.8	347
Poland	28.4	352

Source: *Rocznik Statystyczny* (Statistical Yearbook) 1971.

<sup>13</sup> On January 1, 1973 the administrative division of Poland was reformed to the effect that urban settlements were abolished as independent administrative units (16 of them were given the status of towns, 8 were incorporated in the neighbouring towns and 29 were reckoned as villages) and, moreover, 13 towns were eliminated (10 were connected with the neighbouring ones and 3 were reckoned as villages). As a result of this the number of towns was reduced to 836.

ted to Poland's area yields the mean index of towns density equal to 28.4/10,000 km<sup>2</sup>. In other words, one town "pertains to" approximately 352 km<sup>2</sup>. This value differs with regions (Table 1). The urban network is densest in the Katowice voivodship. The density index there is 7.8 times higher than in the Lublin voivodship. The density of the urban network determines the share of urban areas in the total area of a voivodship.

Another characteristic feature of the network of Polish towns is that complex settlement forms are created (groupings of towns and settlements). According to the statistical data,<sup>14</sup> as soon as in 1965 more than 20% of the total number of towns and almost 52% of the urban population fell to groupings of towns. After S. M. Zawadzki,<sup>15</sup> in 1970 urban complexes occupied 5.1% of the country's territory and 35.4% of the country's population (60% of the whole urban population) lived there. Hence it follows that in the social-economic life of our society it is not the small "islands of urbanization" that play the leading role, but groupings of towns that accommodate a great part of the population and a lot of different facilities.

The above data are significant. They are the starting point for the consideration of the progress of urbanization in its spatial bearing. As towns develop, which is expressed by the increase of their economic basis and population, they always expand in space. Sometimes this happens prior to administrative changes and the town, so to speak, overflows its boundaries.

In view of this quick development, especially of bigger towns, and the necessity to keep a reserve of territory, the territories of many Polish towns were expanded after World War II. Thus, when a town's territory is expanded in this way, it does not necessarily evidence the progress of urbanization.

The area occupied by towns has greatly increased since the war. In 1950 it was 15.5 thousand km<sup>2</sup>, i.e., 5% of Poland's area. Then a wide-scale territorial expansion of towns (mostly big ones, being the centres of voivodship administration and industry) took place. This, as well as the fact that in the fifties many new towns and settlements were established, resulted in the urban areas having increased up to 20.6 thousand km<sup>2</sup> by 1960. In the sixties the boundaries of towns were newly delimited so that their area was (slightly) reduced to 20.5 thousand km<sup>2</sup> by 1970. In 1950-1970 the urban area in Poland increased by over 5,000 km<sup>2</sup>. At the moment it is 6.6% of the country's area.

The towns that increase in space most dynamically are the big ones having over 100 thousand inhabitants. The small and very small ones, as well as the majority of medium-sized ones have not expanded. Their territories — often formed in the distant past — have become unchanged, or almost unchanged, till now.

As for the towns of populations up to 10 thousand, it was more often that an area of from several to several dozen or even hundred hectares was separated from a town than that the neighbouring village areas were incorporated into it. The greatest increases of urban areas — through incorporation or town-creation (the latter being proposed to mean giving the status of a town) — have occurred in the regions of high economic development, such as the Katowice, Cracow, Warsaw and Opole voivodships. In the other voivodships the changes were insignificant, except for Szczecin and Olsztyn where the urban areas were reduced by separation of waters and tree stands.

<sup>14</sup> *Satystyka miast i osiedli 1945-1965* (The statistics of towns and settlements 1945-1965), GUS, Warszawa 1967.

<sup>15</sup> St. M. Zawadzki, *Polska. Przestrzeń, społeczeństwo* (Poland. Space, society), Warszawa 1973.

The present structure of Polish towns is shown in Table 2. The small and very small towns are most numerous in Poland. They also occupy the most part of the country's area. The urban population, on the other hand, tend to live mainly in bigger towns. The towns of less than 10 thousand inhabitants constitute nearly 65% of all urban settlements and occupy over 40% of urban area. However, their inhabitants form just a little over 15% of the total urban population. At the same time the towns of over 100 thousand inhabitants form as little as 2.7% of all towns, their area constitutes 15.8% of the total urban area, but they accomodate over 43% of the urban population and 22% of Poland's population.

TABLE 2. Structure of Polish towns in 1971

Specification	Size groups of towns according to the number of inhabitants ( .000)						
	< 5	5-10	10-20	20-50	50-100	100-500	> 500
Number of towns	360	216	165	97	27	19	5.8
% of towns	40.5	24.3	18.6	10.9	3.0	2.1	0.6
% of total urban area	26.1	20.7	17.3	14.2	5.9	8.8	7.0
% of the total of urban population	6.5	9.1	13.3	17.1	11.0	21.6	21.4

Source: Bilans użytkowania ziemi w Polsce (Balance of land use in Poland), *Dok. Geogr.*, 2, Warszawa 1972; *Roczniki Statystyczne Wojewódzów* (Statistical Yearbooks of Voivodships).

After the war the structure of land use in Poland was greatly transformed. This was first evident in a reduction of agricultural areas from 66.9% in 1949 to 62% in 1972 (simultaneously, the arable land and orchards were reduced in area, whereas the pastures were expanded), and in a great increase of forest areas (from 22.5% to 27.4%) and a slight one of water.

The territorial expansion of towns, especially the increase of areas with investment, evidence the changes in land use, mostly those due to rapidly progressing urbanization. According to Z. Galperyn,<sup>16</sup> investment areas increase by almost 40,000 ha yearly.

As regards urban areas, the changes will become evident when we analyse not merely the territorial expansion, which might be due to administrative decisions, but the changes in the structure of investment. Although there are no official statistical data, available estimates reveal that areas with investment in Poland have greatly increased since World War II and form now over 1% of the country's whole area. This is due to the development of towns, the more so that urban settlements have always been centers of economic activity.

We concentrate not so much on the dynamics of changes in land use in towns in Poland as a whole as on the different intensities of land use in towns depending on their size.

Towns occupy over 2 million hectares in Poland. The shares of particular size groups of towns in the whole urban area are shown in Table 3.

The smallest towns, which are most numerous, occupy the most part of the country's area, whereas the share of the biggest towns, which are scarce, is

<sup>16</sup> Z. Galperyn, *op.cit.*, pp. 234-255.

TABLE 3. Groups of towns by number of inhabitants (,000)

	below 5	5-10	10-20	20-50	50-100	100-500	> 500
% of total urban area of Poland	26.1	20.7	17.2	14.3	5.9	8.8	7.0

smallest. The message of this statement is rather obvious. What should be emphasized is not the share in the total urban area but the (mean) territory in each size group. The size of a town defined by the number of inhabitants and the territory of a town of a given size group are obviously interrelated. The less populated towns have a smaller territory and those having more inhabitants — a bigger one. Considering the real (not mean) territories of towns in particular size groups one can state that the difference between the extremal values is enormous for small towns and rather insignificant for the big ones (Table 4).<sup>17</sup>

TABLE 4. Proportions between town areas, by size of towns\* (in ,000)

below 5	5-10	10-20	20-50	50-100	100-500	500
132	47	26	12	6	5	2

\* The numbers show how many times the smallest territory in a given town group differs from the biggest territory.

Hence it follows that the size of a small and often of an average town is determined by chance. This is true for both historical reasons and due to the lack of any definite spatial policy with respect to this size group of towns. The group of small and medium-sized towns includes settlements that were given the status of a town in the distant past. Frequently they hardly differ from the neighbouring village settlements, but nonetheless maintain their status by inertia. The same size group may simultaneously include settlements that were given the status of a town not long ago as a result of economic development and loss of agricultural function. It is particularly common in the eastern parts of the country that old towns have very wide territories including areas of agriculture. This is often due to the fact that the authorities tend to keep agricultural areas utilized by the inhabitants of a given settlement within its territory.

The bigger a town (i.e., the more inhabitants it has), the more its non-agricultural functions are developed and the less the importance of agriculture for its economy. In such cases agriculture is undesirable. When the territory is limited — and it always is — it is necessary that every scrap of land be utilized as efficiently as possible. For this reason the local, superior and central authorities pay more and more attention to the problems of space (productivity of land). In many towns having no more than 50 thousand inhabitants the authorities do not wish to have large areas of agriculture, waste land, waters and forests.

<sup>17</sup> In the size group of the smallest towns we do not include Krynica Morska, which is a curiosity of administration, having a population of less than 1 thousand and a territory exceeding that of Łódź.

It happened that when these were in excess difficulties arose which were overcome by separating such areas from a town.

In contrast to the small and medium-sized towns, the authorities of big towns often try to enlarge the town's area to secure space for future development of the town (settlement areas, industry, traffic) and to provide it with various services (recreation, waste utilization, sporting activities, etc.).

The territories are least differentiated in the group of big and biggest (in terms of population) towns: the divergence between the extremal values of area is rather small here. For this group of towns a spatial policy has been worked out, concerning the type of construction developments, too. The development of the towns of this group mainly consists in improving upon the utilization of the areas the town already uses.

In urban areas all the land uses specified in land use balances are encountered. However, the proportions between them clearly differ from those found in villages (Table 3).

From Table 3 it follows that the share of settlement, traffic and various areas is much bigger in towns. At the same time that of agricultural areas is strikingly high — over 50%. This means that in establishing the boundaries of towns a high percentage of chance is involved and that the areas of towns and settlements are utilized rather extensively.

According to the preliminary assumption, we have concentrated on the shares of agricultural areas and those with investment in a town's territory and on the extent to which they differ depending on its size. The intensity of land use in towns can be gauged by the share of areas with investment: where this is high, the land use intensity is high, too, and vice versa.

The share of agricultural areas in a town's territory gives us clues as to the extensiveness of land use. This share is high in Polish towns of all size groups. In all towns of up to 100 thousand inhabitants it is 50% or more. The divergencies between the extremities are noteworthy — in some cases a town has almost no areas of agriculture, while in others they form as much as 95% of the total area.

In this respect the size group of towns of more than 100 thousand inhabitants is exceptional. In towns of a 100–500 thousand population the share of agricultural areas is 36% and in those of over 500 thousand inhabitants — 38.3%. In the latter case the high index is due to the rather big share of agricultural areas in Warsaw. Since the boundaries of Poland's capital were expanded in 1951 and vast suburban areas of agriculture incorporated into it, Warsaw is often mockingly termed “the greatest village in Poland”. It includes approximately ten thousand farms that specialize in intensive commercial gardening.

The picture we get when analysing the share of agricultural areas in a town's territory is somewhat confusing, except for the biggest towns. When areas with fixed capital investment are studied, the results obtained are easier to interpret. In Poland as a whole the areas with fixed capital urban investment constitute 14.4% of urban area. The share of areas with urban investment is, or rather should be, the main index of urbanization from the spatial point of view. The values of this index differ with the size groups of towns (Table 4) and form an increasing sequence, whereas the shares of particular size groups of towns in the total area with urban investment are almost equal. Comparing these two sequences one can see that the land use intensity in small towns is low, while in the big ones it is higher, or even definitely high.

Analysing the above-mentioned sequences a more general conclusion can be drawn. Namely, we can define what is called the critical point or threshold whenceforth an area can be considered to be urbanized in terms of space. In our opinion a 10% share of areas with investment in the town's territory is a suitable value. Settlements in which this index is lower will thus be considered from the point of view of space to be poorly urbanized. Anywhere below 5% the areas are reckoned as village.

From Table 4 it follows that two size groups of towns, namely those of up to 5 and from 5 to 10 thousand inhabitants, do not reach the critical point. The land use intensity there is low and thus these towns are found to be poorly urbanized.

Comparing the shares of areas with investment in a town's territory and those of areas with investment of a given town in the total area with investment for particular size groups of towns (Table 4) one can state great differences, too. These may be used as a simple tool for a rough estimation of the land use intensity in a town and of spatial urbanization there. Moreover, to compute the differences in the land use intensity in towns of particular size groups (i.e., the relative investment intensity index for each of them) we suggest the following equation:

$$Iw = \frac{Z_i}{U_i} : \frac{Z_1}{U_1}$$

where  $Iw$  is the relative intensity of investment of urban area,  $Z_i$  — the share of areas with investment in the total area of the  $i$ -th group of towns,  $U_i$  — the share of the  $i$ -th group of towns in the total area with urban investment,  $Z_1$  — the share of areas with investment in the total area of towns of the first size group (the smallest towns),  $U_1$  — the share of the first size group of towns in the whole area with urban investment.

The result obtained will make it possible to state how many times the degree of investment of one size group exceeds that of another. Moreover, if we compare it with the qualified population density index, the results will serve as a tool for the estimation of the relative land use intensity in towns, a tool not only useful, but even necessary for the study of urbanization from the point of view of space.

To determine the areas of high urbanization and intensive land use we base not only on the structure of land use, but also on the population index. The opinion is common that in urbanized areas the population density should reach 150 or more people per 1 km<sup>2</sup>, while in urban areas it should be over 300.

In Poland 1 km<sup>2</sup> of urban area is on the average populated by 835 people. In the smallest towns this index is almost four times lower, whereas in the biggest ones it is 3.5 times as high. Of all the Polish towns Chorzów is most densely populated (4,540 people per 1 km<sup>2</sup>), although its population is less than 200 thousand people. Among the biggest towns Łódź is exceptionally densely populated (3,570 people per 1 km<sup>2</sup>). Considering the population densities in particular size groups of towns it can be stated that the group of smallest towns (as a whole) has not yet reached the limit of population density characteristic of urban areas. The settlements of this group have been urbanized to a high degree, but nonetheless they are not towns. Of course, this statement is often untrue if applied to particular cases, as divergencies between the extremal values are enormous: in the group of towns of up to 5 thousand inhabitants — from some thirty to over 4 thousand people per 1 km<sup>2</sup>. In the group of towns of 5–10 thousand inhabitants — from sixty to over 2.5 thousand people per 1 km<sup>2</sup>. In the group

of towns of 10–20 thousand inhabitants — from 100 to over 3.6 thousand people per 1 km<sup>2</sup>. Thus the three groups of small towns include settlements that in fact might not be reckoned as towns as far as population density is concerned. As for the medium-sized and big towns, in none of them does the population density fall below 300 people per 1 km<sup>2</sup>. Also the divergencies between the extremal values of indices are markedly smaller in the latter case, which points to a much more uniform intensity of land use in those towns. The extremal values of population density indices in particular size groups of towns are shown in Table 5.

TABLE 5. Land use structure in 1970

Land use	Towns and settlements		Gromadas (village groups)	
	,000 ha	%	,000 ha	%
Settlement areas	218.5	10.6	474.5	1.6
Transport areas	110.9	5.4	776.4	2.7
Mining areas	5.2	0.3	22.4	0.1
Agriculture	1,039.2	50.6	18,529.7	63.4
Forests and tree stands	466.7	22.8	8,144.4	27.4
Waters	96.7	4.7	697.3	2.4
Various areas	74.0	3.6	190.1	0.7
Waste land	33.9	1.7	335.0	1.1
Others	7.0	0.3	44.4	0.1
Total	2,052.1	100.0	29,214.2	100.0

Source: Bilans użytkowania ziemi w Polsce (Balance of land use in Poland), *Dok. Geogr.*, 2, Warszawa 1972, p. 18.

Analysing the qualified population density indices, i.e., those defining the number of people per 1 km<sup>2</sup> (or hectare) of areas with investment, we arrive at a structure of land use intensity in towns that only slightly differs from the above. The mean qualified population density in Poland is 6,226. In other words, there is 1 town inhabitant per 161 m<sup>2</sup> of area with investment.

The differences in qualified population density between the smallest and the biggest towns are significant (2,640–10,291 people per 1 km<sup>2</sup> of area with investment), but not as great as those in general population density. The same

TABLE 6. Indices of urban investment according to size groups of towns

Index	Towns of number of inhabitants (,000)						
	up to 5	5–10	10–20	20–50	50–100	100–500	> 500
Share of the urban area with investment in the total urban area	8.4	9.9	13.1	16.9	24.3	24.6	26.7
Share in the total urban area with investment	15.3	14.2	15.8	16.8	9.9	15.1	12.9

Source: Bilans użytkowania ziemi w Polsce (Balance of land use in Poland), *Dok. Geogr.*, 2, Warszawa 1972.

analogical differences within particular size groups of towns are also apparent (Table 6).

The above data enable us to conclude that although the land use intensity in areas with investment of towns of various size groups can be different, these differences are not essential. They most depend on the town-planning standards applied in Poland, as well as the stage of development of the economic basis and technological infrastructure of a given town. In other words, the population density and the intensity of land use must be and in fact are different in towns of sparse and low-building developments, with poorly developed infrastructure (water supply, means of transport, public baths, laundries, etc.), and in those of compact, high-building and block-type developments and a high share of services.

The situation stated in 1970–1971 may change if the standards of urbanistic planning and certain branches of administrative law are verified and the character of construction developments modified.

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We have dealt with selected spatial problems of urbanization. The index of urbanization in terms of space that is most often used is the share of urban areas in the country's whole area. Such an approach is, however, too formal. For that reason other factors must be taken into account, especially those that would make it possible to determine the land use intensity within the towns territory. For this intensity, which clearly differs with the size of a town,<sup>18</sup> defines the degree of urbanization from the point of view of space.

The above-mentioned factors include the share of area with investment in a town's territory and the density of population in the former. For urban systems, these factors can be employed in studies on areas of the same or similar legal structures (cf. the rules of administrative law concerning the status of a town). If, however, our approach and method of study were to be applied to regions of legal and urbanistic standards other than the Polish ones, they would have to be verified and — possibly — improved. Our results point to differences between particular size groups of towns. They also provide enough material for the characterization of individual regions of Poland. It is a disadvantage, though, that one cannot study the dynamics of urbanization processes from the point of view of space. This, however, is impossible in view of the lack of any statistical data on this topic. Such a study is indispensable, since knowing the regularities of spatial urbanization can have an enormous effect on the future spatial form of our country's economy.

The analysis carried out justifies a further subdivision of areas with investment. Thus, areas of settlement, industry, trade, recreation and transport can be distinguished. Due to this the study and its results will become more relevant and hence more valuable from the point of view of both pure cognition and feasibility. Finally, it seems reasonable that the boundaries of the smallest towns be newly delimited, the status of some of them verified and, what is most important, a consistent spatial policy with respect to towns worked out.

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<sup>18</sup> It can be stated that land in the smallest towns is 8–16 times less intensively used than in the biggest ones.



## REGIONAL CENTERS AND URBAN GROWTH CENTERS IN POLAND

ANTONI ZAGOZDZON

**ABSTRACT:**<sup>1</sup> A factor ecological study was conducted for the set of 150 cities in Poland, ranging in size between 15–500 thousand inhabitants. The aim of the study was to identify major dimensions of the differentiation of urban system of Poland, particularly from the point of view of central functions. Out of 30 variables, relating to population characteristics, housing, institutions and services, employment structure, and transportation facilities, 3 factors were derived, out of which  $F_1$  was identified with the role of central functions and  $F_2$  with city growth dynamics. A typology of urban places based on factor scores was presented and discussed.

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<sup>1</sup> The results of the research reported on in the paper are also presented in a parallel article by the author published in *Geographia Polonica*, 33, 1976, pp. 59–74.



## THE PROBLEM OF THE "SECOND TOWN" IN URBAN SETTLEMENT SYSTEMS

VADIM V. POKSHISHEVSKI

### ON THE APPLICATION OF MATHEMATICS TO THE URBAN GEOGRAPHY (A FEW HISTORICAL REMARKS)

In the early 1950's some experts in the UNO prepared a comprehensive report on the demographic trends at that time and the way the problem had been dealt with in scientific literature. They wrote: "Certain writers have made efforts to develop mathematical formulae or 'laws' which would account for observed patterns and trends of population distribution in terms of certain measurable factors. In general, it appears that little progress has yet been made in this direction".<sup>1</sup>

Since this cautious and sceptical evaluation was made, two decades have gone by. In the meantime the geography of population has lived through a period of great infatuation with mathematical methods. In the West it originated with the contributions of Christaller, Isard, Loesch and other writers. In the main their efforts were directed quite perceptibly towards an attempt at founding a sort of "social physics". This research trend found most active support on the part of American geographers studying population problems and the town in particular. Out of the many, the names of Zipf, J. Stewart, Harrison, Berry and several others have acquired quite a renown. As a matter of fact, this turn in methodology has met with a rather strong opposition among the Western scientists, too. Speit, an outstanding geographer, wrote with great irony about the "omnipotency" of formulae and matrices, and criticized the infatuation with them from purely gnoseologic positions.<sup>2</sup> In the United States Ch. Stewart, Jr., was also sceptical as to the application of mathematical methods in the studies of cities. Some French progressive bourgeois geographers, while not denying the need of looking for quantitative relationships, emphasized that "Christaller has proposed a conventional, purely theoretical schematic pattern... However... with reference even to western Europe it is rather hard to prove that the theory in question is well founded... Whatever schematic pattern we may adopt, it should not be too different from concrete reality. In this case we are dealing with a geographical reality: mountains and plains, lakes and rivers. Any geometrical figures are immediately subjected to an interference by the natural environment, they get stretched, deformed".<sup>3</sup>

Beginning with the 1960's Soviet geography, in particular the geography of settlement, has been working on a large scale upon the feasibility of mathemat-

<sup>1</sup> The Determinants and Consequences of Population Trends, UNO, *Population Studies*, 17, New York 1953, p. 177.

<sup>2</sup> O.N.K., Quantity and Quality in Geography, *Ann. Assoc. Amer. Geogr.*, 1960, 4.

<sup>3</sup> J. Beaujeu-Garnier, G. Chabot, *Traite de Geographie Urbaine*, Paris 1963 (Russian translation: *Ocherki po geografii gorodov*, Moskva 1967, pp. 412-413).

tical methods. However, when discovering quantitative regularities, the Soviet geographers have insisted on imbuing them with social essence, on making them reflect specific traits of the relations of production. N. I. Blazhko, who together with her pupils has contributed a great deal to establishing and justifying a mathematical way of "ranking" the towns (classifying them according to "grades"), has been working on the system of towns in the USSR, but, instead of starting with an abstract pattern of the kind adopted by Christaller-Zipf, she departed from the realities of economic life; the grades she has arrived at reflect different stages in the cyclic development of the composition of areal productive complexes.<sup>4</sup> V. G. Davidovich (in 1968 and in his later works), investigating the interrelationship between the localization in towns of the places of residence and that of the places of work, has also been mindful of closely correlating his findings with the specific social traits of our society.<sup>5</sup> S. J. Nymmik has studied mathematical determinants in settlement taking into account the pattern of the distribution of economic enterprises.<sup>6</sup> G. A. Golts, through a mathematical analysis of the development of towns in several countries during a period of almost 200 years (the newest data for the Soviet Union have been particularly scrupulously examined), has found out that in his dynamic series of correlations, different growth rates are apparent, which proves that in a settlement network changes occur in a regular way, commensurate with the development of the forces of production.<sup>7</sup>

There are only a few works by Soviet geographers in which authors, espousing too abstract ("metageographical") a point of view, do not pay adequate attention to the socio-economic contents underlying various formulae of urban distribution or development (which exposes them to the danger of siding unwittingly with the "social physics"). It is beyond our intent to criticize them in this paper, since their errors will be set straight at once as soon as they begin to deal with concrete subjects.

Realistically minded geographers in capitalist countries understand quite well the idea expressed in Soviet works that the quantitative regularities in the settlement and the spatial organization of the economy are inseparably bound together. Ch. D. Harris, for instance, an American scientist particularly well acquainted with the Soviet geographical urban studies, appreciated highly the Soviet research works inspired by these ideas.<sup>8</sup> The author of this paper feels it appropriate to mention also his polemics with W. Christaller during the debates at the 19th International Geographical Congress in Stockholm.<sup>9</sup> A French monumental work on urban geography interpreted the Soviet views on the

<sup>4</sup> N. I. Blazhko, S. I. Grigoryev, Y. I. Zabotin, *Matematiko-geograficheskiye metody issledovaniya gorodskikh poselenii* (Mathematico-geographical methods in the study of urban settlements), Kazan 1970.

<sup>5</sup> V. G. Davidovich, *Kolichestvennyye zakonomernosti rasseleniya otnositelno mest raboty* (Quantitative regularities in settlement relative to the places of work), in: *Rasseleniye v gorodakh*, Moskva 1968.

<sup>6</sup> S. J. Nymmik, *O yadrah rayonobrazovaniya* (On the Nuclei of Region Formation Processes), *Vest. Mosk. Univ., Ser. Geogr.*, 1970, 1.

<sup>7</sup> G. A. Golts, *Issledovaniye dinamicheskikh zakonomernostey razvitiya seti gorodskikh poselenii* (An investigation of dynamic regularities in the development of urban settlement network), in: *Problemy regulirovaniya sistemy rasseleniya*, Uch. Zap. Permsk. Gos. Univ., 307, Perm 1973.

<sup>8</sup> Ch. D. Harris, *Cities of the Soviet Union*, Chicago 1970.

<sup>9</sup> *XIX Mezhdunarodniy geograficheskiy kongress v Stokgolme* (The 19th International Geographical Congress in Stockholm), AN SSSR, Moskva 1961.

This comment was briefly related in the Soviet review of the Congress (*XIX Mezhdunarodnyi...*, 1961, p. 344); cf. also G. Chabot's relation of it in *Annales de Geographie*, 1961, p. 468.

priority of economy, expounded in this discussion, in the following way: "It is inevitable that the development of the urban network in the socialist countries and in those of free enterprise should take different paths. In the socialist countries towns come into existence there where it is dictated by the interest of industry; trade here is only of secondary importance. In the free enterprise countries towns are born under the stimulus of trade. Pokshishevski very well expressed this idea at the International Geographical Congress in Stockholm in 1960. Actually, however, the differences do not seem to be as categorically opposed as that... In the socialist countries there are market-towns as well, which have been created for the sake of exchange, i.e., in order to perform regional functions".<sup>10</sup> To this, we may observe that actually Soviet geographers prefer to speak, instead of narrowly conceived market functions, rather of organizational-economic functions of a much wider scope which are often combined with administrative, cultural, and political functions. The very concept of a "multifunctional town" is one of the fundamental notions in the Soviet theory of urban geography, and though this notion is used also by bourgeois geographers, it is obvious that from a social point of view the essence of functions entering into this multivariuous unity is quite different.

#### THE RULE OF INTERDEPENDENCE OF TOWN POPULATIONS AND OF THE PLACE OF TOWNS ON A RANK SCALE

Among urban geographers outside the Soviet Union particularly widespread acknowledgment has obtained the so-called "Urban Ranke-Size Rule", usually known as the "Zipf-Stewart law". Its formula is the following:

$$P_j = P_1 \cdot j^{-\alpha},$$

where  $j$  — serial number of the town on the rank scale, and  $P_1$  — the population of the first (the biggest) town. The parameter  $\alpha$  is to be chosen for a given system; in the simplest case  $\alpha = 1$ , the second town of the rank-series should be twice smaller than the first, the third — one-third as great, etc. The original variant of the "law" was presented by Singer as early as 1936;<sup>11</sup> we shall see further, though, that it was Russian geography which was first in determining the tendency expressed by the Singer variant.

It is quite obvious that the probability of a small town coming into existence is always greater than that of a big one; undoubtedly, too, only a part of towns will grow enough to have reached a considerable size (and the part will be the smaller, the higher is the threshold we choose to set for it). But to this empirical observation<sup>12</sup> was ascribed the meaning of a "law" inferred, for instance, from

<sup>10</sup> J. Beaujeu-Garnier, G. Chabot, *op.cit.*, p. 413.

<sup>11</sup> In formulas:  $\log y = A - a \log x$ , or  $yx^a = 10^A$ , where  $x$  — number of inhabitants,  $y$  — the number of towns whose population is greater than  $x$ ;  $a$  and  $A$  — constants. Cf.: H. W. Singer, The "Courbe de Population". A Parallel to Pareto Law, *The Economic Journal* (U.K.), June, 1936.

<sup>12</sup> In 1938 this was done by M. Jefferson who established for 44 countries the average relation of the first and second towns as amounting to 100:46. In the Jefferson's opinion the first (the primate) town in every country is possessed of particular qualities owing to which it sharply prevails over the entire system of towns which are subordinated to it. In the Soviet literature the idea was critically reviewed by O. A. Konstantinov (*Izv. VGO*, 1949, 2) who brought to light an idealistic approach to the very mechanism of "leadership".

Pareto's curves of normal distribution; Barry and Harrison endeavoured to establish its internal relevance with Christaller's theory of central places.<sup>13</sup>

In time, however, the expectation that the second town will be twice smaller than the first one, the third — one-third as great, has often proved to be misleading in practice. In a paper of our's<sup>14</sup> we have already pointed out that, according to an investigation made by Ch. Stewart, Jr. in 1956 (it referred to 72 countries), the median value of the population of the second town appeared to be not twice but 3.25 times smaller than that of the first one. A study by M. Jeffery in 1961 brought the average relation between the first and the second town down to the level of 100:39.

It could have been expected that in much smaller urban systems than those embracing whole national territories, the equal spacing of regression, as expressed in the "Zipf-Stewart law", would prove to be more in accordance with reality, since in the minute systems there is no room for the action of those "magic powers", which for many reasons endow the capital city (or any other main town) with a special, "leading" importance. It is understandable that, from this point of view, the Soviet urban systems are of particular interest. They are numerous enough and scattered throughout vast and very varied areas, which makes it possible to look for these or other trends to appear while relying upon massive data.

