

LEVELS OF THE SPATIAL ORGANIZATION OF TRANSPORT SYSTEMS

УРОВНИ ПРОСТРАНСТВЕННОЙ ОРГАНИЗАЦИИ ТРАНСПОРТНЫХ СИСТЕМ

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У статті розглянуті різні рівні просторової побудови транспортних систем та методичні підходи до визначення та розвитку саме тих конфігурацій, які є найбільш привабливими в економічному, соціальному, інформаційному, інноваційному та комунікаційному аспектах.

Problem statement

Development of transport systems and the decision in the field of spatial planning - two elements interdependent and mutually conditioned. Decisions in the field of transport planning influence development of corresponding territories, in turn, territorial conditions immediately influence transport activity - directly, through physical presence of corresponding territories for transport actives, and mediate, through placing and development projects. Communication is comprehensive, having a number of co-operating effects that, is important for understanding of process of the integrated planning so that separate decisions were base of strategic problems formation.

The purpose of given article is definition of levels of the transport systems spatial organization promoting rationalization of their development in system of existing communities on makro - meso- and microlevels.

The analysis of researches and publications

The decision of territorial development problems is reflected in a number of the theoretical researches spent at various times in following directions:

- The theories considering as a basis of development the geographical factor;
- The theories investigating a complex of factors (natural, labour, financial resources, a geographical position);
- The theories defining a role of institutional, economic, transport, social, information, scientific factors in development of separate territories.

Nevertheless, the large quantity of the researches devoted to the spatial organization of economy, insufficiently accurately defines a place of a spatial component in system of economic growth factors. Modern lines of spatial development are rather inconsistent and demand deeper judgement.

Statement of the basic material of research

Existing kind of activity in the given territory or land tenure system define a configuration of a transport network. Thus as the basic the information on goods origin, destination, a route, volumes of transported cargoes and quantity of the passengers moving on this network is important. The steady empirical interrelation between a spatial


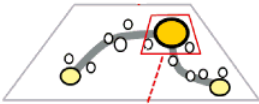

configuration of manufactures and requirement or demand for transport services is obvious.

Historically transport networks in different degree structured space, and the higher mutually conditioned of national economy, the more closely communication with a transport complex - the base and the factor forming this conditioned.

Communication between the transport and spatial organization is expedient for analyzing in three basic measurements - at macrolevel (global aspect), mesolevel (regional) and microlevel (local).

Table 1

Levels of the spatial organization of transport

<i>Levels</i>		<i>Knots</i>	<i>Connection</i>	<i>Interdependence</i>
Makro-		Ports & hubs (sea ports, airports)	Sea & avia routes	Investment, trade and manufacture
Meso-		Cities	Corridors (railway, high speed routes, channels)	City systems of managing and internal territories
Mikro-		Commercial activity	Roads and transit systems	Switching and distribution

Sours: Rodrigue, Comtois, Slack

At macrolevel, thanks to possibility of conducting international trade, transport forms and promotes maintenance of specialization of the certain country, growth of productivity of its economy. Any of transport system perfection though expand the markets and increase possibilities, however carries out it non-uniformly; this non-uniformity is reflected both in the spatial organization and in structure of the international transport system. Globalization promotes growth of commodity streams and interdependence, and telecommunications, sea and air transport thanks to scale of given services serve an overwhelming part of these streams. Character and spatial structure of these streams can be considered from the point of view of two basic approaches:

The center/periphery: this approach assumes that all world space is divided into the central and peripheral countries where for the central the high level of development is characteristic, high technology and convergence of trading streams, they dominate over the peripheral countries that is visually reflected in trade and transport where access to network elements essentially above, than in the peripheral countries that aggravates inequality level between them and promotes dependence of the last at different levels. Transport at such organization is considered as the polarization factor. It is obvious that such organization is favourable only parts of the international community, other is considered as marginal and gets to a complete dependence. However the situation can be changed, if the international cost of transportation towards their reduction is reconsidered.

Example, the Asian countries which have chosen the export-focused strategy of development which assumes open access to global distribution of their cargoes. Thus, even at such rigid scheme of construction, the relation periphery-center can be built rather flexibly.

