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SYSTEMS RESEARCH INSTITUTE
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INTEGRATED RURAL/SPATIAL DEVELOPMENT:
ELEMENTS OF SYSTEMS ANALYTIC APPROACH

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VI. REGIONAL ANALYSIS AND PLANNING

EFFICIENCY CALCULUS IN PROGRAMMING OF DEVELOPMENT OF SETTLEMENT SYSTEMS: SOME PREREQUISITES

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A.S. Eddington once jokingly remarked /Eddington, 1934/ that the difference between a physicist and a mathematician boils down to the fact that a physicist knows what he is talking about, but does not know what he says, while a mathematician, knowing what he says, does not know what is he saying it about. Such comparison can nowadays be attributed to communities of specialized sciences on the one hand, and to systems scientists on the other. The same applies to spatial planners. They know the elements of urban or regional systems, they guess interrelations among these elements, but are, in general, incapable of formalization of these relations. Systems scientists deal with /mathematically/ formalized methods, but are not aware of the contents of questions they want to force into those formalized frames.

In order to achieve a harmonious cooperation between systems scientists and specialists such as spatial planners, basic epistemological questions have first to be sorted out.

Let us begin with the notion of efficiency as appearing in the title of this paper. One can associate with it an economic or a social quality measure, which will determine ultimately the nature of the calculus we have in mind.

Secondly, it is necessary to analyse the notion of settlement system, as used in the title of the present paper. One can consider development of individual

elements of this system, i.e. settlement units, or of settlement subsystems, or of settlement networks over a region or a country, that is, of appropriate settlement systems /for some of these notions see Malisz, 1981/. Again, the form and role of appropriate calculus shall differ depending upon such choices.

Having thus distinguished epistemological questions, let us look at the substantial problems with more of precision.

1. Efficiency

Assume that e c o n o m i c e f f i c i e n c y is considered. This category is expressed through the ratio of costs to outputs /or conversely/ of a given activity. The analysis of economic efficiency consists therefore in comparison of a number of alternative solutions in terms of this ratio. Thus, both costs and outputs have to be measurable in monetary units. In case of settlement systems one could, theoretically, calculate costs associated with creation of a given predetermined normative type of town or region. Practically, however, this is very difficult, and quite often simply impossible, especially when prices in force do not correspond for some reason to actual costs of products and service.

The situation is even worse on the output side. Effects of a realized settlement system are multiple, primarily expressed through the system's utility. This sort of effect is on a larger scale very difficult or impossible to measure, while it can be of quite a high importance /e.g. increased labor productivity owing to higher standard of living/.

In addition, output effects are related to system's organization on various levels, and therefore to plans appearing on these levels /e.g. local, regional and country-wide spatial plan/, since such plans are mutually highly interrelated. Thus, an effect from town development design does, in fact, depend upon the solution adopted at the higher level, i.e. region or country. This implies a need for a multi-level economic calculus scheme, in which every

single investment undertaking would be related to the whole national economic plan design. An outline for such a calculus, put forward by K. Porwit /Porwit, 1969/ could not, however, be implemented in Polish planning system* /.

On the top of multi-level nature of efficiency calculus there is also the problem of time horizon of the calculus. Depending on the time interval for which the calculus is carried out the effects assessed shall differ. Since every economic efficiency calculus involves internal return rates, then depending on these - assumed - rates, shorter-term or longer-term effects are preferred /i.e. they take on higher numerical values/. It is characteristic for settlement system that its effects have to be evaluated over long time periods, otherwise important losses to national economy may arise, eventually appearing as additional social costs.

Thus, facing insurmountable difficulties with calculation of economic efficiency of settlement systems development, one might want to turn to the notion of *s o c i a l e f f i c i e n c y*.

Social efficiency is, although we do often use this term knowing intuitively what we mean, rather a fuzzy category, which is virtually unquantifiable. Hence, intended social efficiency calculus cannot anyhow be treated as formal calculus.

What is, therefore, the way out of this dilemma? I personally am of the opinion that one should settle for a more modest solution, which may, however, be practicable and useful. The procedure could be divided into two parts: in the first one social effects would be defined awaited from the settlement system development considered, while in the second - necessary costs resulting therefrom would be computed and compared.

As we know from Lange, 1959, /vol. I, p. 132/, effects which are not fully quantifiable, can still be ordered

*/an intention of implementing such a multilevel planning system is, perhaps, most clearly pronounced in the Soviet Union, where theoretical work in this direction is being conducted for almost two decades now in many scientific centres /eds./.

according to their ranks corresponding to the degree of achievement of predefined goals. Hence, one could compare solely those solutions which ensure adequate achievement of these goals. Such type of comparative cost calculus is theoretically known to economic literature.

Notice, however, that the above approach transfers the whole difficulty from mathematical formalization aspect to definition of social goals. Hence, the question now being widely discussed /see Klassen, 1977/ arises of who is capable of stating what is good for people? Spatial planners, accused of technocratic tendencies? Authorities, who are tempted to impose their arbitrary priorities? Or population itself, whose members usually see these problems via their own troubles, which leads to diversification and internal inconsistency of goals?