The writer of this paper has never met in the Soviet geographical literature with any attempt to apply to the territory of the USSR as a whole the above mentioned regularity of spacing in the regression. Such an attempt has first been made by a foreign scientist, namely Ch. D. Harris in his monographical study on the cities of the Soviet Union.<sup>15</sup> Harris chose to go, in a sense, the opposite way; for the big cities in the USSR he "picked up" such convergence areas, in the limits of which physical relationships between the population of towns were closest to the postulated spacing in regression. And so, the Tatar ASSR he "allocated" to the region centering on Gorkiy, the western Kazakhstan to the region with Kuybyshev at its head, the Krasnoyarsk *kray* to the region with the central city of Novosibirsk, etc. Regardless of such "putting the problem upside-down", in many cases the discrepancies between the actual series and the computational ones were big enough (from 0.8 to 1.6).

#### THE "SECOND" TOWNS IN THE SETTLEMENT SYSTEM OF THE USSR

What is actually the position in the USSR of the towns that are located at the "second step" of urban settlement systems? To the writer this "second step" seems of particular interest. In any territory small towns — primary centres

<sup>13</sup> More than 30 years before the publication of the work by Jefferson, a very realistic treatment of the particular role of capital cities was presented in Russia by A. I. Voeykov. He established a rule (it is his own expression) to the extent that the "relative importance of the capital city is smaller in countries (states) or autonomous territories with big populations, whereas it is greater in the countries and territories whose population is smaller" (A. I. Voeykov, *Raspredelenye naseleniya zemli v zavisimosti ot prirodnykh uslovii i deyatel'nosti cheloveka* (The Distribution of Earth's Population in Relation to Natural Conditions and Human Activity), *Izv. Russk. Geogr. Obshch.*, 42, Sankt-Petersburg 1906). The "rule" was explained by Voeykov quite clearly. I had the occasion of mentioning the priority of the great Russian scientist already a long time ago (cf. *Uch. Zap. MGPI im. Lenina*, 120, 3, Moskva 1958, pp. 20-21).

<sup>14</sup> V. V. Pokshishevski, O probleme "vtorogo goroda" (On the problem of the "second town"), in: *Territorialnye sistemy proizvodstva i rasseleniya* (Uch. Zap. Permsk. Gos. Univ., 311), Perm 1973.

<sup>15</sup> Ch. D. Harris, *op.cit.*

of production and economic organization of space — are always numerous. They form a network; but not always has this network already become a system. However, if in a ranked chain of towns the upper links have achieved a higher grade of development, the network unavoidably reaches the level of a system; but at this instance it is of utmost importance to find out whether the “second” and “third” towns (in particular the second ones) are of a significance great enough, or perhaps the entire system is monocentric, and all its towns, with the exception of the main one, are nothing more but local centres. In the latter case, in the opinion of the writer, we have to do only with a network, and if we insist on calling it a system, then we must realize it is a system of quite a different kind, a system which is characterized by a very low degree of spatio-economic maturity.

In a quest for urban systems in the USSR the writer investigated the towns of the Union republics that are not subdivided into *oblasts*, the towns within the *oblasts* or *krays*, as well as those in the Autonomous SSR and Autonomous *Oblasts*. According to the rules of equalized spacing of regression, the population of the second town in these systems should be twice smaller than that of the first town. In the USSR the facts do not support the plausibility of such a relationship: in the greatest number by far of urban systems the first town tops “by many heads” all other urban settlements, and as far as the systems themselves are concerned they are, in their bulk, highly monocentric.

For the lack of space we cannot introduce here the tables that were published in the above mentioned paper<sup>16</sup> and will limit ourselves to the presentation of the most important results arrived at through the analysis of those tabular series. The population of almost 2/3 of the “second towns” amounts to less than 30% of the population of the centres. To the group of towns whose population falls between 40 and 60% of that of the centres (the percentages can be, more or less, considered as corresponding to Zipf’s spacing of the regression) there belong no more than 15.6% of all the “second towns”; above this group (the “second town” having 60 and more per cent of the inhabitants of the first one) one finds only 9.6% of all the “second towns” and there are only four cases (2.5%) when the “second town” is more populous than the administrative centre of a relevant territorial unit. Separately the writer investigated the same relationships for the capital cities of the Union republics or the centres of the national-ethnic autonomous territorial units; in these cases the exceptional position of the capital city is still more manifest. There were analysed altogether 35 such territorial units: in 27 the population of the “second town” was less than 30% of that of the capital and, out of this number of units, in 7 cases less than 25%; besides that, in 4 territories there was no other town at all except the capital city. It is, in particular, a reflection of the special role which in a socialist country is played by the capital cities as main centres in the development of national-ethnic culture.

For all the republics, *krays*, and *oblasts* under investigation taken together, the medium value in the rank series amounted for the “second town” to 23.1%; in other words the latter appeared on the average (after the average value of the median had been computed) 4.3 times smaller than the “first” (main) town. The arithmetic average size of the “second town” was 3.1 times smaller than that of the administrative centre. For the Union republics<sup>17</sup> not subdivided into ob-

<sup>16</sup> V. V. Pokshishevski, *op.cit.*

<sup>17</sup> Only the Lithuanian SSR was not included because of the particular historical role of Kaunas, former capital city of the bourgeois Lithuania.

lasts, as well as for the ASSR and Autonomous *Oblasts* the respective values were 21.4%, 4.7, and 4.8 times, which once more emphasizes a particular importance of cultural and political factors and of the concentration in the capitals of functions promoting the national, ethnic and cultural development.

#### THE GEOGRAPHY OF DISCOVERED RELATIONSHIPS

Taking the country as a whole, the picture of quantitative predominance of "monocentrism" in the urban settlement systems in the USSR is convincing enough. However, as far as the spatial distribution of the relationship between the population of the "second town" and that of the centre town in individual territorial units is concerned, no spatial regularities whatsoever are to be seen; this finds its confirmation in a map, made by the author. It shows no clearly discernible differences, whether we compare the densely and the sparsely settled areas, or the southern and northern parts of the country, or its European and Trans-Ural parts. There is no point, therefore, in analysing our map in its entirety.<sup>18</sup> Only in the "national-ethnic territories" monocentrism is somewhat more clearly pronounced, however, in the USSR these territories are geographically scattered rather widely and therefore they form no "zones" in which any specific relationship between the populations of the "second" and the "first" town could be observed.

In order to find out the conditions that could favour the "second town" rising in relative importance the writer established rank correlations of the importance of the "second town's" population (expressed in percentages of the population of the "first town"); the following characteristics were taken into consideration: (1) the population of the "first town"; (2) the general density of population of a given republic, *kray*, or *oblast*; (3) the area of these territorial units. The coefficients of rank correlation of the population of the "second town" with these characteristics were respectively put down as  $R_1$ ,  $R_2$ , and  $R_3$ . Here are the results: in reference to RSFSR  $R_1 = -0.199$ ,  $R_2 = +0.075$ ,  $R_3 = +0.017$ ; in reference to the Union Republics not subdivided into *oblasts* and to the autonomous territorial units of a lower taxonomical grade  $R_1 = -0.003$ ,  $R_2 = +0.195$ ,  $R_3 = +0.100$ . Whilst the marks + and - correspond to what might be expected, the values of the coefficients themselves are low, which evidences that the dependence of the dimension of the "second town" on the foregoing characteristics is rather weak.

An attempt was also made at grouping the territorial units as regards the distances between the central town of each unit and its "second town" (to some extent this indicator is related to the coefficient  $R_3$ ). The investigation of this aspect of the matter is of importance, since in a number of instances the "second town" seems actually to be a satellite of the first one, and if it is the case, a system of towns, even though the "second town" may be strongly developed, preserves, in fact, its monocentric nature (the centre of the system is an agglomera-

<sup>18</sup> The only exception here should be made for Moscow which deserves a few more words. If we consider Moscow as the centre of the local (*oblast's*) system, then the "second town" of this system (it is Podolsk) has a population quite insignificant when compared with that of Moscow. If we look at Moscow as the centre of the "all-Union urban system" (in which Leningrad is the "second town"), then the equalization of regression will appear more or less true (however, when we consider the next lower grades, the third, fourth, etc. towns, the Zipf "law" does not hold good any more).

tion of which the "second town" is only a part). Taking as an example the RSFSR (where the areas of the administrative territorial units are most contrasting), the writer reached the conclusion that in a rather great number of cases the "second towns" make, from a spatial point of view, a part of an agglomeration centred upon the "first town". Within the distance of less than 100 km (and such a distance is already favourable to making many aspects of production and social environment interdependent) more than one-third of the "second towns" are situated (28 out of 76 considered). Thus, monocentrism is actually stronger than the quoted figures seem to indicate. It stands to reason, that only the "second towns" that are distant enough from the administrative centre are able to create a gravitational field of their own in production, residence and services.

Investigating the relationship between the population of the centres of the urban systems and that of their "second towns", singled out, so to say, by a "roll-call", we grow ever more convinced that there exists a very close dependence between the relatively higher volumes of the "second towns" populations and the degree to which the given *oblasts*, *krays* or republics have been developed industrially. The pattern of settlement, reflecting spatial organization of the forces of production, evidences greater diversification in the cases in which industry is concentrated not in a single but in many centres.

In the series of territorial units that were subject to our analysis (Pokshishovski, 1973) there appeared 44 "second towns" whose population reached 40 and more per cent of that of the unit's centres. In no less than two-thirds of these 44 towns, industrial enterprises of first class importance were evident. At the head of the list there were Novokuznetsk, Cherepovets, and Kokand — each of them had a population larger than the administrative centre of the *oblast* in which it was situated. Farther down the list we meet such towns as Rudnyi, Vorkuta, Orsk, Krivoy Rog, Chernogorsk, Makeyevka, Kovrov, Komsomolskon-Amur, Tekeli, Svobodnyi, Angarsk, Orsha, Severodvinsk, Rybinsk, Navoy, Magnitogorsk... This very enumeration conveys a clear message: it says, that although the localities with a relatively bigger population of the "second town" form rather queer patterns on the map, they mostly cluster in greater densities exactly in those regions that are particularly developed industrially (what we have in mind are not single detached centres but virtual zones). Thus, relatively high levels of the population of the "second town" (and even of those down the ladder) are characteristic of the *oblasts* of the Donetsk-Pridneprovsk region, the Ural, Kuzbass, and several *oblasts* of the Central Region (like the Yaroslav and the Vladimir *oblasts*; here, in the Central Region, these relatively high levels are of particular interest, for the powerful impact of nearby Moscow is plainly evident).

True, the picture is often blurred, for there are also other functions that might have contributed to the "second towns" having reached a relatively high population. Among this kind of towns we note Sevastopol, Sochi, and Piatigorsk, which have approached the population level of the administrative centres of the respective *krays* or *oblasts* owing to some specific harbour or health resort functions, as well as such "complex" town as Kaunas, Mukachev, Velikiye Luki, and Kremenchug. But such cases are not too numerous; sometimes they can be explained away by their history (former role of a capital city in the case of Kaunas, of an *oblast's* centre — in that of Velikiye Luki).

At the end of our list, i.e., among those *oblasts* where the role of the "second town", as compared with the population of the first one, is insignificant, there are the *oblasts*: Leningrad (Vyborg, the "second town", has no more than

1.6% of Leningrad's population), Moscow (with reservations as made in a note above), Omsk, Novosibirsk, Kharkov... They are typical "oblasts-agglomerations" (sometimes only *in statu nascendi* like that of the Omsk oblast).

If we wish to overcome the "monocentrism" in the urban settlement systems (and such a task is, in the writer's opinion, often very timely), the main leverage in accomplishing it should be further to develop and increase spatial diversification of industry. It once more corroborates the fundamental thesis of the Soviet geography that the forms of settlement are, first of all, tied up with the pattern of spatial distribution of the national economy. If we look at them in their dynamics, in their development, the settlement pattern and the areal organization of the entire process of social reproduction appear to be nothing else but various aspects of a single system. Just as we have progressed from "artificial" localization of enterprises to creating complicated industrial nodes and even extensive spatio-productive complexes, in the same way in the field of settlement, regional planning opens before us wide possibilities of finding co-ordinated solutions of the problem of urban development, a development that would be harmoniously linked up with the distribution of spatial groupings in production. Neither the abstract Zipf "law", nor the "pyramids of towns" built upon Christaller's concepts of central places are able to explain actual socialist realities. The gist of the matter lies here in the geography of the processes of social reproduction.

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## SETTLEMENT IN THE LIGHT OF ANTHROPOECOSYSTEMS APPROACH

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### EVALUATION APPROACH TO MAN'S ECOLOGICAL ENVIRONMENT

Settlement is a field where people are featured most prominently as part of the object of geographical study. This prompts the theme of geography's approach to this component that would take into account the dominant role of man in the development of territorial systems studied by geography. The choice of approach would crucially depend on two factors.

Firstly, certain pointers are provided by the results of many sciences embodied in concepts far less vague than the much too general category of "people". Presumably, well-elaborated concepts usually pinpoint aspects of a phenomenon that are most essential for practice. Adoption of established scientific concepts ensures continuity of results. Effort is thus concentrated on a few crucial directions of scientific search (which does not rule out the choice of directions leading into a "dead end" or no longer topical).<sup>1</sup>

Secondly, present-day constructive geography has reached a level of maturity when it can claim to be able to give answers to some difficult challenges facing man. The scientific method described in the present article belongs in that category. It attempts to give criteria for the assessment of various settlement schemes in terms of their rationality, potential for the future and favourableness.

Such a task goes beyond the traditional boundaries of natural studies<sup>2</sup> inasmuch as it introduces the concept of the goal of development into the object studied. In the most general way the task can be formulated as assessment of the arena of man's life. The question is raised of the methods of studying territory as man's environment. This involves finalistic formulas concerning the environment, reflecting evaluation of the environment in terms of man's needs, as distinct from the conventional approach which has been concerned with the causal relationships for the object under study.

Evaluation judgement of man's environment is closely connected with the recent momentous change in our ideas about the object of geography. Apart from the concepts of geographical sphere, the geosphere, terrain, geographical complex and geosystem, man's environment becomes increasingly a focus of attention. The new term cannot be regarded as a synonym for any of the above-

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<sup>1</sup> Y. V. Medvedkov, Internal structure of a city: An ecological assessment, *Reg. Sci. Ass. Papers*, 1971, 27.

<sup>2</sup> Cf.: M. Eigen, *Self-organization of matter and evolution of biological macromolecules*, Moscow 1973.

mentioned terms. It signals a new approach to the object of study prompted by the demands of the time. Two factors should be mentioned which have long been in evidence but which have recently assumed dramatic urgency: (1) the abundance of anthropogenic changes and technical devices which modify the original natural basis of the physical space developed by man; (2) concern for further development of this space to guarantee man's continued existence.

The former prompts geographical study of the natural complex in combination with the anthropogenic and technogenic change. If  $N$  is territorial organization of the natural complex and  $T = T_1 + T_2$  means territorial organization of technical devices ( $T_1$ ) and anthropogenic change of the natural sphere ( $T_2$ ), the first approximation to a working model of the object under study is

$$M = (N, T_1, T_2). \quad (1)$$

For the sake of clarity and brevity, symbols are here used to denote basic concepts. It must be explained that the expression within brackets in the right-hand part of (1) represents a cortege, i.e., an ordered set of components in which the nomenclature of components as well as implied character of links between them is essential.

The second factor prompts the need to evaluate components  $N$  and  $T$  in anthropocentric terms, i.e., to consider man as part of the object of study. Man is treated as the central component of the geographic model and a criterion by which all the other components are judged. The object of study is modeled as an anthropoecosystem, i.e., a special kind of geosystem anthropocentrically constructed. Only such a conceptual notion of the object studied can be properly identified with the concept of "man's environment".

Man is included in the environment model in at least two ways. Firstly, he is present in the notion of spatial organization (let us designate it with the symbol  $S$ ). Secondly, and most importantly, man is the source of requirements to  $N$ ,  $T$  and  $S$ . These requirements are vastly significant because they refer to the transformative activity of man with regard to  $N$ ,  $T$  and  $S$ . Apart from the causal links between  $N$ ,  $T$  and  $S$ , stemming from the objective properties of things, it is necessary to know the reaction of the people to these links and the environment components. Let the reaction of people be designated  $A(N, T, S)$ ,  $A(N)$ ,  $A(T)$ ,  $A(S)$ , respectively. That yields the second approximation to the model of the object under study

$$M = [A(N, T, S), A(N), A(T), A(S), N, T, S]. \quad (2)$$

The expression (2) is a model of man's environment. To emphasize its difference from the traditional models of a geographical complex which are not concerned with man's goals with regard to the complex, it may be useful to write down the traditional model in the symbols adopted here:

$$M = (N, T, S). \quad (3)$$

The relative paucity of the traditional model will readily be seen.

The category of "man" in geography calls for further elaboration. This can proceed in three directions. The objects of study may be: (1) man as a biosocial individual, (2) population as the group of persons living and acting on a certain territory, (3) society as exponent of certain social principles and economic organization methods.

Let the geographical data on the individual, population and society be designated respectively by the symbols  $A_1$ ,  $A_2$  and  $A_3$ . Accordingly, the symbols  $S_1$ ,  $S_2$  and  $S_3$  can be introduced to denote spatial organization of the individual's

activity (spatial behaviour) ( $S_1$ ), the functional organization of settled territory ( $S_2$ ) and spatial organization of society, as exemplified by administrative division, the hierarchy of relationships in administrative geography, etc. ( $S_3$ ).

Let us posit the relationship  $A = [(A_1), A_2, A_3]$  and  $S = (S_1, S_2, S_3)$  which do not seem to be at variance with the real state of affairs and at any rate are convenient as generalized formulas for the categories of "man" and "man's spatial organization". The evaluation model as settlement thus assumes the following shape:

$$M = [A_2(N, T, S), A_2(N), A_2(T), A_2(S), N, T, S]. \quad (2.1)$$

This model accords with the view that the population has the prerogative of judgement about its environment. Model (2.1) is applicable to local situations, a field usually represented in geographical works by the study of settlement on a large scale. That would include evaluation of settlement within a city or a small rural district. For non-local situations a more bulky model has to be used:

$$M = [A_3(N, T, S), A_3(N), A_3(T), A_3(S), A_2(N, T, S), A_2(N), \\ A_2(T), A_2(S), N, T, S] \quad (2.2)$$

Similarly, by combining evaluations in terms of  $A_1$  and  $A_2$ , one can arrive at a model applicable in the assessment of man's environment in terms of health needs.

It is interesting to consider the varying frequency of geographical subjects studied in connection with the categories  $A_1$ ,  $A_2$  and  $A_3$ . Category  $A_1$  is mostly used in medical geography in the study of the impact of the environment on man's organism. A recent new area of study concerned with  $A_1$  is the geography of day-to-day activity, for example, works on the mean information field<sup>3</sup> and areas of activity.<sup>4</sup> Category  $A_2$  is the most frequent object of geographical study, the most widespread examples being offered by works on settlement and economic-geographical regional studies. Category  $A_3$  usually is present as a background, while special study is made of certain aspects of  $A_3$  (in works on political and social geography). A promising new area is the study of  $A_3$  that reflects geography's interest in economic management.<sup>5</sup>

## EVALUATION APPROACH TO SETTLEMENT

The above views on the evaluation of man's environments is not a speculative theory on future scientific search but a systematization of the essence of work already actively pursued by many scholars. There are grounds for singling out a new trend in geographical research devoted to the assessment of environmental conditions. It proceeds from the common thesis that makes the subject of assessment a necessary element, with regard to which the environment is being assessed. This thesis takes on various shapes depending on the aspect of the environment assessed. It has been formulated with reference to

<sup>3</sup> R. L. Morill, F. R. Pitts, Marriage. Migration and the mean information field: A study in uniqueness and generality, *Ann. Ass. Amer. Geogr.*, 57 (1967), 2.

<sup>4</sup> Cf.: Y. V. Medvedkov, The habitat and ecology of man, in: *Man and environment*, Leningrad 1974.

<sup>5</sup> Cf.: Y. R. Arkhipov, Information aspect of the study of territorial system, in: *Mathematical methods in geography*, Kazan 1971.

the population's needs as a whole,<sup>6</sup> to certain aspects of people's life,<sup>7</sup> to compare environment with technological needs,<sup>8</sup> recreation,<sup>9</sup> economics,<sup>10</sup> etc. Similar approaches are found in studies and applied works outside the Soviet Union concerned with the quality of the environment.

The subject of assessment looms largest in health geography works concerned with the impact of hazards on groups of people exposed to hazards.<sup>11</sup>

A large number of works in behavioral geography are concerned with identifying groups of population reacting to the environment in similar ways.<sup>12</sup>

Unanimous acceptance of the thesis on the need of a subject of assessment in all questions involving "good and evil" argues potently for using the same approach in the study of settlement. By expressing the universal thesis in a relevant symbolic form, we have been able to highlight an additional circumstance. Models (2.1) and (2.2) stress that both the subject and object of assessment are structured. The presence of structure is revealed in the fact that the set of components as well as their inter-relationships are found to be essential both in the object and subject of assessment. This has necessitated two models for settlement assessment (for cases when the subject of assessment is the population and society). The ordered nature of environmental components is emphasized by the use of cortege symbolization (although that does not offer an operational method of assessing the order, of which more will be said elsewhere).

One special variety of the (2.2) model is so extensively used in practice as to be scientifically trivial. This is the model

$$M = [A_3(T_1, A_2), A_3(T_2, A_2), A_3(N, A_2), A_3(S, A_2), A_3(N, T, S, A_2)], \quad (3)$$

where  $A_3$  — profit from social use of a certain combination of benefits expressed in the form of a cortege. In particular,  $A_3(T_1, A_2)$  — profit from the processing industry,  $A_3(T_2, A_2)$  — profit from agriculture and extractive industries,  $A_3(N, A_2)$  — differential rent 1, i.e., the part of profit accounted to the original properties of the raw materials and land;  $A_3(S, A_2)$  — profit in the service sphere,  $A_3(N, T, S, A_2)$  — differential rent 2, including that part of the returns due to the advantage of geographical position. The need for labour as factor of profit is indicated by the inclusion of population ( $A_2$ ) in all the sets for benefits used in the economy.

Model (3) is quite operational, resting as it does on socially accepted money measures for the expression of the marketable results of the benefits used. However, money measures are notoriously inadequate and insufficient. That is especially felt in attempts to assess the impact of settlement conditions on the

<sup>6</sup> Cf.: V. L. Kotelnikov, Y. G. Saushkin, Population and nature, in: *Scientific problems of population geography*, Moscow 1967.

<sup>7</sup> E. B. Lopatina, On selecting criteria and indices in assessing natural conditions of man's life, *Vopr. Geogr.*, 1968, 78.

<sup>8</sup> L. F. Kunitzin, L. I. Mukhina, V. S. Preobrazhensky, Some general questions in technological assessment of natural complexes in engineering development of territory, *Izvestia AN SSSR, Ser. Geogr.*, 1969, 1.

<sup>9</sup> Cf.: I. P. Gerasimov, A. A. Mintz, V. S. Preobrazhensky, N. P. Shelomov, Contemporary geographical problems of recreation organization, *Izvestia AN SSSR, Ser. Geogr.*, 1969, 4.

<sup>10</sup> Cf.: A. A. Mintz, Complex economic assessment of natural conditions and resources in light of the tasks of modern geography, *Izvestia AN SSSR, Ser. Geogr.*, 1965, 2.

<sup>11</sup> A. Medvedkov, E. Rossi, *Epidemiological area analysis as an assessment of health needs*, Geneva, WHO/RECS Papers, 1971; R. W. Armstrong, Tracing exposure to specific environments in medical geography, *Geogr. Analysis*, 1973, 2.

<sup>12</sup> K. R. Cox, R. G. Golledge (eds), Behavioral problems in geography, *North-western university studies in geography*, 1969, 17.

quality of life. For this reason model (3) is irrelevant for the main purpose of this article.

Because rationality, prospects and amenity of settlement cannot be easily expressed in money terms, there is a temptation to sidestep the task of assessment altogether. One wide-spread form in which that has recently been done is by replacing value judgments by references to "scientifically grounded norms". However, while planners and city-builders may well be justified in referring to norms developed elsewhere (presumably by scientists; scientists themselves cannot hope to receive these norms from somewhere else).

Wide-scale experiments in mathematical modelling of settlement launched in the sixties were able for a time to ignore the task of correcting norms and bringing them into line with the aspects of the environment of most concern for the population. This may seem odd. However, one should recall that early models were based on linear programming methods. It was deemed possible to solve the settlement tasks almost in passing, as part of a vast programme aimed at optimizing the economy's sectoral structure and geography, the settlement and resource development. Such a global approach implied just one sufficiently obvious and generally accepted criterion for assessment. At first sight such models seemed to suggest that any additional research into the characteristics of environment, and the arena of life involved in the process of settlement are unnecessary and even unwarranted ("local optimum!").

However, a more thoughtful approach to such "supermodels" of global optimization reveals that they meet cognitive needs rather than those of management and forecasting. A number of fundamental difficulties arose in the way of implementing a model covering "all and sundry".

Firstly, it presupposes a degree of knowledge of causal relationships unattainable in practice.

Secondly, there is the complexity of the world which seems to increase as the frontiers of knowledge are advanced, in particular the dynamism of man and his creations which constantly starts new chains of causal relationships.

Thirdly, the surrounding environment is a complex system, i.e., an object of a kind in which "it is impossible to trace the causal relationships determining the behaviour of each subset of elements".<sup>13</sup> Consequently, one cannot expect a global model to be capable of providing an answer to any problem that suddenly assumes importance in the life of man.

Concrete analysis of concrete situations is obligatory in solving the optimization tasks. They have been successfully solved only if set not instead of but on the basis and after a study of what is possible and desirable.<sup>14</sup>

Other arguments which downgrade environmental assessment, too, do not stand up to criticism. These include: (A) unqualified faith in projects and meliorations, (B) assuming absolute character of certain environmental parameters in terms of man's physiological needs, (C) the idea that environment should be planned within the available resources of society, i.e., by distributing scarce environmental benefits in accordance with socially accepted criteria.

Argument (A) posits faultless and complete norms for the improvement of the environment. However, one needs hardly go to any length to prove the need for constantly updating the norms in the dynamic modern world. Besides, argument (A) ignores the phenomenon of self-organization in the environment, which

<sup>13</sup> D. B. Yudin, Economic cybernetics and mathematical economics, in: K. Lancaster (ed.), *Mathematical economics*, Moscow 1972.

<sup>14</sup> Cf.: H. Aben, Y. Kilari, L. Halai, On the use of cybernetics methods in drawing up city general plan, in: *Questions of urban construction economics in the Estonian SSR*, Tallinn 1966.

imposes considerable restrictions in projecting. Restrictions are also manifested in the fact that the norms are interdependent. They arrange themselves in a cortege, on the pattern of models (2.1) and (2.2).

Argument (B) is untenable because it extends the criteria suitable for an individual ( $A_1$ ) to the population ( $A_2$ ) and society ( $A_3$ ). It also ignores the population's ability for adaptation by changing the environment and/or forms of activity. A more general weakness of argument (B) is that it assumes invariable attributes of the object and the subject of assessments. Meanwhile, both the environment and man (especially  $A_2$  and  $A_3$ ) are highly variable dynamic phenomena.

Argument (C), on closer inspection, implies a limited interpretation of the object of assessment in the evaluation of environment. It effectively proposes to pay attention only to the benefits that are scarce at the moment. Because scarcity occurs later (sometimes much later) than awareness of the benefits there is always a danger of such assessments lagging behind the events. The method of early diagnosis of the environmental qualities most prized by man (before they become scarce) is much to be preferred to the procedure following from argument (C). For the rest, argument (C) does not diverge from the models of environmental assessment as represented by formulas (2.1) and (2.2).

#### WAYS OF REALIZING THE EVALUATION APPROACH

Having explained what settlement evaluation means and why such evaluations are necessary, some indication must be given as to how these evaluations could be realized. If one confined oneself to raising the questions, the reader might conclude that assessment procedure is unrealistic and premature because of undeclared snags.

Let it first of all be stated that assessments under models (2.1) and (2.2) can be carried out by experts. For some fragments of models these assessments are already being carried out, and the task now is to bring them together. Indeed, the integrated approach is one of the salient features of models (2.1) and (2.2). The formulas (2.1) and (2.2) put certain demands to the structure of assessment judgments. Everything argues in favour of expert conferencing being conducted in accordance with a formalized procedure, for example, the Delphi method.<sup>15</sup>

Specifically, realization of model (2.1) by the Delphi method would require experts to indicate in points or through more crude value judgment ("many — few"): (1) the population's reaction to natural environmental factors, i.e.,  $A_2$  ( $N$ ); (2) positive and negative impact of technical devices, i.e.,  $A_2$  ( $T$ ); (3) how far the functional planning of spatial organization accords with the requirements of the population, i.e.,  $A_2$  ( $S$ ); (4) the balance among the above three environmental factors, i.e.,  $A_2$  ( $N, T, S$ ); (5) possible changes of these aspects, trends of corresponding environmental changes, the possibilities of influencing these trends, i.e., ( $N, T, S$ ).

Subsequent analysis consists in calculating a master index for variants of settlement development, and the probabilities for each variant to be realized. Such a procedure can readily be seen to be similar to standard practice of considering projects in planning bodies.

<sup>15</sup> Cf.: O. Helmer, Future analysis: Delphi method, in: *Scientific-technical forecasting for industry and government bodies*, Moscow 1972; see also G. Gordon, New approaches to the Delphi method, *ibid*.

Unfortunately, expert judgments do not guarantee early identification of new trends and newly-arising important environmental factors. Without additional research geared to the particular task in hand, the expert can only fall back on facts which have long commanded attention. This involves the risk of lagging behind the times, i.e., of marking time in accordance with the earlier considered approach (C).

