Theories and Models of Functional Zoning in Urban Space

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Abstract

The city is an "organism" that converts raw materials, energy and information, reacts and changes through self-organization and especially through anthropic-conscious organization. The "urban" character of the space therefore implies clear attributes, with obvious effects on its organization: low density, adequate technical and construction equipment, differentiation of functional areas corresponding to the multitude of functions accumulated over time, etc. The characteristics of the urban space itself change: the density of population and constructions increases, the density of investments per unit area increases considerably, a true "market" of labor is formed, in which demand and supply determine a certain professional, but also social mobility; over time, there is even a certain segregation of habitat (by social class or ethnic origin), activities and jobs.

The urban zoning with a functional character is an action destined for the urban remodeling, by delimiting the functional areas within the urban space and constitutes a major requirement of the contemporary urbanism. The objective of this article is to present the recent theories and models of delimitation of functional areas in the urban space that allow the identification of functional mechanisms for establishing the functional areas, taking into account, as far as possible, the dominant activity of the territory.

Keywords: *urban space, functional zoning, models, theories*

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1. Introduction

The city is an "organism" that converts raw materials, energy and information, reacts and changes through self-organization and especially through anthropic-conscious organization (Alpopi, C. et al, 2018). It is a special geographical space, made up of elements of different natures (ecological, demographic, technological, architectural, etc.), between which relationships are established, explicit in the flows that transfer people, products, materials, etc. and

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entering into “dialogue” with its environment, it exchanges with it (Burlacu, S. et al., 2018).

Through its economic, social and territorial development it directly influences the neighboring spaces; it changes the behavior of the rural space, it leads to the dissolution of the traditional space and it uniforms the behaviors; modifies the specificity of the agricultural space through urban agri-food consumption; determines trends of relocation of urban activities in peri-urban or rural areas (Bodislav, A. et al, 2019).

The characteristics of the urban space itself change: the density of population and constructions increases, the density of investments per unit area increases considerably, a true "market" of labor is formed, in which demand and supply determine a certain professional, but also social mobility (Angheluta, S. P. et al, 2019); over time, there is even a certain segregation of habitat (by social class or ethnic origin), activities and jobs (Negescu Oancea, M.D. et al., 2019)..

The "urban" character of the space therefore implies clear attributes, with obvious effects on its organization: low density, adequate technical and construction equipment, differentiation of functional areas corresponding to the multitude of functions accumulated over time, etc. (Bran, F. et al., 2018, 2019).

The tendency of organizing the urban space began to become more pronounced at the end of the 19th and the beginning of the 20th century, when, by the strong development of the industry and the unprecedented polarization of the workforce, the residential and the economic areas are becoming more evident (Dima, C. et al, 2020). The organization and arrangement of these spaces starts from the need to adapt them to the problems raised by the industrial and economic growth in general (Jianu, I. et al., 2019). The necessity of organizing the urban space derives from the imbalance between the support space and the economic-social functions, the objective of the organization consisting in the implantation of a new function in a given space, the design in space of this function (Burlacu, S.; Alpopi, C.; Popescu, M. L. 2018). J. Labasse speaks of a double action of the authorities responsible for organizing urban space: organizing and arranging urban space and stopping its expansion to two levels: industrial decentralization and the reclamation of agricultural land.

The first models of organization date from the interwar period and generalize some morphological features of the cities (Rădulescu, C.V. et al., 2018). They can be grouped into several categories, of which three are of greater importance:

- descriptive (morphological) models - which retain the main elements of the internal structure of the cities;
- explanatory models - which, in order to explain the structuring of urban space, uses quantitative methods;
- futuristic models - trying to design for the future certain models of urban space development, models based on ecological concepts.

2. The state of knowledge

Recent studies confirm the theory that functional zoning delimits areas within a city / village in accordance with regulations issued by the local authority and establishes a set of regulations to decide the type of urban function for each of them. Also, it is considered that the zoning includes general details regarding the location, size and shape of buildings, level of coverage (RAP – ratio of floor area) and intensity of land use (SC – Site coverage%) expressed by density indicators.(Babe & Babe, 2015)

In the studies on flexibility and subjectivity in defining urban boundaries, indicators are frequently used to measure the urban green function. These, such as the average green area per capita and a total percentage of green area, may reflect the real efficiency of services for citizens. The authors use the accessibility of the landscape as an element that can use an urban ecological service or operation. They believe that measurement can only be an index that is commonly used to operate urban green areas (and some services), but can also be used to assess the impact on landscape change and environmental capacity of living. urban (Kongjian, Y., Tiewu, D., & Dihua, L., 1999).

Some researchers believe that the principle of functional zoning for the allocation of residential, business and industrial areas should be rejected. Instead, a mixed-use area could be emphasized (Vorontsova, Vorontsova, & Salimgareev, 2016).

