Wanda Maria Gaczek

The locational value of urban area versus the process of changes in land use of a city

1. Introduction

Changes in the land use in an urban region which accompany town development result, on the one hand, from the necessity of settling a growing population and, on the other hand, from the wish to assure: 1) a high standard of living for the town's population; and 2) spatial efficiency of the development structure under changing technological conditions.

Determined in this way, the spatial goals of the process cause its discontinuity in time. The intensity of the process of changes in the land use in a town depends on the rate of the population growth, changes in the technology of production, transport and construction, and also on the accepted model of consumption. These are exogenous factors usually independent of the towns characteristics. They determine the demand, for as well as the size of the needs for areas for particular town functions. Accelerated growth of the country-side's economy, an advantageous economic situation and investment booms connected with this, as well as a rapid

flow of immigrants will obviously cause acceleration of the process. However the impact of changes introduced in the technology of transport, town communication, industrial output or the housing industry is not so univocal. These can cause either an increase of demand for building sities or a decline in demand. In recent years much of the literature has stressed the phase character of the city development process and of changes in land use connected with subsequent concentration and deconcentration of spatial development[1].

Simultaneously with the process of concentration which causes a concentration of certain functions (e.g. services) in CBD of cities, the process of spatial deconcentration becomes more and more important. This results in the transfer of certain functions from CBD to the periphery (e.g. heavy industry). Other functions (e.g. housing) owing to increasing significance of such factors of location as the quality of the environment, select locations in the peripheral areas of the city or in the suburban zones. Centrifugal forces which cause spatial deconcentration have great significance in certain phases of the development of a city. Analysis of long--term urban-spatial evolution in the metropolitan world suggests that rapid growth of population in their peripheral areas is hindered at present[2].

Apart from differentiation in time, the process of changes in land use a city is characterized by discontinuity in space. The goals of the process can be obtained through land use which takes place in different ways and in different places of the region. Most often these changes are of two complementary types: a process of expansion of outlying areas, and a process of reorganization of the existing structure of land use inside the city. The first type consists mainly of taking for city building development free areas (agricultural, wasteland, etc.), and thus occurs at the same time as the succession of function and form of land use. The second type, however, shows much greater differentiation. It may have the character of simultaneous succession of function and form, but can also be the succession of function alone, or, more rarely, a change of the form itself. These changes do not show spatial continuity: land use conversion occurs on some sities while other areas remain unchanged[3].

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[1] Forms of the prosess of changes in urban land use show further differentiation, depending on the place of their appearance and the reassons. Their detailed classification can be found in the following studies: M. Kosonen, A Procedure for Determining the Expansion of Urban Areas as Exemplified by the Town of Kuopio, Fennia 154, Helsinki, 1978, pp 9-12; L. S. Bourne, Urban Structure and Land Use Decisions, Annals of the Association of American Geographers, T. 66, 1976 pp 531-547. Since 1970 the growing importance of the process of internal reorganization of the structure of land use in the prosess of city development has been pointed out in many publications. See B. Goodal, The Economics of Urban Areas, Oxford, Pergamon Press 1972, p 205-231; J. W. R. Whitehand, Long--term Changes in the Form of the City; The Case of Redevelopment, Geografiska Annaler B. T 60, 1978 N2 pp 79-96.

[2] Leo van den Berg, Urban systems in a dynamic society, Erasmus Universiteit Rotterdam, 1985 (proefschrift); see too: Arnoud Mouven, Peter Nijkamp, Measurement and tests of long-term urban--spatial evolution, Paper presented at the Sixth Advanced Studies Institute in Regional Science, Bamberg, August 1984.

[3] Wanda M. Gaczek, Some characteristics features in the process of urban land use changes, Zeszyty Naukowe AE w Poznaniu, z. 106, Poznań 1983, p 17-31.

The lack of spatial continuity of the process in caused by endogenous factors, i.e. internal factors independent of the area's characteristics.

These would be, among others, natural conditions, the state of building development, location in relation to the centre and communication system of the town, and the given site's vicinity[4]. These factors determine the supply of vacant areas and areas suitable for investment, or those already built-up which a succession of function or form of land use is possible. Thus they determine the usefulness or, in other words, the attractiveness of areas for location of particular town functions, condition the choice of places for land use conversion and define the spatial direction of investment expansion in the city's region.

The strength of impaact of endogenous factors is changeable in time. It seems that in an a period of accelerated city development, often termed investment boom, demand factors from the group of exogenous factors determine the course of the process of changes in land use both in time as well as in space. Conversely in a period of slow development, land use concersion will take place only in areas of maximum attractiveness, with supply factors from the group of endogenous factors being decisive for the process.

This paper is an attempt at defining the concept of localization value of areas as a basic, general factor of the process of changes in land use in cities. It aims at determining the variability of the localization value of areas in time and in a city's space as well as at explaining the utilization of areas and the location of particular city functions. In order to exemplify the assumed theoretical concepts, some data concerning land use in the city of Poznań is utilized.

2. The locational value of urban areas

Changes in the intensity of economic development and in the functional structure of land use in a city are a result of changes in the locational value of these areas[5]. A definition of this value and identification of the factors which condition it, as well as determination of the relation between the value and intensity of land use and the size of area occupied by urban funcctions, will make it possible to describe the mechanizm of the analysed process.

The locational value of an area or simply of a given place in a city is the sum of the advantages obtained by industrial enterprises, service institutions and the popula-

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[4] Such an approach to variability in the space of geographic-economic systems is presented by R. Domański in „alternative model of geography" – R. Domański, Teoretyczne podstawy geografii ekonomicznej, PWE, Warszawa 1982, p 89-105.

[5] The locational value of towns as a basic concept of the theory of processes in the Settlement System has been introduced by R. Domański „Outline of the Theory of Processes in Urban Settlement System", Przegląd Geograficzny t. XLVIII, z. 2, Warszawa 1976 p 211-233. This concept, by analogy, can be transferred to the internal structure of a city. The locational value of city areas is here also an idealization concept allowing us to explain the mechanism of the process of changes in land use in the city region.

tion from locating themselves exactly in this place. It consists of a number of elements. With the assumption of national and effective activity in space, these would include advantages of agglomeration and urbanization, advantages for the environment and the limitation of losses resulting from resistance of the distance. In an urban economy the real advantages of location in a gives place will be, for example, savings in outlays for technical and social infrastructure, limited investment costs due to utilization of areas having better engineering, geotechnical, environmental and aesthetic parameters, savings in transport costs for the population and goods, the possibility of settling a side of sufficiently large area, facilitated economic and social contacts due to other units' vicinity and the availability of service, cultural and educational centres.

Analogously to R. Domański's definition of the relative and absolute locational value of cities, it is possible to distinguish the relative and absolute locations value of city areas.