An effort must be made to disseminate the method of analysing concealed structures which enables one to assess the living conditions with due attention to new emerging trends that are still barely noticeable.<sup>16</sup> The technical methods of data processing may vary. One can apply factor analysis,<sup>17</sup> regressive analysis of data transformed by the analysis of the main components,<sup>18</sup> canonical analysis or analysis of hidden structures proper by the Lazarsfeld algorithm. The main requirement in the environment assessment by the hidden structures method is preparation of the data in such a way as to make them indicate the attitude of the population towards observed and changeable environmental factors. Data search presupposes collection of information about preferences among the population (or its specific groups) for parts of territory which offer different sets of benefits.

Necessary information can be obtained by observing the self-organization of the population in daily movement, choice of workplace location, residence, recreation and other forms of leisure. These data are tantamount to an opinion poll about the rationality, prospects and amenities of various settlement patterns and the environment as a whole. The "hidden poll" procedure is in many ways preferable to direct opinion surveys. It rules out distortions stemming from the wording of the questions and enables the analyst to involve large groups, including the whole population. Facts of self-organization of the population which are tantamount to a "hidden poll" can often be gleaned from current records. This dramatically reduces the cost of finding out the required assessment data on the environment. This provides a basis for deriving assessments from a continuous series of observations, which is a way of monitoring people's reactions to environmental conditions.

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<sup>16</sup> Cf.: Y. V. Medvedkov, Analysis of hidden structure in assessment of urban living conditions, in: *Assessment of natural conditions and settlement*, Moscow 1974.

<sup>17</sup> N. Vinokurov, Methods of spatial analysis of the population's life, in: *Dynamic models of spatial planning*, Central Mathematical Economics Institute, USSR Academy of Sciences, Moscow 1972.

<sup>18</sup> Y. V. Medvedkov, *Ecological diagnosis of street accidents in Hannover and COMP program development*, Geneva, WHO/RECS Seminar, Nov. 1971.



## ON MODELLING AND PLANNING THE DEVELOPMENT OF URBAN AGGLOMERATIONS

PIOTR KORCELLI

## INTRODUCTION

This paper attempts to interpret the existing theory of spatial structure of urban agglomerations, and their change, from the planning perspective. A brief review of some of the major theoretical approaches is therefore in order. In a certain sense, these approaches are all useful from the planner's point of view since they build a stock of knowledge and information which is needed both at the plan study and the plan design stage. For instance, theoretical patterns of population density and directions of their evolution, following the city growth, its age and technological improvements in transportation, have to be taken into account while planning the future structure of urban agglomerations, since this may constitute one of the prerequisites for plan accomplishment. Another example is the need to consider the increasing spatial mobility of population — a phenomenon widely discussed in the literature on urban studies. The planning implications are still more evident in the case of the spatial socio-demographic structure of urban areas. The realization of such a vital goal as the minimization of spatial variations in the distribution of those population and housing characteristics which have been identified as major dimensions of socio-ecological space, requires the knowledge of conditions which give rise to particular variations.

The approaches mentioned so far, although quite interesting and important for the planning profession, fail generally to provide tools to be used in everyday planning practice. Such tools, however, are provided by a broad group of concepts and models relating to functional interdependencies within urban and metropolitan areas. The urban economic base theory, which has been widely used in planning practice, both in the Soviet Union and Poland (K. Dziewoński, 1971) is a classical example here, although it deals with the city as one spatial unit rather than with its internal patterns. When merged with spatial interaction models, however, that concept has also proved helpful as a tool in predicting as well as planning the intra-urban and intra-metropolitan patterns.

A growing interest in numerous aspects of urban theory and a rapid accumulation of empirical work in the field have precipitated a number of reviews of a more or less comprehensive character. One such review by the author of this paper has been published recently (P. Korcelli, 1975). Therefore, it is mainly one type of concepts, i.e., those relating to spatial functional patterns and interactions which will be referred to below.

## CONCEPTS OF SPATIAL ORGANIZATION

One can identify two approaches within the group of concepts defined here as the study of spatial organization at the urban agglomeration level. One approach relates to territorial division of labour; another deals with patterns of movements and flows. Each approach is in turn composed of a number of more specific concepts and some of these will be now discussed briefly in turn.

### MODELS OF TERRITORIAL DIVISION OF LABOUR

#### *Urban agglomeration as a labour market area*

A number of authors have concluded recently that the range of commuting to work constitutes the best approximation of urban agglomeration (metropolitan) boundaries. This view is consistently represented in the Soviet geographical and planning literature, for example, in the studies by D. J. Bogorad (1966), V. G. Davidovich and G. M. Lappo (1964). As far as work by Polish authors is concerned, one should mention the monograph by J. Rajman, on urbanization processes in the outer zone of the Upper Silesian Industrial District. The spatial structure of that large conurbation is interpreted by Rajman as a set of functionally interrelated employment and residential clusters.

There have also been suggestions to use the labour market definition of urban agglomerations for statistical purposes. As early as 1967 B. J. L. Berry proposed the replacement of a complex set of delimitation criteria for Standard Metropolitan Statistical Areas in the United States by much more unequivocal criteria relating to the range and intensity of commuting to work (see: B. J. L. Berry and F. E. Horton, 1970). Later, Berry elaborated further his concept which is now widely known as Daily Urban Systems (B. J. L. Berry, 1973). It has been used and reformulated by P. Hall (1973) in his comprehensive study on physical planning and urban growth management in England. Hall developed the definitions of SMLA (The Standard Metropolitan Labour Area) and MELA (The Metropolitan Economic Labour Area) which he subsequently used as "building blocks" in the analysis of spatial change. It may be noted that such definitions take it largely for granted that employment fields of individual residential zones are nested within the labour shed of particular urban agglomerations.

The concept of urban agglomeration as a labour market area is therefore that of a system and in this respect it differs markedly from earlier definitions based on morphological criteria mostly, such as land use and physiognomy. The commuting range serves as a proxy for a number of flow variables, all of which refer to everyday contacts and activities of the population involved.

#### *Metropolitan dominance patterns*

In a generic sense, this concept refers to tertiary activities mainly (D. J. Bogue, 1949) although, similarly as in the case of the central place theory, it can be extended to account for the totality of the economic structure of urban agglomeration and its surrounding region. The concept has been used to explain the transformation of traditional settlement patterns within the metropolitan hinterland to a pattern which is featured by an internal functional specialization of individual component zones and subareas. In the case of an industrial conurbation, a process like this was described and interpreted by D. J. Bogorad (1968) and K. Dzięwoński. The growth in functional specialization can assume divergent forms, for instance — the capture of former economic functions of a given

peripherally located subcenter by the core, or by another outer zone subcenter. Similarly, a shift in proportions between the population size of a subdominant center may result out of the expansion of its residential functions performed with respect to the whole agglomeration.

One of the questions calling for further study concerns directional (or sectoral) variations in types of relations between the core and the remaining parts of an urban agglomeration. Up to now these variations were usually traced back to the development of main transportation axes which, in turn, were related to the distribution and location of other large cities and urban agglomerations. Another vital question concerns the formation, under planned economy conditions, of the functional structure and profile of central versus peripheral zones. It should be anticipated, to what an extent, in the near future, the functions which have been traditionally located in central areas are likely to be taken over by the marginal zone.

#### *Spatially discontinuous functional patterns*

In addition to interactions taking place within the territory of an urban agglomeration, as well as its linkages with the surrounding regions, it is the functional interdependence with other agglomerations that is of major consequence for the understanding, predicting and planning the development of the spatial structure of large urban areas. According to K. Dziewoński urban agglomerations tend to form a subsystem within the national settlement system, therefore, in terms of the intensity of flows of goods, persons and information, they may constitute a territorially discontinuous, albeit functionally interdependent pattern. M. M. Webber (1964) calls such a pattern the urban realm, which is a concept quite opposite to the traditional notion of a city, or a metropolitan area, as a spatially well defined cluster of population and infrastructure. The development of urban realms proceeds along with the growing importance of those linkages which extend beyond physical urban boundaries, and which intertwine the city with other centers of similar, or different size and character. What follows from the concept of urban realms is that in order to trace as well as predict the consequences of locational decisions taken at one place, decisions relating in particular to the creation of new employment opportunities and to the development of basic technical infrastructure, one has to look simultaneously at the whole subsystem of urban agglomerations at the national level. An analogy and actual feedback between this concept and the widely acknowledged growth pole theory is self-evident, the latter also being concerned with the growth generated within a spatially discontinuous system.

#### MODELS OF FLOWS WITHIN URBAN AGGLOMERATIONS

##### *Passenger transportation models*

The development of this branch of urban studies started rapidly at the beginning of the 1960's, when it became greatly facilitated by the improvement and spread of computer technology and its growing application in socio-economic research. Urban transportation models rely heavily on allocation formulae of gravity and intervening opportunity type, which were developed by such authors as W. G. Hansen (1959), M. Schneider (1959) and M. O. Chauke (1960). In Polish literature the most relevant reference is the work by T. Zipser (1973). The allocation formula in question assumes generally the existence of a tendency to minimize distance, measured in time, cost, or effort to overcome space. This tendency is interpreted both in terms of spontaneous phenomena, and as

a planning objective. It was defined by G. A. Golts (1972) as a statistical rule of spatial self-organization in population distribution with respect to the structure of transportation costs.

In early urban transportation models the land use pattern was treated as the major determinant of hypothetical distributions and intensity of flows, and individual land use categories were assigned different parameters representing their ability to generate traffic. This concept has been gradually replaced by typological analyses of individual trips, such as journey to work, to school, shopping and recreational trips. Such an analysis is usually based on actual distributions of trip origins and destinations. A more recent development are models based on daily activity patterns and contact systems which allow to associate different types of destinations within a single spatial-temporal system. Assuming the existence of a high spatial mobility of people within urban and metropolitan areas, one can expect that urban transportation models, based on the concept of trip typology and daily activity systems, should prove to be quite effective as planning tools when compared to the more traditional approaches. By emphasizing the mutually interrelated activity systems they are also likely to contribute to land use development planning and management.

#### *Spatial interaction-economic base models*

Only a few short comments will be offered here as these models are discussed in greater detail in another paper by the author (P. Korcelli, 1975).

Spatial interaction models are genetically related to the urban transportation models but their aim is not so much to predict the volume and distribution of traffic as to simulate the distribution of population, land use and economic activities within a city or an urban agglomeration (see I. S. Lowry, 1964).

Planning applications of spatial interaction models have been traditionally related to impact studies, i.e., the tracing of spatial implications of change in exogenous employment, transportation improvements or general population increase. They have also been used to test possible effects of single hypothetical locational decisions pertaining to the development of industrial, service and transportation facilities. Under planned-economy conditions spatial interaction models can be integrated with other models, such as regional economic growth models, or migration-labour force models into more comprehensive modelling frameworks. This would allow to establish feedbacks between exogenous and endogenous sectors in the models' structure.

#### TYPES OF SPATIAL PATTERNS PROPOSED AND THEIR PLANNING IMPLICATIONS

One can assume that a broad array of models of urban growth and structure based on theoretical concepts of spatial organization and interaction, can and should be actually adjusted to fit the planning needs. At the same time it is important to anticipate what kind of an influence such an approach can have on the process of plan construction both for individual urban agglomerations and even for the whole national or regional systems of settlement. It may be instructive at this point to recall some of the relations between the three basic types of models traditionally identified, i.e., descriptive, predictive and planning models.

There are several approaches as to the place of prediction in the planning model. One of them is to treat a long-term (i.e., 25-30 years horizon) plans as

predictions; another approach is to restrict the planning proper to the variables under control, while to consider all uncontrolled, or partly controlled variables as subject to prediction only. The latter type of variables include, for instance, demographic change, technological progress, or climatic conditions.

Interrelations between planning models, on the one hand, and descriptive and predictive models, on the other, depend also on the character of plans and their implementation conditions. They are a function of the share of the positive component in the plan, i.e., the degree to which the model in question assumes a transformation of the existing spatial structure, the transformation based not so much on trend extrapolation, as on adjusting the spatial pattern to the conditions determined within the system of development goals and objectives. Hence the size of the positive component in the plan is dependent on socio-economic conditions, the scale and the level of detail in the plan, as well as on the time horizon. Under planned-economy conditions the positive component in the plan is, of course, much greater than in market economy conditions, although predictions are quite broadly used as information inputs.

Some illustration of the questions discussed is provided by the recent discussion on future settlement patterns and the development of urban agglomerations in Poland. In the course of this discussion some twelve concepts were presented, based mostly on the assumption of time horizon extending between 30–50 years from now (S. Herman and P. Eberhardt, 1973). Although these concepts widely differ one from the other in terms of assumptions, means of presentation, and methods used, one can distinguish among them three basic types referring to distinct spatial patterns proposed.

The first concept under discussion is that of a concentrated urban pattern which could emerge as a result of territorial expansion and an eventual merging of several major urban agglomerations of southern and central Poland. The following assumptions are used: concentration of population on a national scale will be progressing; proportions between the individual sectors of the economy will evolve in the directions so far identified, i.e., most of employment growth going to tertiary and quaternary activities which will continue to be attracted to big cities. Finally, on a local scale, deconcentration processes will assume the dominant part. This factor is made responsible for the anticipated rapid expansion of individual urban agglomerations and their ultimate physical integration into large urban complexes.

The above model reflects the features of contemporary urbanization in Poland (particularly the spatial structure of commuting to work), and extrapolates the trends observed in the past adjusted on the basis of available predictions concerning spatial mobility, time budgets and intersectoral proportions. It is a predictive model since the pattern proposed is a probable one. As a planning model it meets some requirements and fails in the case of others. (Speaking of a planning model I am referring first of all to the explicit or implicit social and economic goals rather than to the methodology of plan-making and plan presentation). Thus a highly concentrated pattern of an extensive urbanized region is believed to answer one of the basic development goals, namely the maximization of the effectiveness of investments in production and, therefore, the maximization of the rate of economic growth. On the other hand, it is recognized that the costs of providing technical and social infrastructure tend to be higher than in the case of less concentrated patterns. The concentrated pattern also brings about the problems of environmental disfunctions of large magnitude though, at the same time, it leaves ample space for less intensive uses.

The second type of concepts refers to linear settlement patterns or urbanized belts which, according to their proponents, are generated by such factors as spatial differentiation of natural conditions, linear spread of innovations, and the inertia of fixed assets and socio-economic structure. Some authors claim that urban agglomerations emerge at points where two or more corridors cross each other; according to others the opposite is true, that is the belts develop as links between the large urban centers.

Analyses of spatial patterns of settlement indicate that urbanized belts tend to develop along physical barriers to movement or following high attractiveness zones (such as seacoast). Therefore a prediction, according to which urbanized belts become a major component of the whole settlement network, is not based on trend extrapolation. Instead, it contains an assumption of an increasing importance of the technical infrastructure, especially major transportation lines as factors in the evolution of settlement forms on a national scale. As a rule, the linear models contain more normative elements than the remaining types of constructs. They are believed to allow the accomplishments of a number of basic social and economic goals, such as the effective distribution of productive forces, the equalization of living conditions, and a rational utilization of resources.

The third of the basic patterns discussed is similar to the city-region concept. It is a polycentric growth model whose principal assumptions refer to the role of urban agglomerations, and big cities in general, as focal points of social and economic activity. According to this approach, the territory of Poland could be divided into spheres of everyday contacts oriented toward the major cities and urban agglomerations. The model represents certain actual characteristics of the contemporary structure of urbanization in Poland, but it is primarily of a predictive and planning type. The elements of prediction pertain to the assumed increase in the mobility of the population and the growing spatial range of daily and weekly activity patterns, whereas the elements of choice consist mainly in pointing to the social and economic benefits of promoting a polycentric network of urban places, characterized by a lower degree of concentration than either of the two patterns earlier discussed.

This brief review of three basic types of spatial patterns proposed shows that the differences which have been noted stem in part from the relations between the descriptive component, the conditional prediction component pertaining to the future change of spatial structure, as well as the elements of evaluation and choice. All these components are represented in the concepts described, although variations in their proportions are quite considerable. On the other hand, a common feature of the concepts discussed is that they all make reference to spatial organization and spatial interaction threads in the theory of urban structure, i.e., to principles of interrelation between the patterns of residence, employment, recreation and other major types of human activity. Still, they represent ideal and simplified views rather than fully-developed operational constructs.

Discussion in this paper was organized from the point of view of application of existing theory and models in the planning of urban structure, both at the scale of the national settlement system and that of individual urban agglomerations. However, the opposite input loop is at least as valid and it should command much research effort in the near future.

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## BASIC FEATURES AND KEY PROBLEMS OF THE DEVELOPMENT OF URBAN AGGLOMERATIONS

GRIGORIY M. LAPPO

An urban agglomeration represents a compact group of urban settlements which owing to intensive and varied links among them is converted into a unified dynamic system.

Urban agglomerations are active elements in the spatial organization of the forces of production. Under the conditions of planned economy, their inherent progressive features can be strengthened and the negative ones weakened. The manifold and complex problems of urban agglomeration development are of particular importance, for they are in close relation to many other problems, such as: determining the direction and accelerating the pace of the scientific and technological progress; raising the productivity of social labour; solving the most acute questions concerning the environment (whose urgency is the effect of the urban agglomerations concentrating a predominant part of the urban population); preventing the threat of an ecological crisis, etc.

As far as the typology is concerned, urban agglomerations are extremely varied as to their functions, origins, and morphology. Let me point out some of their general characteristics.

Urban agglomerations are dynamic entities and this feature makes them stand out as active links in the settlement system which, on the whole, is noted for its inertia and, to a degree, conservative tendencies. Urban agglomerations not only develop rapidly,\* but they also exert strong influence on the neighbouring systems of regions and centres, as well as on the transportation network by spreading their links far into the outer area. As a rule, settlements tend to be inert, yet the agglomerations are the yeast of development.

Urban agglomerations are a stage on which diametrically opposite processes are at work: concentration and dispersion, differentiation and integration. They act together within the framework of an agglomeration, stimulating one another. Urban agglomerations are actually a unity made of antagonisms. What should be emphasized in particular is the differentiation and integration of activities: the concentration of production, of the non-productive zones, of population, and at the same time their diversification in space.

All these processes are not simply located in an agglomeration — they determine, indeed, its essence, are an expression of its main features.

Urban agglomerations are by their very nature multifunctional. This aspect derives from the fact that they concentrate propitious conditions and means

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\* The most often quoted data referring to the dynamics of the number of inhabitants support this fact, but only approximately so, since they leave out the whole question of qualitative changes which are more than anything else characteristic of the processes occurring in agglomerations.

which enable them to attract most different activities, and also from the circumstance that some functions seem to pave the way for others, stimulating their development.

Under the conditions of an agglomeration (the spatial proximity of a multitude of diversified functional elements, the ease of establishing numerous contacts, high informational "conductivity") the tendency of various processes to integrate, of functions to react on one another reaches particular momentum and produces quick and striking results. All this makes the urban agglomerations a sort of experimental "firing range" of production, the generators of what is novel in the field of science, manufacturing, management, education, culture and art.

A distinct feature of an agglomeration is its extraordinary intensity of internal links making it a whole, a unified entity.

It is entirely justified to define the urban agglomerations as areas of mutually related settled places, for this is one of their important features; however, if we stop there, we leave in the shadow their economic basis. The relations resulting from working and living conditions of the population have assumed in the agglomerations a specific form of rhythmic, pendulum-like migrations, which give the agglomerations a kind of pulsation of their own. This aspect of the matter has already been well investigated by the urbanists, but the same cannot be said as far as the production links are concerned. The explanation of this neglect can perhaps be found in the fact that the production ties are not specific to agglomerations, they are not contained within their limits, and it is not the production links that define their boundaries. Although, because of their character, the production ties are not peculiar to agglomerations only, nevertheless they, too, express their essence. Generally speaking, the production links inside agglomerations (as well as other intra-agglomerations ties) are singled out of the totality of production links because the former are near at hand and that brings about great economic advantages.

There are two reasons for grouping together production enterprises, that form the basis on which an agglomeration's towns and smaller settlements grow and develop. First, it is easier to overcome the difficulties that present themselves in creating and setting in motion an enterprise (improving and fitting the plant's perimeter, constructing workshops and laying out transportation lines, bringing in equipment and technology). Second, one can take advantage of the effect of the production links that are already on the spot; this effect is not limited only to its transportational vector, important as it may be, but includes also the possibility of establishing suitable contacts, the technological ones included, that secure constant renovation and progress of the enterprise. The effect of proximity in the matter of relations appears, no doubt, a fundamental feature of an urban agglomeration.

In time, the importance of municipal economic ties within an urban agglomeration grows ever greater, since a system of well developed municipal economy, uniform for all the urban and rural settlements of the agglomeration, is an objective necessity. It is dictated by the desirability of utilizing more sparingly and economically the territory and its resources, and, first of all, by the general aim of protecting the environment.

The dynamic nature of development, multifunctionality, a tendency to integration, the effect of the proximity of relations — all these are the main features of the urban agglomeration as an environment qualitatively set apart from other kinds of geographical realities; its specificity is all too important

for any kind of both productive and non-productive activities and for Man's life in general.

This new environment is capable of changing rapidly, of adjusting itself to the demands of time and tide, and of very quickly mobilizing and setting in motion its possibilities.

High and dynamic density of the urban agglomerations (the density of static elements and that of relations), the intensity of a whole tangle of heterogeneous processes, crowded in a limited area, make the agglomerations an inherently contradictory phenomenon.

It is just this contradictoriness that has been the reason why there is such a diversity of opinions about the agglomerations. The judgements have grown divergent, for when some investigators have been stressing the progressive features of agglomerations, the others have dwelled upon the shadowy aspects.

The positive and negative sides of urban agglomerations are closely knit together, since they are the effects of the same processes. The failures of the agglomerations are a sequence of their merits.

While the concentration of functions, bringing evident economic, social and ecologic advantages, is at the foundation of a favourable environment which fosters comprehensive development of human personality, it is inseparable from troublesome effects originating in the production, and also from increasing burdens that Nature and Man have to shoulder. The concentration works both ways: for the betterment and the worsening of the environment in which people have to live.

Urban agglomerations possess an extraordinary faculty of attracting various functions, but, on the other hand, their areas being limited, they have to act within only very narrow possibilities in localizing these functions and securing necessary resources for them.

This brings about a phenomenon which can be labelled the "emulation of functions".

The contradictions born out of the growth of urban agglomerations are possibly not limited to their own frameworks only. In the concentration of functions in a few agglomerations there is (latent danger of the potentialities of other areas being inadequately put to use — in other words, a threat of macroareal economic disproportions coming into existence. It may lead both to disturbing the ecological balance and to overstepping the threshold of economic rationality. This is where the hypertrophy of urban agglomerations is most clearly visible (as, for instance, in the United States) — a feature condemned not solely by Soviet scientists, but by foreign researchers as well.

In view of the fact that urban agglomerations begin to assume key positions in the industrial and territorial structures of the national economy and become the most absorptive areas for the population, it is of utmost importance that the right direction of their development should be properly safeguarded.

The dynamic development of the urban agglomerations, both intense and contradictory, makes it unavoidable that they should be constantly monitored and subjected to a management that is scientifically justified. It is exactly like a technological process which, if it is to continue, must be systematically controlled as to its main parameters which are to be kept within definite limits.

Should the management of the urban agglomerations be faulty and not rational enough, the society, instead of accruing benefits, is apt to suffer damages that will visibly be expressed in its economic, social, and ecological spheres of activity.

Under the socialist system of government the development of urban agglomerations should be controlled and managed in a goal-directed and planful way.

The main aim of urban agglomeration management is the welfare of Man, a full-scale utilization of the outstanding economic potentialities inherent in the urban agglomerations, thereby securing the creation of an environment benevolent to the life of the population and enhancing the increase of efficiency in productive and non-productive activities.

The results in the sphere of production should by no means be obtained at the cost of making the environment suffer damage. It is the requirements of the environment that determine the main parameters of production and of joining different kinds of economic activity within the limits of an agglomeration; it is they that condition the development in agglomerations of what may be called, following academician N. Federenko, an ecological economy.

People's welfare will to a large degree depend on the extent to which the complicated and acute problems of the urban agglomerations are solved. And the creation of an environment that is propitious for human living is a management task of top priority.

The main principle of managing the development of urban agglomerations is to approach them from an all-national economic position. The same is true of a city more than once the misfortunes of "bureaucratic" towns have been described), but it is still more pertinent in the case of urban agglomerations, systems that are much more complicated than a city.

In this field we should be fully aware of the danger latent in unilateral, biased actions disregarding the integrated wholeness of an urban agglomeration and forgetful of how widely ramified and rapid the chain reactions in an agglomeration are.

What the urban agglomerations need is a management which would secure a balanced development, would not lead them astray beyond the limits of economic expediency and ecological equilibrium.

When distributing capital outlays among different subsystems of an urban agglomeration due care should be taken that the principle of commensurability be observed. The technological possibilities of improving the environment already within our reach cannot usually be fully exploited for the means are scarce. When production is unilaterally promoted, the environment may suffer serious damage, and to remove it in the future will require costs, the magnitude of which will be greater than any other outlays.

Success in the complicated task of controlling and managing urban agglomerations is, to a high degree, dependent on how deep and reliable is the scientific justification of our endeavours. In view of the nature of the urban agglomerations as described above, there is a necessity of their comprehensive and interdisciplinary investigation, that will require a collaboration of many sciences, including a far-reaching and thorough contribution of a whole series of geographical sciences. This scientific co-operation should be directed toward the main key-problems and should insure that they are solved not piece-meal but integrally. In particular, efforts should be concentrated on discovering what is the national economic potential of the urban agglomerations and on justifying which are the ways leading to their most expedient utilization from the point of view of the national economy.

The national economic potential of an urban agglomeration depends on two main factors: on its economico-geographical position and on the local capacity of the area in which the agglomeration is being formed. The former expresses the possibilities of an urban agglomeration that are the result of external forces,

the latter — those created by internal conditions. Both factors are historical categories subject to changes in the course of the scientific and technological progress and the formation of spatial structure of the national economy. To find out and evaluate the potential of urban agglomerations (of those already existing as well as of those that are only prospective), to forecast the possibilities of change — these are the reasearch tasks of top priority. It is important to find out the ways by which the local capacity could be increased, as, for instance, through changes in the natural environment, the restoration of damaged landscape, or through supplying the agglomeration with the resources of other areas.

The realization of the national economic potential of an urban agglomeration is done by means of a combination of co-ordinated measures, including: (a) improving the functional structure of the urban agglomeration as a whole and also of its component parts (the core-town and the satellite towns); (b) improving the structure of planful zoning by taking into account, among others, internal differentiation of the agglomeration's area; (c) setting the most rational target-aimed directives for spatial development, due attention being paid to concrete conditions; (d) making sure that the development of the central town of the agglomeration and that of its satellite settlements are properly co-ordinated; (e) developing the infrastructure.

In view of the fact that in an urban agglomeration the area is limited and different functions are competitive, strict rules should be applied in selecting them, the guiding principle being their feasibility under the objective conditions of the agglomeration's development.

Urban agglomerations are a very peculiar kind of environment, where conditions for human production and living are especially advantageous. To create and develop an urban agglomeration enormous outlays of capital are necessary; the relative (per one inhabitant) inputs of capital in the infrastructure must be higher than in other kinds of settlements; the costs of operating a very complicated communal economy must be proportionally greater; the extremely costly measures aimed at the protection of the environment must be enforced, etc. The conditions that are characteristic of urban agglomerations can be created only by prolonged efforts of the entire national economy directed at a comparatively limited number of "dots". Therefore particular care should be displayed when dealing with an urban agglomeration's potential. It is irrational to utilize urban agglomerations for purposes of any indiscriminate kind of development, to burden them with all sorts of mass production plants that can as well be located anywhere else. The development of urban agglomerations represents important reserves not only for increasing production, but also for creating the most dynamic elements in the national economy and culture, namely those elements that are determinant factors in achieving progress in all sectors of the life of the society. Careful localization of such elements in urban agglomerations not only secures the most favourable conditions for their development, but also makes it easier to include them into the productive and spatial structure of the national economy. And it is just this way of regulating the growth of urban agglomerations that will contribute most to speeding up the scientific and technological progress, which is an inherent trait of urban agglomerations and of which they are a most important vehicle.

It is important that the combination of functions in the towns of an agglomeration should be a result of a rational choice. It should be guided by multiple yet integrated requirements: social, techno-economic, technological, ecological. From the point of view of production, an urban agglomeration appears, as

a rule, to be an intricate spatial productive complex. When the combinations of functions to be located in the individual towns forming an agglomeration are being decided upon, it may happen more than once that the requirements of ecological nature and the necessity of taking a fuller advantage of the labour reserves (this ties up with raising the levels of family budgets) may have to be given precedence before technological and industrial demands.

The differentiation of activities and the integration of their various types are the driving forces of agglomerations. These objective processes being the basis of our decisions, it is necessary to construct the foundations of individual towns in an urban agglomeration as combinations of functions, as complexes that are socially effective, ecologically admissible, and economically rational. The shortcomings of narrowly specialized centres are not so clearly visible under the conditions of an agglomeration as they are when they are made to stand separately. These disadvantages are, however, quite perceptible when the specialization basis of satellite towns is too narrowly limited. It can be avoided through stimulating multifunctional development of towns and smaller settlements inside urban agglomerations.

The primary aim of laying down plans for an urban agglomeration structure is to create conditions conducive to the welfare of the inhabitants and to the realization of the agglomeration's functions. A planned structure should satisfy sanitary and health requirements, secure that the loss of time in travelling is not excessive, as well as it should be flexible enough to make further development possible without creating too many hard problems for urban engineers and ecological conservationists.