Some researchers use functional zoning theory to empirically examine the role of land prices in the decision to allocate free land and for other zoning classifications based on the value differential that may exist. Thus, in order to estimate the land prices needed to calculate the differential of land prices, land prices are estimated by recognizing the endogenous nature of the zoning decision. If land prices are used to determine the classification of land use areas into plots, the researchers believe that selection bias should be present in estimating land price equations and thus the coefficient on the selection variable provides evidence of the zoning authority's impact. It is concluded that within a competitive market system, the expected price of a use in a plot area should be higher than the expected price, if it is not zoned for use and a positive coefficient on the selection variable would be expected if the zoning is determined in a competitive market. Research results thus confirm the impact of zoning on land prices (Munneke, 2005).

Some researchers believe that the strategy for the development of the city should be based on increasing the efficiency of local businesses and increasing the competitiveness of their products by attracting competent administrative staff, encouraging the intense development of entrepreneurship, better relationships with the stakeholders based on a code of corporate social responsibility (Cristache et. al, 2019), strengthening the education sector and creating a favorable investment climate, all contributing to the growth and efficiency in the public administration (Rakhmetova, R., et al. 2018).

3. Models, methods and theories used in town analysis

According to Haggett's definition, the model is a schematic representation of reality, developed for the purpose of demonstration. According to this definition, the model is a simplification of reality and an abstraction of it, a construction that allows the Hellenic times to disprove certain phenomena, processes, etc.

Modeling is a research method through which numerous operations are mediated, such as: planning, forecasting, scientific management, being a means of perfecting the initial model.

The main moments of the modeling process are:

- simulation, which represents the process of applying the model to a real situation, in order to validate it;
- calibration, which represents an approximation of reality by changing the value of the parameters;
- residues, which represent certain gaps, distances from reality, which could not be explained by the model.

Material models generally allow a visualization of reality through universally accepted conventional means. In this sense, the map can be appreciated as one of the most used models in geography.

The models can be of several types:

A	Ideal (theoretical)	A presentation or a logical-mathematical construction
	Materials	Moquette
B	Similar	It is of the same nature as the original systems
	Analogical	It is of a different nature from the original systems characterized by mathematical equations, but in the same form as the original system

Specialized literature abounds with models and theories that can be used in the functional delimitation of urban space. A summary of them is shown in the following:

A. Geography-specific theories and models

Central Place Theory (FTA) is based on consumer behavior, namely that it will tend to frequent the place closest to its place of departure (usually home or work place), initially developed by geographer Christaller, in 1933, and perfected by the economist Losh, in 1940.

However, the behavior of the modern consumer is different from that of inter-war Germany, when this theory was based. The changes are related to higher selectivity, increased mobility, giving a greater weight to the price of the product than to its transport. The essential change of the present era is the grouping of the points of sale, as a result of these behavioral changes. This theory can be applied in

its older form, as well as with the changes imposed by modern society, in order to achieve the degree of dependence of the cities located in the middle part of the urban hierarchy, but also to see what place these units occupy in relation to nearby rural units.

Localization models (MLAs) are recent constructions that make central place theory operational (Gosh, Ruhton, 1987). MLAs are conceptually grounded by Weber's theory, which builds a localization model based on the principle of existence of markets (m) in a finite number of points in the territory

The general formula proposed by Weber is: min T = Sum(m)Sum(g/)tg x qgm x dms

where:

T - the total cost of transporting inputs and outputs;

g - inputs and outputs;

t - the unit price;

q - the quantity carried;

d - traveled distance;

s - optimal location of the activity.

The MLA determines the optimal location of the markets, respectively, of the shopping centers as well as of the affected areas and can be applied to see to what extent the small cities have the optimal facilities for the surrounding rural area, if we look at them as markets (according to the theory) and only as urban settlements of a certain size.

The gravitational model correlates the interaction between the attractiveness of the centers and the length of the roads between them. It is an analogical model supported by the observation that between the flow of exchanges between two localities, their size and the distance between them there are quantifiable relations, of direct or inverse proportionality.

This model serves to determine the areas of influence and is made using the Reily-Converse formula, which indicates the relationship between the distance between two cities and their critical mass (population).

Due to the easy calculations and the accessibility of obtaining the necessary data, as well as the ease of graphical representation, this formula is frequently used to determine the areas of theoretical influence of cities, regardless of their size.

The hierarchical organization, also known as the "rank-waist law", argues that the distribution of settlements in a region can be known using mathematical rules and functions. The most common use is to hierarchically sort the centers of an area, by population, and to see the place they occupy in that hierarchy.

B. Theories from other sciences

The theory of the economic base explains the growth or decline of a city within a region, by the size and nature of the basic activities. According to these theories, local economies are subdivided into two sectors:

a) basic activities or export base, which include industries for which the demand is outside the localization area.

b) secondary activities or local industries, which satisfy the demand of the resident population in the localization area.

The changes (increases / decreases) caused by the changes of the external consumption over the region are evaluated using the ratio of the basic activity / secondary activities.:

Methods of city analysis

Research method is a system of rules or principles of knowledge and transformation of objective reality. Method in science arises by converting fields of theoretical, declarative instructions on how to properly approach an object to hold him authentic knowledge.