Nevertheless, one can try to formulate a basic set of goals, as indicated by common sense: health of population, i.e. adequate biological conditions of living, possibly full employment, habitat of appropriate standard and with sufficient level of service, accessibility of sane and active recreation, development of personality and of interpersonal links. It is additionally important to have a p o s s i b i l i t y o f c h o i c e, in each of these areas, since this requirement constitutes the condition of happiness.

Simultaneously, considering such needs of groups and individuals which may be conflicting, it becomes necessary to adopt an ordering rule, according to which hierarchically higher are goals of a bigger portion of the population.

Hence, in defining the hierarchy of goals authorities should consult population, with spatial planners providing methodological tools.

2. Spatial organization plan and plan design

The whole task in designing the spatial organization plan consists in the accurate, in-depth analysis of the present state of things, which is the basis for determination of

concrete objectives, and hence also of the development plan, its constraints, alternative spatial solutions ensuring achievement of goals and satisfaction of constraints, and finally - indication of social and economic consequences of each of these alternative solutions. From the thus defined set of alternatives representative power chooses the one which seems to be the most desirable /for the outline of the whole procedure see Malisz, 1981/.

One of the most important links of this process is transformation of plan objectives into spatial structures. In order to do so, each particular objective has to be expressed in terms of concrete aims, formulated in such a way that it becomes possible to assess ex post whether they were achieved and in what degree, for a given solution alternative /see Malisz, 1981/.

The indicated complexity of the procedure organization and contents make it impossible to contain them within one, integrated mathematical model^{*}/. Design of a spatial plan concept requires spatial imagination, intuition and creativity, as well as synthesizing capabilities. Hence, in spite of just tendencies to rationalize the whole procedure, it will always remain, at least partially, an art of composing.

It is therefore necessary to point out the place and role of the socio-economic efficiency calculus within this procedure.

One would agree with Regulski, 1982, in that the objective optimization of the whole settlement or region development plan cannot be believed in. Furthermore, economic analysis does not, as he justly points out, apply to a spatial outline of a town or region, not only because of their individual nature and development dynamics, which make it difficult to speak of a "terminal state", but also because

*/ this one and the following are debatable points, for theoretical capacities certainly exist, and it is primarily the technical matters that constitute nowadays main obstacles for realizing computationally the procedure outlined /eds./.

one can hardly imagine an economic sense of an evaluation concerning a very long time horizon, attributable to spatial structures. The question is not in providing a "cheap" design, but such one, which ensures adequate functioning and possibly high correspondence with social needs.

Experiences from the United States indicate that any urban or regional spatial outline meant to satisfy possibly fully social needs will incur comparable social cost. Differences in costs for various alternatives are smaller than errors committed in general in estimation of future cost structure /see Smit, 1969/.

This is not to say that economic efficiency calculus is inapplicable in planning and programming of settlement systems. To cite again Regulski, 1982, this calculus should form the basis for the choice of kinds and scopes, as well as timing of the activity program, constituting the spatial policy of proper authorities. The adequate application of such a calculus can be done in the framework of the strategic choice approach, born in United Kingdom within the scope of structural planning methods /see Bather, Williams and Sutton, 1975, and also Malisz, 1981/. The essence of this method, in which computational technique of Analysis of Interconnected Decisions /AIDA/ is used, consists in determination of main "problem areas", that is, sets of crucial questions to be solved. First, various "scenarios" of future possibilities are defined for each problem area and on this basis "sets of policies" are determined, carried out through concrete "actions". These actions represent subsequent "steps" of a policy and the states thus obtained, so that they can be subject to evaluation. e.g. through the calculus of economic efficiency of envisaged investments.

Hence, within a settlement system outline, meant for a remote time horizon, since it can only be evaluated from the social objectives' viewpoint, evaluation of economic efficiency is applied solely to consecutive "steps" which lead, ultimately, to realization of this outline. Thus, data

appearing in the economic efficiency evaluation can be quantifiable and economically soundly based, since analysis is limited to short-term evaluation and narrower scope of objects.

3. Threshold analysis

One of the methods which can be applied in the comparative analysis of settlement system costs is threshold analysis, now widely known and used in many countries /see Kozłowski, 1973/. Full explanation of the principles of this method can be found in Malisz, 1971, or Kozłowski and Hughes, 1972. It may suffice here to notice that the threshold analysis is based upon the observation that the growth of a settlement subsystem in geographical space can be treated as a jump process. This observation results from the fact that a settlement in its spatial development encounters subsequent threshold-like limitations, resulting from diversification of the space, technical infrastructure development regularities, and wearing away of constructions and equipment. The gist of practical threshold analysis is comparison of alternatives of spatial growth in a settlement subsystem from the point of view of necessary outlays. According to the principle pronounced in Lange, 1959, and quoted here, only these alternatives can be compared which attain predefined goals in a given degree. It is essential for the threshold analysis that it considers uniquely the "threshold costs", while other, "normal", categories of costs /as e.g. for building construction/ are omitted, since they are alike for all the alternatives of growth. Hence, only these outlays are compared which result explicitly from location of planned extensions.