In the process of its development many an urban agglomeration faces the necessity of transforming the structure that was formerly planned for it, in order to take greater advantage of the local absorptive capacity of the area or making the environment more wholesome, or acquiring resilience and adaptability indispensable for its further development. Usually on this occasion steps are being taken better to fit the spatial organization of the urban agglomeration with the spatial economic structure of the surrounding economic region or of a large part of it. When setting targets for the future development of an urban agglomeration one should consider not only the internal requirements of the agglomeration itself, but also the needs that may influence the forming of the spatial structures of larger areas.

The problem of how to make the development of the central town of an urban agglomeration and that of its satellites mutually correlated consists essentially in determining proper proportions with reference to the whole as well as to the groups of functions.

To the first group belong the leading elements of the progressive branches of production and of cultural, institutional, and managerial activity: the headquarters and main enterprises of scientific-industrial institutes and production management federations; the headquarters of scientific and designing institutions; all sorts of economic and administrative offices; the institutes for training highly skilled cadres; the leading establishments of the cultural complex, such as theatres, museums, conservatories, central libraries, publishing houses, and expositions. Concentrated primarily in the core-town, they are also introduced into the satellite zone as the urban agglomeration grows and develops. The process of de-concentration envelops mostly those links that are in need of larger precincts, but it affects also those that can do without widespread and particularly vigorous communication ties (some productive plants, scientific,

educational, and designing institutions). The degree to which the enterprises and establishments of the first group are de-concentrated is one of the criteria by which the maturity of an urban agglomeration can be measured.

The second group consists of elements which co-operate with the enterprises and institutions of the first group. Here we find all kinds of subsidiaries, co-operants, junior partners (plants specializing in the production of machine parts, warehouses and reserve material lots, experimental ranges and facilities, record offices, etc.). By way of an example we can consider the following "chains": the main plant for producing finished products (the central town) — enterprises supplying it with parts (satellite towns); a scientific and designing institute — experimental facilities; an institution of higher learning — a field-work and production experimenting terrain; a medical research centre — its out-of-town hospital.

The links of the second group show a stronger tendency to settle down in the satellite zone than do those of the first group. Their localization there is determined by such factors as the transportability of produced goods, interference with the environment, space requirements, availability of skilled labour, frequency of the contacts with the headquarters of enterprises and institutions, tolerable loss of time in travelling to the enterprise headquarters or shipping freights over to them.

The third group is made of enterprises and institutions which attend to the needs of the entire economic complex of an urban agglomeration and its population. Some of them are inseparable from the agglomeration, as for instance mass recreation facilities, waterworks and air conditioning installations, refuse disposal plants, airports, railway shunting tracks, etc. To this group there belong also building material producing plants, exploiting largely local raw materials and supplying bulky goods which for economic reasons it is inconvenient to haul over long routes, large greenhouses, animal husbandry and poultry breeding farms, whose produce does not stand up well to transportation over longer distances and which, besides, can be well integrated with the municipal economy (through the utilizing of food refuse, otherwise superfluous heat, etc.).

What is important here is the purpose of production, namely making sure that the needs of the population are well taken care of — it is the reason with which the localization of the said enterprises in an urban agglomeration are usually justified. Actually, however, this purpose can hardly be regarded as presenting sufficient grounds for such localizations (it is understood we do not have in mind the links whose localization lacks elasticity). When considering these problems it is obligatory to start with the general principles of expediency that have already been listed above.

Improvements in the infrastructure ensure an integrated unity of an urban agglomeration, an effective interdependence of its constituent parts, and also supply most important instruments for controlling its areal development. A purposful expansion of the infrastructure stimulates harmonious development of the urban agglomeration and strengthens those centres that, by developing, not only do not increase the disadvantages of the urban agglomeration, but, on the contrary, contribute to its merits finding full expression. At the present time the objective process of urban agglomeration formation in the Soviet Union is slowed down, to a large extent by the agglomerations being not quite adequately equipped with a faultless and planfully developed infrastructure.

An urban agglomeration, just as an individual town, cannot be, for the purpose of scientific investigation, economic planning, and town designing, torn apart from the whole system of settlement.

The urban agglomerations are the skeleton of the spatial structure of the national economy. They are simultaneously points of leverage for the surrounding areas and the main knots where the interrelations of economically differentiated areas meet and turn the areas into a unified territory. Thus the agglomerations are the main foci of the country's economic, political, and cultural life, and the preferentially developing poles of growth.

What kinds of functions should be joined in an urban agglomeration depends on its basic purpose and the place it takes in the spatial structure.

The combination of functions is significantly different in different urban agglomerations: centres of the Union republics and autonomous republics, nuclei of autonomous regions and subregions, links in the chain of economic integration, bases for the exploitation of the resources of an area, etc.

It stands to reason that where the agglomerations are located is not determined solely by the presence of favourable conditions at this spot or the other, but by the necessity of the country's having at its disposal a developed network of focal points on which it can rely in order to foster the geographical division of labour. The articulation of this skeleton over the different parts of the country should, historically speaking, reflect the maturity of such parts.

The development of the urban agglomerations, concordant with the processes of the geographical division of labour and the formation of economic regions as specialized parts of the country, will bring about the "effect of agglomeration", which, taken broadly, resolves itself into the agglomerations influencing the development of the systems of settlement, areal production complexes, economic regions, and the entire system of the country's inter-regional and international relations.

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## MECHANISM FOR CONTROLLING THE DEVELOPMENT OF URBAN AGGLOMERATIONS

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### EXPLANATION OF THE PROBLEM

The need to submit the problem of controlling the development of urban agglomeration to a critical analysis results largely from the observed imperfection of spatial planning, especially the all too frequent deviation of practical realization from planning intentions and anticipations. On the urban-planning and regional levels, that deviation concerns a problem that is of paramount economic and social significance for the national economy: the efficiency of the plan (whether economic or spatial), which is the basic tool for attaining the socio-political objective of socialism.

Because big urban agglomerations fulfill a crucial role in the general structure of the national plan, it is of utmost importance to identify the principal mechanisms of their development and, against this background, the methods of controlling the development of agglomerations in accordance with the objectives pursued. So far, although it keeps turning up in most urban-planning analyses and discussions, that problem is not known well enough yet. The difficulty to master it consists in the spatial scale in connection with territorial size of a big urban agglomeration together with the surrounding area of influence and, moreover, in the complexity of the problem itself. While the problem of development control occurs in all urban-planning phenomena and groupings, even the simplest ones such as settlement or small town, in agglomerations (a summary term for urban groupings treated together with the other concomitant urban groupings including agricultural areas, forests, etc.) there are many phenomena of different qualitative characteristics than those known from smaller towns.

We are now aware of the fact that the plan of spatial development by itself is not the only — or not even the most important — element of controlling the development of towns and agglomerations. We realize that this problem involves a whole gamut of various elements of economic, administrative, socio-political, technological and planning nature, which only in their total network (which is more than their mere mathematical sum) of mutual interactions in cybernetic systems affect the development of the intricate spatial processes with which we have to do in the big agglomerations. The frequent complaints on the imperfection of our planning, especially on the discrepancy between decisions actually

made and the underlying planning intentions, must certainly be traced back not only to subjective factors but also to a misunderstanding of the mechanisms governing the development of the more complex urban structures in Poland, to a one-sided, often idealistic concept of the role of the plan for urban development and the resulting lack of a complete method of controlling spatial development.

To give a concise description of the essence of the mechanism of controlling the development of urban agglomerations the following selected problems must be discussed:

- (1) the mechanism of development of agglomerations,
- (2) the nature, objective and mechanisms of development control,
- (3) the role and form of the spatial development plan in the process of control,
- (4) the program of research projects.

#### THE MECHANISMS OF DEVELOPMENT OF AGGLOMERATIONS

In a rough distinction, we can classify the types of mechanisms of development of agglomerations as either objective or subjective.

Objective mechanisms of development are not universal in scope. They could be arranged into an involved genetic-typological table, taking account of the diversity of agglomeration types due to their different origins, historical vicissitudes, conditions and functions. Here let us restrict ourselves to the two fundamental spatial structures: centrifugal and centripetal structures, that correspond to the principal trends of the functional-spatial development of agglomerations.

Centrifugal urban structures emerge in the course of development of a settlement point which was expanding in response to growing needs, usually along the principal transport lines and as a rule according to the "fat-spot" pattern, i.e., jutting out in various directions in an uncontrolled development. This plasma-type development is concentric in its pattern. Some settlement ribbons gradually draw out off the centre to reach a point in the vicinity of a major town where, under its influence, they develop into smaller settlements thus creating patterns of satellite towns. This is the pattern of development of one type of agglomerations.

Centripetal structures of agglomerations emerge predominantly with the development of mining industries. A number of more or less equipotent settlement points which usually owed their origin to the necessity to link the residential area with the mining centre are gradually expanding and, in their growth, establish more and more close function-spatial ties with one another. In contrast to the previous type of structure, which from the very outset of its development is distinctly monocentric, the centripetal agglomeration is essentially polycentric, especially in its early phases of development.

But centripetal and centrifugal agglomerations with mono- and polycentric structures occur in pure form usually in the early phases of development of the settlement network. In the higher phases of development one phase characteristically passes into another on a cyclical basis. This process can be called the "pulsation" of the settlement system.

This specific "law of pulsation" consists typically in passing from a monocentric settlement structure to a polycentric structure, and subsequently, on

a higher level of development, again tending toward a monocentric structure till, together with its quantitative growth and expanding territory, it once more becomes a polycentric structure and so on. The case of the Upper Silesian Industrial District, which is now passing from a polycentric to a monocentric structure (with Katowice city as its core) but in further development will fuse together with the Cracow agglomeration thus again attaining a polycentric structure, seems to be a good illustration in this connection.

One significant and interesting moment in this development cycle which proceeds in accordance with the law of pulsation is the transmutation of mono- into polycentric structures. This occurs mainly in result of the centripetal development of several towns or minor urban agglomerations situated close to one another. But as the minor settlement units that are getting (functionally and quantitatively) closer to one another are rarely equal in their economic and social potentials as well as in growth rates, at first it is the two strongest and most dynamic settlement units that normally tend to get closer to each other. Such a process of emergence of bicentric urban agglomerations can be said to take place according to the "rule of two". In Poland there are several agglomerations of very different socio-economic scale and import that can be cited as illustrations of bicentric agglomerations having developed according to the "rule of two": the Kalisz-Ostrów agglomeration as the smallest of all, the Gdansk-Gdynia or the now emerging Bydgoszcz-Toruń agglomerations as somewhat bigger in scale, and the emerging Upper Silesian-Cracow macro agglomeration as biggest in scale in Poland.

This process of pulsation of structure occurs in agglomerations composed of several settlement units which are continually attracting and repelling one another, depending on the specific physiographic, economic and socio-political situation at the given phase of development. This phenomenon can be said to be typically dialectic in that it consists in the gradual intensification of integrative and growth-furthering activities and trends in settlements based on continually clashing trends toward equilibrium and disequilibrium of the system. In consequence, towns tend to integrate with one another, in a sense, according to the principle of "natural selection" which results from the complementary nature of the individual settlement units. That complementarity consists in the existence of diverse complementary relations including natural conditions, convenient traffic lines, economic cooperation, cultural heritage, demographic dynamics, etc.

One characteristic manifestation of this process is the dispersal of some local settlement system. Such a problem turns up especially when a big monocentric structure reaches the limits of its endurance which can be called its concentration limit. At that limit a critical point is reached beyond which the existing spatial structure ought to undergo a qualitative change if it is to continue serving the supreme task of creating optimal spatial conditions for life in the towns. It is primarily at that moment that a whole series of external incentives and actions, which can be collectively termed the apparatus of controlling the development of agglomerations, should be introduced into the process of structural-spatial transformations.

The above-described pulsation is a phenomenon concomitant with cyclic processes of growth and change and is inextricably connected with the concept of concentration. On the general level of agglomerations, concentration is the most overall concept as it characterizes the general trend and pattern of creation and development of agglomerations. This, however, does not mean that concentration is unconditional and mechanically "spontaneous" as an element which

automatically accompanies the development of agglomerations. Many instances could be cited of various agglomerations in which concentration takes different forms depending on specific conditions. It can be said, however, that the trend toward high concentration is desirable in the current phase of socio-economic development of our country, provided it is submitted to adequate control. This does not mean that similar trends will be equally desirable in the future, too. It is to be expected that after some definite level of socio-economic saturation has been achieved, dispersal and deconcentration actions will be launched. This process can generally be described as the road toward deconcentration through concentration.

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Mechanisms of subjective character are another type of mechanism of development of agglomerations. Their operation is closely connected with the problem of controlling development processes. In their role and efficiency they are conditioned by objective mechanisms such as the crystallization of centrifugal and centripetal spatial structures, the law of concentration, the law of pulsation, the rule of two, or with the determination of the highest concentration limit.

When discussing the subjective mechanisms of development of agglomerations we should primarily mention the role of planning and management both of which have a significant quantitative and qualitative effect on the shape of the agglomerations. But their operation is integrally connected with the problem of development control.

#### THE NATURE, AIMS AND MECHANISMS OF DEVELOPMENT CONTROL

Thus the development of urban agglomerations turns out to be an objective phenomenon and any actions directed against the above-mentioned laws are bound to run counter the "natural" trends of development of settlements and thus are presumably doomed to failure. But before we proceed to a discussion of the prospects and directions of development control let us clearly state which are the desirable and the undesirable features of big agglomerations.

The desirable features include, among others:

- passing to new higher forms of organization of production on the basis of the full utilization of the modern technologies; this is a process providing for the society's civilizational advance,

- the undelayed and ubiquitous access to new facilities in education, culture, the easy exchange of cultural goods and the easy access to knowledge; this provides for the socio-cultural advance,

- conditions favouring the search and finding of forms of work, dwelling place, entertainment etc. such that would meet a variety of personal or group preferences; this provides for the sense of freedom in that it furnishes conditions of "freedom of choice",

- a higher rate of growth of material production based on large and technologically advanced plants; this provides for a quicker material advance of the population,

- the lower unit costs (per new inhabitant) of extending the service and municipal facilities; this provides for higher economic effectiveness of development of big towns as compared with medium-sized and small towns.

The adverse features, on the other hand, include:

— the steady concentration of people, goods, constructions and transports in the centre of the agglomeration; this burdens the conditions of life, work and movement, leads to more and more functional and technical clashes thus deteriorating the functionality of the agglomeration's principal area — its core,

— the steady biological degradation of the natural environment; this raises the incidence of illnesses due to growing noise, fumes and a haste-dominated life style, etc. (coronary inefficiency, neuroses, heart failures, etc.) and reinforces man's isolation from nature thus encumbering both the physical and mental life of individuals,

— the severance of natural social ties, the loss of the sense of social contact in a "lonely crowd"; this reinforces social pathological phenomena such as hooliganism, drug addiction or alcoholism,

— a trend toward a chaotic development of whole city portions; this depreciates the architectural-aesthetic effect and eliminates the human factor in architectural and town-planning design.

Each of the above phenomena, whether desirable or adverse, is primarily connected with the law of concentration, and the mechanism of this effect relies strongly on a system of feedback-type relations. This is best observed in the transformations of the principal urban centres. Efforts to make the core more accessible to users necessitate its technical reconstruction to provide for the easiest traffic connections, car parking, etc. This increases the inflow of more and more users to the core thus further contributing to its congestion. New efforts are then made to raise the accessibility of the core which in consequence increases its attractiveness and results in another inflow of users. This incessant process eventually produces big urban centres, complicated and unfeasible urban machineries which have a deteriorating effect on both the physical and spiritual life of their inhabitants. One frequent way out of this situation is the creation of a system of smaller district centres whose function it is to decongest the principal centre or else the creation of service centres outside the strictly urban construction developments, in the free areas of the agglomerations. Such centres are characterized by a relatively easy access to transport facilities though they may be far off the agglomeration's core. Generally, however, even those centres are incapable of inhibiting the process of concentration in the agglomerations.

If we were to define the most obvious aims of controlling the development of urban agglomerations in view of the above remarks, then in addition to the general aim of the creation of optimal conditions for the biological and cultural life of their inhabitants, we should primarily point out that development control must ensure putting a check on the uncontrolled advance of concentration so as not to foil the advantages it brings. Thus the strategic end of controlling the development of agglomerations could be said to consist in the struggle for channelling and the proper utilization of concentration processes in such a way as to secure a proper spatial pattern for urban agglomerations.

To put it generally, the concept of controlling is used here to denote a system of various forms of exercising a deliberate influence on some definite phenomenon. Accordingly, the concept of controlling the development of big agglomerations implies a system of mechanisms intended to impart spatial development patterns that would secure the best possible utilization of the advantages of agglomeration and prevent the adverse effects involved in it.

If it is to be efficient over longer periods of time, such a system of mechanisms should obviously tend to transform into a self-regulating rather than

a voluntaristic system, because it is only the former that can secure the efficiency of the process of control.

The next step in this reasoning is to consider the possible and desirable foundation for the above-mentioned self-regulating system.

The operation of the self-regulating system must be based on the formerly described objective laws of the development of agglomerations together with appropriate decision-making in accordance with other objective principles of social development as tools for the regulation. Those tools should function as a kind of specific catalyser for the self-regulation system of the development of the agglomerations in the desired direction.

The most efficient tools of this type will include economic, administrative-legislative and technological decisions.

The still unsolved problem of basing land price on its real value in Poland is a ready example of a tool of economic type.

In capitalist countries land price is the principal factor determining the specific form of urban construction patterns. The price of land is composed of a number of elements, for example the location of the given plot with respect to the centres and other major points of organization of social life, the existence in the plot of different networks of technological infrastructure, easy transportation links with the principal agglomeration centres, etc. But even planning intentions go into land price as a separate element, too. It is realized that under these conditions the capitalist system encourages land speculation and all kinds of financial machinations. Yet while we refute that speculationist superstructure which is so characteristic for capitalist conditions, we must admit that by divorcing the price of land from its real value and relying exclusively on the system of planning decisions we deprive ourselves of a fundamental tool for regulating the pattern of urban developments; in practice, this results in furnishing equal conditions for the location of great industrial plants, municipal parks or family houses in one area. The case of Stockholm is a good illustration: the municipal council had bought out definite building areas in which construction developments are materialized according to an earlier plan, and the city and regional administrations make extensive use of land price in its urban-planning policies. Before deciding on any location for his project an investor carefully considers the need to incorporate an appropriate sum into his building and running cost estimates payable to the city or regional authorities for leasing a given plot. In the cost of land purchase and in that of land leasing (both of which are commensurate to the real value of the given plot of land) the planning administration holds a powerful tool for creating concrete economic incentives for the correct self-regulation of the urban-developments structure.

As it is now in Poland, this economic factor is being reduced to the value of the technical infrastructure (water-supply piping, sewage facilities, gas and heating supplies, roads etc.) that is already installed in the given area. But even this value is not incorporated in the investment cost estimate when making the location decision because the investor obtains his plot as a specific "gift" from the local authorities regardless of whether or not the plot has been furnished with all kinds of technical infrastructure. Accordingly, in the phase of preparing the location decision the investor directs most of his efforts to securing for himself a plot with as many facilities of the technical infrastructure as possible in it already. The net effect of this situation is that we give up the fundamental factor of self-regulation based on a full-scale economic calculation, and the

methods of controlling the development of urban construction patterns and land organization in towns are practically reduced to arbitrary-choice factors, and so is the spatial development to a large extent. It seems advisable that the socialist countries should create their own system of economic incentives which could constitute an essential factor of self-regulation in land-allocation policies in areas assigned to urbanization.

Legal-administrative decisions are the second group of tools for self-regulation. Though they are less efficient than economic incentives, their impact can be raised enormously if they are coordinated with the economic incentives to contribute to a common end. It seems sufficient to mention of problem of a town's administrative boundaries and its effect on the economic development of the area concerned to realize what that problem overshadows. Fixing the administrative boundaries without regard to studies on the concept of development of the given agglomeration as a whole may have a disastrous effect on the structure of land use.

Thus the system of regulations and laws relating to administrative areas appears to be an important factor of self-regulation. Whenever various regulations and by-laws failed to constitute a consistent legal-administrative system coupled with the whole system of spatial planning and reduced to sporadic solutions of isolated problems the effect on the structure and form of construction developments was deplorable. This is often seen in what is called the suburban zone of the big urban agglomerations.

A third important type of tools of self-regulation includes actions and facts of technical character. Those facts can be said to constitute the base for the economic-type tools but they can also be viewed as independent factors. For instance, the opening of a new sewage or transport line activates some land tract. Thus it is similar to a factor which creates a new economic situation in that area of the agglomeration. But that new economic situation has been generated by decision-making and practical activities of technical character and hence these latter can be treated as primary factors.

From the above it follows that all three types of principal tools of self-regulation can be fully efficient only when they constitute one consistent system of mechanisms of controlling the development of agglomerations. The flaws and failures of spatial planning are mostly due to the casual application of various elements of that system rather than to their joint mobilization which should basically correspond to the essence of planning in socialist conditions.

Apart from the above-described objective mechanisms of control, which under optimal conditions operate as a self-regulating mechanism, there are a number of subjective mechanisms which fulfill an important role in the system of controlling the development of agglomerations. These are primarily:

- planning decisions (resulting from the economic plan and from the plan for spatial development),
- the system of management and decision-making,
- the forms and methods of investment project implementation.

Each of these mechanisms can be said to operate efficiently if its operation is based both on the objective laws of development of agglomerations and on the above-described objective tools of control which constitute one self-regulating system of control mechanisms. Each of these mechanisms have also their own specific character, which makes it necessary to submit them to critical analyses. By way of example let us now discuss one problem, the role of the spatial development plan for spatial development as a mechanism for controlling the development of the agglomeration.

## THE PLAN FOR SPATIAL DEVELOPMENT: ITS ROLE AND FORM IN THE PROCESS OF CONTROLLING THE DEVELOPMENT OF AGGLOMERATIONS

The plan for spatial development (henceforth for conciseness referred to as the agglomeration plan) is the basic document determining the strategy of all actions constituting the process of development of a given settlement unit. In the case of the urban agglomeration, the problems of the plan derive from the borderland between the local plan (the city's urban development plan) and the regional plan. Practice has so far indicated that the agglomeration plan consists mainly in presenting a tentative project for spatial development determining the terminal shape of the agglomeration in a relatively remote time ("guideline" and long-term plans) complete with an illustration of how to reach that terminal shape in the form of phase plans each of which characterizes the status of development of the areas concerned at the end of some intermediate period of several years. All those plans are essentially static in their presentation of the city's picture and it is just this static approach that makes them so imperfect. Practical experience has shown that the anticipation of the forms of development of agglomeration over longer time intervals tends to fail to conform to what has actually been materialized, and the sum total of deviations from the earlier-approved plan is often large enough to sap the foundation of the plan itself.

Thus the problem faced here is to devise a procedure for preparing the agglomeration plan that would be elastic and dynamic enough without losing its essence as a document laying the road of planned action relating to spatial phenomena.

The above criticism of the forms of urban planning becomes more obvious as the scope of phenomena relating to the given type of plan is growing (i.e., the larger the area). Accordingly, the criticism applies fully above all to the plan of urban agglomerations whose territorial extent and multiplicity of the problems involved make them particularly liable to becoming large and complicated combinations of phenomena, actions, and functions. For the larger the area comprised by the plan, the larger the number of unpredictable elements whose impact has to be provided for in the elastic structure of the agglomeration plan. This view suggests that the form of the plan as it is now, i.e., as it illustrates a certain state of things at a definite moment, must be superseded by such a form in which the plan illustrates the processes of possible and desirable changes. In such a situation we may deem it necessary to carry out far-reaching studies for a proper method of urban planning.

Of course, the search for new forms of planning for changes, of planning a process, does not mean that the methods of urban designing which produce "tentative visions" should be discarded. Such tentative visions are very important, inspiring and action-stimulating elements in the planning system but they can hardly be viewed as the only — not to say the most important — method of determining the strategy of action. In such a context there appears the idea of what may be called the "walk-on plan", that is, a planning system which consists of steadily developing cycles of plans superimposing on one another and illustrating the state of possibilities of our predictions by virtue of the knowledge we have at the given moment. In other words, we could say that the plan we prepared in the form of a "tentative vision" at a given time is an objective picture of our intentions resulting from the information on hand as extrapolated by the urban planner into a now predictable future state of things. That picture enables us to make planning decisions which in these concrete

conditions involve the smallest risk of error. With the lapse of time, however, when new information is obtained due, for instance, to some previously unpredictable factors having come into play, a new plan must be prepared or the previous one amended. That subsequent plan is again an objective reality which results from the altered conditions in a new period of time which furnish the foundation for a new tentative vision such that is possible at the moment.

Decision-making on the basis of the "walk-on plan" is one of those methods that can collectively be termed methods of dynamic planning. But even that method does not fully conform to the postulates to be fulfilled, a plan devised to represent processes of change. It is actually based on successively superimposing detailed plans that are worked out in the form of ready-made and finished spatial visions. It is in this domain that urban planners seem to be facing a great and very promising task though it may not be too easy.

As regards the role of the agglomeration plan, special mention must be made of its extraordinary importance in crucial moments, when we are faced with the necessity to overstep some significant qualitative threshold. In such moments that "vision-plan" may fulfill a crucial function. In the case of agglomerations this phenomenon occurs, of course, at the overgrowth of phenomena in quantitative terms, that is, when the growth of the agglomeration has come up to a point at which it is indispensable to find a new qualitative form for it, to ensure a passage to another system of urban structure. For instance, we try to find a new system such that would relieve us of the steadily reinforced system monocentricity which leads to a degeneration of the functions, the role and operation of the agglomeration's core.

Let us here recall the interesting idea proposed by the Danish urban planner Hugo Markussen. He suggested the creation of a new type of settlement pattern on the isle of Zeland near Copenhagen basing on an urbanized ribbon running along the main transport and infrastructure lines on regional scale. Markussen expects this new settlement system to become with time an urban structure competitive with the overpopulated metropolitan area in that it contributes to decongesting the agglomeration's core. In its further development that process should produce a polycentric urban pattern to substitute the present overburdened monocentric system which has nearly exhausted its capacity to fulfill its functions.

But this bold and, apparently, promising vision carries with it a trace of a utopian idea. It is difficult to say to what extent it provides for the possibility to mobilize actions and tools of economic, legal-administrative and technical character for the self-regulation of the development of the agglomeration in the desired direction. If such a type of self-regulating system of mechanisms could be brought to life, a system that would not contradict the general laws of development of agglomerations, then the question asked before could be answered in the affirmative—in the form of a captivating urban planning vision.

#### A PROGRAM FOR RESEARCH

As there are still many unexplored phenomena or even fields of knowledge connected with the topic, the above-described gamut of factors and observations concerning the essence of a the mechanisms for controlling the development of agglomerations is rather incomplete and contains many gaps. This indicates the need for further extensive research in many aspects on the basis of multifactor analysis.

The above considerations disclose the great significance of the problem for the country's economic life and its enormous socio-political responsibility. For this reason, in conclusion it seems useful to recall some problems that are of basic importance to this issue and hence must be submitted to further studies. These include primarily:

- the extension and sophistication of the mechanisms and regularities of development of the agglomeration, especially on the basis of theoretical foundations with concrete examples,

- testing the operation of the above-mentioned mechanisms at different moments in different periods and under various external conditions,

- organizing the objective and subjective mechanisms of controlling the development of agglomerations into a system parallel with the necessity to remarkably extend the field of observations of those mechanisms and disclosing their full range,

- the full and many-sided description of economic, legal-administrative and technical tools for self-regulation, on the basis of comprehensive studies of their operation,

- analysing selected agglomeration plans as regards their efficiency in different periods, under various conditions, and evaluating their elasticity,

- working out the principles and forms of preparing agglomeration plans as plans for both possible and desirable changes,

- creating a consistent system of principles and forms of controlling the development of agglomerations.

Such studies have to be carried out by large teams of researchers who operate the newest methods including computer techniques. Several research groups working parallel to each other must be created to cooperate on an international basis.

Because of the rate and scale of urbanization processes and the complexity of the problems involved, different points of view and research methods must be in steady confrontation. This is increasingly important insofar as the excessive accumulation of adverse effects of urbanization begins to seriously jeopardize the very foundations of human life. The mobilization of efficient mechanism for controlling the development of big agglomerations should thus be a major postulate of an integrated programme for the protection of man's environment.

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## GENERAL PRINCIPLES OF THE PERSPECTIVE DEVELOPMENT OF URBAN AGGLOMERATIONS IN POLAND

ANDRZEJ JĘDRASZKO

### INTRODUCTION<sup>1</sup>

The growth of the country settlement system in Poland has been characterized for a period of time by the processes of concentration of population, activities and fixed capital assets in certain areas and the subsequent gradual development of urban agglomerations. As early as before World War II, the idea that these processes would intensify had led a group of progressive and far-sighted planners to develop an original methodological approach to planning of such urban concentration, embodied in the proposal known as "Functional Warsaw". After the war, although the system of planning introduced in Poland adhered generally to the idea of town and village as separate entities, the principle of planning of larger functionally and/or spatially related groups of settlements have been carried on further. This principle was applied in the development of "Upper Silesia Industrial Complex Plan" (1953), in several proposals developed for Warsaw, and also for a group of sea coast cities Gdańsk-Gdynia. That idea was also supported by numerous transportation studies and proposals developed for the largest cities and planning outlines worked out for several suburban zones.

However, the above mentioned planning proposals were developed independently and they only bore loose relation to the future development of the settlement system of the country as a whole. The concept of planning of urban agglomerations along the lines of the latter idea came into being in connection with the development of the "National Spatial Development Plan" initiated by the central authorities in 1972. That Plan constitutes an integral part of "Principles of Perspective Development of National Economy" worked out for the period 1971-1990.

The "National Spatial Development Plan" adopted in its general principles in 1974, has been based on two main premises:

- moderate, poly-centric concentration of population activities and fixed capital assets,
- development of the country's settlement system in a node-band spatial form.