Relative locations value results only from the location of a point in the city region. It is an effect of the advantages which are assured by location in a city determining the possibilities of spatial links and contacts. However absolute locational value is the advantages which result both from the location of a given site in the city system as well as from its specific environmental conditions and the state of hitherto existing development. Spatial differentiation of the absolute locational value of areas depends, therefore, on main factors as well as on indirect factors, in other words general and local. Differences in relative value depend only on the impact of general factors; when defining it we can assume homogeneity of physical conditions. Separation of relative locational value gives a possibility of generalization of regularities and of determining rules governing the changeability of this value in time and in space for all cities.

Let us assume at the begining the constancy of environmental conditions and consider the factors of relative locational value of a city. Such a procedure is in accorfance with the idealization approach used also in economic geography. It consists in explaining socioeconomic phenomena through analysis at the initial stage of only general factors i.e. the most essential ones from the point of view of, for example, the study's goal, and in subsequent stages of the procedure gradual concretization of the formulated statements with the inclusion of indirect factors.

In classical theories of urban land use in which the basis for explaining the structure of city areas use is the differentiation of land rent, it is assumed that rent is a function of location. R. M. Haig, regarded as the founder of the economic grounds for the theory of urban spatial structure, assumed that the volume rent is determined by the volume of savings resulting from accessibility of a given place from other points of the city[6]. However, the spatial structure of rent sufficiently reflects the distribution of accessibility understood as the reverse of aggregated

[6] R. M. Haig presented his views on the subject of site rent in his publications from 1926-1927, P. Korcelli, Theory of Intra-urban Spatial Structure, Studia KPZK PAN t. XLV Warszawa PWN 1974 p. 37-39.

transport costs. In a mono-centric city this distribution takes the shape of a cone with its peak over the centre. In such an approach the distance from the city centre is a measure of distance resistance and is a negative variable for the site rate: the greater the distance the lower the rent value.

Among other elements which condition the rent value and thus locational decisions in a city, the factor of the size of the area occupied by particular users, introduced by W. Alonso[7], is essential. The size of the site (parcel) for settlement is often treated as an alternative value in relation to accessibility regarding savings in transport costs. In big cities of the USA and Canada, as has been shown by L. S. Bourne, the possibility of occuping vacant areas as well as their vicinity, thereby giving a chance for spatial expansion in the future, is considered to be the basic locational factor[8]. With distance from the centre, the size of the area of urban units (so-called urban blocks) increases and the size of vacant areas hitherto not built-up increases as well. In such an approach the distance from the city centre will be a positive factor for land value: as the distance from the centre grows, the amount of vacant area grows too. The user, thus, has a possibility of occupying a parcel of adequately large area and of desireable shape.

The quality of the natural environment, and particularly that of one basic element of this quality, is air pollution, can be considered in a similar way. The influence of the quality of environment on the choice of location in the city, especially of housing but also of other functions, is constantly growing[9]. In mono-centric city where car transport dominates at present and where most employment is still concentrated in the centre, air pollution is biggest in the centre and decreases with the distance from CBD. Also in this case the distance from the centre can be treated as a positive factor for the land value: together with the increase of distance the quality of environment increases and thus the value as the importance for investment of peripheral areas of the town increases.

On the basis of a survey of the literature it can be stated that the factors of relative locational value of areas in city are the following accessibility, a size of vacant areas where settlement is possible, with the quality of the natural environment positively correlated with the latter variable. Let us assume that we are discussing a mono-centric city where most of employment is concentrated in the centre with a concentric communication system which develops in a physiographically homogeneous space. Let us also assume initially that the locational preferences of the population, industry and services are nearly the same due to the necessity of their functional – spatial connections.

Acceptance of such substantial simplifying assumptions will not limit the changes in locational value of town areas in time. It is a dynamic feature which

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[7] The factor of the size of area occupied by particular users is the most essential component of the theory of location and urban land use presented by W. Alonso, Location and Land Use Toward a General Theory of Land Rent, Harvard Unicersity Press, Cambridge, Mass 1964.

[8] L. S. Bourne op.cit. pp 540-541.

[9] H. Yamada, On the Theory of Residential Location: accessibility space leisure and environmental quality, Paper of the Regional Science Association Vol. 29, 1972, pp 125-135.

changes under the influence of new industrial investments, development of new services, innovations in transport and communication, new technologies of production in manufacturing and the housing industry, as well as the deterioration of existing development.

Changes in the relative locational value of areas in relation to the distance from the city centre — with the assumptions given above — are presented on Fig.1. They are an effect of changes in the structure of accessibility and depletion of vacant areas due to spatial expansion of technical uses in the city.

Changes in accessibility in the city area show a noticeable cyclical nature in time connected with the dominant form of transport in a given period[10]. The initial phase is characterized by maximum, high accessibility of the city centre and its rapid decline as one moves towards the suburbs. In subsequent phases stagnation of the centre's accessibility is observed until its decline caused by exessive congestion of the road network and of the means of transport in this part of the city. Simultaneously, the availability of peripheral areas increases. Thus the indicators of accessibility for the area of the whole city remain generally stable. The final phase is another increase in the value of the centre's accessibility which occurs due to reconstruction of the road network or to the introduction of new means of transport (e.g. an underground).

Changes of the second factor of locational value, i.e. the possibility of occupuing areas for investment, is also characterized by a certain, not so distinct cyclical nature. Spatial expansion of technical uses embraces external zones around the centre which in a longer period of time take the shape of concentric zones[11]. Exhaustion of vacant areas in the centre, after utilization of possibilities of intense growth both in the horizontal and vertical sense, will limit investment activity in this area. This will cause their moving towards peripheral areas which offer the users parcels of bigger area and of any shape. However, as has been noted earlier, the changes of land use structure in city also embrace a process of internal reorganization which has the character of renewal of reconstruction of built-up areas. In subsequent phases of city development the possibilities of areas being occupied in the city centre for investment may appear again. This may be an effect of building ageing the deterioration and necessity of replacement of single blocks or full reconstruction of whole urban units. It may also result from technological progress in the

[10] The structure of accessibility in a city and its changes in time is presented among others in the following papers: W. R. Seyfried, Location and the Centrality of Urban Land Value, „Land Economics", 1970, Vol. 46 pp 329-331; P. Korcelli op.cit. p 45; K. B. Davidson, Relationships between Land Use and Accessibility, Department of Planning and Transportation, Transportation Branch, Greater London Council, May 1973.

[11] A model of the expansion structure of technical uses in a city in which zones corresponding with phases of development, i.e. initial, fulfillment, saturation, conection and katabatic for Cracow has been presented by R. Mydel, Development of Cracow Spatial Structure, Ossolineum, PAN, Oddział Kraków 1971, pp 41-55.

construction industry which often makes it possible to occupy vacant areas so far treated as unsuitable[12].