Having in mind these basic principles let us look at the economic problems which arise in extending the settlement subsystems and in shaping the settlement system of a region or whole country.

For an individual settlement subsystem the basic economic question is how to sequence the areas taken up by the growing /according to needs/ urban infrastructure. Local authorities

face the following questions:

- to take up new areas or to rebuild existing /worn out/ urban structure?
- if take up new areas, then which, and in what sequence?
- until when the settlement unit can grow concentrated before shifting towards the deconcentrated type of growth?

All these questions can be answered with the appropriate use of threshold analysis.

In the first case, it is enough to compare the costs of rebuilding the area of the substandard, aged constructions, /new buildings excluded/, with the costs of preparing the most easily accessible external territories /between the first and second threshold line/. Having an assumed /desired/ population density, one can readily calculate unit per capita costs resulting from the analysis.

In the second case, analogously, threshold costs will be compared corresponding to various /in principle: all practicable/ alternative locations of new constructions. It is important to include in the threshold costs these costs which are associated with equalization of utility conditions in various location alternatives.

Finally, in the third case, when spatial growth of a settlement subsystem encounters especially high threshold cost constraints, it should be analysed whether a decentralized development, i.e. formation of new, separate structural units would not be more economically justified /less costly/. As in the second case, the threshold costs should be complemented with utility equalization costs.

For a regional /or even country-wide/ settlement system the economic choice problem consists in determining the most rational way /economically efficient/ of locating the anticipated increase in regional or national population. This problem is, however, extremely complex, and the threshold analysis cannot pretend to be able to solve it entirely. This method can, though, give an important prerequisite for the solution. It can indicate which of the individual existing units can be developed with relatively low threshold costs.

The procedure implied would then be to perform the threshold analysis for all the settlement units in the region, thus determining the threshold costs and the ordering of units according to these costs. This sequence of cost preferences can thereafter be compared with economic needs of a given region /locations of services and production/ to yield a "matrix of assignments".

Such analyses were some time ago performed for a number of regions in Poland, including the Warsaw province. Similar, but more in-depth analysis was carried out in 1968 for allocation of tourist flows over southern Yugoslavian sea-coast /the Montenegro coast/ - see Malisz, 1971.

It should, however, be strongly emphasized here that in all the cases mentioned the results of the threshold analysis can only be treated as prerequisites for the proper decision making. The alternative pointed out by this analysis as the most efficient one does not necessarily have to be accepted for realization. Authorities capable of decision making may choose another alternative, which, having somewhat higher threshold costs, may offer greater social benefit. The difference in costs between the chosen alternative and the least-cost one is, in a way, an economic "price" of the additional, immeasurable social benefits.

4. Concluding remarks

The present paper was meant to give an overview of the way the spatial settlement system planning problem is perceived from the side of a spatial planner. The same problem, as analysed by systems scientists, takes on a different form and can be subject to different solution procedures. In order to achieve a synthesis in problem formulation and solution phases, an epistemological agreement must be reached.

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1. Introduction

In many countries, including the Federal Republic of Germany, a general consensus exists that the establishment of equal living conditions ranks high among the goals of regional development policies.

This objective can be pursued by

- improving the regional economic structure in regions with structural deficiencies,
- setting positive incentives for regional labour markets especially in regions with low employment levels,
- securing minimum standards in the infrastructure supply to the regional population.

However, views differ with respect to the question whether the instruments which are available or employed in the federal regional policy context are sufficient for the accomplishment of these goals.

One instrument, the establishment of a set of regions to be advanced by the joint federal and state venture of "Gemeinschaftsaufgabe Verbesserung der regionalen Wirtschaftsstruktur (GAW)" in the Federal Republic of Germany has actually slowed down the decrease in the number of persons employed in industry (in the period from 1969 to 1975) in those development regions as compared to other regions. Thus, for the majority of the GAW-regions an above average increase in per capita income can be stated. However, in spite of these temporal successes for the regions included in GAW measures the aim of equalising the economic living conditions still remains unfulfilled.

It has to be investigated whether the instruments applied in order to influence regional development need to be supplemented, replaced or altered. In this context, a number of considerations and their results shall be reported on.

2. Growth Poles

The concept of growth or development poles as a methodological basis for regional policy measures rests on the hypothesis that expenditures - especially investments - lead to a considerable economic expansion if carried out at those points in space and in those sectors which, through strong linkage effects, induce further growth at other places and in other sectors.

This hypothesis, however, is - at least in its generality - rather controversial. It is easy to see that transport investments may hinder regional development if they support the out-migration or out-commuting of productive factors, especially labour. This will be the case if investment activities - investments in the network and the nodal infrastructure, and private investments - are not adequately balanced. Although the term growth pole has been satisfactorily defined, - due to a lack of an operational definition - it could not be incorporated in decision models for a regional development policy.

One objective of the research project GROWTH POLES¹⁾ was to implement the spatial growth pole concept for the evaluation of regional policies based on a 79 region subdivision of the Federal Republic of Germany.

1) Funck, R., et al.: Operationalisierung des räumlichen Wachstumspolkonzepts als Basis einer effizient zu gestaltenden regionalen Entwicklungspolitik, Karlsruhe 1980.