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<sup>1</sup> This paper is a revised and updated version of the paper entitled *Principles of the perspective development of urban agglomerations and settlement clusters in Poland* prepared by A. Jędraszko and W. Karbownik for the Second Soviet-Polish Geographical Seminar.

Within that spatial development concept the main role has been ascribed to a system of about 50 urban concentrations, which are considered as foci of economic, cultural and scientific activities, as well as centres of initiation and dissemination of innovations. It is the selected 18 agglomerations which are expected to play the major role within that system.

This general concept derives from a historically developed poly-centric settlement system existing and characteristic for Poland and from the established fact that it is in the urban agglomerations that the greatest progress has been achieved in the postwar period. This concept also assumes that at the present stage of the socio-economic development of the country the enhanced development of urban agglomerations is likely to bring about a number of economic advantages that will contribute to faster growth of the national economy as a whole.

In view of the important role given to the development of urban agglomerations in the concept of the "National Spatial Development Plan" it was decided to undertake large-scale research and planning work carried out parallelly to the framing of the "National Spatial Plan". The agglomeration planning work was substantively carried out by the planning offices of the respective National Councils, and guided from the methodological point of view by the Institute for Environmental Development in close collaboration with the Department of Spatial Planning of the National Planning Commission. That planning work has three main objectives:

- providing the "National Spatial Plan" with a set of premises derived from the local situation and, at the same time, working out principles of development of the selected urban agglomerations, principles that would incorporate national guidelines;

- development of policy guidelines in the field of housing, technical infrastructure, environmental protection and land management to constitute the basis of the work of the Ministry for Local Economy and Environmental Protection as regards urban agglomerations;

- stimulating development of planning methodology for urban agglomerations and making suggestions for framing of a development control system for them.

This paper presents a short summary of the concept of an urban agglomeration as applied in the studies in question, an outline of some development principles worked out so far, and the most general suggestions as far as the methodology of planning of agglomerations is concerned. There is no doubt that further studies on spatial development of the settlement system and its component parts, as well as the tendencies of the overall socio-economic development of the country, will result in modifications and improvements of the principles established so far.

#### DEFINITION OF URBAN AGGLOMERATION AND ITS DELIMITATION

The term "urban agglomeration" can be defined in a variety of ways. In Poland, the question of that definition, as well as the criteria of delineation of the confines of urban agglomerations have been subject to research and studies. A number of definitions, procedures, principles and criteria of delineation deriving from those studies have been formulated, some of them in a comprehensive manner. According to those proposals, an urban agglomeration is to be understood, in broad terms, as spatial and functional concentration, the size and

shape of which depends on the type and the accepted level of the indices taken as the basis for their delimitation.

The definition, procedure and criteria for the delimitation of urban agglomerations used during the initial studies<sup>2</sup> on the "National Spatial Plan" have led to the identification of 18 urban agglomerations constituting nodal areas of the national settlement system. In addition, six larger towns have been classified as "potential" agglomerations which in accordance with the guidelines of the "National Spatial Plan" are expected to grow into full-fledged agglomerations as the result of planned investments and development till 1990.<sup>3</sup>

The existence of a variety of delimitation approaches necessitated their critical appraisal at the outset of the agglomeration planning work. That appraisal led to the following general findings as far as the underlying principles of those delimitations are concerned.

(a) Identification of an agglomeration on a relative index basis

That index, often related to the total population of the country (e.g., 1%) or to the average density in the country, presents major drawbacks as far as comparisons over time are concerned and also creates difficulties when international comparisons have to be made.

(b) Definition criteria

While they cover a wide range of phenomena, they are aimed at measuring the degree of urbanization of component parts of an agglomeration obtained at the present moment (or in retrospect). Furthermore, they often tend to be restricted to the urbanized parts of an agglomeration, neglecting the fact that beyond the urbanized area there exist a number of areas of facilities indispensable for proper and dependable functioning of an agglomeration as a whole.

(c) The continuous area principle

While it provides for a geographical entity, it also tends to distort the reflection of the pattern of the spatial distribution of functions as well as of the actual processes of urbanization. Furthermore, if also results in an extension of the total area of an agglomeration, an approach that may distort the results of research and planning conclusions.

The main conclusion derived from the above findings was that those approaches aimed primarily at research and statistical purposes — although they provided valuable backgrounds — did not fully respond to the needs arising from the requirements of planning and development control of urban agglomerations. Consequently, it was found indispensable to frame planning goal-oriented principles of delimitation so as to make them consistent with the methodology used in the work on planning of agglomerations. This new approach has been developed by the Department of Agglomeration Planning of the Institute of Town Planning and Architecture in Warsaw,<sup>4</sup> and applied in planning work on 24 agglomerations undertaken as an integral part of the "National Spatial Development Plan".

<sup>2</sup> The factors taken into consideration were that such a group of settlements — functionally linked and influenced by a central core — should have a population not smaller than 1% of the total present population of the country, while the density of population should be three times the national average and employment in industry double the national average.

<sup>3</sup> Effective from the 1st of June 1975, a new territorial division has been introduced in Poland which divided the country into 49 voivodships in place of previous 17. This new division will undoubtedly bring about a change in the approach to the "potential" agglomerations putting them on a par with other capitals of voivodships.

<sup>4</sup> Cf.: W. Karbownik, Z. Rejzner, T. Topczewska. *Koncepcja przeprowadzenia charakterystyki obszarów aglomeracji miejskich i ich delimitacji* (A proposal for the urban agglomerations characteristics and delimitation), *Miasto*, 1974, 4.

TABLE 1. Criteria of delimitation of the area of an urban agglomeration as well as the areas functionally and spatially related to an agglomeration.  
Applicable both to 1990 and 1970

Features considered to be criteria for the delimitation	Indices							
	the area of urban agglomeration			the area functionally and spatially related to urban agglomeration				
	nodal areas			urbanized areas	areas being urbanized	agricultural areas	recreation areas	areas of important technical infrastruc- ture facilities
	centre	nodal areas with differentiated functions						
<i>I. Functional features</i>								
1. No. of non-agricultural workplaces		10,000						
1a. No. of inhabitants*		40,000						
2. No. of workplaces in sector III+IV	20,000							
3. % of population with non- agricultural income			80%	50%				
4. Population density (exclud- ing forest areas)			200 inhabitants km <sup>2</sup>	100 inhabitants km <sup>2</sup>				
5. % area under vegetable cultivation in total cultivated area						more than 5%		
6. % of orchards in total cultivated area						more than 5%		
7. Environmental features fa- vourable for recreation							According to special studies	
8. Important technical infra- structure facilities								According to specific studies

*II. Features of functional and spatial links (expressed by distance)*

- |  |                |            |            |                       |
|--|----------------|------------|------------|-----------------------|
| 1. Between the centre and the closest nodal areas, and between the pair of the closest nodal areas | 45 km<br>25 km |            |            |                       |
| 2. Between the urbanized area and the nodal area   |                | 30 minutes |            |                       |
| 3. Between areas being urbanized and nodal area  |                |            | 30 minutes |                       |
| 4. Between agricultural areas and nodal area   |                |            |            | maximum<br>15 km      |
| 5. Between recreational areas and nodal areas  |                |            |            | maximum 45<br>minutes |

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\* To be used in case a given centre has no clearly defined number of workplaces

The point of departure of that concept was the definition of an agglomeration describing it as a pattern of settlement units inhabited by a sizable population having mostly non-agricultural sources of income; as a result of functional specialization, intensive, usually every day, interactions represented by movement of persons, goods, services and information take place among those units; that interaction leads to a functional integration of the entire area. Following that general definition, the main features which permit identification of an urban agglomeration in the settlement system of the country is the existence of intensive functional interaction within a pattern of settlement units (a system),<sup>5</sup> characterized by:

- the degree of concentration of non-agricultural population;
- the degree of concentration of agglomerative functions in the nodal areas;
- the degree of intensity of interaction between nodal areas.<sup>6</sup>

The above relates both to the principles of description and delimitation of the areas of agglomerations. The analysis carried out with accordance with them indicates that under the conditions prevailing in Poland an agglomeration is a settlement system comprising not less than 1/2 million people concentrated in nodal areas.

The above general principles constituted the foundation for outlining the method of delimitation. That method took into consideration the following main premises:

- The functional and spatial structure of the component areas of an agglomeration constitutes the basis of delimitation. The scope of characteristics of the component areas should reflect the scope and methodology of the development plan of an agglomeration.

- The description of the functional and spatial structure should refer both to the existing (possibly also historical) and the perspective structure of an agglomeration, and permit drawing comparisons between them. However, the final delimitation should follow the planned development pattern and be defined on the basis of the accepted spatial development concept as viewed in the perspective plan (i.e., in the year 1990).

- The spatial structure of an agglomeration consists of two principal elements: nodal areas<sup>7</sup> being large functionally integrated concentrations of workplaces provided with substantial technical infrastructure, and urbanized areas performing non-agricultural functions linked spatially and functionally to the nodal areas. Those two components constitute the area of an agglomeration which is not, as a rule, a continuous area. However, a development plan for an agglomeration should include, in addition, certain areas that are functionally and spatially related to an agglomeration. Altogether, they constitute the "planning area" which has to be geographically continuous in nature; that requirement may result in inclusion into "planning area" of some areas that expose weak relationship to the urban agglomerations as a whole. The specific indices applied uniformly in the delimitation procedure have been given in Table 1.

- The "planning area" as defined above is not wide enough to study and plan some of important aspects of the development of an agglomeration. In par-

<sup>5</sup> The degree to which such a system is open and the question of functional relationship with other agglomerations is not dealt with here.

<sup>6</sup> The morphological features play a secondary role in this approach; they are assumed to reflect the processes of functioning of an agglomeration.

<sup>7</sup> Nodal areas are further subdivided into "agglomeration centre" and "other nodal areas".

ticular, the problems of natural environment, water economy and week-end leisure should be studied against a wider background delineated specifically for the subject and the agglomeration in question.

#### MAIN DEVELOPMENT GUIDELINES

The processes of agglomeration characterizing the present stage of development of the settlement system in Poland have as their roots the social and economic advantages resulting from the concentration of population, economic activities, fixed capital assets, etc. However, the observation of the development of large agglomerations appears to indicate that those positive phenomena are accompanied as well by certain negative ones which may do away with the accruing advantages. Consequently, one of the fundamental principles concerning the development of agglomerations embodied in the "National Spatial Development Plan" is to take advantage of concentration and to prevent either excessive concentration or the emergence of disadvantageous spatial structures that could reduce (or in extreme cases obliterate) the advantages resulting from concentration. That fundamental principle is to be effected in the development of agglomerations through the application of three main strategies.

It is believed that the growth of an agglomerations beyond a population figure of 1 million is undesirable. The rationale is that a smaller population number is also able to support concentration of supralocal services and is likely to diminish the potential conflicts resulting in degradation of the natural environment; at the same time a smaller concentration of population may not require a more complex and expensive technical infrastructure that is indispensable for efficient and dependable functioning and development of an agglomeration. Furthermore, considering the total population of Poland, a concentration below 1 million people appears not to contradict the accepted formula of polycentric development of the country's settlement system. Consequently, the development control exercised at the central and local tiers of government should be aimed at keeping the degree of concentration at a moderate level.

The other strategy is the progressive modernization of the existing employment of urban agglomerations. It is to be remembered that during the post-war period, Poland has gone through a process of industrialization. Although the spatial policy in this respect has shown certain variations over the years, nevertheless a large part of industrial development took place in agglomerations, the result being that today — looking from the point of view of their employment structure — they become primarily centres of production and to a lesser extent (with a few exceptions) centres of services. A reversal of that trend appears to be unavoidable on at least three main grounds. First, one of the prime objectives of the entire economy of the country is to bring about a substantial increase of labour productivity through the application of various ways and means; this is bound to decrease the relative level of employment in industry. Second, modern economy requires major input of science and supporting services that would call for an increase in non-industrial employment. Third, the raising of the living conditions of the population is inescapably bound to a much higher level of provision of services for which manpower will have to become available.

The third strategy is the reconstruction of the spatial structures of agglomerations so as to ensure that they provide a better foundation for a substantial

improvement of the quality of the living conditions of the population, particularly as far as the natural environment conditions are concerned, facilitate a more efficient performance of the functions within an agglomeration, and contribute to the enhancement of the values of human environment being created in the process of development.

#### EXPECTED CHANGES IN THE DEMOGRAPHIC AND EMPLOYMENT STRUCTURES

It is expected that the planned development of urban agglomerations will bring about the increase of the total number of their population from about 12,8 million in the year 1970 to almost 18 million by 1990. As a result of that development, the share of population residing in agglomerations with respect to the total population of the country will rise from about 39% to about 48%, respectively.

The rate of growth of the population of urban agglomerations during the period 1971-1990 is expected to amount to about 140%; this rate is not much different from that expected for the total population of Poland residing in towns (145%). Under such circumstances the principle of a dynamic development of urban agglomerations contained in the "National Spatial Development Plan" is to be understood both as a quantitative growth and as development and change of the internal structures of urban agglomerations.

The principle of moderate concentration accepted in the "National Spatial Development Plan" implies that the scope of development of every agglomeration should not be in conflict with the programme of the improvement of living conditions, with efficient working of the urban economy, etc. At the same time, every agglomeration is different in terms of its degree of economic and spatial development and environmental conditions. Taking the above into consideration, the agglomerations have been divided for development planning purposes into three categories:

- the "developed" agglomeration (11) already having a large population potential and at least one city bigger than 1/4 million population,
- the "developing" agglomerations (7), having at least one city bigger than 1/10 million population,
- the "potential" agglomerations (6) which at the present moment are cities bigger than 50,000 population.

The planned increase in population of individual agglomerations depends on the present socio-economic situation in each of them and reflects the development strategies laid down for different categories of agglomerations.<sup>8</sup> Therefore, the expected population increase is differentiated and ranges from an average of about 36% within the category of "developed" agglomerations (in some of them situated in the southern part of the country even less), to about 50% in the average for the category of "developing" agglomerations. Still higher indices (about 65) characterize the group of "potential" ones, with four of them expected to almost double their population.

It is expected that the application of the policies outlined in the "National Spatial Development Plan" will result in the following population size distribution of the urban agglomerations in 1990:

<sup>8</sup> Cf.: A. Jędraszko, W. Karbownik, *Planowanie aglomeracji miejskich w Polsce. Raport o założeniach rozwoju* (Urban agglomerations planning in Poland. A report on the foundations of development), Instytut Kształtowania Środowiska, Warszawa 1974.

bigger than 2 million	1-1.2 million	0.5-1 million	0.15-0.5 million
Warszawa	Łódź	Szczecin	Legnica-Głogów
Katowice	Gdańsk	Kielce-Radom	Bielsko-Biała
	Kraków	Wrocław	Koszalin
		Poznań	Częstochowa
		Bydgoszcz-Toruń	Białystok
		Opole	Tarnów
		Lublin	Rzeszów
		Rybnik	Kalisz-Ostrów
		Chrzanów	Olsztyn
			Zielona Góra

The demographic forecasts prepared in connection with the work on development plans of urban agglomerations have indicated that the population increase expected to take place in the process of development of urban agglomerations during the implementation of the perspective plan will take place primarily through immigration. This tendency has two main roots. First, there is a general process characteristic of agglomerations in Poland of continuing reduction of natural growth caused by lower fertility, social tendencies to small families and aging of population. Second, the necessity for improvement of services in all agglomerations will call for an increase of employment in the service sector; the indispensable service force may be provided only by migrants. Under such circumstances, the natural increase expected to take place in urban agglomerations will play a secondary role, and it is unlikely that its share in the total population increase in all agglomerations will exceed 25-30%.

However, various agglomerations will vary in that respect. That variation of the natural increase component will be the result of the existing demographic structures in various agglomerations. In eleven agglomerations more than 4/5 of the total population increase is expected to be the result of migration, the Warsaw agglomeration being an extreme example (98%). The agglomerations of that type will require particularly large investments in social infrastructure indispensable to the creation of favourable conditions for the integration of immigrants into the new urban environment.

The planned development of agglomerations will require a per saldo immigration of approximately 3.5-4 million people in the period 1971-1990. The main source of that migration is going to be the rural areas. However, the question of population distribution in agglomerations should not be viewed in isolation. The planned population increase in urban agglomerations may drain the most creative and efficient force from the rural areas causing a labour shortage in agricultural economy.

Until now the process of migrations took place usually on a limited geographical basis, mostly within the areas of a voivodship or neighbouring voivodships. It may be expected that in the future that geographical basis will have to be widened considerably, extending in a large number of cases over the territory of the entire country. To encourage such long-distance migration, some preferential policies will have to be established, not only as regards income but also the general living conditions, i.e., through offering better housing, more amenities and services, better environmental conditions, etc.

The performance of the functions assigned to the urban agglomeration by the "National Spatial Development Plan" will result, as indicated by the development programmes prepared for all agglomerations, in an increase of total em-

ployment from about 6.5 to about 10 million persons in all sectors of economy. Consequently, the share of workplaces in these areas in the total number of workplaces in the country will increase from about 42% in 1970 to about 51% in 1990.

The increase of the number of workplaces in the group of "developed" agglomerations is generally moderate and considerably differentiated; the respective rates of increase vary from about 130% for Katowice and Łódź to more than 170% in the seaside agglomerations. In the group of "potential" ones the rate of increase is much higher, in some cases even as high as 230%.

Until now, the development of urban agglomeration in Poland has been closely related to the process of industrialization and the dominating part played by the employment in industry in that process. The perspective development plans of agglomerations take as principle a more moderate increase of the rate of growth in industry and envisage that the changes and processes of growth should result in more balanced, functional structures of agglomerations. It is to be indicated, however, that during the implementation of the perspective plan only an initiation of that development is likely to take place.

The development of agglomerations will bring about the following changes in the employment structures of agglomerations:

	1970	1990
primary sector	11%	6%
secondary sector	48%	46%
tertiary sector	38%	43%
the fourth sector	3%	5%

The "Principles of Perspective Development of National Economy" provide for a considerable increase of income of the population, put a stress on the cultural development of individuals and indicate that the amount of leisure time will be increased. The implementation of the above objectives is closely connected with an expansion of services and an accompanying increase in employment in the tertiary sector. The expected improvement in services is reflected in the table above. However, it is generally modest and in some of the agglomerations still inadequate.

The expected trends in the employment structure of the 24 agglomerations appear to indicate a considerably high degree of inbuilt resistance to change resulting both from the historical process of development and an insufficiently innovative approach to future transformations. Consequently, it seems to be advisable to identify and/or establish, within the national economy, a system of mechanisms that would induce a faster change in the employment structure of urban agglomerations.

The expected modest modernization of the employment structure of urban agglomerations results to a large degree from the still prevailing tendencies toward an exorbitant employment increase in industry which is not in accordance with the guidelines contained in the "Principles" mentioned above. Considering that there will be an increasing shortage of available labour force in urban agglomerations, such a tendency toward extensive industrial employment may both restrict the intended scope of improvement of services and general living conditions and delay indispensable rapid increases in labour efficiency. That is why the next stages of planning should remove the discrepancy that still exists between the guidelines contained in the "Principles" and the development plans of urban agglomerations.

## GENERAL DIRECTIONS OF SPATIAL DEVELOPMENT

The main tendencies of spatial development of urban agglomerations in Poland until now could be described as more or less concentric expansion of urbanized areas around nodal areas of agglomerations. Only in a relatively few cases has the geographic configuration of the site caused a band-like expansion of urbanized areas.

The development of spatial structures of agglomerations in the future should not only take into account the conditions created by the past processes and forms of urbanization but give due considerations also to the qualities of the differentiated natural conditions, the socio-economic requirements of the population, the future tendencies of development as well as the means and ways which are likely to be available for the purpose of development of agglomerations. Two particular future tendencies will play an important role in the spatial development of agglomerations: a major increase in car ownership foreseen in the economic development programme of the government and substantial expansion of industry and power generation (based on coal); both of them are likely to affect also environmental conditions in large agglomerations.

As a consequence of the rise of the number of individual automobiles causing congestion and environmental degradation, growing air pollution as well as increasing complexity and decreasing dependability of the systems of technical infrastructure, it is to be expected that the efficiency of a concentric spatial structure and the attractiveness of its central areas will tend to diminish, creating at the same time more favourable development potentials in the outlying areas. That general tendency is going to be connected with:

- rising trends for relative deconcentration of workplaces from the central areas to outlying areas;

- intensification of the processes of functional specialization of various component areas of agglomerations as well as development of local concentration of workplaces, services and scientific institutions within the agglomeration;

- continuation of processes of spatial segregation of workplaces and places of residence.

The above processes are likely to affect individual agglomerations in different ways. They will be most pronounced with regard to spatial structures of large agglomerations i.e., those that substantially exceed 0.5 million population each.

The development policies applied in such agglomerations are expected to be aimed at:

- slowing down of the absolute increase of the workplaces in the existing central areas of agglomeration and enhancing their further functional specialization,

- obtaining a relative decrease of workplaces in the existing nodal areas,

- establishing of new sizable concentrations of workplaces at a distance from the existing concentration so as to create new centres and to consider them as growth poles of the new elements of spatial structure of agglomerations,

- expansion of new residential developments in areas not urbanized at this moment,

- improving of living conditions of population of agglomeration and decreasing the residential density,

- establishing housing programmes that would fully reflect social preferences and provide a humane environment,

— locating obnoxious establishments, in particular industrial ones, at places that would be favourable from the point of view of reducing the adverse influences of such establishments on population and environment.

The processes of deconcentration, accompanied by physical expansion of agglomerations that are likely to take place simultaneously with growing local concentration of workplaces and services, unavoidably result in separation of the places of residence from the place of work. Such a situation brings about an increase in the number of commuters and an increase in the distance they have to cover. That contributes to increasing costs and inconvenience of commuting which are important components of disadvantages accruing in an agglomeration at a certain stage of its development. The rational planning and development of an agglomeration permits the minimization of those adverse effects by providing for an adequate number of workplaces and residences within individual spatial components of an agglomeration so as to create conditions conducive to local balancing of the demand and supply of labour. Such spatial arrangement of workplaces and residences could permit a limitation of the average commuting time in an agglomeration to a maximum of 35 minutes (one way).

There are several factors on which the scope of desired changes in the spatial structure of agglomeration depends. As mentioned above, one of the main tools to that end is the location of workplaces in the area of agglomeration and the establishing of local concentration of workplaces. Generally, the greater the number of workplaces that can be located in new areas, the greater the scope for change of the spatial structure. The perspective economic development plan of the country provides a unique chance in this respect — the number of workplaces in an agglomeration will rise by 50% in the average, while in some agglomerations it is even likely to double.

The second important factor is the expected size of new investment in housing and industry as well as in the technical infrastructure. Again, the perspective economic plan provides for tripling the dwelling stock in urban agglomerations, substantial industrial development requiring an addition of approximately 1/2 to the existing industrial areas, as well as launching of fundamental technical infrastructure investments, particularly in the field of water supply, sanitation, transportation and energy supply.

The natural environment and man-made conditions constitute another significant factor. It is important that the resources which come into being in the process of fast urbanization be effectively utilized, and cultural and historical values embodied in them be preserved. At the same time it is essential that the development of the spatial structure of agglomeration utilizes the resources and values presented by the natural environment of every agglomeration and does not upset the dynamic balance of that environment.

Finally the modernization of the spatial structure of agglomeration will be greatly influenced by the scope to which the central areas of agglomeration can be redeveloped. These central areas which have grown in the process of historical development may not in many instances provide the necessary latitude to permit their adaptations to the changing needs of the time. Consequently, the restructuring of their spatial pattern and enhancement of specialization may become inevitable.

As the result of the implementation of the socio-economic programmes of development of agglomerations the average density of the residential (including local services) areas will be reduced from approximately 10,100 (1970) to approximately 9000 (1990) inhabitants per km<sup>2</sup>. This is the consequence of a major

improvement of the housing conditions (both in terms of floor space and facilities), introduction of a lower floor-to-space ratio in new settlements in order to provide better housing environment conditions, providing for up to now inadequate social services, open spaces as well as road and parking area. That decrease of the average density will take place in particular in those agglomerations in which the intensity of land use and congestion is most excessive at the present moment.

A considerable fall in the density of workers per km<sup>2</sup> in the industrial areas of agglomerations is also to be expected. That density will drop from about 4800 (1970) to 3900 (1990) and a tendency to certain degree of uniformity among agglomerations in this respect is likely to appear. That change will be brought about primarily through introduction of new technological processes in industry and an improvement in the working conditions which are associated with higher space requirement as well as by the intended structural reconstruction of industry in individual agglomerations.

The specific density indices of various agglomerations vary within a fairly wide range. That phenomenon is to be attributed largely to the differentiation of the initial conditions, variations in their perspective socio-economic development programmes and specific conditions of spatial development. That is why each agglomeration should be looked upon separately from this point of view, and a large measure of insight is required before any more thorough technoeconomic analyses are attempted.

As the result of the planned development of urban agglomerations their total area, which amounts today to about 12,700 km<sup>2</sup>, i.e., 4% of the total territory of the country, will grow to about 16,300 km<sup>2</sup>, i.e., 5% of the total area of the country. The overall average density of population will rise accordingly from about 1000 inhabitants per km<sup>2</sup> (1970) to about 1100 inhabitants per km<sup>2</sup> (1990).

The development of urban agglomerations takes place in a set of conditions created by the natural environment that are unique for every agglomeration. The implementation of the envisaged perspective development programmes is bound to bring about changes in those conditions. The growing concentration of population, economic activities, and various kinds of fixed capital assets unavoidably leads to large-scale degradation of the natural environment; at the same time, however, it is in the urban agglomerations that the best chances for rational development of the environment exist.

Judicious utilization and rehabilitation of the natural environment resources existing in the area constitute fundamental criteria for the evaluation of the proposed structure of the spatial development pattern of an agglomeration. This criteria, when applied to the long-term plans are not, as a rule, in conflict with the principle of deconcentration of workplaces and residences, but in particular cases the full adoption of these criteria may result in an increase of the average commuting time for a population group located in a particular area. Application of these criteria, however, presents substantial difficulties when used for evaluation of short-term economic development programmes. These programmes, by their very nature tend to minimize current investment costs and to overcome constraints imposed by persisting insufficient capacity of the specialized engineering contractors through curtailing necessary investments in technical infrastructure. Such conditions create contradictions which are unlikely to be solved satisfactorily within the framework of the methods of economic evaluation, both of spatial development plans and investments, that have been developed so far and which largely ignore the social costs and the amenity values involved.

The natural environment conditions of the urban agglomerations are very differentiated. This is the result of their geographical location and the man-made inputs accumulated in the process of historical development. The combination of these two basic factors have brought about certain types and degree of environmental degradation and resulted in a differentiated development potential of various agglomerations or parts of them. In a number of developed agglomerations, water, both its quality and quantity, has become a major development constraint. In a still greater number of agglomerations, the air pollution resulting from production technologies used and injudicious land development exceeds, at times, the established pollution standards.

The economic development programmes to be implemented till 1990 are likely to put a further strain on the natural environment of agglomerations. That strain will be caused by a major increase (3-4 times) in industrial, mining and energy production and a rise in population income accompanied by a higher consumption, in particular much higher car ownership. Even if "clean" technologies and satisfactory treatment of effluents could be widely applied, the total volume of pollutants is bound to increase considerably, and will add to the present strain on the environment.

The information basis on pollution is still insufficient and the forecasting methodology and techniques are at a formative stage. Although that situation makes it risky to pass judgements on the conditions of the environment that will be obtained in each agglomeration by 1990, it is to be expected that in many of them it will be difficult to decrease the degree of pollution and in some of them pollution is likely to rise. Under such circumstances it becomes desirable to restructure, in the next stage of planning work, the spatial development patterns so as to make them more consistent with conditions of the natural and man-made environment. In agglomerations expected to have a high degree of pollution that review could, *inter alia*, lead to a shift of the future residential and recreational areas away from areas subject to heavy and persistent air pollution, a decrease in the density of development and a much wider introduction of low-rise residential projects, an increase of the forest area within agglomerations, preparation of alternative locations for the main polluters beyond the areas of agglomerations in places which allow for the best dispersion of pollutants.

#### SOME PROBLEMS OF AGGLOMERATION PLANNING METHODS

Within the general framework of the studies and preparation of the "National Spatial Development Plan", the local planning agencies have been entrusted with the task of elaborating the guidelines and development principles of individual urban agglomerations. It has been found in the course of that work, however, that the planning of development of urban agglomerations should not be thought about as a task which can be satisfactorily solved by the application of local planning procedures, methods and techniques, as provided for in the Spatial Planning Act of 1961 and subsequent rules and regulations, nor does it bear a close relationship to regional planning as defined in that Act.

The scope, substance and methodology to be applied in planning agglomeration development is to be derived from the tasks which that particular type of planning is expected to perform within the overall system of planning, and is largely conditioned by the specific features of the urban agglomerations as

such.<sup>9</sup> It appears that the main task this particular type of planning should fulfill is to fill in the gap that has existed between the regional and local planning so far. In particular, planning of agglomerations should be aimed at providing a better basis for:

- making decisions on location of investment identified as being of strategic importance for the development of an agglomeration as a whole,
- formulating planning guidelines for the framing of plans for constituent parts of an agglomeration being subject to more detailed planning,
- allocating funds and construction capacities to main technical and social infrastructure projects which are financed from the budgets of the National Council operating within smaller administrative areas included into the area of an urban agglomeration. Additionally, such plans may also be of great assistance to the central authorities allocating funds for central projects in the area.