Thus it can be assumed that changes in relative locational value have a cyclical character. It is an effect of changes in accessibility modified by the availability of vacant areas, the impact of which is additionaly strengthened by the factor of environmental quality.

In the initial period maximum locational value is observed in the centre of a city and its closest vicinity. Outside these areas as the distance from CBD grows, the value of land rapidly declines (line t_1, Fig.1). At this time in view of the lack of distict limitations of vacant areas accessibility becomes a decisive factor for locational value. In the subsequent phase of city development the locational value of centre areas is established at an unchanged level or begins to decline in relation to the previous period. The value of peripheral areas within the city regions boundaries of this period grow at a slow rate, however. The decline of the value of the centre area and the slow growth of the value of peripheral areas is caused more by ehaustion of land resources than by their lower accessibility.

The next period (line t_3, Fig.1) is characterized by a clear decline in the locational value of centre areas, but in its profile the crater of the centre's value is not yet seen. The locational value of areas remote from CBD accessibility, which have rapidly increased after car transport has been introduced, grows as well, to a larger extent than previously. Thus, at the same time one can observe a stabilization of indicators of accessibility in the areas of the whole city and then — delayed in time and to a smaller degree — the beginning of a stabilization of the locational value of areas.

The next phase (line t_4, Fig.1) shows in the cross-section the explicit crater of the centre[13] and a shift of maximum values to areas around CBD. At the same time the locational attractiveness of peripheral areas rises, which causes further levelling of its indicators in the area of the whole city region. The decline of the value of the centre is caused by a drastic lowering of the accessibility of these areas with a simultaneously maintained high, or even growing in relation to the previous period, availability of external areas. The exhaustion of vacant areas and the lowering of the environmenal quality of the area of the centre have a great influence on the profile of land value. This phase has been identified in most large cities in Poland since the second half of the 70'ies.

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[12] Urban buildings' aging cycle and, connected with them, the grounds for construction activity, as depending on the distance from CBD, have been identified for Cracow by R. Mydel, Construction Activity in Urban Area. Spatio-temporal Model of Urban Buildings Age Evolution and Ageing Cycle, Folia Geographica Series Geographica-Oeconomica, vol. 17, PAN Oddział Kraków, Ossolineum 1984, pp 5-23; see also B. Goodall op.cit. pp 212-214.

[13] The crater of population density of the centre characteristic of big cities, and often similar to the whole density profile, is explained by the value of site rent and the differentiation of urban areas' utilities, depending on their location. See P. Korcelli, Theory of ... op.cit. pp 50-64; M. H. Yeates, Some Factors Effecting the Spatial Distribution of Chicago Land Values, 1910-1960 Economic Geography, 1965 Vol. 41, N1, pp 57-70.

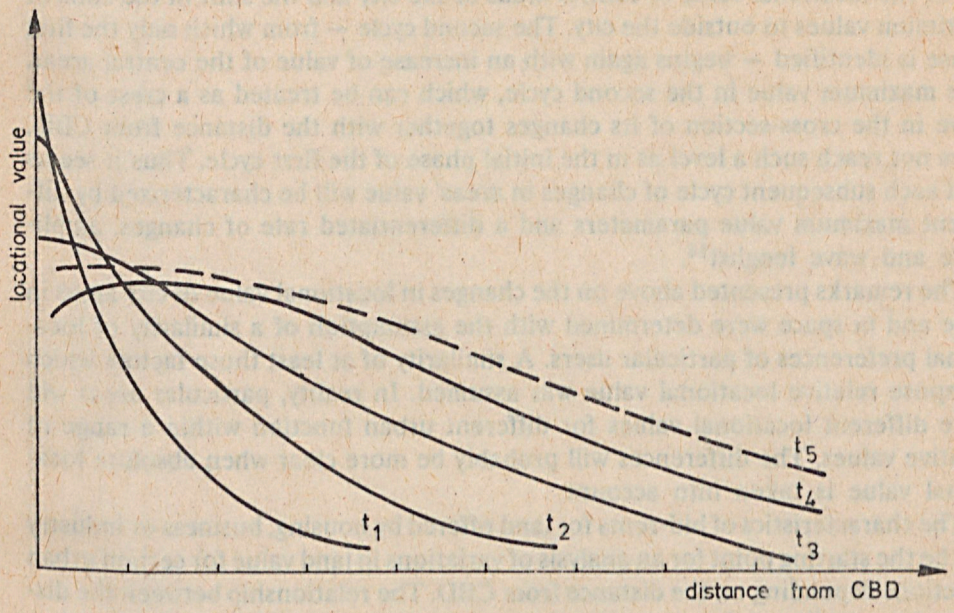


Fig.1. The locational value of areas and the distance from the city Centre (in time t_1–t_5)

The next phase (line t_5, Fig.1; the broken line indicating that so far it has not appeared in Polish cities) is the returned growth of the locational value of central areas with a simultaneously maintained but slightly slowed in comparison with the previous periods, increase of the value of peripheral areas. The rise in locational value of central areas is not big. It does not reach the level of period t_3 and is definitely lower than in the initial stages. Therefore we practically do not observe the dominance of locational attractiveness of these areas in the city. A noticeable rise of the value of the centre in relation to the previous period is caused, on the one hand, by the repeated increase of accessibility of these areas and, on the other hand, by widening possibilities of renewal of their physical structure. The second of the mentioned factors also has a stronger influence on locational value because of the exhaustion of land resources on the city's peripheries. Maybe some influence is also exerted by the fact of introducing on a bigger and bigger scale neutral production technologies in transport, industry and the municipal economy, which over a long period of time will bring improvement in the environmental quality.

The cyclical nature of changes in the locational value of city areas, which has so far been most distinct in the centre, is manifested in the sequence of particular

phases of the first full cycle of changes and the appearance of the first phase of the subsequent cycle. The phases of the first cycle embrace the process of lowering of the locational value of central areas of the city and the shift of the zone of maximum values to outside the city. The second cycle – from which only the first phase is identified – begins again with an increase of value of the central areas. The maximum value in the second cycle, which can be treated as a crest of the wave in the cross-section of its changes together with the distance from CBD, does not reach such a level as in the initial phase of the first cycle. Thus it seems that each subsequent cycle of changes in areas' value will be characterized by different maximum value parameters and a differentiated rate of changes, amplitude and wave lenghst[14].

The remarks presented above on the changes in locational value of city areas in time and in space were determined with the assumption of a similarity of locational preferences of particular users. A similarity of at least those factors which compose relative locational value was assumed. In reality, particular areas will have different locational values for different urban function within a range of relative values. The differences will probably be more clear when absolute locational value is taken into account.