The following operationalized definition was applied to describe regions with characteristics of growth poles:

A spatial growth pole

- has major importance for interregional commodity flows with respect to both, their delivery, and input relationships,
- is - within its production structure - equipped above average with key sector activities, and
- contains the necessary equipment with respect to natural, human, and capital resources and material infrastructure for establishing and developing those key sectors.

The high importance of a region with respect to its interregional commodity flows is based on input and output dependencies in those production sectors which produce spatially mobile goods. These regions are identified using a graph-theoretical algorithm which, as a first step, investigates the connective characteristics of the structure of delivery flows, and then classifies all regions according to their importance in the commodity flow systems, considering circularities in the delivery interrelationships.

Sectors which show above average sectoral growth rates, and - for a given increase in final demand - lead to high production increases in other sectors due to their high intensity in the network of delivery flows, are called key sectors. They are identified using input-output tables for several consecutive years.

The regional equipment with resources is described by 80 indicators which include the educational standards of the regional population, and the transport infrastructure as well as the quality of housing and the climatic conditions, all of which are supposed to be relevant for regional growth.

If all of the 79 regions are ascribed to one of nine classes according to the intensity of their interregional linkages and their equipment with key sector activities, an investigation of the relationships between regional factor equipment and development classification can be carried out by employing statistical techniques like mean, correlation, and multiple-regression analysis, the following results can be found:

Regions belonging to higher development classes offer-with the exception of certain secondary schools (Realschulen) - better educational opportunities to their population; the lower quantitative supply of housing is balanced by higher quality; these regions are far ahead in communication infrastructure. Although the supply of health services strongly varies over the 79 regions, its average does not differ significantly between the types of regions.

Regions in top development classes have a far better transport infrastructure, in the middle and lower classes the differences however are small. The share of land taken by transportation and housing in the upper category regions is twice as high as in the other classes, at the cost not so much of agricultural land but of forests, swamps and areas used for recreational purposes.

The share of adults in the population and the degree of occupation increase in the upper development classes; this also holds for the indicators of school education. The share of self-employed persons is higher in the lower class regions.

The equipment with fixed assets in the three highest development classes is, in relation to population, twice as high, in relation to regional area, ten times as high as in the regions of all other classes. The equipment with key sector industries is of greatest interest: In the upper regional classes the corresponding value is four times as high as in the middle classes and ten times as high as in the lower classes.

The identification of the strategic components of the regional resource equipment - especially subdivided by infrastructure categories - which are suitable for regional development policies and the analysis of the regional economic structure as determined by the region's share of key sector industries offer two possibilities for the empirical application of the growth pole concept:

- A growth oriented regional development policy should concentrate its growth inducing activities on spatial growth poles. Thus, it can be expected, that high growth rates can be attained and growth effects will spill over into the regions surrounding the growth pole; this should lead to a levelling off in the differences in regional living conditions.

- Regions classified as lower level - development regions and handicapped by deficiencies in per capita income and resources are a focus for a regional development strategy directed at improving regional development potentials. Such a strategy should be supported by investment activities in motoric sectors, in human and material infrastructure and productive capital. Thus lagging regions which have a development potential, may be turned into growth poles.

3. Regional labour markets

A principal goal of labour market policy is attaining and keeping full employment and satisfying the demands for labour force. This includes the balancing of supply and demand for labour in a way that takes into account differences in skills and spatial distribution. From the point of view of regional policies it is important to realise, that on the one hand economic development calls for appropriately skilled labour in the region, on the other hand only the supply of job opportunities adapted to the level of regional labour qualification provides chances for an increase in regional income..

The question of a regional coordination of labour markets is dealt with in the research project REGIONAL LABOUR MARKET POLICY¹⁾. This venture is based on theoretical considerations concerning the structure of labour markets with the following hypotheses:

1) Pfaff, M., Regionale Arbeitslosigkeit, Augsburg 1978.

- Regions with a high share of skilled labour have a below average regional unemployment rate; this also holds for unskilled labour in these regions.
- Regional unemployment increases with
 - (1) the share of unskilled labour and low educational standard,
 - (2) the share of female work force,
 - (3) the regional quota of foreign workers,
 - (4) the share of higher age groups in the regional labour force.
- The share of less skilled labour among the unemployed is above average in those regions which are characterised by a branch structure resulting in demand for labour with unspecific skills.

These hypotheses were operationalised and empirically tested against data for the Federal Republic of Germany for the years 1967 to 1977 and 142 labour districts. The results generally confirm the theoretical expectations. The following conclusions may be deducted for regional labour market policies:

An investment into human capital balanced by an increased establishment of firms which demand higher skilled labour seems suitable to decrease regional unemployment as compared with the interregional average. At the same time, such a policy will further regional economic development.

4. Regional Mobility

The question remains open whether it will be possible to influence the sectoral structure of a region in the desired way by establishing new firms; this is especially doubtful in economies with low growth rates.