Since urban agglomerations have been recognized as the nodal areas of the country's settlement system, and consequently about 2/3 of the total capital investments of the perspective plan (1971-1990) are going to be located in them, the general principles for their planning have to (and in fact did) originate and be coordinated at the central planning level. These principles should be operationalized by providing guidelines as to population and employment (industry and IV sector) limits, indications as to water economy (lowest flows in rivers, location of large river basins, transit canals), indications as to the exogenous technical infrastructure systems affecting agglomerations and basic social indices reflecting the model of social life to be fostered.

The characteristic features of planning urban agglomerations requires that such planning should be given a distinct role and place within the overall planning system of the country. Its relation to other elements of that system (regional planning, local planning) should be clearly defined, and adequate methodologies and techniques developed. The acceptance of the principal development outlines and the strategy of the plan implementation should be the subject of central authorities. Such an approach would also greatly facilitate coordination of agglomeration development with other elements of the country's settlement system.

The work carried out so far permits one to establish initial premises on which the methodology of agglomeration planning could be based.

The planning of urban agglomerations should be established as a continuous process. On the basis of continuous studies it should be possible to develop the various essential elements of the plan, and submit them in accordance with needs, which may vary in substance, time and the receiving authority (central, local, sectoral, etc).

The main substantive problem of planning is the definition of development objectives of an agglomeration, that would serve, at the same time, as a set of criteria for the evaluation of alternative proposals. In this field, there is a particularly severe inadequacy of theoretical knowledge and practical experience.

In the process of agglomeration planning various methods and techniques should be tried, derived from socio-economic planning, sectoral planning and spatial planning, both regional and local.

A considerable differentiation existing among individual agglomerations implies a thorough investigation whether planning methodology should not be

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<sup>9</sup> Cf.: A. Jędraszko, Z. Rezmer (eds.), *Planowanie aglomeracji miejskich w Polsce. Materiały metodyczne* (Urban agglomerations' planning in Poland. Methodological materials), Instytut Kształtowania Środowiska, Warszawa 1975.

differentiated in relation to type and kind of relationship of a given agglomeration to the contiguous elements of the country's settlement system. Should this be found justified, the institutional arrangements of planning should also be differentiated accordingly.

The plan of development of an agglomeration is, in essence, a structural plan. Its scope should be limited to the main elements leaving problems which can be solved in local plans and in short-term economic plans to the respective levels of planning. Consequently, the main problems to be solved in the planning of agglomerations could be described as follows:

- identification of key issues of spatial development and definition of their possible and preferred solutions; only such problems should be addressed the solutions of which can be converted into strategic objectives,

- defining of the expected changes in the relationship of an agglomeration with higher systems,

- forecasting the change in the social and natural environment,

- optimization of utilization of social, man-made and natural resources from the point of view of the objectives defined by the "National Spatial Development Plan" and having in view the improvement of living conditions within agglomeration,

- spatial distribution of main functions, such as work, services, residence, recreation,

- definition of interactions and links among functional parts to allow proper planning of various networks (transportation, infrastructure, etc.),

- division of the area into structural units to become subjects of local planning, and definition of planning guidelines for each of them,

- definition of areas of concentrated and coordinated development of agglomeration-wide importance in the next 5-10 years,

- definition of the necessary resources and time schedules for implementation of strategic investments on which the development of an agglomeration as an entity depends,

- indications as to the appropriate development control mechanisms and instruments.

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## REGULATING THE DEVELOPMENT OF BIG URBAN AGGLOMERATIONS IN THE SOVIET UNION: EXPERIENCE AND PROBLEMS

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The historical process by which the territorial forms of organization of production and settlement become evermore complex in the USSR has objectively led to the formation of a rather mass type of local socio-economic structure known as urban agglomerations. The integrational character of this structure is the result of the prevailing tendencies towards intensification of the production and other aspects of present-day social life and reflects in many ways the deep-lying processes leading to the improvement of the material and technological base of society and engendered by the scientific and technological revolution.

One of these processes is the growing share of manufacturing industries in the industrial structure, and their gravitation under the impact of progress of means of transport and the relative reduction of transport expenses per unit of transported raw material, semi-raw-materials and manufactured goods (including the reduction of material expended on manufactured goods) towards big industrial centres. The reason for this gravitation lies also in these centres' abilities (in the conditions of the stable tendency towards a relatively narrow specialization of industries) to ensure effective intra-branch and inter-branch interaction. Finally, the growing influence of science and scientific servicing which speeds up considerably and complicates production is also connected chiefly with big industrial centres.

Changes have also taken place in the motive forces accounting for transformations in the system of urban settlement: while in the past the character of settlement was to a great extent determined by the distribution of industry, today it is the areas with concentrated population and a functioning production and infrastructure apparatus that attract industrial and other units. In most cases this is connected with the increased significance of the category of manpower (particularly of skilled workers) and the extensive organizing role of building bases with a high level of technical equipment under conditions in which new industrial projects have to be completed within a much shorter space of time. Socio-ecological factors, which are particularly active in urban agglomerations, also introduce radical changes into distribution of production and population.

As concrete economic-geographical phenomena, urban agglomerations have become widespread in the USSR. It has been estimated that over half of the country's urban population and upwards of 3/4 of its industrial output falls to big urban agglomerations (BUA).<sup>1</sup>

<sup>1</sup> G. M. Lappo, V. Y. Lyubovniy and I. M. Maergoiz define BUA as agglomerations having a population of not less than 250 thousand in their city-centre. In the USSR there were 55 BUA in 1959 and 75 in 1970. Cf.: G. M. Lappo, V. Y. Lyubovniy, I. M. Ma-

Urban agglomerations hold key positions in both the branch and territorial structure of the country's economy, for there one finds the concentration of the most progressive elements of the productive forces: the administrative and managerial apparatus, scientific potential, designing activities, and industries ensuring scientific and technological progress. Owing to such major peculiarities as advantages of economic and geographic position, developed character of the production and social infrastructures, availability of scientific and designing organizations, they have large-scale reserves for promoting social production, raising its economic efficiency, and intensifying many major aspects of human activity.

In the USSR the territorial and functional modifications of BUA are extremely diverse. We shall dwell only on the essential distinctions in the macro-geographical aspect of BUA in the eastern and western areas. In the western areas, and particularly the Moscow, Leningrad, Kharkov, Kiev, Minsk, Baku, Sverdlovsk, Gorkiy, and Kuybyshev agglomerations, BUA have already taken shape and the immediate task is to improve their inner structure in conformity with the targets of communist construction. The BUA in the eastern areas — Novosibirsk, Tyumen, Omsk, Krasnoyarsk and Khabarovsk — are only developing, and they are increasing their productive and scientific potential at an accelerated pace. From the functional point of view, they first play a major role in ensuring the country's scientific and technological progress; secondly, they serve as bases for developing resource areas.

Both types of BUA have a complex composition including production and social units between which dialectical contradictions take place in the process of their development and functioning which can be settled by means of current and long-term national economic plans.

The problem of planned regulation of BUA is raised by the fact that the socialist state is extremely interested in making extensive use of the BUA form as one conforming to the demands and spirit of the scientific and technological revolution for the territorial organization of production and settlements. However, the increasing concentration of production and settlement units that comes with this brings up a whole range of planning problems that are difficult to solve promptly and complicates living conditions in agglomerations, particularly in its centre, the city proper.

In other words, the endeavour to achieve the utmost effect as regards both production and settlement in the BUA comes as a rule into conflict with the BUA town-building capacity determined by the sum total of its planning resources: territorial, water, agricultural, recreational (short-time leisure), and infrastructural constructions. It is the task of the national economic plan to foresee and preclude this conflict.

It is necessary to stress that the existing disproportions in the development of big cities and urban agglomerations are the result of planned and on-the-spot decisions dealing with the distribution of productive forces that had previously been adopted at the national and republican levels of planning and management. Some of them had been undoubtedly taken in emergency situations and were conditioned by the limited character of the material and technological resources available to the state at that or another period for smothering over the negative consequences of excessive concentration of production and population

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ergoiz, *Formation of Urban agglomerations and their place in the territorial organization of productive forces* (in Russian). See: *Economic and geographic problems of formation of territorial-production complexes in Siberia*. Scientific Collection, 5, Novosibirsk 1973.

in BUA. Others were the direct result of errors on the part of economy planners and planners of town building who failed to make a sufficiently deep and scientific study of this problem at the plan and project stage.

The complex character of the processes involved in the development and functioning of BUA, the need to create conditions for their harmonious development and the interaction of their constituent elements, and the timely prevention of disproportions between the BUA's main units, makes the need for elaborating on a scientific basis the basic trends of development and planned regulation of the country's BUA, as a specially aimed long-term national economic programme, particularly vital.

The customary procedure of carrying out pre-plan research in the USSR and the functional mechanism of planning the country's productive forces are highly conducive to the implementation of this programme which on the ultimate end will facilitate the effective regulation of development of BUA.

One can cite in this connection the experience of studying the territorial composition, the functioning mechanism and ways of regulating on a planned and balanced basis the development of BUA in the USSR and RSFSR. In the Ukraine this work was started by D. I. Bogorad, one of the founders of district planning in the USSR. Perhaps this circumstance predetermined the fact that the Ukrainian experience of regulating BUA taken in its scientific and practical aspect is still tantamount to planned limitation based chiefly on the practical experience of regulating BUA within the framework of planning administrative regions and industrial districts.<sup>2</sup>

In the RSFSR, on the other hand, work to determine the composition and trend of regulating the development of BUA was carried out by research institutions and higher educational establishments in close cooperation with local (regional, territorial, republican) planning bodies and the State Planning Committee of RSFSR, a cooperation which gave this work the character of being predominantly concerned with regulating the national economic basis of agglomerations. The outlines were based chiefly on the scheme for the development and distribution of productive forces over the RSFSR and its economic districts for 1971-80, which provided for several measures dealing with the mechanism of planned regulation of big cities and urban agglomerations on the Russian Federation.

The scheme dwelt on the need to impose differentiated urban rents on industrial enterprises for use of infrastructural facilities: water and gas mains, electric transmission lines, city transport and transportation hubs, housing facilities, schools, and medical institutions. This help do away with the unjustified privileges enjoyed by industry in big cities and would provide grounds for achieving a more correct estimate of the sum total of outlays while mapping out the most effective distribution of industrial enterprises in different cities. The scheme underscored the fact that by introducing sharply differentiated urban rents into the building outlays of industrial enterprises one would set into motion the mechanism of cost accounting against the further concentration of industry in big cities and its confinement to medium and small cities.

The following main propositions of the scheme dealt directly with regulating BUA: confining the growth of population in big cities chiefly to its natural increase; recommending the further development of the industrial bases of such cities by introducing measures dealing with the employment of technological

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<sup>2</sup> *City Agglomerations in the Ukrainian SSR (Main propositions and conclusions)*, Kiev 1966.

progress and aimed at raising labour productivity without any considerable increase in the number of industrial personnel; limiting (for general development plans outlined for big cities by the State Building Committee of the RSFSR Council of Ministers) the expansion of building sites into areas with arable land with the aim of retaining the latter for agricultural production.

Particularly extensive work was carried out by the authors of the scheme to single out facilities requiring rehauling and to site new industrial and other enterprises during the period 1971-80 taking into account problems of regulating the national economic base of BUA. These investigations carried out in the pre-plan period in the RSFSR and other republics have undoubtedly provided grounds for including in the decisions of the 24th Congress of the CPSU the directive on the need to take a steady course for containing the growth of big cities, and preventing the appearance of new industrial enterprises in these cities with the exception of facilities dealing with communal services and public utilities, which is being implemented under the current five-year national economic development plan of the USSR.

A study of problems dealing with the development of the Moscow, Leningrad, Kuybyshev, Sverdlovsk, Chelyabinsk and other BUA of the Russian Federation, carried out in recent years by special research teams of the Central Research Institute of Town Planning, the Institute of the General Plan of Moscow, the State Institute of Town Planning, the Leningrad State Institute of Town Planning, the Central Research Institute of Economics under the RSFSR State Planning Committee, the Institute of Geography of the USSR Academy of Sciences, the Kuybyshev Institute of Planning, the Sverdlovsk Institute of the National Economy, the Perm, Bashkir and Kazan Universities, and by local economic, state, and Party bodies in Moscow, the Moscow Region, Leningrad, Leningrad Region, Sverdlov and other regions, has created grounds for implementing, to our mind, an effective form of planned regulation of BUA. This involved the working out of special complex plans of economic and social development for 1976-80 by way of an experiment for Moscow and the Moscow Region, and Leningrad and the Leningrad Region. These plans embrace the factual territory occupied by two of the country's biggest urban agglomerations — the Moscow and Leningrad BUA.

To raise the effect of measures regulating the development of the aforementioned BUA, the USSR State Planning Committee has worked out a procedure by which the elaboration of a five-year plan for the economic and social development of the territories of the Moscow and Leningrad BUA, planned as a complex, is preceded by the working out of sectoral five-year plans by the Ministries and Departments. This allows them to forestall the adoption of sectoral economic decisions undesirable for the agglomeration, to raise the question of liquidating industries untypical of BUA, to carry out enterprises harmful from the sanitary point of view beyond the borders of the agglomeration, to foresee the necessary rates of development for the municipal economy, and to introduce diverse measures to improve the living, working and recreational conditions of BUA dwellers.

By providing the opportunity to solve the most vital social problems within the framework of complex BUA plans, the USSR State Planning Committee, while defending national economic interests, demands that economic, state and Party bodies of Moscow and Leningrad make effective use of the BUA form for accelerating scientific and technological progress in the country, enhancing the vanguard role of these BUA in the economic life of the USSR. This accounts for the fact that measures aimed at reconstructing and technically rehauling

the working enterprises, ensuring their rational specialization and concentration, bringing down considerably the amount of material and labour put into manufactured goods, sharply raising the quality of output and its competing powers in the world market, increasing labour productivity in all the branches of the BUA economy, and reducing the number of workers have become an integral part of the complex five-year plans for the development of the Moscow and Leningrad BUA.

Extensive work has also been put into the elaboration of a complex plan for the development of Sverdlovsk and the Sverdlovsk Region, which envisages measures for regulating the development of the Sverdlovsk and Nizhniy Tagil BUA.

The working out of complex plans for the development of BUA economies is a significant stage of their planned regulation. With sufficient experience in regulating the national economic base of BUA, it will be imperative to achieve its countrywide implementation.

Taking the aspect of social conditions, the problem of planned regulation of BUA should be viewed in regard to two taxonomic levels:

(1) All-Union (Republican) level, dealing with problems of nationwide territorial division of labour and the system of settlement in keeping with the interests of the entire economy and nationwide social aspects;

(2) Intra-agglomeration level, ensuring a harmonious development of all the units of the agglomeration and the effective fulfilment of its national economic functions in the territorial division of labour and in creating living conditions for its dwellers.

At the topmost level the development of big cities and urban agglomerations can be influenced by improving their national economic basis and the general character of the territorial organization of production and settlement.

Regulation of the national economic basis of BUA must go through several consecutive stages. Firstly, it is necessary to define the long-term functions of the agglomeration's city-centre in the nationwide division of labour to compare these functions with the city's economic potential, the forecast of the local demographic situation, and the town-building capacity of the city and of the entire BUA. The next stage is to determine the scope of development of the city's major economic branches, specify the correlation of their separate elements, analyse the compliance of the entire system of research institutions and those dealing with design and technology of the city's industrial tasks, the system of personnel training in higher educational establishments, technological-secondary and vocational-technical schools, etc. This will reveal the optimal structure of the city-centre and the BUA as a whole, and ensure the proportional development of the major and ancillary branches of the economy and the industrial and social infrastructures.

It must be borne in mind that BUA regulation at the topmost level connected with improving the territorial organization of production and settlement throughout the country can be achieved by means of setting up new or speedily developing the existing economic centres, creating new focal points that would serve as a "counterbalance" to draw new types of production away from agglomerations that have already reached a high level of maturity and used up their town-building capacities. This type of regulation can be used chiefly in the country's western areas.

Regulation of the development of agglomerations at the lower levels should be carried out, in the authors' opinion, along the following three lines: (1) impro-

vement of territorial organization of production and settlement; (2) demographic regulation; (3) regulation of town planning (including the ecological aspect).

The first aspect of intra-agglomeration regulation can be achieved by making a precise division of the territory of the agglomeration into functional zones, specializing the existing and emerging populated areas according to their specific functions, extra-agglomerational, i.e., enhancing and supplementing the national economic specialization of a big city in the territorial division of labour, and intra-agglomerational, i.e., promoting the development of the industrial and social infrastructure and the servicing of industrial enterprises. Such regulation of the intra-agglomeration economy will ultimately make it possible to raise the town-building capacities of BUA.

Demographic regulation is aimed at promoting the formation of an optimal structure of the population in the city-centre and the entire BUA by maintaining a favourable correlation between age and sex groups, i.e., the size of the population should be in accordance with all the national economic functions and needs of the BUA proper. This task, owing to its social character, cannot be solved by administrative measures alone; it must be enhanced by a whole complex of economic, social and legal measures.

The regulation of town planning must be preceded by an analysis of the town building capacity of the city-centre and the entire BUA to be used as grounds for considering the future prospects for developing the city and the agglomeration, and for correcting their role in the territorial division of labour.

The tasks of regulating town planning are:

(a) to work out a flexible planning structure for the city-centre and the BUA as a whole, with a view to their long-term development (up to 100 years), including the realization of the agglomeration's basic functions (by employing the influence of town planning) for the envisaged period while singling out the immediate planning targets;

(b) to ensure a satisfactory sanitary and hygienic atmosphere, protecting the environment, developing recreational zones, creating a system of open spaces, and observing proportions in the built-up and vacant areas.

By realizing the outlined trends in regulating BUA, it will be possible to view the agglomeration proper as an instrument for regulating the development of a big city, one that allows an increase in its national-economic potential and to a certain extent neutralizes the negative aspects involved in its growth.

In outlining practical ways, forms and methods of regulating the development of BUA, the following must be noted:

(1) Regulation of the national-economic basis of the BUA must be achieved in the pre-planning and planning stage of state economic planning, and become an integral part of long-term, five-year and yearly plans. In the pre-planning stage (in the schemes for the development and movement of production forces or in other forecasting materials), the national economic specialization of the big city and the entire BUA should be specified and corrected. It is expedient that pre-planning materials contain special chapters on the development of the BUA due to the formation of production and territorial complexes (PTC). These chapters as applied to the formation of concrete BUA should contain:

(a) a general idea of the BUA's development, based on its national economic functions and the forecast of its demographic situation, its economic potential and town-building capacities;

(b) the basic trends in the stage-by-stage improvement of the BUA's structure of production and settlement, providing for its fulfilment of these functions and its harmonious development.

In general state plans, the BUA must be singled out as independent planned projects — this will facilitate the realization of the pre-planning proposals on their development. The national economic development plans for Union republics, territories, regions and Autonomous republics may contain the following aspects of BUA development:

(a) improving the national economic base (industrial specialization, expressed in production indices for the major types of output in monetary or natural units; main trends in research; the specialization in training personnel in higher and specialized secondary schools and vocational-technical schools; basic trends in developing other types of non-productive activities);

(b) implementation of measures of general-agglomerational character to develop the industrial and social infrastructure calling for inter-department decisions;

(c) forecasting the size of population (in accordance with the potential capacity of the agglomeration) and breaking up the period for its achievement into stages.

(2) Experience shows that legal and administrative forms of regulating the development of big cities and BUA should be supplemented by a system of measures of economic influence (stimulation) to be used in carrying out regulating measures. There can be singled out two levels of such stimulation: (a) in siting new building projects or reconstructing (by including in the estimated building outlays for these projects the cost of developing the industrial and social infrastructure, establishing a centralized expansion fund for medium and small cities where it would be expedient to transfer undesirable facilities from the big city, encouraging the economy of siting territory for industrial facilities at the project stage, etc.); (b) at the stage of exploiting the working facilities (by fixing differentiated payments for different industries for their use of resources and services pertaining to the entire agglomeration, depending on the desirability or non-desirability of their enterprises in the BUA territory, making conditions more severe for the functioning of water, fuel and material consuming industries; differentiated payments can be established for different zones of BUA with the tendency toward lower payments in areas desirable for siting enterprises that are “difficult” for the city-centre).

(3) Socio-demographic regulation should distinguish between long-term and short-term measures. The first include the evening out of the socio-economic level and creating living standards as equal as possible (with regard for national peculiarities of the population) in different types of cities, reducing the demands of big cities for personnel by a selective development of their national economic base, intensifying industrial processes, modernizing plant and raising labour productivity, developing “counterbalances” to draw enterprises and population from the biggest centres. As a temporary state policy one can contemplate such measures as the legal regulation of big cities, including a severe passport regime, the fixing of quotas for attracting young people to big cities to improve their age and sex structure, additional development of the network of suburban transport to attract working people to the big city from its satellite dwelling areas.

(4) The regulation of town planning should embrace the entire BUA territory according to a single planning scheme which must envisage the solution of such problems as improving the territorial organization and zone lay-out of the agglomerations, creating of flexible planning structure, developing the infrastructure for the agglomeration as a whole, creating the necessary suburban

zone, reserving neighbouring territories (fixing a rigid building regime) for the possible growth of the agglomeration.

(5) A major and complex problem from the practical point of view is to establish the order of priority in regulating BUA, concretizing types of regulation, defining the demands for resources for implementing the necessary regulation measures (with account for substantiating their economic and social effectivity), outlining ways (order) of financing, reconstruction and building, first of all, of projects pertaining to the whole agglomeration.

Of the 75 BUA in the USSR (1970) nearly one-third (26 agglomerations) requires the implementation of radical planned measures. The other two-thirds also require those or other regulating measures, but they need not be of a cardinal nature.

The BUA recommended for priority regulation require different regulating measures: in some cases it is necessary to employ all types of influence (regulation of national economic basis, town-planning and demographic regulation), while in others, preference should be given to one of the enumerated types.

Novokuznetsk-Prokopiyevesk can serve as an example of an agglomeration requiring all types of regulation. Its priority specialization in heavy industries (iron and steel, coal mining, chemistry, building materials industries) has resulted in violation of the sanitary atmosphere in this part of the Kuznetsk Basin, hampered town planning, and led to specific complications of a socio-demographic character. That is why alongside of restricting the rates for the future development of the iron and steel industry and introducing enterprises oriented toward women workers, it is also necessary to introduce a range of sanitary measures leading in the ultimate end to the solution of town-planning problems.

At many BUA of the USSR such important planned measures will be introduced as changes in specialization or improvement of specialization at operating enterprises, sharp intensification of intra-agglomeration cooperation by transferring to populated areas of the agglomeration less complicated production processes from the major plants and factories located in its centre (Moscow, Leningrad, Volgograd, Sverdlovsk BUA, among others).

For separate BUA, it is vital to implement measures to raise their capacities owing to the exhaustion of those or other resources. Thus the Donbas and Karaganda agglomerations call for additional water resources, the Ufa and Kuybyshev agglomerations are awaiting reconstruction of the material and technological base of their exterior transport and economic ties.

Gosplan of the Byelorussian SSR, Minsk

Gosplan of the Russian SFSR, Moskva

## THE STRUCTURE OF THE SOCIO-ECONOMIC SPACE OF WARSAW IN 1931 AND 1970

GRZEGORZ WĘCŁAWOWICZ

### INTRODUCTION

The socio-economic transformation of Poland, especially her quick-paced industrialization following World War II, reinforced previous processes and generated new ones affecting the spatial structure of towns. The adjustment of the historical spatial structures of towns to modern social and economic requirements and the reconstruction and extension of towns contributed to their internal differentiation.

The rapid demographic and spatial developments created new social, economic, biological, technological and planning problems in towns. To solve those problems in conditions when the urban society is becoming almost equivalent to society in the general sense of the word, it is indispensable to enhance the range of problems of urban studies.

### THE ECOLOGICAL STRUCTURE OF POLAND'S TOWNS: A SURVEY OF STUDIES

In Poland geographers in their studies of the internal structure of towns usually focused on topographic, physiological-morphological, functional and land-use problems. The status of this type of research was frequently presented in a number of studies, for example by K. Dziewoński (1962), A. Jelonek and A. Werwicki (1971), J. Grocholska (1974) and others.

After the end of World War II geographic research in the spatial structure of towns characteristically tended to extend their scope by including population problems too. K. Bromek (1964) investigated the demographic differentiation of Cracow's spatial structure disclosing several concentric zones in the city's area.

In their spatial-structure study of the town Tarnów, A. Jelonek and A. Werwicki (1971) included not only morphological and functional elements but also such features as population density, age and sex structure, social structure, occupational structure.

A. Werwicki's study (1973) is a continuation of that research project. His analysis of the morphological and functional structure of seven towns enabled him to define the spatial structure of a medium-sized town fulfilling the function of province capital as being of the centric-sectoral-polynuclear.

However, the morphological and land-use studies to be found in Polish geographic literature present a rather one-sided picture of the town's spatial differentiation, one which is usually limited to its material elements.

It was only after the analytical methods of social ecology had been employed that more penetrating studies of the urban spatial structure became possible. The problems of social ecology were primarily tackled by sociologists.

Stanisław Rychliński (1935) was the first to make use of the concepts of classical ecology in Poland. It was also in Poland that Florian Znaniecki enriched the classical social ecology with culture and social elements as well as with the concept of space as a value already in 1938. W. Firey's study of 1945 which incorporates in ecology culture elements in the form of such concepts as prestige, symbol or settlement is frequently referred to in western specialist literature.

But it was only after 1945 that concrete studies on the spatial structure of towns taking recourse to the methods and classical concept of urban ecology appeared in Poland for the first time. The primary concern was to answer the question to what extent the socio-economic and political changes following World War II were affecting the classical ecological processes and spatial structures of Polish towns.

The first postwar study of the internal structure of a whole town in the ecological aspect was published by J. Ziółkowski (1960). In a study of the town Sosnowiec, he described the urban communities and the structure of the urban space which they constituted. The study which was carried out in 1948–1950 to assess the differentiation of the elements of the town's spatial structure in its historical development covers mostly the prewar period.

Compared to the classical schemes, J. Ziółkowski's pattern of the spatial development and structure of Sosnowiec (for 1939) confirms the hypothesis of C. D. Harris and E. L. Ullman (1945) on the polycentric development of towns.

Concerning the principal factors that determine the development of a polycentric structure, especially the distribution of social groups in the spatial pattern of Sosnowiec, J. Ziółkowski mentions economic, national and socio-cultural factors, in this order of importance. The changes that took place in Sosnowiec after 1945 consisted mainly in that workers moved into houses and residential blocks that had been abandoned in the course of wartime resettlement actions. But he also found that certain better-equipped "natural zones" inhabited by white-collar groups survived almost unaffected in their prewar condition.

Z. Pióro's (1962) empirical study of Lublin and Toruń carried out toward the end of the nineteen-fifties enabled him to identify several current processes and phenomena. He concluded that the processes conducive to the prewar spatial division of the two towns, such as white-collar areas distinguished from workers' town quarters, were still at work. That spatial selectivity was reinforced by the immigrant rural families' tendency to settle in the workers' quarters and the white-collar families' to settle in areas already dominated by the "intelligentsia". Z. Pióro saw round the centre of Lublin a typical "transition zone" which is characteristic of many capitalist towns. Spatial factors were also found to correlate with the social structure of the population, dwelling conditions, and social and biological pathology. Similar data were found for the town Toruń. Thus, in spite of the application of restrictive legal-administrative and planning measures, the spatial differentiation induced by ecological factors continued to persist.

In his study of the town Częstochowa, J. Braun (1964) devoted much attention — more than normally in Polish ecological studies — to the links between the group of factors of the geographic environment and the population's living conditions. The town was found to have a strongly differentiated spatial structure, and natural areas were found on the town's territory which owed its devel-

opment to the spatial correlation of different individual physical elements with socio-economic elements.

Another ecological study is contained in W. Piotrowski's (1966) book on the city of Łódź. His study of the socio-spatial structure of that city was based on the results of a questionnaire submitted to parents of seventh-from elementary school children and on statistical data collected according to selected spatial units called "basic districts".

This study disclosed the city's general layout and its socio-spatial structure to be determined by the one-way industrial process of development of the capitalist city. Although after the war the city got new urban-generating functions serviced by definite population groups, the inherited old socio-spatial structure underwent no fundamental alterations.

But the city's spatial structure was found to coincide closely with E. W. Burgess' hypothesis of concentric zones. The central area of Łódź exhibited a high concentration of institutions, offices and services and its socio-occupational structure was dominated by the "intelligentsia". With time the construction of new housing developments led eventually to its deconcentration. The zone encircling the city centre was characterized by a mixed occurrence of industrial areas interspersed with residential areas. The last zone comprised satellite areas of local communities and housing settlements which were composed of spatially isolated units and were largely suburban in character.

Later ecological studies carried out in 1963 and 1964 by means of questionnaires circulated among randomly selected families in six dwelling units related to Wrocław (B. Jałowicki 1968). Wrocław city, too, was found to be spatially segregated as concerns the socio-occupational categories, and the segregation often correlated with dwelling conditions.

Characteristically, the socio-spatial structure of Wrocław, a city which had been heavily destroyed during the war and whose population was replaced almost in its entirety, reappeared in much of its prewar form. This circumstance points to the persistence of spatial structures and suggests the existence of certain ecological processes differentiating the socio-economic space in Poland's specific conditions also in the nineteen-fifties and at the beginning of the nineteen sixties (Z. Pióro 1962, J. Ziółkowski 1964, B. Jałowicki 1968). That structure undergoes change gradually, together with the creation of new settlements which, however, often tend to reinforce previous or generate new natural zones. One example of this is the town Płock where E. Kaltenberg-Kwiatkowska (1973) studied the socio-spatial changes induced by the development of the big petrochemical works with the concomitant investment projects. Taking 1960 as the reference year Kaltenberg-Kwiatkowska found a socio-spatial differentiation in the town and continuing processes of ecological selection. During the ten-year period of 1950 to 1960, the immigrant population tended to settle in the town's peripheral areas or in the worker-dominated quarters, if the immigrants were unqualified manpower or if they came from rural areas. Another trend, egalitarian in its nature, was also disclosed: the social structure tended to equalize owing to the old white-collar areas losing their exclusive nature and with the worker-dominated areas rising in social importance.