The characteristics of bid-rents for land offered by housing, business or industry can be the starting point for an analysis of variations in land value for certain urban functions depending on the distance from CBD. The relationship between the distance from CBD and the price offered for land is clearly one of inverse proportion. The strength of this relationship however is greatest for the business use and smallest for residential use (see Fig.2).

Differences of locational preferences are most clearly seen for the multi-family and one-family housing (Fig.3 and Fig.4) and for services (Fig.5).

In the case of multi-family and one-family housing the crater of locational value of central areas will be seen much earlier than is shown in Fig.1. In the one-family housing, the whole, as identified for the XXth century cycle of changes of locational value, consists in the lowering of the attractiveness of the centre and the shift of the maximum which constitute the crest of the wave outside of the CBD (Fig.3, lines t_1-t_4). It seems that the subsequent cycle of changes of locational value of areas this function will not embrace the central area and the rise of the value will occur rather in the surrounding areas. However the crater of relative attractiveness of the central areas of city multi-family housing begins to appear already in the third phase of the first cycle of changes. In the third and fourth phases a sudden deepening takes place. Obviously the crest of the wave, i.e. The maximum locational values of areas for the multi-family housing is situated at the longer distance from CBD as in the case of the one-family housing. (Fig.4, lines t_1-t_4). At the same time the depth of the crater is clearly differentiated (see Fig.1,2,3).

[14] The concepts of urban wave development in relation to changes in the distribution of population density and to other elements of the spatial development of cities are presented by P. Korcelli, Theory of ... op.cit. pp 119-129; see also R. Mydel, T. Ishimizu: Evolution of the Spatial Functional Structure of Japan's Metropolitan Areas, Zeszyty Naukowe UJ, Prace Instytutu Geograficznego UJ, z. 87, Kraków 1985.

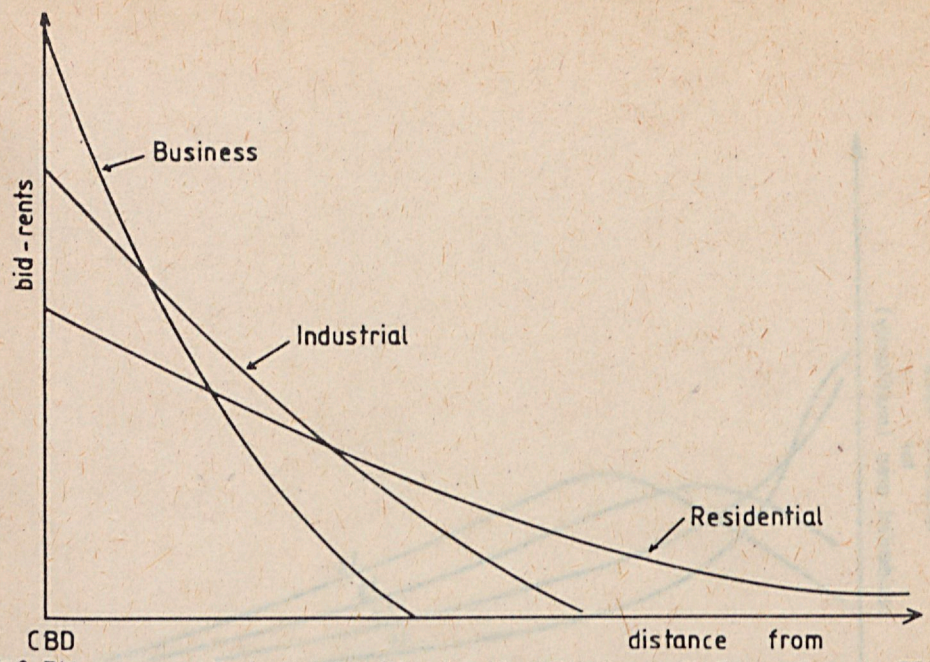


Fig.2. Bid-rents among business, industrial and residential land use with distance from the CBD. Source: Ronald R. Boyce., 1978: The Bases of Economic Geography, Holt, Reinehart and Winston, p. 310.

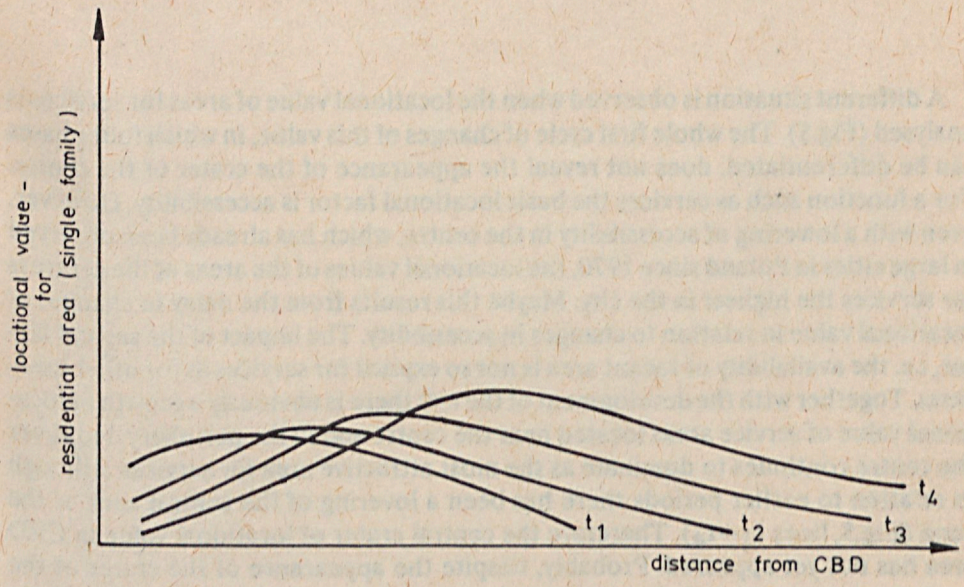


Fig.3. Changes in the locational value of areas for one – family housing in time $t_1 - t_4$.