Poles: at the given approach transport is considered as the factor of convergence of all world economy in which streams of cargoes and passengers are regulated by poles depending on qualitative and quantitative presence of a corresponding infrastructure, ability to distribution and business activity. Thus poles are subject to action both centripetal, and the centrifugal forces promoting concentration of one kinds of activity, and a dispersion of others. The world economy, thus, is based on distribution of cargoes on transport networks - to routes and the knots directing and regulating these streams. The global spatial organization is a priori caused by the central structure - ports and hubs, each of which brings the contribution to movement of people, cargoes and the information streams.

Ports thanks to the arrangement and presence of a corresponding infrastructure provide access to streams of cargoes and passengers, often representing manufactory-information-distribution centers where various types of transport are concentrated.

Hubs - the central points of accumulation, sorting, processing and distribution streams of cargoes in certain territory.

Frequently in region the central points provided with the corresponding infrastructure - terminals of ports and the airports are concentrated some. When they work is co-ordinated, providing multimodal interaction, they can be considered as central system to which the link role in global system of cargoes distribution is assigned. At the same time, they can represent a bottleneck in this system because of certain restrictions in an infrastructure or in management of deliveries chains.

Development of transport systems in space shows more and more amplifying tendency of the development distinct from process of manufactures spatial development. Manufactures tend to a dispersion of the capacities in regions which provide the least level of cumulative costs while the centers on granting of services concentrate in a zone of big cities which can accept subsequently the status of the world centers more and more. These are the centers of financial services (banking, insurance), and the main offices of transnational corporations, and the intermediary centers, thus more and more strengthening a dichotomy of manufacture and rendering services spheres.

Mesolevel is formed by system of cities and areas (regions) in which spatial structure it is possible to designate three key components:

- An arrangement of some specialized branches, such as manufacture or a mining industry which gravitate to resource factors - to raw materials, to labour, commodity markets etc. Frequently it export-oriented manufacture branches thanks to which activity the profitable part of the region budget is formed, being the basic source of its growth and development.

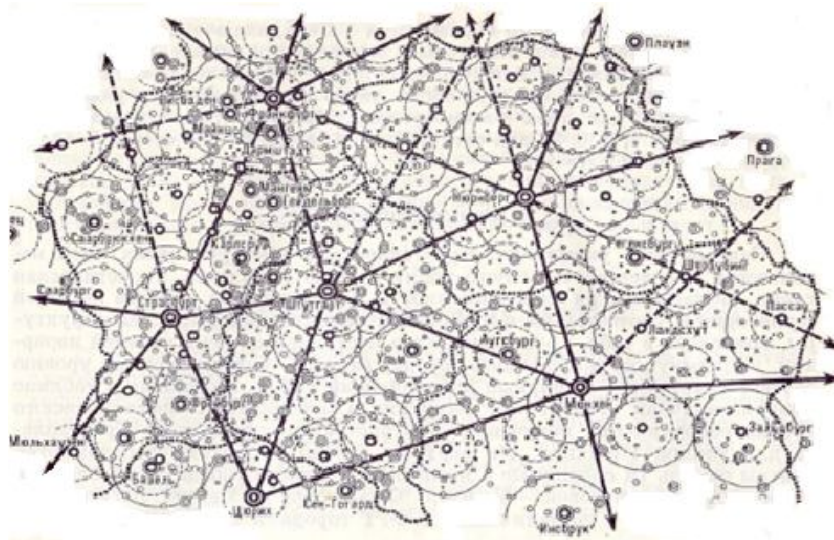
- An arrangement of the organizations of services sphere, including financial, insurance, consulting and other big cities concentrating in a zone for the purpose of the maximum access to a manpower and attraction of potential clients.

- System of transport knots and accompanying communications - highways, the railways, ports and the airports which are the basic economic centers of business activity.

In common, these components define the spatial organization of region, in the majority representing hierarchy of interrelations in which streams of passengers, cargoes and the information are included.

For an interrelation explanation between transport, city systems and regional development enough considerable quantity of concepts and models which are considered by the author in other articles is offered. Among other within the limits of the approach offered in this article, it is necessary to allocate three conceptual categories of the regional spatial organization:

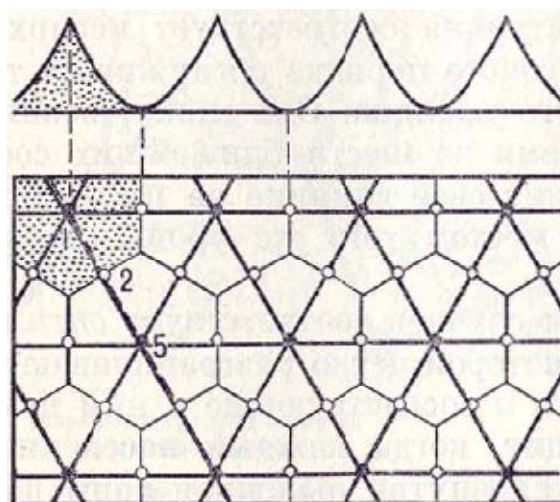
- Models of "the central places» or system of cities which try to explain interrelation between the size, quantity and geographic distribution of cities in region. The set of regional spatial structure variants, including within the limits of the central places theory of Walter Christaller (1933, Bavaria) according to which there is an optimum frame-network structure of settlements which provides access to objects of services sphere, as much as possible fast moving between cities and efficient control territory is investigated.



Drawing1. Southern Germany, placing of cities, towns and villages it is shown taking into account seven levels hierarchical co-ordination (k).

The system of settlements possesses the certain hierarchy, which number of levels in direct ratio to social and economic development of territory. With growth of hierarchy level the settlement gives the increasing set of services to the increasing number of subordinate settlements.

There are also other principles of the organization of territory on model of Christaller where the network of settlements can be modeled in three different ways, expanding and rotating six-coal cells. Then these cells can be grouped in a principle co-ordination to receive numbers of the central places of higher hierarchical rank. The offered scheme (fig. 2) shows the centers of higher order (k=4):



- - The central place
- - Served settlement
- (thin line) - Border of supplementing area
- (thick line) - The highways connecting the central places

Drawing 2. Optimization of transport structure ($k=4$)

The variant at $k = 4$ creates the best conditions for building of transport ways as in this case the greatest number of the central places will be located on one line connecting more big cities that will provide the minimum costs on road building, i.e. the given central place will be on the shortest distance to the two nearest centers of higher level of hierarchy.

Christaller's models are criticized for unreality for the several reasons. First, such geometrically correct construction meets seldom enough as set of historical, political and geographical factors break symmetry and strict hierarchy of distribution; secondly, numerical research of the evolutionary model based on Christaller's ideas, has shown that symmetric distribution is unstable - enough small fluctuations that there were zones with high concentration of activity and have caused outflow of the population and activity reduction in other zones. Besides, these distortions can be and such nature:

- The distortions caused by agglomeration (W. Izarda's updating);
- The distortions caused by localization of resources;
- The distortions caused, the main means of communication

However, despite these comments, making a start from Christaller 's ideas, new theories, their authors - August Lösch, Wilhelm Launhardt, Alfred Weber, Walter Izard, T. Hägerstrand and many other things have been developed.

- Model of "growth poles», offered by the French economist François Perrouxin which economic development represents the structural change caused by growth of new industries in certain territory. Development begins with these poles, and then gradually diffuses in space. This development is non-uniformly distributed within the limits of regional systems as first of all preferences are taken by the central kernel and only then,

being gradually integrated into system of streams, periphery. In this theory transport represents the factor of access which strengthens positions of poles.

As growth poles it is possible to consider not only sets of the enterprises of in the lead branches, but also the concrete territories which are carrying out in national economy or region function of a source of innovations and progress. Theoretical positions about development poles are used in many countries by working out of spatial economic development strategy. Thus ideas of the polarized development differently adapt, so far as concerns economic mastered regions or about new regions of economic development.

In the first case polarization results from modernization and re-structuring of industrial and agrarian regions, creation in them of the advanced (innovative) manufactures together with objects of a modern industrial and social infrastructure. Such approach was applied in France, the Netherlands, Great Britain, Germany and other countries with enough high density of economic activities.

In the second case the most typical poles of growth are industrial knots and especially territorial and production complexes (TMC) which allow to master in a complex natural resources, creating a technological chain of manufactures together with objects of an infrastructure. The basic economic benefit is reached thanks to concentration and agglomeration.

- The transport corridors representing directed streams and the corresponding infrastructure, ensuring functioning of different types of transport; the joints structured along lines as the centers or ports, thus, regulating streams at local, regional and global levels. For example, in all development of high-speed trains systems is carried out along the main transport corridors that strengthens the existing regional spatial organization even more.