One instrument of regional development policies is the amelioration of regional infrastructure (and balancing it against environmental needs). This subject, however, shall not be discussed here ¹⁾. The mobility of the production factor labour is determined by several overlapping migration tendencies:

- The immigration from Southern Europe and the Near East, although slowed down by the present situation labour market and federal control,
- the large distance migrations with in the Federal Republic of Germany from the northern and eastern to the southern and western regions,
- the still existing attractiveness of high density urban areas on the mobile rural population, and
- the small scale migrations to the fringes and the hinterland of the cities which generates - beside other problems - large commuter flows.

1) See e.g. Funck, R.H., Blum, U., Regional Development and Investment in the Transport Infrastructure, Manuscript 1981 forthcoming.

This is one reason why the problem of MOBILITY OF POPULATION has drawn increased attention. The question has been analysed ¹⁾ whether the situation of local labour markets and local quality of living influences mobility. As a second variable the economic distance to the location which offers alternative residential or job opportunities is included in the decision situation. It can be shown that the comparison of the working situation dominates the direction of regional mobility. However, the question of whether to commute or to migrate is answered on the basis of the attractiveness of housing and the economic distance between the alternative places.

The SPATIAL MOBILITY OF INDUSTRIAL ENTERPRISES ²⁾ is an outcome of changing conditions for production and sales. From the point of view of regional policy the attempt is made to direct those primary relocation tendencies that are considered to offer permanent working places and income opportunities into lagging and underdeveloped regions by means of specific incentives.

The reality of regional economies shows that in the past, these incentives did not always prove to be successful: branches with a below average economic development e.g. the clothing industry, show a high degree of mobility. The volume of incentives is, in most cases, insufficient to relocate motoric firms out of high density areas.

1) Peschel, K., Bestimmungsgründe der Pendel- und Wanderungsbewegungen, Kiel 1979.

2) Treuner, P., Infrastrukturelle und wirtschaftsstrukturelle Bestimmungsgründe der industriellen Standortwahl, research project in progress.

Another research project ¹⁾ gives even bleaker results concerning the relevance of measures of regional policy with respect to economic growth. Financial incentives have almost no stimulating effect on regional growth as they are insufficient to overcompensate the dominating importance of the degree of regional agglomeration and of overall spatial location.

Medium run instruments to improve the economic structure seem to be available; however, their effects depend on the availability of a sufficient degree of intraregional agglomeration and interregional delivery relationships. The result of a third research project ²⁾ shows, that industrial enterprises migrate only if their existing location quality falls below certain levels of discomfort with respect to the availability of labour force, infrastructure supply etc.

Investments into transport and public infrastructure remain as possible strategies with a certain importance; at least they did play a dominant role in the past. However, in the Federal Republic of Germany today the equipment of comparable regions with infrastructure is so highly developed that an entrepreneur evaluating alternatives of moving will not find many differences.

1) Von Böventer, E., Bestimmungsfaktoren regionalen Wachstums, München 1979.

2) Bade, F.J., Mobilität von Industriebetrieben, Karlsruhe 1980.

It can be argued that under present conditions entrepreneurs will decide for locations in less developed regions only if the extremely high external production costs - costs of polluting the natural environment etc. - in highly agglomerated areas are consequently internalised, that is if causality principle is consequently applied.

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INTEGRAL PLANNING OF
POLYCENTRIC REGIONAL DEVELOPMENT

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1. Integration as a category of regional theory and method

First, presence of the "integration" category in the system of notions related to regional theory and method is pronounced. The use of the term "category" implies fundamental nature of the notion of "integration". This category appears in theories and methods of regional development and of activity location, and is synthetically reflected in agglomerative and deglomerative tendencies.

Within the regional growth theory the use of integration is most distinct in concepts of growth pole and of polarised growth. Growth pole constitutes there a core of integration scheme, while polarisation, as an effect of pole's functioning, is a type of integration mechanism. Growth pole and polarisation theory postulates integrated regional development, which should be expressed through intensification of economic links, decrease of differences in ways and standards of living, as well as achievement of common goals related to national interests /see Boudeville, 1973/. It is proved that thus conceived regional integration is enhanced by regional economic specialisation, either shaped autonomously or through a hierarchical system.

Another systemic concept of regional development makes appear integration under the term "consolidation" /Hilhorst, 1971/. This term is used for concepts postulating internal close linkage in the regional structure, i.e. certain type of strategy for central and regional authorities. This strategy

is chosen as a result of common solving of regional development problem. Consolidation strategy ensures intensification of regional economic activity using dispersed or concentrated means. It depends upon the rank of a center and its hinterland, and therein upon the magnitude rank of a regional center and the reach of its influence. In the above understanding of integration - strongly connected with the structure of a region - enhancement of integration by a continuous diversification process of regional structures as systems of centers, is emphasized.

In the domain of methods of regional analysis it is the analysis of complexes that comes to the forefront. Urban and industrial complexes are, in terms of this analysis, schemes of regional integration processes of settlement and industrial systems. They are used for modelling of structures of industrializing and urbanizing regions. Attempts at formal optimisation of urban and industrial complexes, started already in the fifties /see Isard, Schooler, Vietorisz, 1959/ reflected the justified conviction that the essence of development planning of industrial and urban regions lies in selection of:

- activity clusters, whether settlement- or industry - based, showing - due to technical and market interdependences, close interrelation of costs and benefits;
- factor clusters, determining correlated activity development and allowing estimation of costs and benefits from their agglomeration or deconcentration.