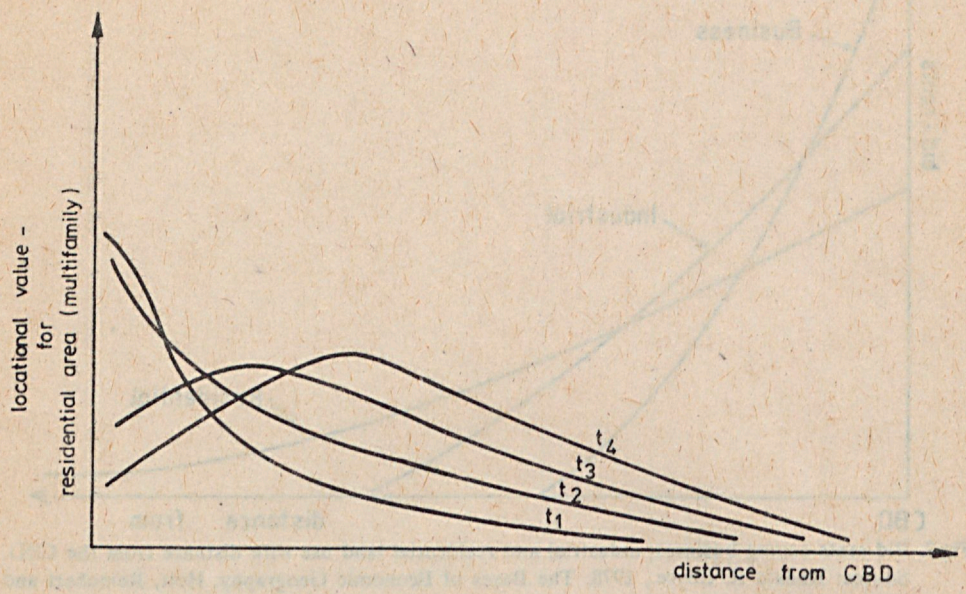


Fig.4. Changes in the locational value of areas for multi-family housing in time $t_1 - t_4$.

A different situation is observed when the locational value of areas for services is analysed (Fig.5). The whole first cycle of changes of this value, in which four phases can be differentiated, does not reveal the appearance of the crater of the centre. For a function such as cervices the basic locational factor is accessibility. However, even with a lowering of accessibility in the centre, which has already been observed in large cities in Poland since 1970, the locational values of the areas of the centre is for services the highest in the city. Maybe this results from the delay in changes of locational value in relation to changes in accesibility. The impact of the second factor, i.e. the availability of vacant area is not so explicit for services as for other functions. Together with the development of the city there is obviously a growth of locational value of service areas located near the centre and in the periphery. However the centre continues to dominate as the most attractive area for services although in relation to earlier periods there has been a lovering of the central apex of the cone (Fig.5, lines $t_1 - t_4$). Therefore the central crater of locational value in CBD area has not yet appeared. Probably, despite the appearance of the crater of the centre, a lengthering of the wave of changes of value in the next cycle will be observe. This is caused by a shift of intensive and extensive housing to the peripheral areas of cities. In large cities of the United States the second cycle of

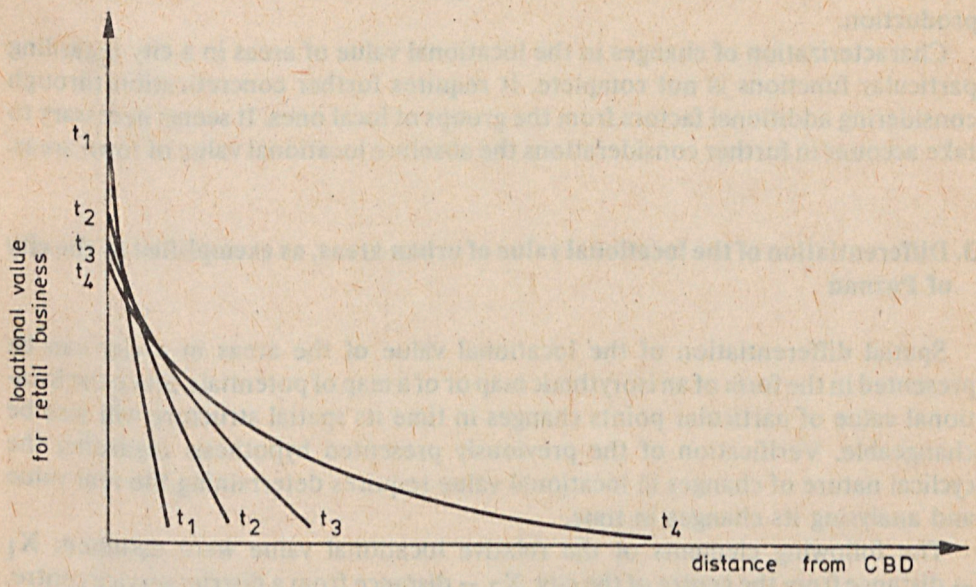


Fig.5. Changes in the locational value of areas for services in time $t_1 - t_4$.

changes of areas' attractiveness is already visible even for location of services. Apart from the appearance of a shallow crater of the centre, a shift of high locational values of areas for services to external areas also takes place[15].

Preferences for the location of industry in town seem to be much more diversified. The accessibility of areas defined in relation to the city's centre probably plays a smaller role as a locational factor for industrial enterprises which produce goods for external markets. Economy is the costs of transport of goods can be taken into account as a locational factor for industry producing for the needs of the industrial market of a town. Deglomeration and relocation of industrial enterprises to external zones, which have observed for more than thirty years, seem to suggest a greater role for other locational factors[16]. Among the factors which contribute to relative locational value, the availability of vacant areas of sufficiently large area and adequate shape will have considerable importance for industry's location. This factor carries the condition that for industry, the locational value of

[15] B. J. L. Berry, F. E. Horton, Geographic Perspectives on Urban System, Prentice-Hall, Englewood Cliffs 1970, pp 468-475.

[16] B. J. L. Berry, F. E. Horton, Geographic Perspectives ...: op.cit., pp 459-483; see also W. E. Lever: The intra-urban movement of manufacturing: a Markov approach, Trans. Inst. British Geogr., Nr 56, 1972, pp 21-39.

peripheral areas also increases in relation to the initial period. This tendency, however, can be restrained in view of the implementation of new technologies of production.

Characterization of changes in the locational value of areas in a city regarding particular functions is not complete. It requires further concretization through considering additional factors from the groups of local ones. It seems necessary to take account in further considerations the absolute locational value of town areas.

3. Differentiation of the locational value of urban areas, as exemplified by the city of Poznań

Spatial differentiation of the locational value of the areas in a city can be presented in the form of an isorythmic map or of a map of potentials. Since the locational value of particular points changes in time its spatial structure will also be changeable. Verification of the previously presented hypothesis regarding the cyclical nature of changes in locational value requires determining the real value and analysing its changes in time.

The following elements of the relative locational value were assumed: X_1 – distance from the centre of the city, X_2 – distance from a district service centre, X_4 – distance from a local access road, X_5 – distance from a tramway or bus line. Absolute locational value was additionally supplemented by the subsequent elements: X_6 – distance from a water-line, X_7 – distance from a sewage line, X_8 – the percentage of area unsuitable for building due to disadvantageous geological conditions, X_9 – the percentage of area with good or very good soil, X_{10} – the percentage of built-up area. When determining absolute locational value, greater weighting of the importance of x_1, x_8, x_9 and x_{10} was applied. In regression analusis where a dependent variable was the intensity of area development and an independent variable was the values of particular factors, exactly these four factors differentiated above had the highest regression coefficients in all the analysed periods. This justifies the introduction of the weight.