Microlevel - the local distribution, considering the spatial organization of transport at city level as the urbanization and transport are two interconnected concepts. Each city needs well provided ability of transportation - as for passengers (to the places of residence, work, shops, for leisure), and for cargoes (delivery of the goods, foodstuff, energy, building materials and export of a waste), thus the largest knots represent zones of the greatest employment which together with appeal zones are the most important elements forming local spatial structure of a city.

More and more increasing dissociation between "sleeping" areas and business centers to the greatest degree occurs because of society motorization. Existence of employment zones far from residential zones has served as the reason of increase in number of cars and durations of trips. Such tendency is especially strong in the advanced industrial countries and their urbanized zones though for today the same tendency is observed and in developing countries.

Attractive zones represent certain places in which the basic part of the population moves for the purpose of acquisition of the goods, reception of professional services, possibility of formation, leisure and other. According to the theory of "the central places», there is a certain hierarchy of services within a city zone, ranging from the central business areas offering a wide spectrum of specialized services, to the small local centers specializing on granting of base services. The role of motorization cannot be underestimated, however, and other factors, including a city social segregation, increase of the earth cost etc. make the impact on the spatial organization of cities. The car represents today the desirable's individual means of transportation, promoting chaotic growth and the space organization between city zones (residential, industrial,

commercial). Transport brings the contribution to the organization of city zones, but thus at construction of networks, it is necessary to consider city morphology to provide them complementary and mutually condition.

Conclusions

Creation of modern transport system is one of determinatives of modern placing of industrial production, beginning from the separate enterprise and finishing a large industrial-territorial complex. Experience of the comparative analysis of transport development levels and economy of our country specifies in almost chronic backlog of transport from its requirements. It is obvious that the best economic results the state reaches in that case when optimum proportionality of transport development and all other branches of economy is observed, thus the balance concerns both a network routing, and to them carrying capacity. At overflow of transport capacity the state sustains losses from the maintenance of not used vehicles and an overabundance of a labour. At insufficient development of transport manufacture and goods turnover with all negative consequences of this phenomenon restrains.

In the developed countries creation of various objects of transport communications always made a state prerogative. Within many decades the problem of placing of the industry was considered mainly depending on a cost of transportation on transportation of raw materials, goods and products. Thus, such factors as presence and qualification of labour, salary level, non-manufacturing infrastructure, etc. However first of all transport costs were considered. In process of improvement of communication facilities, and also development of manufacture, regularity of the industry placing all less depend on an arrangement fuel and raw-material bases. The general tendency of modern placing of the industry at which defining factors are presence of transport communications of the corresponding level, the qualified labour, commodity markets however prevails. Manufacture and transport unite in such industrial-transport system in which frameworks they co-operate as separate subsystems. Thus change not only criterion functions of both subsystems, but also criteria and indicators of their work. On the foreground the problem of minimization of losses acts at their interaction.

It is important to underline that in this case transport is considered as an active element of interaction at which it not only will organize transportations with the account of changing requirements of manufacture, but also manufacture actively orders communications and forms the programs of development, proceeding from possibilities and requirements of transport. Transport function in such interaction consists not only in full maintenance of requirements of manufacture in transportations, but also in qualitative and timely transport service of suppliers and consumers with fluctuating rhythms of work, i.e. taking into account constantly changing conditions of market economy.

References

1. Гаврилов А.И. Региональная экономика и управление: Учеб. пособие для вузов.— М.: ЮНИТИ-ДАНА, 2002. — 239 с.;
2. Jean-Paul Rodrigue, Claude Comtois and Brian Slack The Geography of Transport Systems, Hofstra University, (2009), New York: Routledge, 352 p.;
3. Reza Banai. Evaluation of land use-transportation systems with the Analytic Network Process, University of Memphis – The Journal of transport and land use, Volume 3, № 1 [Spring 2010] pp. 85–112;

4. Button. K.J. and Keeler. T. (1993) The regulation of transport markets, *Economic Journal*, 103: 1017-28;

5. Berliant. M. 2005. Well isn't that spatial?! *Handbook of Regional and Urban Economics: A view from economic theory*. Forthcoming in the *Journal of Economic Geography*;

6. Christaller. W. 1933. *Die Zentralen Orte in Süddeutschland*. Jena: Fischer. Translated by C.W. Baskin. 1966. *Central Places in Southern Germany*. Englewood Cliffs: Prentice-Hall;

7. Fujita. M., Krugman. P. and Mori. T. 1999. On the evolution of hierarchical urban systems. *European Economic Review* 43, 209-251.