Optimisation of industrial or productive complex analysis is presently closely related to notions of: regional specialisation and spatial organisation, constituting, within the framework of strictly centralised economic management systems, a tool for so called pre-plan studies, see Bandman, 1980, and of pole and polarisation in regional growth, constituting, in the framework of state-and-market economic system, a tool of regional planning and economic policy, see Nijkamp, 1972.

In each of the approaches mentioned complexes are called for in order to shape development of the so called problem regions /backward, stagnating etc./. They provide development

plans bringing in industrialisation and urbanisation, desindustrialisation and desurbanisation, or reindustrialisation and reurbanisation. Processes enumerated should be, or are, subject to regional integration, whose models the complexes are. Analysis of complexes as economic analysis of regional development consists in studying internal relations and external economies of activities, resulting from agglomeration forces and benefits. Concept of this analysis pervades in an increasing degree the methodology of project planning, see Squire and Van der Tak, 1975, and investment programming, Kendrick and Stoutjesdijk, 1978.

Trends towards broader utilisation of integration can also be observed in theories and methods of activity location. Within this domain the location coherence principle was formulated, postulating a mutual correspondence between location and activity. This gives rise to two complementary approaches, first consisting in determination of optimal locations for activities, and a second, aiming at best land use, see Zawadzki, 1973. Increasing importance is attached to locational correlation of activities. More precisely, on the basis of forward and backward inter-activity relations, account taken of transport costs, there appears certain bilateral activity attraction, see Van Wickeren, 1973, which thereby affects the whole of infrastructural amenities.

The above trend find its reflection in methods of location analysis, especially those founded upon the input/output relations of activities. On the one hand it is the group location analysis explaining common location pattern for a set of activities. It provides a logical closure for activity cluster analysis through identification of conditions for common location orientation of inter-related activities, see Czamansky and Czamansky, 1977. In every location method mentioned spatial regional structure models are formulated, which are regional integration schemes. These are the complex location models.

Integration category, as present among notions of regional growth and location studies is most spectacularly reflected

in the quasi-generally observed trend towards activity and population agglomeration. This trend is co-created by concentration and integration. These two processes define the dichotomic essence of the agglomeration trend. Since dispersion is the alternative to concentration, it is straightforward to refer to connection of dispersion and integration as to deglomeration. Assumption of dispersion introduces, however, a change into the integration model concept. Hence, integration should be considered in a broader agglomerative and deglomerative context. Models created therefrom encompass concentrated integration, monocentric or polycentric, and dispersed integration - unidirectional or multidirectional. When choosing a particular model attention is also paid to the two-way integration mechanism, i.e. autonomous /horizontal/ and hierarchical /vertical/ integration.

From the economic viewpoint agglomeration and deglomeration are shaped by cost and benefit analyses and by the resulting game, played by representants of regional activities and centres. This game makes autonomous regional agglomerative and/or agglomerative forces appear.

The forces can also be shaped hierarchically, on the basis of the results of cost and benefit analyses carried out within the central or local authorities.

2. Planning integration and integral planning on the regional level

The notion of planning integration on the regional level, as connected with horizontal integration, refers to two basic forms of planning, i.e. to regional economic and spatial planning. Besides that, there is also vertical multilevel integration of economic and spatial planning. Depending on the concept of the governing system, the latter would either postulate creation a system of both kinds of plans in which plan solutions of a lower level are subordinated to plan solutions of a higher level, or, it would require a correlation of plan solutions of neighbouring levels, which goes together with preservation of autonomy and exclusion of

automatic administrative subordination of each level to its superior. The second approach corresponds to the idea of economic and territorial self-government.

Horizontal integration of regional economic and spatial planning is the logical consequence of the fact that each economic plan entails spatial effects and vice versa, Malisz, 1966. Moreover, economic plans do contain definite spatial contents, as well as spatial plans do encompass economic problems. Although such interdependences occur on both national and local levels, they are especially pronounced in regional planning, which has therefore generally become a bridge between economic and spatial planning. The interdependences cannot, however, make disappear essential differences in the subject and method of both these planning forms. One of the basic motives for integration of regional spatial and economic planning is the wish of reshaping resource allocation, i.e. introducing resource reallocation among various population regions and sectors of activities, see Integration..., 1975. This means that the basic thread of unity of regional spatial and economic planning appears in their allocative character. Economic planning in its allocative function considers division of investments among various activities and their location. Spatial planning, as allocative, considers population "assignment" to regions and land use allocation for settlement and economic purposes. Hence, overlaps appear, which, if uncoordinated, weaken the effectiveness and realism of regional planning in both its aspects.