The whole area of the city region (besides Poznań, it also embraced the suburban zone little towns of Luboń, Swarzędz, Czerwonak, Plewiska and Koziegłowy, in permanent boundaries established in 1983 having an area exceeding 280 km^2) was divided into squares of 0,50 km on a side (Fig.6). From these squares a representative sample of 258 units were drawn. This sample embraced 24% of the total number of elements. The net of squares was unchanged throughout the whole studied period. For the drawn squares the relative and absolute locational value of area and intensity of development in six cross-sections of time 1938/39, 1950, 1958, 1970, 1976 and 1983 were determined. This paper presents only the characteristics of the initial and final periods.

Changes in the spatial structure of the relative locational value are presented in Fig.7 and Fig.8 (only a fragment of the city region towards the north-west from the centre on the left bank of the Warta river).

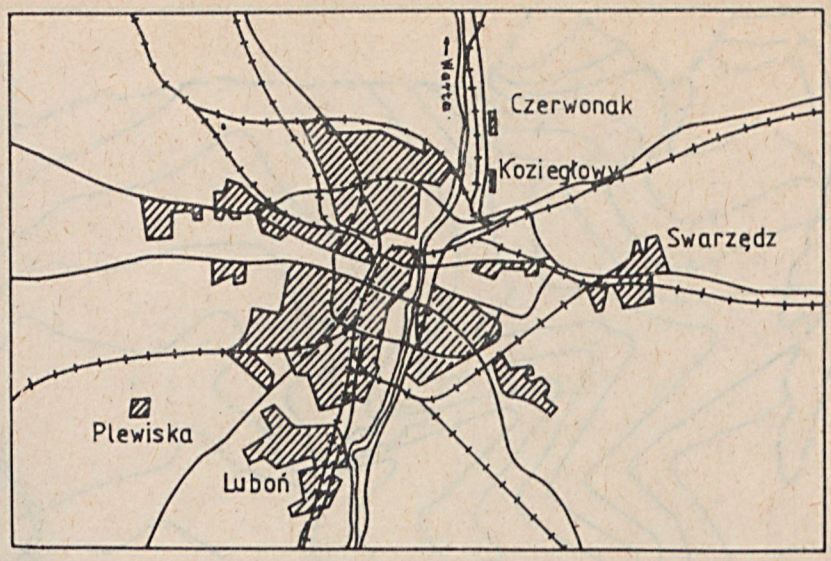


Fig.6. Poznań and surroundings in 1984.

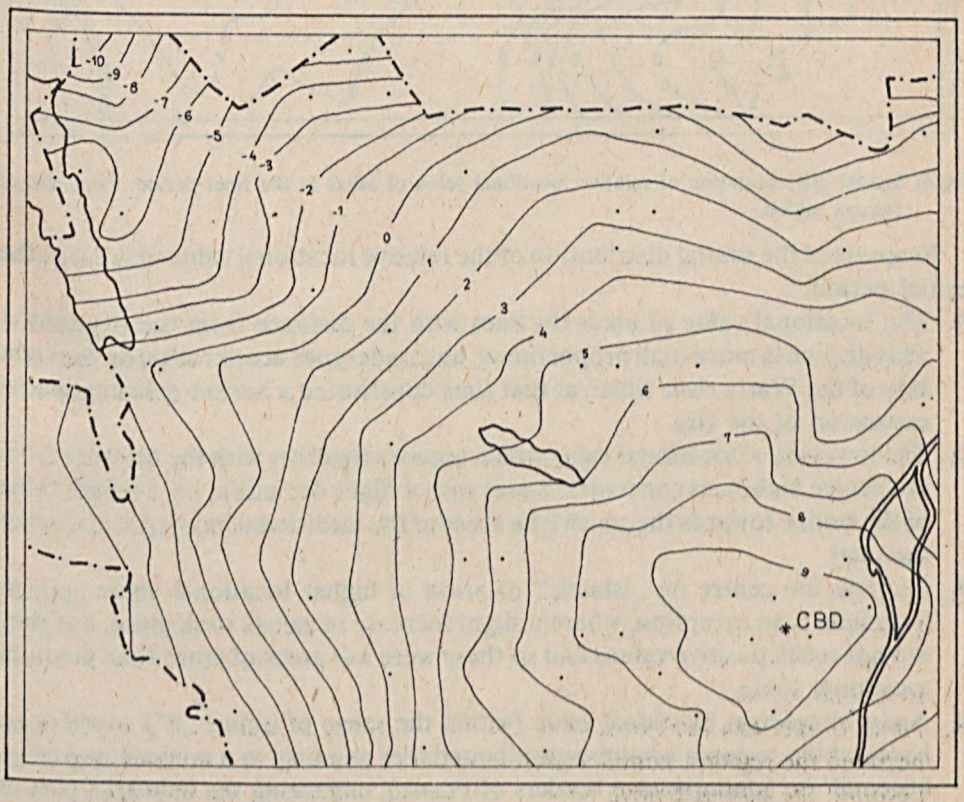


Fig.7. Spatial differentiation of relative locational value of area in the initial period, Fragment of Poznań region.