Аннотація

Развитие транспортных систем и решения в области пространственного планирования – два элемента взаимосвязанных и взаимообусловленных. Решения в области транспортного планирования влияют на развитие соответствующих территорий, в свою очередь, территориальные условия непосредственно воздействуют на транспортную деятельность - напрямую, через физическое наличие соответствующих территорий для транспортных активов, и опосредованно, через размещение и проекты развития. Связь комплексная, имеющая ряд взаимодействующих эффектов, что, важно для понимания процесса интегрированного планирования таким образом, чтобы отдельные решения являлись базой формирования стратегических задач.

Решение проблем территориального развития отражено в ряде теоретических исследований, проводившихся в разное время, тем не менее, огромное количество исследований, посвященных пространственной организации экономики, недостаточно четко определяет место пространственной составляющей в системе факторов экономического роста. Современные тенденции пространственного развития весьма противоречивы и требуют более глубокого осмысления.

Исторически транспортные сети в разной степени структурировали пространство, и чем выше взаимообусловленность экономики страны, тем теснее связь с транспортным комплексом - фундаментом и фактором, формирующим эту взаимообусловленность.

На макроуровне, благодаря возможности ведения международной торговли, транспорт формирует и способствует поддержанию специализации определенной страны, росту производительности ее экономики. Любые совершенствования транспортной системы хотя и расширяют рынки и увеличивают возможности, однако осуществляют это неравномерно, эта неравномерность отражается и в пространственной организации и в структуре международной транспортной системы. Глобализация способствует росту товарных потоков и взаимозависимости, а телекоммуникации, морской и воздушный транспорт благодаря масштабности предоставляемых услуг обслуживают подавляющую часть этих потоков. В работе предложены два основных подхода, которые помогают рассмотреть характер и пространственную структуру этих потоков.

Мезо- и микроуровни подразумевают рассмотрение пространственной организации транспорта в плоскости региона и города, поскольку урбанизация и транспорт являются двумя взаимосвязанными концепциями.

Создание современной транспортной системы является одним из решающих факторов размещения промышленного производства, начиная от отдельного предприятия и кончая крупным производственно-территориальным комплексом. Опыт сопоставительного анализа уровней развития транспорта и экономики нашей страны указывает на почти хроническое отставание транспорта от ее потребностей.

Очевидно, что лучших экономических результатов государство достигает в том случае, когда соблюдается оптимальная пропорциональность развития транспорта и всех остальных отраслей экономики, при этом баланса относится как к начертанию сети, т. е. к географическому размещению транспортных коммуникаций, так и к их провозной способности. При излишне избыточной мощности транспорта государство несет потери от содержания неиспользуемых транспортных средств и его трудовых ресурсов.

В развитых странах создание различных объектов транспортных коммуникаций всегда составляло прерогативу государства. В течение многих десятилетий проблема размещения промышленности рассматривалась главным образом в зависимости от транспортных расходов на перевозку сырья, материалов и изделий. При этом, учитывались и такие факторы, как наличие и квалификация рабочей силы, уровень заработной платы, внепроизводственная инфраструктура и др. Однако в первую очередь учитывались транспортные издержки. По мере усовершенствования транспортных средств связи, а также развития производства, закономерности размещения промышленности все менее зависят от расположения топливных и сырьевых баз, превалирует общая тенденция современного размещения промышленности, при которой определяющими факторами являются наличие транспортных коммуникаций соответствующего уровня, квалифицированные трудовые ресурсы, рынки сбыта. Производство и транспорт объединяются в такую производственно-транспортную систему, в рамках которой они взаимодействуют в качестве отдельных подсистем. При этом меняются не только целевые функции обеих подсистем, но и критерии и показатели их работы. На первый план выступает задача минимизации потерь при их взаимодействии.

Важно подчеркнуть, что в этом случае транспорт рассматривается как активный элемент взаимодействия, при котором он не только организует перевозки с учётом изменяющихся потребностей производства, но и само производство активно упорядочивает связи и формирует свои программы развития, исходя из возможностей и потребностей транспорта. Функция транспорта в таком взаимодействии заключается не только в полном обеспечении потребностей производства в перевозках, но и в качественном и своевременном транспортном обслуживании поставщиков и потребителей с колеблющимися ритмами работы, т. е. с учетом постоянно изменяющихся, и в перспективе в условиях рыночной экономики часто неопределенных потребностей производства в транспортных услугах.