The principal element of industrialization-induced change was the strong tide of immigration of highly qualified personnel to Płock who settled predominantly in new settlements and the expansion of new block-type housing developments.

Studies of socio-spatial differentiation within Polish towns took usually recourse to the classical concept of urban ecology. All studies confirmed that

most Polish towns were spatially differentiated as regards such elements as: socio-occupational composition, social origin of the population, dwelling standards, and social and biological pathology.

The studies carried out up to now suggest that the spatial structure of the Polish town was dependent on: its functions fulfilled within Poland's settlement system, its size and spatial growth, its historical development, the level of its economic development, and the overall socio-occupational structure of its population.

Poland's towns represented more than a single type of spatial structure. All classical urban spatial structures were found to occur: the concentric structure — as in Łódź, the polycentric structure — as in Sosnowiec, the sectoral structure — as in Radom, and mixed structures too.

Notwithstanding the occurrence of restrictive factors many ecological processes such as invasion, succession, selection, etc. were observed to occur concurrently. As regards the distribution of immigrant population in the towns, the area chosen for settling was found to correlate with their occupational qualifications and social origin.

It must be emphasized, though, that the above general observations resulting from the discussed studies apply to the situation of towns as they were in the 1950's and the early 1960's. Their use for studies of the present situation may at best consist in their exploratory nature or in that they can be taken as preliminary hypotheses only. The process of radical change in the towns' internal structure took on special impetus particularly in the 1960's together with the accelerated economic development and, consequently, with the rising rate of housing construction. With time the social advance of the younger generation of the urban population has been gaining in importance as a major factor of structural change.

#### THE AIMS AND METHODS OF THE STUDY

In my study of the spatial structure of Warsaw city I used the methods of factorial ecology. As the point of departure I assumed that Warsaw city in its boundaries presents a specific type of socio-economic space and constitutes a separate region as this term is defined in the theory of economic region.

Within this Warsaw-region, the socio-economic space was internally differentiated. The principal aim of the study was to explore the spatial differentiation and the internal structure of a big city like Warsaw. The notion of spatial structure of the city denotes here the structure of its socio-economic space, in other words, the division of the socio-economic space into certain types each with its specific system of variable values.

The exploration of Warsaw's spatial structure permitted the establishment of the spatial schemes of its development in conditions of a centrally planned economy (1970) and under capitalist conditions (in 1931). Moreover, it was possible to test the schemes in terms of the ecological and social-geographic theories of the concentric, sector and polycentric patterns. The features introduced into the study were assumed to be representative measures that can be used to investigate the structure of the socio-economic space. The use of a considerable number of variables characterizing the socio-economic space enabled me to partly test the hypothesis of E. Shevky and W. Bell (1955) in conditions of a socialist city as well as several concepts from factorial ecology that seem to confirm that hypothesis.

The analytical model of principal components was used as the one most frequently employed in factorial ecology.

The factors (components) were identified by the "principal components analysis" and submitted to orthogonal rotation by the Quartimax analytical technique according to the simple-structure criterion (H. H. Harman 1960). The study was concluded with a spatial typology carried out on the basis of a matrix of factor scores.

#### THE ECOLOGICAL STRUCTURE OF CAPITALIST WARSAW OF 1931

The city's spatial structure reflects its historical developments. The Warsaw of 1931 was predominantly a product of the 19th century formative processes, in particular those that took place in the first phases of the capitalist industrialization from 1864 to 1913.

In that period, although Warsaw city had lost its function of the nation's capital (Poland had been partitioned and occupied by her three powerful neighbours — Russia, Prussia and Austria) it continued to be a main centre of economic, political and cultural life in the Russian-occupied part of Poland and it was the principal centre of the so-called Polish Kingdom. In connection with its economic and population growth Warsaw was steadily gaining in importance. The growth of the city's population, which at first was slow, was gaining momentum after 1864 (Fig. 1).

In a brief introduction it is impossible even to list all processes that contributed to Warsaw's ecological structure. But in view of the city's historical development till 1931 we can give a rough indication of the elements that participated in the creation of that structure. These were the following:

- the capitalist phase of industrialization and the concomitant changes in socio-occupational structure,
- the step population growth,

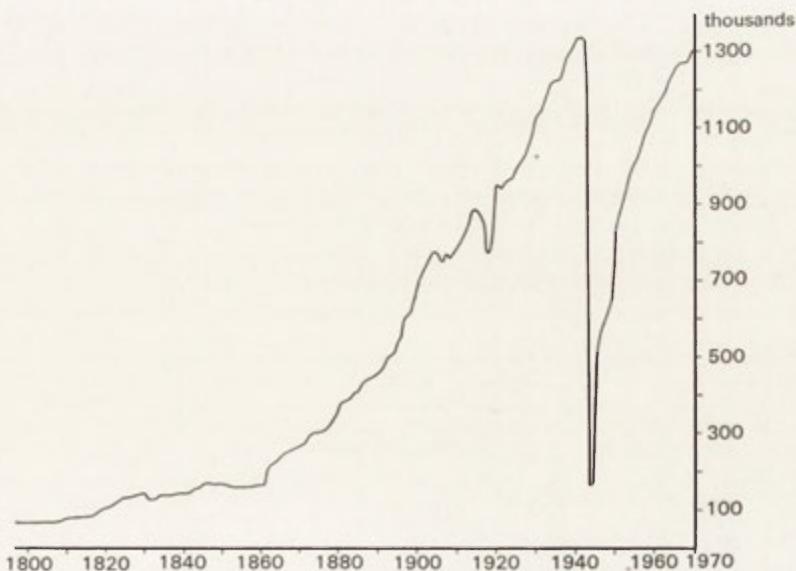


Fig. 1. Warsaw population development

— the restitution of the Polish state and restoring the function of capital city to Warsaw.

The analysis for Warsaw of 1931 was made on the basis of data for 84 census districts and 26 features. It was to be a test of the methods and techniques of factorial ecology in Polish conditions. The small size of the matrix of observations ( $84 \times 26$ ), due to the scanty statistical materials, was of decisive importance here.

The materials selected to the analysis derive from the population census of 9 December 1931. They refer to population density, age and sex structure, mortality, denomination, sources of income, social status and dwelling conditions (Table 1).

TABLE 1. Analytical features for the 1931 data

No.	Feature
1	Population density
2	Females in total population, %
3	People aged 0–14 in total population, %
4	People aged 15–59 in total population, %
5	People aged 60-and-more in total population, %
6	Tuberculosis-caused deaths per 10,000 population annual mean of 1929–34
7	Cancer-caused deaths per 10,000 population, annual mean of 1929–34
8	Deaths of infants below 1 year of age per 100 live births, annual mean of 1929–34
9	People professing Judaism in total population, %
10	Illiteracy, people above 10 years of age unable to read or write in total population, %
11	People living on industrial activities and crafts in total population, %
12	People living on trade and insurance in total population, %
13	People living on transports and communications in total population, %
14	People living on public administration services in total population, %
15	Social position—office employees in total population, %
16	Social position—workes in total population, %
17	Social position—independent earners not hiring employees in total population, %
18	Social position—independent earners hiring employees
19	One-floor buildings in total number of bulidings, %
20	Four-floor and higher buildings in total number of buildings, %
21	Brick-and-concrete buildings in total number of building, %
22	People occupying single-room dwellings in total population, %
23	Persons per dwelling
24	WC-equipped dwellings in total number of dwellings, %
25	People occupying dwellings with water-tap and sewage facilities in total population, %
26	Electricity-equipped buildings in total number of buildings, %

TABLE 2. The component structure, 1931

Factor	Eigenvalue	Total variation
<i>CI</i>	14.325	55.10
<i>CII</i>	4.894	18.82
<i>CIII</i>	2.294	8.82

The calculations yielded three components altogether accounting for 82.74% of total variation (Table 2).

The set of features of which component *CI* is composed (Table 3) includes the indicators that define the social and occupational status as well as dwelling conditions. The features characteristically divide into those positively and negatively correlating with component *CI*.

TABLE 3. Component *CI*, 1931: Class-economic status

No.	Features	Loading (correlation coefficient)
25	People occupying dwellings with water-tap and sewage facilities in total population	+0.91
26	Electricity-equipped buildings in total number of buildings, %	+0.89
4	People aged 15-59 in total population, %	+0.89
24	WC-equipped dwellings in total number of dwellings, %	+0.89
21	Brick-and-concrete buildings in total number of buildings, %	+0.89
20	Four-floor and higher buildings in total number of buildings, %	+0.86
18	Social position independent earners hiring employees	+0.83
12	People living on trade and insurance in total population, %	+0.83
2	Females in total population, %	+0.67
15	Social position office employees in total population, %	+0.64
1	Population density	+0.61
16	Social position — workers in total population, %	-0.95
19	One-floor buildings in total number of buildings, %	-0.90
3	People aged 0-14 in total population, %	-0.87
22	People occupying single-room dwellings in total population, %	-0.84
6	Tuberculosis-Caused per 10,000 population, annual mean of 1929-34	-0.82
8	Deaths of infants below 1 year of age per 100 life births, annual mean of 1929-34	-0.78
11	People living on industrial activities and crafts in total population, %	-0.72
10	Illiteracy, people above 10 years of age unable to read or write in total population, %	-0.68
13	People living on transports and communications in total population, %	-0.63

This division reflects the social differentiation of the population of Warsaw in 1931. On the one hand, there are highly positive correlation values with features related to high dwelling standards and the higher socio-occupational groups. But there are negative correlation values with features relating to lower socio-occupational groups, mortality and illiteracy.

Considering the features that define it, component *CI* can be regarded as a measure of class-economic status. This is further confirmed by the spatial distribution of the values of component *CI* (fig. 2). The highest values constitute a compact zone in the centre of Warsaw, which is zonally surrounded by units of lower values.

Component *CII* accounts for 18.82% of total variation. The features constituting this factor (Table 4) disclose it as an indicator of denominational and economic status. In spatial distribution, component *CII* attains its highest values in areas dominated by Jewish population groups (Fig. 3).

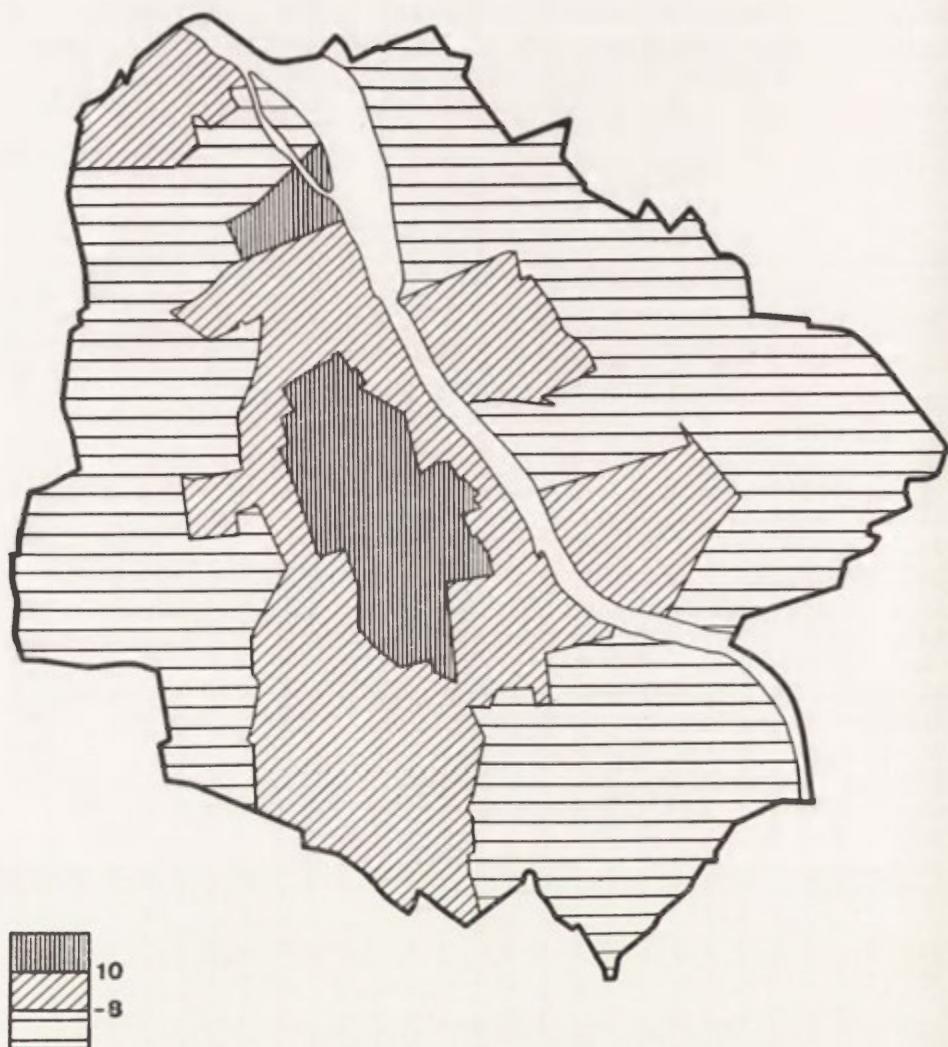


Fig. 2. Spatial distribution of factor scores *CI*-1931. Class-economic status

Component *CIII* which accounts for 8.82% of total variation is difficult to define both as regards the composition of the explanatory features (Table 5) and its spatial distribution (Fig. 5). Although it is analogous to what A. Jelonek (1971) in his study of Poland's demographic structure termed "old age and mortality", this component has a purely theoretical interpretative value.

Factor *CIII* has been defined as old people — the demographic factor.

Next Warsaw's socio-economic space (as for 1931) was submitted to a composite regionalization procedure which produced four zones (Fig. 5):

- (A) the central zone
- (B) the ethnic-type zone
- (C) the transition zone
- (D) the suburban zone

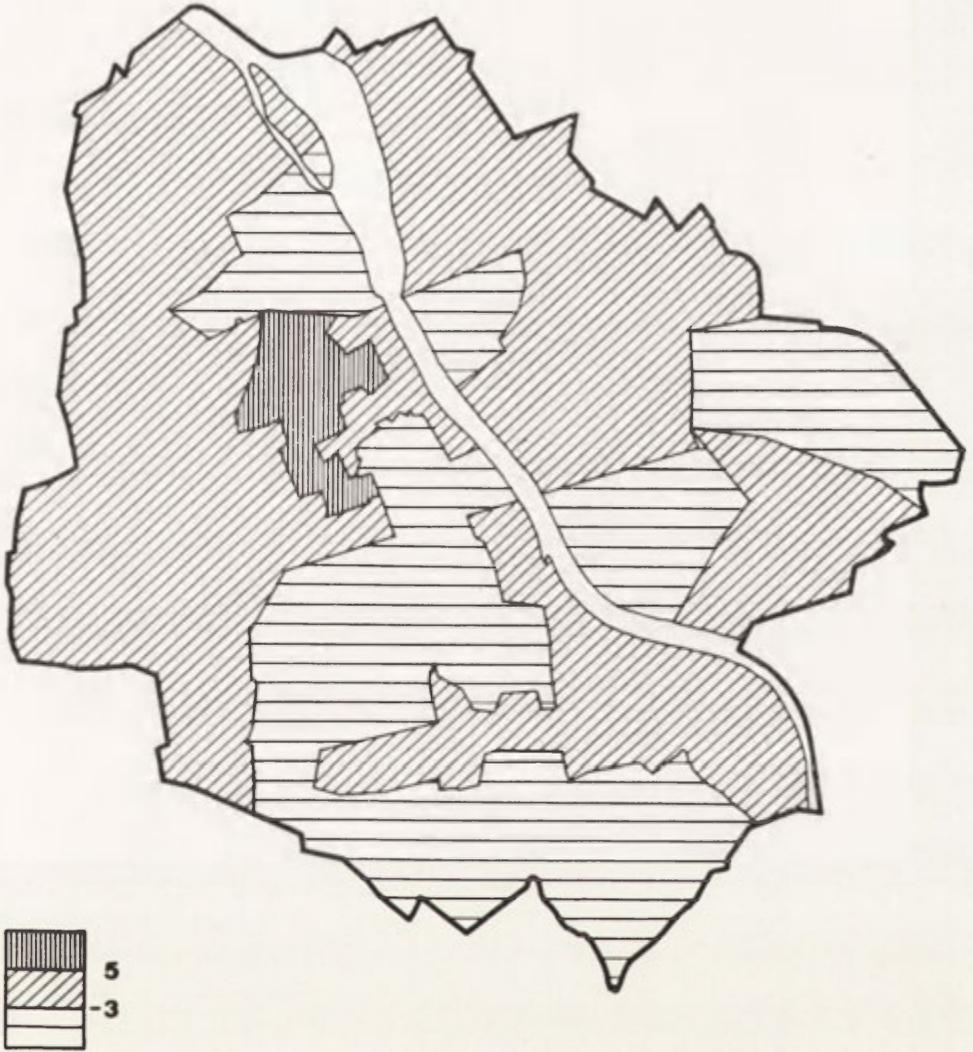


Fig. 3. Spatial distribution of factor scores CII-1931. Religious-economic status

Both in their spatial pattern and in their composition, the zones provide a most general confirmation of the city's concentric structure though with marked elements of a strongly sectoral development. It must be pointed out that, whereas in E. Burges' classical concept of concentric development of a city, population groups with higher socio-economic status tended to concentrate in the city's outer zones, in the case of Warsaw there was a distinct tendency to concentrate in the central zone.

E. Shevky and W. Bell (1955), the authors of the concept of analysis of social areas, distinguished three structures characteristic for the social differentiation and stratification of the modern American city: economic status, family status, ethnic status. Analogous factors have been distinguished in several studies in factorial ecology, e.g., R.-A. Murdie 1969, P. H. Rees 1970, B. T. Robson 1969.

TABLE 4. Component *CII*, 1931: Denominational and economic status

No.	Features	Loading (correlation coefficient)
23	Persons per dwelling	+0.90
17	Social position— independent earners not hiring employees in total population, %	+0.87
9	People professing Judaism in total population, %	+0.84
1	Population density	+0.62
10	Illiteracy, people above 10 years of age unable to read or write in total population, %	+0.56
11	People living on industrial activities and crafts in total population, %	+0.50
12	People living on trade and insurance in total population, %	+0.46
15	Social position office employees in total population, %	-0.67
14	People living on public administration services in total population, %	-0.65

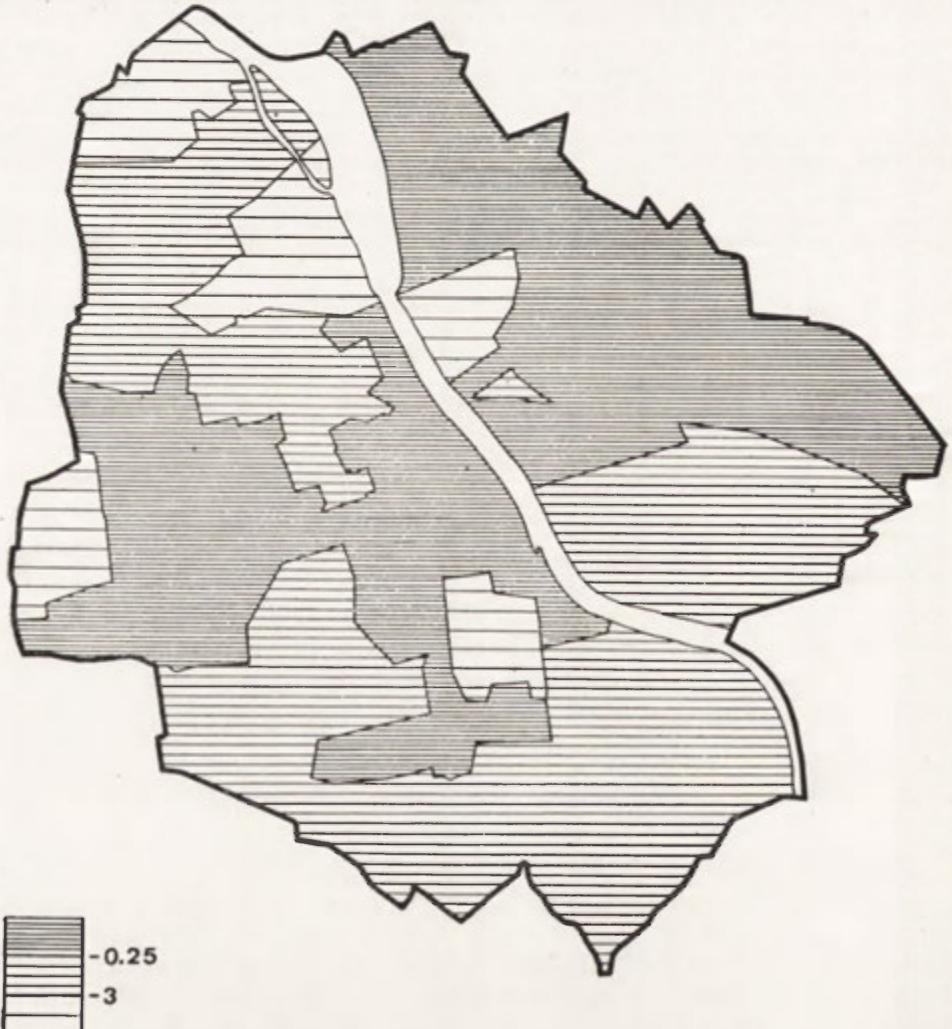
Fig. 4. Spatial distribution of factor scores *CIII*-1931. Demographic status

TABLE 5. Component CIII, 1931: Demographic status

No.	Features	Loading (correlation coefficient)
7	Cancer-caused deaths per 10,000 population, annual mean of 1929-34	+0.69
5	People aged 60-and-more in total population, %	+0.67
14	People living on public administration services in total population, %	-0.58

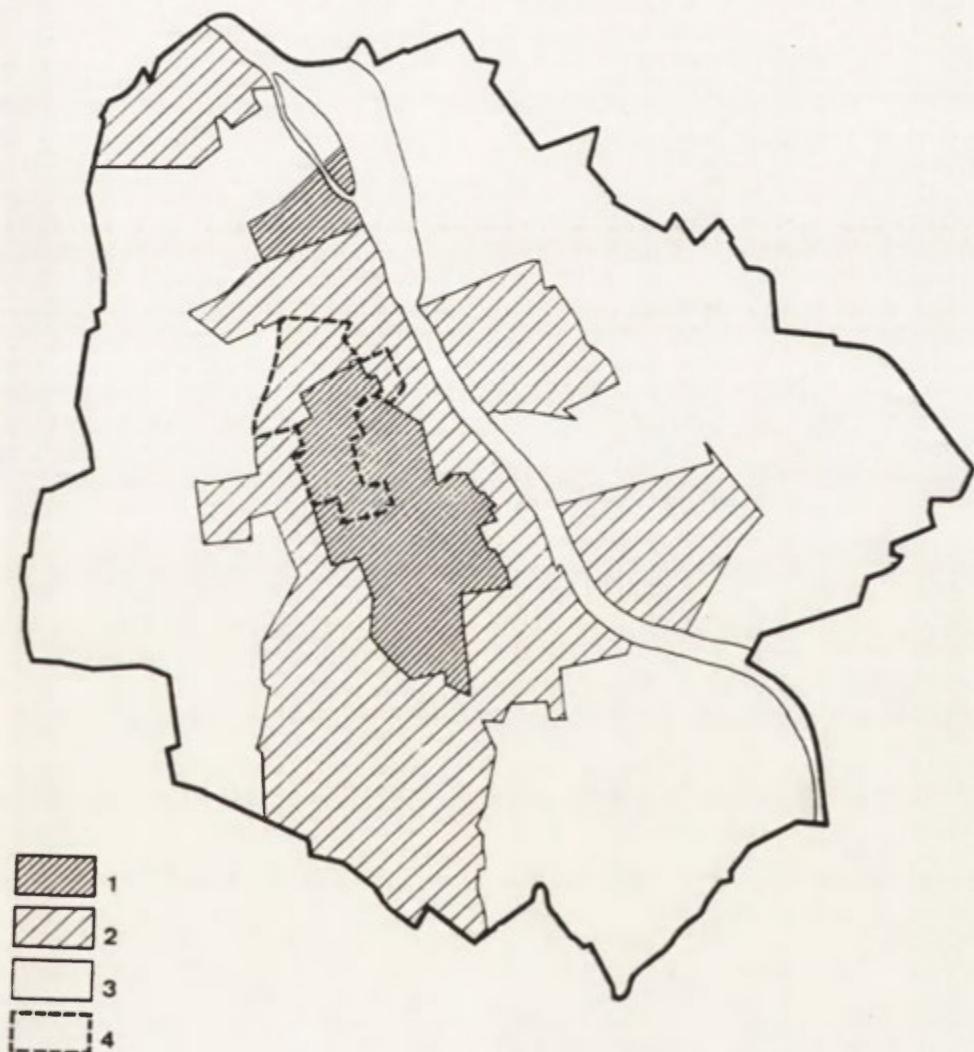


Fig. 5. Basic zones of Warsaw's socio-economic space, 1931: 1 — central zone, 2 — transition zone, 3 — suburban zone, 4 — ethnic zone

The fact that ecological structures such as class-economic status, denominational status or economic status, which in their statistical representations are very similar to the economic and ethnic status factors, did occur in Warsaw partly confirms the hypothesis of E. Shevky and W. Bell.

The ecological structures (components) identified and their spatial distribution reflect the ecological structure of the capitalist city Warsaw in 1931, a city whose population was strongly differentiated both in class and ethnic terms. Social differentiation was reflected in the specific spatial structure which, in a feedback-type effect, tended to reinforce the social differentiation. In result of this, the city's spatial structure tended to form a concentric-sectoral pattern (Fig. 5) in which the central zone was inhabited by population groups with the highest class-economic status.

#### THE ECOLOGICAL STRUCTURE OR SOCIALIST WARSAW, 1970

The socio-economic system of Warsaw with its spatial structure that had developed in the interwar period was completely destroyed in the course of the war.

Over the period of World War II about 800,000 people of Warsaw's total population were killed. From 1945 till 1970 the city's population grew from 162,000 to 1,315,000 (Statistical Yearbook for Warsaw 1973). Of this population growth, M. Latuch (1973) estimates, about 190,000 were due to natural increase, 173,000 to administrative developments, and as much as about 800,000 people were immigrants.

While in the first years of reconstruction immigration to Warsaw was entirely uncontrolled, in the ensuing years it was gradually slowed down through the planning of new jobs and by imposing certain administrative restrictions. Migration became principally selective in character. The primary concern in this respect was to ensure a full supply of manpower and to secure a population potential such that would conform to certain criteria.

The other basic element of the spatial structure is the set of municipal service facilities, in particular dwelling standards and dwelling quality.

During the war Warsaw's dwelling resources were destroyed in 72% (F. Gliszczynski 1967), especially in the central zone of the city. The rapid and intensive reconstructions was closely connected with the restructuring and extension of the city. Block-flat complexes became the dominating form of new housing developments. The standard of dwellings and their equipment improved remarkably as compared to the prewar conditions (J. Cegielski 1968). Yet the remaining prewar housing resources, often poor in dwelling quality, and the circumstance that individual block-flat complexes were built by different investors at different periods account for a certain differentiation in dwelling conditions (F. Gliszczynski 1967, A. Dobrucki 1973).

Simultaneously, the reconstruction and extension of the city, the location of new and the extension of old industrial plants and the development of the capital-city functions (K. Dziewoński 1966) together contributed to the emergence of new social and occupational structures of Warsaw. The scale of destruction as recorded in 1945 and the subsequent decision to rebuild it as the capital city under new political conditions both channelled the ensuing process of the city's future spatial structure in a definite direction. By 1970, after 25 years of reconstruction and extension, this structure was already well developed but still in the phase of further alterations.

Principal components analysis for 1970 was carried out on the basis of a data matrix composed of 41 features and 923 spatial units. The territorial scope of the analysis was larger than that for 1931, too (Fig. 6). The features related to: population density, age and sex structures, social position, occupation, education, origin, household structure, dwellings depreciation and ownership, and dwelling conditions (Table 6). All statistical data used in the analysis were taken from materials obtained in the National Census of 8 December, 1970.

The calculations disclosed the following components structure (Table 6).

The first component has the highest explanatory value, as it accounts for 29.19% of total variation.