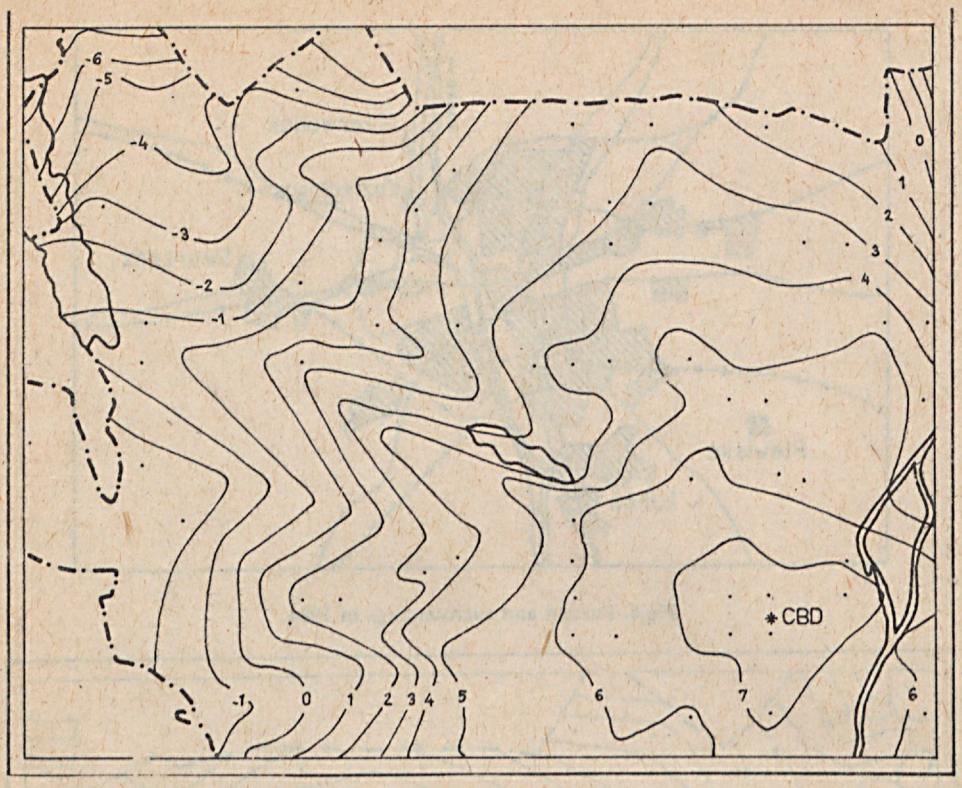


Fig.8. Spatial differentiation of relative locational value of areas in the final period. Fragment of Poznań region.

Features of the spatial distribution of the relative locational value of areas in the initial period:

1. The locational value of areas declines with the distance from the city centre. This decline is more than proportional, and undergoes acceleration on the right side of the Warta river which at that time constituted a barrier delaying spatial expansion of the city.
2. The lowering of locational value which appears together with the distance from the centre embraces concentric zones with a slight deviation, i.e. a lengthening of the isoline towards the south (the areas of the traditional industrial district of the city).
3. Outside the centre no „islands" of areas of higher locational value appear. Swarzędz is an exception, where a slight increase in values took place, but they did not reach positive values and so these were not areas of more than medium locational value.
4. Areas of medium locational value (within the range of isoline „0") nowhere go beyound the region a administrative boundaries and only to a minimal degree go beyound the administrative borders of Poznań, embracing the industrial part of Luboń.

5. A bigger condensation isoline showing a more rapid decline of locational value of areas appears near the region's boundaries rather than in internal areas.

Features of spatial distribution of relative locational values of areas in the final period:

1. The centre of the town still has maximum locational value in relation to the remaining areas of the region. However in comparison with the initial period, this value decreased considerably.
2. Similarily to the initial period, locational value still declines with distance from the centre of the city. The decline, however, is not even, and its rate changes depending on the direction. It becomes weaker in the areas situated north and south of the centre on the left bank of the Warta river.
3. The course of the isoline joining points of the same locational value is much more complicated than in the initial period. „Islands" of higher value in relation to the surrounding areas can be seen. They appear around points of higher accesibility or around the developing district centres.
4. Areas of medium locational value apread in comparison with the initial period. This is particularly distinct north from the centre and in the eastern direction, where isolines of positive values also embrace the areas of Swarzędz.
5. A rise in the locational value of peripheral areas of the region is observed only in the north-west direction from the centre. The remaining peripheral areas in the final period have locational value close to that from the initial period.
6. The lowering of locational value with the distance from the centre in the transitional areas, i.e. those situated around the centre within the range of district service centres, is limited. Isolines are characterized by bigger dilution than in the initial period.

This proces of gradual stabilization of accessibility indicators in the city also involves the areas on the right bank of the Warta river, but it has not yet embraced peripheral areas of that part of the city.

The characterization of the spatial structure of the relative locational value of areas in the initial and final periods allows us to determine at which phase of the cycle of value changes the urban region of Poznań situated. In spite of a continuous lowering of the locational value of central areas in the years 1938-1983 a crater of value around CBD has not been created. However the year 1938 is not the true starting point of the cycle of changes in locational value of urban areas presented in the previous section because earlier the value of central areas was probably even higher. Therefore we can assume that our initial period is actually the second phase and the next to last phase of this cycle.

The absolute locational value of areas involves the advantages which result both from the locational of an area in the city system as well as from its specific environmental conditions, vicinity and the state of hitherto existing development. Neglecting this value in the analysis of the variability of socioeconomic phenomena on a mass-scale seems justified. However in an analysis of the same phenomena on a micro scale neglecting these advantages seems to be an oversimplification. Therefore spatial differentiation of absolute locational value should also be considered.

Spatial differentiation of the absolute locational value of urban areas is of course much bigger than differentiation of the relative value (Fig.9, 10). This is due to the influence of local factors, mainly geological conditions and soil conditions, and of the variable reflecting the state of an area's development.

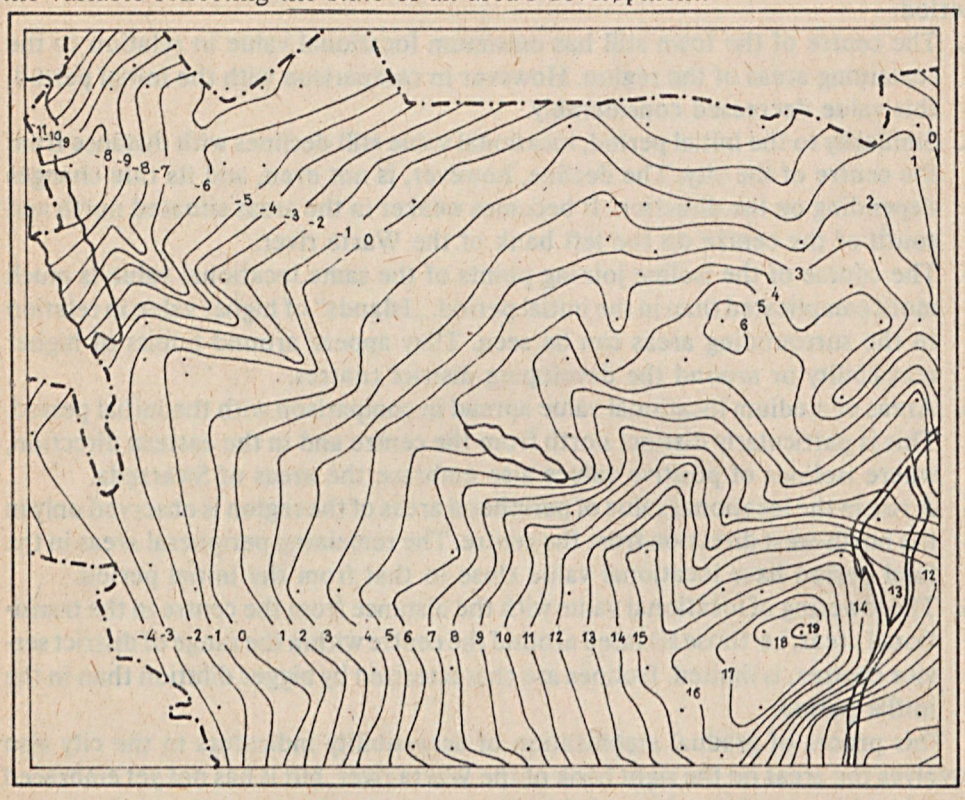


Fig.9. Spatial differentiation of absolute locational value of areas in the initial period. Fragment of Poznań region.