There exists a multitude of forms for integrating economic and spatial planning. In particular, this integration may be performed through: goals, concepts, methods, organisations and systems, see Integration..., 1975. Goals of economic and spatial development provide a framework, within which integration can be reached. This happens during the assumptions, formulation, allowance being made for various ways of attaining predefined goals. On the other hand, regional development concepts may provide a basis for integration of some contents of spatial and economic planning. Thus, concepts formulated within one form of planning find their counterparts

or ever may be useful within the other. Common method considered may be, for instance, a long-term country-wide development plan. This plan, constituting an element of the regional economic development and spatial organisation policy, provides simultaneously an integrative link for regional spatial and economic planning. Effective functioning of this tool may only be ensured when mutual influence is exerted between regional policy and analysis. Integration through organisation may imply institutional connection of economic and spatial planners on a regional level, with the task of preparing a common, "integrated" plan solution. A logical deployment of planning integration through organisation is its inclusion into the multilevel planning system. Thus, regional planning gets "ascribed" to the multilevel economic and spatial planning system.

Out of the integration forms mentioned the most difficult, or even controversial are those based upon methods, organisations and systems (such conclusion is corroborated by practical experience). Integration through methods occurs rarely, because economic and spatial regional planners autonomously fulfill their functions, showing off their methodological distinction. Similarly, a long or medium-term central plan may constitute merely a formal integration instrument. In Polish conditions, for instance, most controversial is the institutional integration of regional planning and institutional integration of multilevel planning system, resulting directly from the order-and-allocate system of governing. The mere institutional structures cannot ensure effective planning integration, until deep-rooted differences, or even conflicts, are not overcome.

Hence, integration of planning has its definite costs, and, in given conditions, a maximum reach, beyond which it may not be possible or senseful to attempt.

An alternative to integration of planning on regional level is regional integral planning. This alternative is akin to the "system of planning or systemic planning" one. To-date experience shows that solely an integral /holistic/ planning

approach could be effective. However, social sciences are yet not prepared to provide such an approach with adequate tools, see Klaassen, 1977. For Polish condition two most mature concepts of integral planning come to the forefront. First one proposes a regional plan which would be a unification of the economic development programme and the spatial setting design. These two would not constitute autonomous parts of the regional plan, but contrarily, their correlation would lead to mutual dependence so that goals of development and settlement location conditions get mutually adjusted, see Zawadzki, 1969. The second concept introduces integral planning through perception of a region as the regional planning subject and the basis for its method. Regional integral planning would integrate economic and spatial matters through its complex features, while regional plan is made up with three interlocked complexes: functional, settlement and complementarily infrastructure, see Kołodziejcki, 1971.

The above indicates that concepts of integral planning on regional level are distinctly differentiated into process and model-oriented. Moreover, there has recently been little progress in this direction, although various schools of regional planning have been proposing integral-like planning approaches. The progress in this domain is crucial insofar as it conditions the adequate shape of regional planning.

3. Regional plan as a holistic solution to regional development problem /a hypothesis/

The hypothesis mentioned in the section's headline will now be formulated as based upon the idea of regional integral planning. Further on the settlement centres shall be treated as basic elements of a region considered. Each centre contains certain economic agents or activities. Hence, regional development would be a multi-centre /polycentric/ one, with activities located in centres determining the nature of development in social and economic terms. Economic producing agents, whose activity uses definite production means, ensure certain growth-related effects /employment, income/ to regional population. Servicing economic agents, using social

infrastructure, ensure certain sociale effects within service and utility domain.

These activities or economic agents are subject to correlated concentration or dispersion in the centres of a region. As it has been demonstrated /Klaassen, 1974/ producing and servicing agents are linked, within a region, via a feedback connection. The essence of the feedback mechanism consists in population and authority income generation by producing agents through wages and taxes, which give rise to service demand. When this demand is met with adequate service supply capacity, infrastructural conditions may exist for further growth on the production side. This mechanism is not only quantitative, but also qualitative in nature, since mutual influences of production and service depend not only on volume, but on kind as well. Diversification process broadens both capital inputs supply and market volume, thereby increasing attractiveness of centres for producing and servicing agents.

The mechanism outlined is valid for such a governing system in which autonomously operating agents choose themselves investment capital sources and are directed by an identified market volume. The effect of this mechanism is the agglomerative trend of both population and activities. Regions, however, can be encountered, in which a reversal of this trend can be awaited or would be welcome. A by-product of the production-service positive feedback is, appearing sooner or later, overexploitation of natural and cultural environment of regions exhausting their growth capacities and multiplying increasingly complex development problems. Ultimately, symptoms appear of violation of norms and values which enter the synthetic category of life quality.

It is therefore of primary importance to be able to control agglomeration/deglomeration trends, so that their internal economic mechanism is complemented with appropriate planning and regulatory means, in order to achieve appropriate economic and social effects. Integral production and service planning mechanism correlated with the production/service feedback loop can be treated as the one which would allow determination of holistic solutions to the regional development problem.

Integral planning mechanism results from the concept of regional plan as a holistic solution to regional development problem. The plan concept is founded upon certain assumptions as to the essence of the development problem. First, it is assumed that prior to formulating the development problem a regional authority identifies goals or programs of producing and service agents according to their location. These goals are then analysed and evaluated from the point of view of regional culture value system. This value system is reflected in a - positively conceived - current of so called regionalism. Regionalism as cultivation and continual enrichment of regionally specific value system is a major factor in polycentric integration of regional productive and service activities. After the evaluation of particular goals and programs from the regional value system point of view had been performed, the development problem could be formulated, consisting primarily in the choice of goals /program optimisation/.