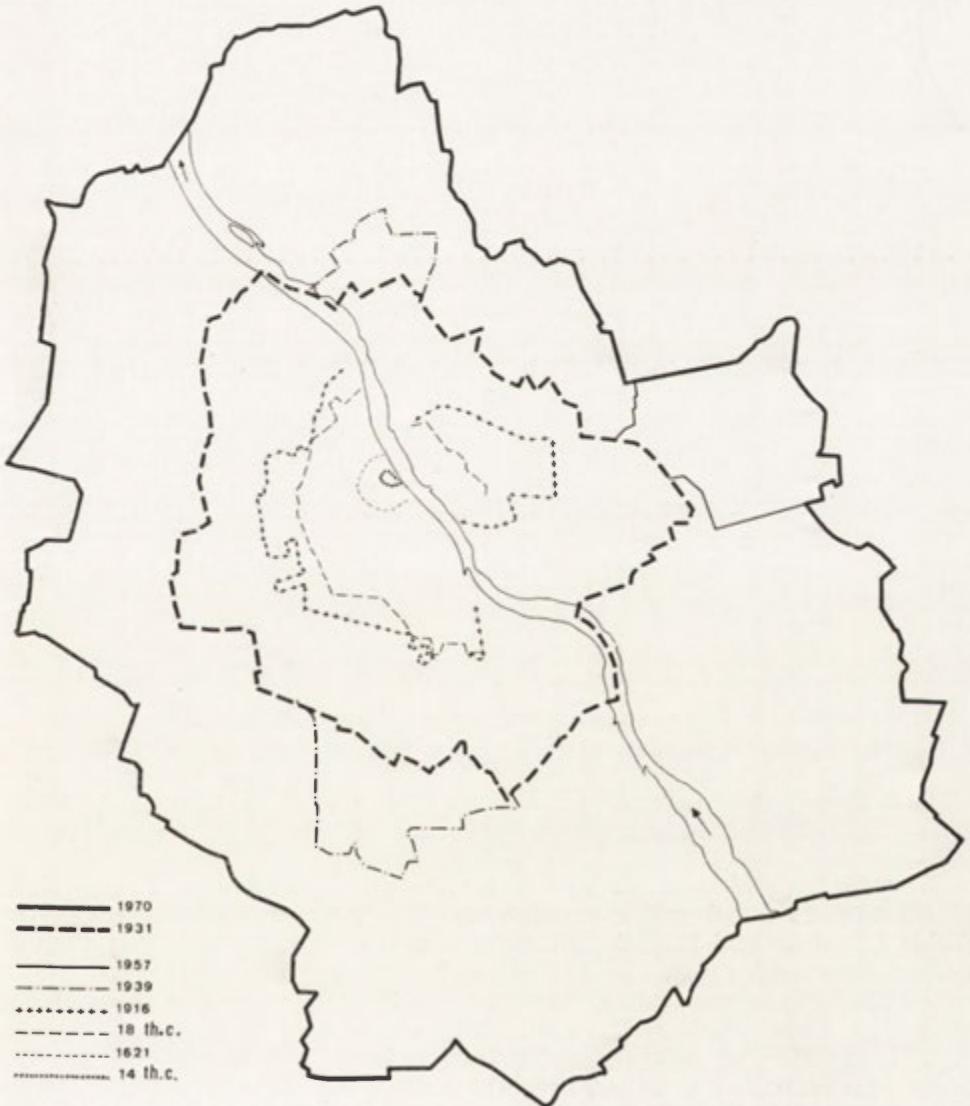


Fig. 6. Spatial development of Warsaw

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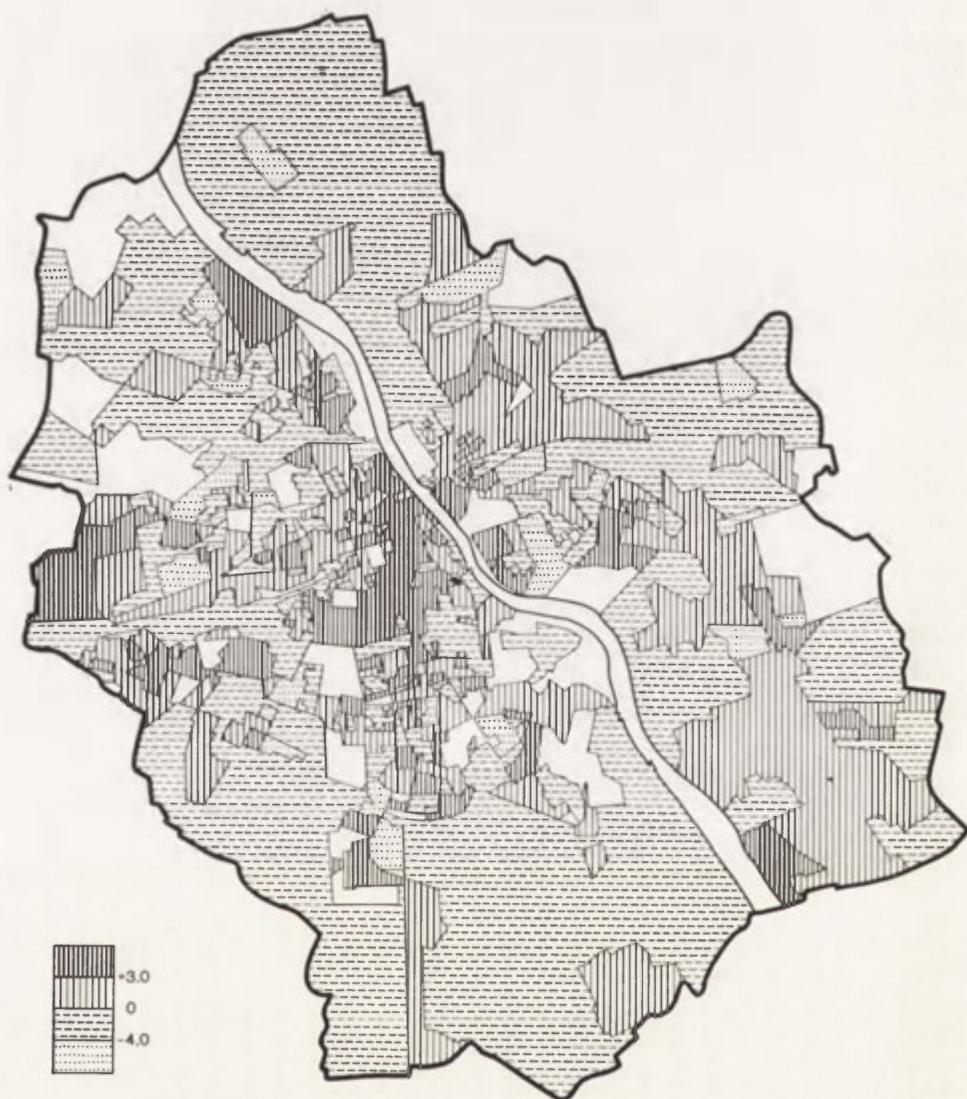


Fig. 7. Spatial distribution of factor scores *CI*-1970. Social-occupational position

In order to furnish an adequate interpretation of component *CI* for 1970, let us identify the social and economic processes that constitute that component (Table 8) and see which spatial phenomena are reflected in the spatial distribution of factor scores (Fig. 7).

As the nation's capital city, Warsaw has a high concentration of population with high professional qualifications. This is reflected in the composition of variables making up component *CI*. Thus it is understandable that the first component includes the feature concerning the occupational group of "writers, journalists, painters, etc." in addition of features Nos. 21, 11, and 23 which relate to the level of education. Hence it is possible to provide an interpretation in

TABLE 6. Analytical features for 1970

No.	Feature
1	Population density — persons per hectare
2	People aged 0–14 in total population, %
3	People aged 15–24 in total population, %
4	People aged 25–64 in total population, %
5	People aged 65 or more in total population, %
6	Social position — office employees in total population, %
7	Social position — manual workers in total population, %
8	Social position — persons working on agent's contracts, on commission or in the putting-out system in total population, %
9	Social position — self-employed persons in total population, %
10	Social position — farmers in total population, %
11	Occupation — workers in total employment, %
12	Occupation — managerial personnel in total employment, %
13	Occupation — physicians and dentists in total employment, %
14	Occupation — research and teaching personnel in total employment, %
15	Occupation — writers, journalists, painters, actors, musicians and similar professions in total employment, %
16	Occupation — administrative and clerical personnel in total employment, %
17	Occupation — commercial, catering and services personnel in total employment, %
18	People of rural origin (village-born) in total population, %
19	People of rural origin living 0–4 years in Warsaw in total population, %
20	People of rural origin living 5–9 years in Warsaw in total population, %
21	People with higher education in population aged 15 or more, %
22	People with secondary education in population aged 15 or more, %
23	People with elementary education in population aged 15 or more, %
24	Single-person households in total number of households, %
25	Female single-person households in total number of households, %
26	Two-person households in total number of households, %
27	Three- and four-person households in total number of households, %
28	Five- or more-person households in total number of households, %
29	Two or more households in one dwelling in total number of households, %
30	State or local authority-owned dwellings in total number of dwellings, %
31	Private-owned dwellings in total number of dwellings, %
32	Dwellings owned by cooperative housing estate in total number of dwellings, %
33	Dwellings built before 1944 in total number of dwellings, %
34	Dwellings built 1945–60 in total number of dwellings, %
35	Dwellings built 1961–70 in total number of dwellings, %
36	Living space of dwellings in m <sup>2</sup> per person
37	Persons per room
38	Dwellings with running water facility in total number of dwellings, %
39	Dwellings with water closet facility in total number of dwellings, %
40	Dwellings with gas facility in total number of dwellings, %
41	Females in total population, %

categories of social position, which is identified with the social and economic value of individual occupations or, more generally, with the quality of the labour force.

Analogously, the occurrence of features 4 and 3 which refer to population at

TABLE 7. The component structure, 1970

Factor	Eigenvalue	Total variation in %
<i>CI</i>	11.97	29.10
<i>CII</i>	7.59	18.50
<i>CIII</i>	4.04	9.86
<i>CIV</i>	1.06	4.05

productive age or features 25 and 24 which concern single persons can be interpreted as indicators of the economic value of the labour force.

The spatial distribution of the factor scores of *CI* explains the occurrence of the above-mentioned features together with those relating to the forms of ownership of dwellings (30, 31, 32).

As regards their spatial distribution, the highest values of *CI* concentrate in areas that had been reconstructed and inhabited earliest, mainly in the city centre. Those areas were inhabited by the most needed population groups, with the highest economic value of labour force. Thus the highest values of *CI* indicate also the first phase of permanent settling.

Thus both the composition of *CI* and its spatial distribution show a selective trend in the housing policies which was inescapable in view of the economic exigencies of the city reemerging from the ruins. The occurrence in this component of many features defining age structure and household structure indicate elements of the family status.

TABLE 8. Component *CI* 1970: Socio-occupational position

No.	Feature	Loading
15	Writers, journalists, painters, actors, musicians, etc.	+0.9351
30	Nonprivate-owned dwellings	+0.8787
21	People with higher education	+0.8264
4	People aged 25-64	+0.8262
25	Female single-person households	+0.8033
31	Private-owned dwellings	+0.7719
3	People aged 15-24	+0.7411
22	People with secondary education	+0.6908
24	Single-person households	+0.6828
8	Persons working on agent's contracts, on commissions or in the putting-out system	+0.5562
9	Self-employed persons	+0.5527
41	Females in total population, %	+0.5506
23	People with elementary education	+0.5160
10	Farmers in total population, %	+0.4763
13	Physicians and dentists	+0.4192
16	Administrative and clerical personnel	-0.8784
2	People aged 0-14 in total population, %	-0.8344
20	People of rural origin living 5-9 years in Warsaw in total population, %	-0.8122
32	Dwellings owned by cooperative housing estates	-0.8120
40	Dwellings with gas facility	-0.7217
26	Two-person households	-0.5790
27	Three- and four-person households	-0.4597
37	Persons per room	-0.4280

The differentiated composition of component *CI* can be interpreted in three mutually complementary aspects:

- (1) the socio-occupational position with some elements of family status,
- (2) a selective trend in housing policies based on the criterion of economic value of labour force,
- (3) the phases of the settlement process.

In spatial distribution the highest scores of the first component indicate areas with:

- the highest socio-occupational position,
- the highest economic value of labour force of the resident population,
- the earliest permanent settlement date.

Areas with the lowest scores have opposite characteristics.

The explanatory value of component *CII* is 18.50% of total variation. The features that correlate strongest with this component relate to dwelling age, social and occupational population groups, and usable dwelling area (Table 9). This permits us to interpret this component in terms of living conditions of social groups. Both in its composition of explanatory features and in its spatial distribution (Fig. 8), this component is complementary to *CI*. The occurrence of features defining various social and occupational groups side by side (7, 8, 6, 14, 18, 11) is probably a reflection of egalitarian trends in housing policy.

This accounts for the fairly high level of spatial integration of various social and occupational groups.

Just as in the case of the first component, *CII* can be interpreted in three aspects:

- the living conditions of different social groups,
- the egalitarian trend in housing policy,
- later phases of the settlement process.

The third component explains a mere 9.86% of total variation. Such a low explanatory value also makes it difficult to interpret this factor. For the pur-

TABLE 9. Component *CII*, 1970: Housing and social situation

No.	Feature	Loading
34	Dwellings built 1945-60	+0.8652
33	Dwellings built before 1944	+0.8643
7	Manual workers	+0.8210
8	Persons working on agent's contracts, on commission or in the putting-out system	+0.8062
6	Office employees	+0.7894
14	Research and teaching personnel	+0.7741
35	Dwellings built 1961-70	+0.7268
38	Water-tap equipped dwellings	+0.4754
3	People aged 15-24	+0.4005
18	People of rural origin (village born)	+0.4166
4	People aged 25-64	+0.3388
24	Single-person households	+0.3132
26	Two-person households	+0.3104
36	Usable floor area in dwellings	-0.8638
11	Workers	-0.6727
37	Persons per room	-0.4823
1	Population density	-0.4280
29	Two- or more households in one dwelling	-0.3218

poses of interpretation we take the feature "managerial personnel" treated as an occupation to be the leading element because it correlates strongly with the third factor (Table 10).

The highest scores of the third component are recorded in areas inhabited by the economically strongest groups, by people who can afford a certain freedom in choosing the location for their residence. This seems to account for the fairly irregular mosaic-like spatial distribution of this factor (Fig. 9).

The fourth component explains but 4.03% of total variation. The features that correlate positively with it relate to the age structure and the household size structure, that is only two of the fundamental elements of family status (Table 11). Factor *CIV* was called "family status".

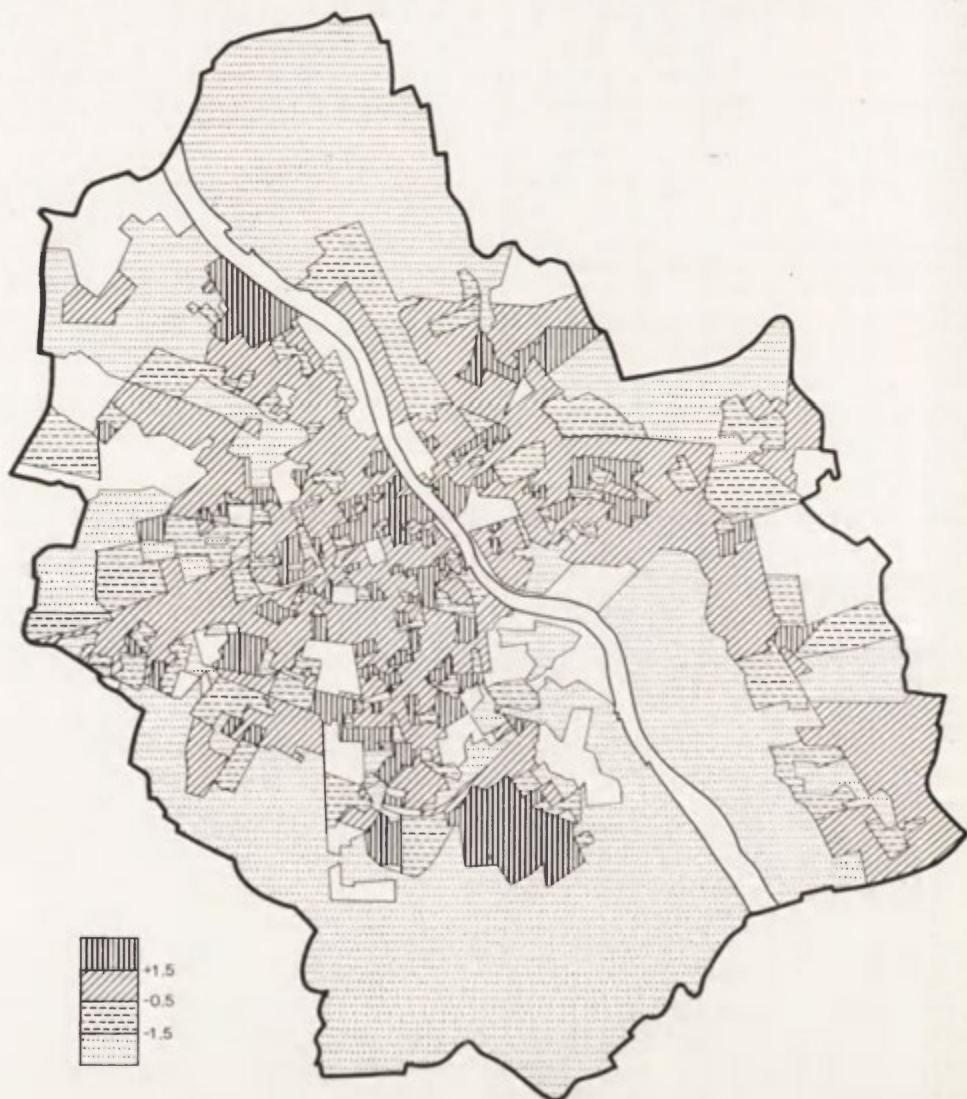


Fig. 8. Spatial distribution of factor scores *CII*-1970. Housing and social situation

TABLE 10. Component *CIII*, 1970: Economic position

No.	Feature	Loadings
12	Managerial personnel	+0.8930
1	Population personnel	+0.7285
28	Five- or more-person households	+0.6694
9	Self-employed persons	+0.4544
39	Dwellings with water closet facility	+0.4201
31	Private-owned dwellings	+0.3669
4	People aged 25-64	+0.3338
19	People of rural origin living 0-4 years in Warsaw	+0.3191
13	Physicians and dentists	-0.6028
3	People aged 15-24	-0.5301
11	Workers	-0.4848
41	Females in total population, %	-0.3228

TABLE 11. Component *CIV*, 1970: Family status

No.	Feature	Loadings
5	People aged 65 or more	+0.4689
27	Three- and four-person households	+0.4515
29	Two or more households in one dwelling	+0.3891
2	People aged 0-14	+0.3528
28	Five- or more-person households	+0.3093
9	Self-employed persons	-0.4292
37	Persons per room	-0.3742

The interpretation of component *CIV* is also possible in terms of labour force value and economic power. High scores for this component indicate groups of population beyond the labour market at pre- and post-productive age (Fig. 10) as well as economically weak groups.

Any more unique interpretation of the results obtained faces the difficulty of mixed patterns occurring in the studied area and, moreover, the low explanatory values of the two last-named factors. All this is evidence of how complex the processes shaping Warsaw's ecological structure actually are.

## CONCLUSIONS

Although it was not originally intended as a principal aim of the present study a comparison of the results of analysis for 1970 to those for 1931 imposes itself. It discloses remarkable differences both in the composition of ecological structures and in Warsaw's spatial structure.

This fact can be partly traced back to the different levels of generality applied in the analyses.

But most significant was the introduction of different variables in the two analyses. In spite of similar or even identical terms individual variables differ in scope. For instance, the variable "workers" denotes occupations in the 1970

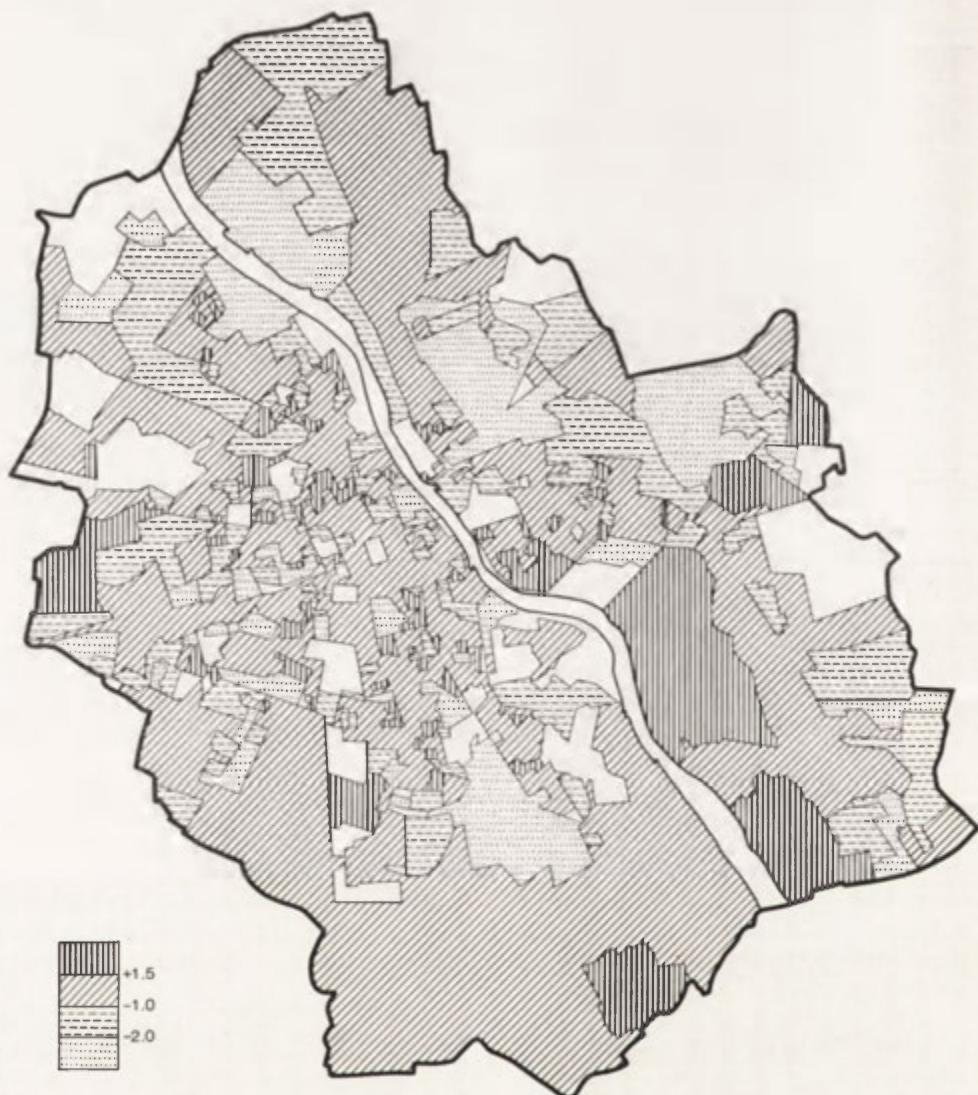


Fig. 9. Spatial distribution of factor scores *CIII*-1970. Economic situation

analysis, whereas in that for 1931 it indicates social position. We must also take account of qualitative differences and of the social position of workers in the thirties and today. Most of the variables included in the 1970 analysis have not even approximate equivalents among the 1931 variables. Analogously, several 1931 variables have no counterparts in the 1970 analysis.

The present author was aware of the incommensurateness of the two analyses from the very outset of the study, for neither the accessible statistics nor their generality were fully comparable.

But the differences in Warsaw's socio-economic structures of 1931 and 1970 are also due to changes that took place over the intervening 40 years. And those changes affected both the intensity and direction of almost all social and economic processes.

The Warsaw of the interwar period was a typical city of the capitalist formation. The city's population was strongly class-differentiated and with national division. The destruction of Warsaw during World War II disorganized the city's old spatial and social structures. The new structures were developing already under new political conditions. The social revolution attenuated and altered the class hierarchy of the population. The city's reconstruction and its economic development attracted large-scale immigration into Warsaw. The increased population mobility accounts for the population of 1970 to have been considerably younger than the 1931 population. In spite of its uni-national character, however, the 1970 population of Warsaw was less integrated than that of 1931.

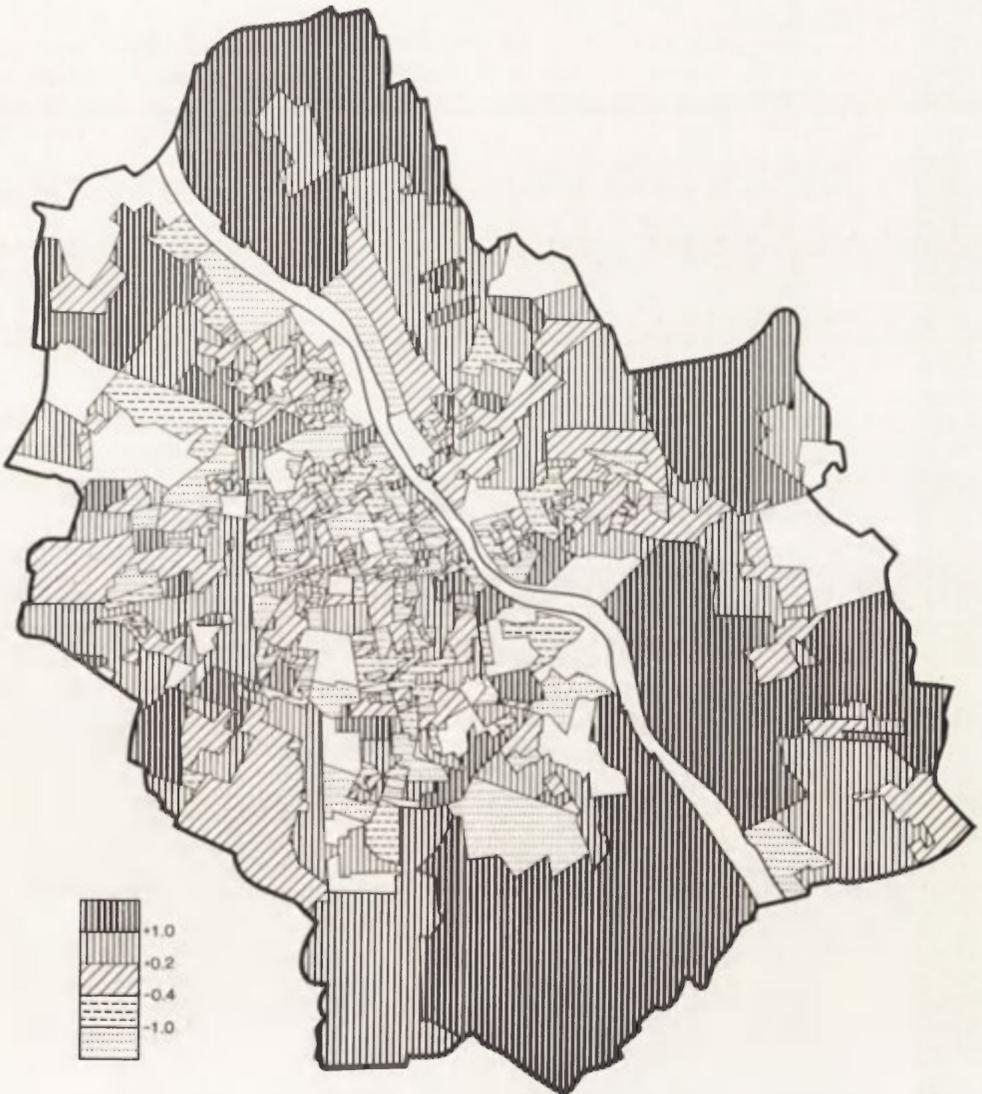


Fig. 10. Spatial distribution of factor scores CIV-1970. Family status

The differences in structure between 1931 and 1970, then, result not merely from the different levels of generality or the limited comparability of the two analyses but above all from the difference in socio-economic conditions in the city at the two historical moments.

The fundamental dimensions of the socio-economic space of Warsaw of 1931 were three components which I called:

- (1) class-economic status
- (2) denominational and economic status
- (3) demographic status

and, for 1970, the following components:

- (1) socio-occupational position,
- (2) housing and social situation,
- (3) economic position,
- (4) family status.

The results obtained indicate that the generality ensured by factorial ecology for the data on Warsaw 1970 is limited, even though there are some similarities in the statistical representation of ecological structures. This is so because the analysis concerned a socialist city which was developing within the framework of a centrally planned economy.

A. Jagielski (1974) was led to similar conclusions in his study of the socio-ecological spatial structure of Wrocław city.

The limited validity of ecological concepts was also confirmed in capitalist cities but only where the socialized sector and development planning played a remarkable role (B. T. Robson 1969).

The results for Warsaw disagree also with results obtained by sociologists for other cities in Poland. This seems to be due to several reasons. Sociological researches were carried out by other methods, in medium-sized towns, and as a rule were completed soon after the war or at the turn of the sixties at the latest. The results obtained in those studies, specifically the inertness of socio-spatial structures related in fact to prewar conditions, or, even when it related to the postwar period, it concerned situations not yet fully shaped by the new socio-economic conditions.

The obtained picture of Warsaw's spatial structure in 1970 discloses considerable typological differentiation. This differentiation indicates that the classical models of the city spatial structure envisage a too high level of generality with respect to the actual structure of Warsaw.

Most generally, the spatial structure of Warsaw in 1970 resembles the sectoral pattern, but in our case it should rather be called the sectoral-band pattern. This pattern, however, has many indentations, of elements of the concentric and polycentric patterns. As a result, at the present phase of research on the structure of socio-economic space it can be said that the Warsaw of 1970 represented a *mosaic pattern*.

It would be definitely too far-fetched to argue that Warsaw's mosaic-type spatial structure of 1970 is a pattern typical of socialist cities. The 25 years are too short a period of time for a typical spatial structure of a city to crystallize fully. This is especially so in the case of a city that had been destroyed and whose population was killed or banned. Only some of the prewar population returned to the city after the war. This city was the site of an unprecedented large-scale interplay of different processes conducive to the development of a new urban community and of revolutionary political, social, and economic transformations. Thus it appears more likely that the mosaic pattern is typical rather of a city which is still in a transitory phase of development and results

from the superimposition of new on old structures as well as from the impact of partly unidentified random factors. What is essential is the unquestionable impact of economic factors of spatial selection, which do operate in spite of considerable restrictions, and the limited possibilities of exchanging of dwellings, which tends to reinforce the once created spatial structures. The fact that centrally planned economies tend to eliminate extreme phenomena (say luxury housing and slums) suggests that the mosaic-type pattern of the spatial structure will persist in the future and thus gradually become an immanent feature of a socialist city.

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