There are a number of methods by which cities can be approached both individually and as a whole, grouped into several categories, analytical or graphical.

Analytical methods

The analytical methods for the analysis of cities represent a set of quantitative / qualitative research techniques of some territorial entities, phenomena or processes, which consist in identifying and objectively and systematically describing them in order to adopt scientific conclusions regarding the functional relations, evolution and trends. possible. Generally, these methods are based on identifying and selecting a number of indicators relevant to each problem and analyzing them in relation to certain reference values or comparing the values for the different elements of the system. These reference values can be national or regional averages (by development regions, counties, etc.) or they may be average values resulting from the analysis of the whole (subsystem of MICI cities).

The indicators used in analytical research come from several fields (geography or other social or economic sciences). The most commonly used are those referring to demographic aspects (birth rates, mortality, fertility, natural or migratory balance, population aging index, activity rate, population structures, etc.), but also related to urban geography (middle range). influence of an urban center, degree of accessibility) or other aspects (rurality index, Hull score, concentration index, factorial analysis, discriminant analysis). They have either real values or standardized values depending on how they are combined and the requirements of the formulas applied.

Graphic methods

The analysis of cities also requires an adequate graphical representation of them. The main methods of representation can be divided into two categories:

- the first, which aims at a more or less realistic transposition of settlements in the context of the geographical features of a territory (maps);
- the second, which aims to identify certain mathematical or hierarchical relationships between the subsystem elements (diagrams, charts, etc.).

In the planning of the urban space, in the current practice of "modeling" the future urban spaces, the structure map is frequently called - which describes more generalized urban processes and phenomena. In order to represent the interdependencies between the main functions of an urban center, for example, a map is used that captures the obligatory relations of spatial proximity.

Moreover, the structural cartograms open and allow the background analysis of the urban system; it signals the causal dependencies and the relations of different types, facilitates the modeling of the transport and circulation flows; is a useful tool for visualizing more abstract processes.

Geographic Information Systems (GIS)

GIS represents a set of spatial data from different origins, stored on a computer medium and structured in order to obtain useful syntheses in the process of scientific knowledge and political decision-making. The large-scale use of GIS is recent, with the new decade being practically the time that marks the spread of computer-assisted mapping processes (through specialized programs, such as, for example, ArcView or Arclnfo that allow, having databases and vectorized maps behind. , making the mapping in an extremely short time, and with a much greater accuracy than the classical mapping).

4. Conclusions

In the case of future development, an important place is held by the scenarios, considering the multiple possibilities and the bifurcation points that appear in the dynamics of the systems. But besides the sophisticated technique that requires the elaboration of scenarios, the material and time effort, the limited importance that they can have, due to the changes that occur in the initial conditions placed at the base of the simulation models, could be taken into account.

The analysis can be used for a wide range of problems, but the broadest spectrum is the development of alternative strategies for future evolutions of the territorial system or the enterprise. The purpose is to take advantage of the valences offered by the favorable elements and to eliminate them or to mitigate the influence of the restrictive ones, considered as weaknesses.

The driving factors of development, which are considered to be essential in the evolution of the city, will be identified, ranked in relation to the potential

impact they have and then selected as being of the highest importance for achieving greater efficiency. Future development alternatives take into account the role of these factors in all the key factors identified by the analysis. Ideally, the simulations are based on a small number of factors, but reality always leads to a higher number, which makes it difficult to even identify the bifurcation points and possible trajectories.

In the process of analyzing each of the factors considered important in the future development of a city, it is used to establish a hierarchy regarding their positive and negative importance for the future evolution. At the same time, the analysis of these factors is made in relation to the major objective to be achieved, but also to intermediate objectives located on the evolution path. In this way the landmarks can be fixed on time horizons, but also possibilities to stimulate or block factors for the same periods. Obviously, numerous qualitative and less quantitative elements are involved in the whole analysis, which is why the subjective factor has high chances of disturbing a realistic analysis. For this reason, the group of experts analyzing the state and the possibilities of development of a territorial system must be as objective as possible, to ignore the individual preferences and to approach the whole problem, based on a thorough knowledge of the reality.

For geographers, less familiar with this method of analysis, such an approach is extremely useful, highlighting the very detailed information they possess in relation to urban structure and dynamics.

The general objectives remain to maximize the assets, mitigate or even eliminate the weak points, to detect and intuit even the opportunities offered by the external environment, to reduce the risks.

Prudence could be the basic feature of the analysis, because it is possible that elements that seem to be trumps at the same time become weak points and vice versa. While not every opportunity must mean a change of strategy, but only after a clear assessment of its duration and potential effects, since some opportunities may be false and subsequently induce catastrophic errors in development. At the same time, all the risks must be considered, but at the same time the responsibility of some decisions must be taken, in relation to the beneficial effects and the possibility of coping with the emergence of risks of certain types.

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