Regional selection of goals of individual agents is influenced by conditions within the centres. These conditions should therefore be identified and made explicit for each of the regional centres. Integral regional planning would refer, in terms of these conditions, to such groups of production agents whose output is determined by regional capital supply, and to such groups of servicing agents, whose output is determined by regional market. In other words, the activities considered would be basic for the region.

Regional conditions whose specification allows performing selection of goals /development programs/ of producing agents are determined by such primary regional factors as: land, water, raw materials, fuels, energy. In an increasing degree one should, though, consider as well intermediate products subject to intersectoral exchange. Flows of the conditioning factors and their accessibility depend upon regional infrastructure, i.e. supply systems such as water supply, transportation, power, telecommunication etc. Conjoint consideration of all these conditions is the subject of diagnoses and forecasting of the technical and resource situation of the region.

The diagnoses and forecasts of regional technical and resource situation should be verified according to regional standards, before they are used in the selection of production- and service-oriented projects. Among these standards there are environmental and life condition ones, as well as those referring to working conditions for various regional professional groups. All these types of standards are a more precise elicitation of requirements resulting from the value system. They serve for evaluation of regional situation, and also constitute the second major factor in polycentric integration of regional productive and service activities. Differentiated conditions within individual centres influence decisively when activity requirements are equal - the attractiveness level of centres for productive and service agents.

Hence, the regional development problem, seen against the background of:

- goals /programs/ of productive and service agents, evaluated from the viewpoint of regional value system,
 - conditions /factors/ in the centres, evaluated from the viewpoint of regional system of standards,
- comes out as the question of project selection on the basis of situation in individual centres. Ultimately, a system of development projects and a system of growth centres are determined. System of development projects constitutes a regional strategy of growth, while system of growth centres constitutes a structure of regional growth.

These two systems in their desirable configuration make up the regional plan. Use of the regional value system as a set of criteria determines optimal nature of the thus conceived growth strategy, while application of regional standards ensures a framework for internal consistency of the structure of growth. Hence, systems of development projects and systems of growth centres constitute consistent sets and complexes, being optimal models of regional integration.

4. Regional planning as a holistic solution determination for the regional development problem /a hypothesis/

Regional plan as a holistic solution to regional development problem, i.e. a system of projects /growth strategy/ and a system of centres /growth structure/ results from an adequate formula and a procedure of regional planning. It is postulated that the regional planning formula encompass two basic groups of functions, namely:

- identification of goals /programs/ of producing and servicing agents, and of conditions offered by regional centres,
- optimisation /selection/ of goals /programs/ of agents under conditions fulfilled by individual centres.

These functions should be performed with integrating analytical procedures. Within the identification function it is the regional value system that shall serve to set up the verifying-integrating procedure for goals /programs/, which would select programs and carry out an initial regional evaluation. Similarly, within this function, the regional system of standards shall serve to set up analogous procedure for conditions in the centres, and thereafter shall constitute a basis for selection of programs under conditions in the centres.

Thus a consistent system of programs and centres is formed according to regional value and standard systems. Hopefully, within this framework, equitarian and efficiency criteria shall be integrated.

Values, norms and functions /Katz and Kahn, 1979/ should be regarded as three components of stable integration of economic agents and regional centres. Thereby hierarchical integration method is created, in which regional values are projected against goals of economic agents and regional standards are projected against conditions in centres, so that regional specialisation pattern and functional interdependence of agents and centres are determined. The resulting functional complex structure, a holistic solution to the regional development problem, enables improvement of social

utility of both economic agents and regional centres.

Within the optimisation function a three-step procedure is carried out with regard to economic agents and their goals /programs/. First, on the level of values regional economico-spatial and socio-spatial optimum is defined. This optimum of economic growth and social development shall serve as a consistency yardstick for ordering goals /programs/ of economic agents. In terms of internal links and external economies this means that the search for regional optimum according to the above yardstick shall ensure better cost/benefit relations for economic agents as well.

Secondly, on the level of the system of standards instruments evaluating capital supply for producing agents and regional demand for servicing agents are developed. Besides that instruments of influence should be determined as well for the domains of technical-and-resource and social-and-market situations in regional centres. These instruments should be internally consistent, i.e. should ensure simultaneous achievement of agents' programs and of regional optimum.

Thus defined sequence of undertakings, i.e. regionally optimal and instrumentally consistent, forms so called development strategy. This sequence consists of projects /or programs/ ordered compactly in space and time, i.e. consecutively and contiguously.

Development strategy ensures attainment of the potentially highest level of operational efficiency of economic agents in given centres. It is a cooperative strategy for agents and centres, providing a holistic solution to the regional development problem under given conditions of activity.

The use of consistency, compactness and convergence criteria /Erbes, 1966/ means in fact application of the autonomous integration method to economic agents located in regional centres.

The hypothetical outline of the regional planning process suggests a type of problem-oriented planning, which:

- when emphasis in it is placed upon goals and objectives - can be classified as innovative,

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