As was observed in the case of relative locational value, the highest absolute value for the whole studied period is also recorded in the centre. The dominance of the central areas in relation to the remaining ones is noticeably lower; differences between the value of central areas in the initial period and in the final period are definitely higher than their relative value. The decline in location value together with the distance from the centre is characteristic, although the rate of this decline is not regular. Numerous condensations and dilutions in the set of isolines and the creation of enclaves of higher value occur, mainly around service centres of lower category of with the lowered value of areas of river valleys.

Comparison of the spatial distribution of both separated values of areas, in which the absolute value contains all the elements of relative value, will enable us to determine the degree of influence of local factors on the locational attractiveness of areas in the city. It turns out that the decline in absolute locational value of central areas in the period 1938-1983 has been faster than the decline in relative value.

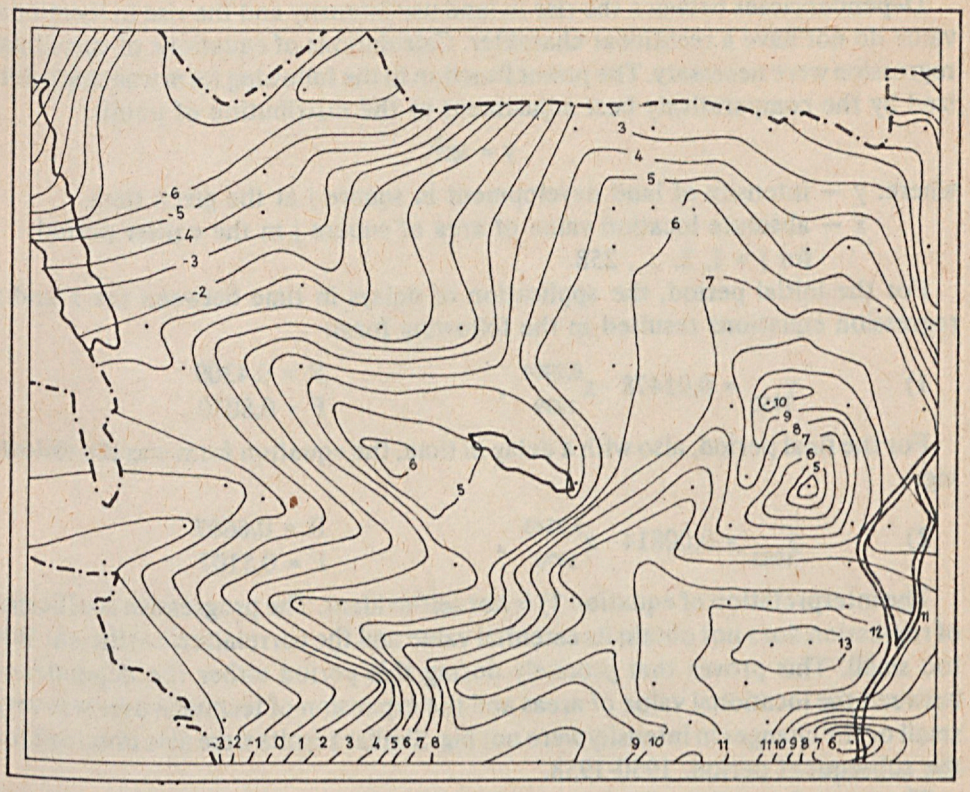


Fig.10. Spatial differentiation of absolute locational value of areas in the final period. Fragment of Poznań region.

The spatial structure of areas of medium value (the spatial range of isoline „0" of relative and absolute values is suprisingly similar both for the initial period and for the final one) depends mainly on the influence of the essential factors. A similar situation appears in the peripheral areas. With the exception of the town of Swarzędz and the Plewiska housing estate in the suburban zone of Poznań, the locational value of peripheral areas is low and does not basically change after taking into account local factors.

4. Locational value and land use intensity

The influence of locational value on changes in land use intensity is different from what would result from a separate analysis of particular location factors. The area value itself is not a simple sum of the considered factors. There is a specific synergic effect as particular factors are to a considerable extent complementary to each other. The power of the impact of all the elements is thus bigger than would result from the summing up of the effects of individual factors.

Dependencieses between the rise in land use intensity and the rise in locational value do not have a rectilinear charakter. Calculations of equations of curviliniar regression were necessary. The power function in the following form was characterized by the comparatively best adjustment to the distribution of points:

$$y = ax^b$$

where: y — intensity of land development in square j at the given time,
x — absolute location value of area of square j in the earlier period; for j = 1, 2, ... , 258.

For the initial period, the application of delays in time between the x and y regression equations resulted in the following form:

1) $$y_{1950} = 0{,}01478 \cdot x_{1939}^{0{,}9704}, \qquad \begin{matrix} R = 0{,}4309 \\ F = 0{,}8010 \end{matrix}$$

For the final period, also with a delay in time, the equation form was the following:

2) $$y_{1983} = 0{,}00814 \cdot x_{1976}^{3{,}2143}, \qquad \begin{matrix} R = 0{,}6687 \\ F = 0{,}5107 \end{matrix}$$

The interpretation of equation 1) is not self-evident. The progressive coefficient of regression does not obtain its essential value and the correlation coefficient R is too small. This proves that precisely during this period either the dependence between the locational value of areas and the expansion of technical uses was very small or the changes in intensity were not big. Similar results were also obtained for the subsequent period, 1950-1958.

The second equation allows us to state that an increase of absolute locational value of the given square area by 10% caused an increase in the intensity of development of 32,1%. The coefficient of power regression is essential and the correlation coefficient R and convergence coefficient F are also sufficient for this interpretation.

The obtaining of such results of calculations confirms the earlier remarks about the changing influence of endogenous factors which constitute the locational value of areas together with the rate of city development. The post-war period has been a period of rapid growth of population, and so the location factors have been demand factors, i.e. exogenous. However, the period 1976-1983 has been a period of slow-down of population growth and limited investment activity, and so the location factors are to a greater extent supply factors, i.e. endogenous. The dependence between locational value and utility intensity of areas of the Poznań region become more distinct in the final period of the studied time.