ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
ECONOMIC STUDIES

Volume 29 (3), 2020

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AREAS AND MEANS OF FORMATION OF TRANSPORT REGIONAL COMPLEXES AND MECHANISMS FOR MANAGING THEIR COMPETITIVENESS IN UKRAINE

The entry of Ukraine into the European Union significantly expands the boundaries of cooperation with different countries of the world. Compliance with the European requirements in the marketing sector will greatly increase the efficiency of its operation in the regions of Ukraine. The method of estimating the development of social infrastructure in the resource support of the management mechanism aimed at increasing the competitiveness of the transport system of the region by the integral indicator, which characterizes the level of social development of the region, is developed in the work. The integral indicator is defined as the sum of the ratios of the current and maximum partial indicators of population security by type of services in the region. The components of the process of social development assessment have been introduced: a limitation on the magnitude of each type of resource used to improve social development indicators; specific expenses of each type of resource in the region in support and improvement of the indicator of social development; the magnitude of the growth of the provision of the region for each indicator of social development; the function of the priorities of social development in the region for each indicator. It is believed that using the results of calculations using the proposed method will increase the validity of relevant management decisions.
JEL: L91; R42; O52

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1. Introduction

The deepening cooperation between Ukraine and the EU is based on the principles of political and economic cooperation. As a result of the Association Agreement between Ukraine and the European Union, an important benchmark is the creation of a legal framework for the free movement of goods and services, as well as the gradual entry of Ukraine's economy into the European Union's common market. Trans-packet networks and services play an important role in the effective life of the country's population.

The growth of the pace of scientific and technological progress leads to a constant complication of the major processes in the transport industry. The study of most scholars shares the view that there is a direct relationship between the levels of development of transport infrastructure and the economy as a whole [1]. As a result, the regional aspect of development and management in the transport sector was clearly distinguished. It has been proved that within the framework of separate regions (districts) infrastructure can and must evolve in different ways [2]. Particularly relevant is the problem of infrastructure development for countries with large territories (in particular, Ukraine), where there are significant differences between regions in natural conditions, socio-economic development, population density, etc.

In this regard, research in the direction of improving the functioning of the transport complex of the region in the conditions of modern Ukraine is of considerable interest and can have wide practical application. Consequently, the further study of production complexes is relevant, and the study of the management process and its operation becomes especially important in practical terms. At the present stage of development of the regional economy in the aspect of increasing their competitiveness transport industry requires a significant increase in the efficiency of production and the scope of services, their intensification [3]. Among the measures aimed at solving these problems, special attention is paid to the creation and management of the transport complex of the region (TKR).

In the process of managing such a complex, the traditional approach is mainly used: a relatively closed system of production or services is provided, the inputs of which are provided with all necessary resources, in order to reach the required level of satisfaction of services in the set time [4]. The effectiveness of the final result under the conditions of TKR operation is mainly ensured by eliminating economic barriers that hinder the balance of capacities of technologically interdependent subdivisions and the coherence of decisions about their activities. At the same time, most of the potential opportunities for TKR to intensify production and service provision remain unused [5].

2. Description of the Model for the Formation of Methods of State Administration in the Transport Region at the Regional Level

Maximizing the efficiency of the transport complex of the region is a multifaceted problem related to solving a complex of economic, legal and production issues [10]. The most significant among them, in our opinion, are:

1) determination of the long-term goal of the transport complex activity;

2) creation of an effective organizational structure for management;
3) to ensure the balance of production capacities of certain sectors of the transport complex in accordance with this purpose;
4) development and implementation of rational development or improvement programs taking into account aspects of increasing the competitiveness of the region;
5) development of a system of economic levers that enable to effectively manage the development and activity of the transport complex in terms of increasing the competitiveness of the region.

First of all, attention is paid to the first two issues and the construction of an effective incentive system, namely the strategic planning of the development and operation of the transport system in the regions, which is usually carried out by traditional methods. All this, in the final analysis, leads to the fact that the management of the transport complex in the regions does not differ from the management of individual industries and industries in the region, which has developed in the conditions of their market functioning. That is why the necessary prerequisite for a significant increase in the efficiency of the transport system in the regions is the development of qualitatively new methods of strategic planning, which ensure balanced development of capacities of individual sectors and units of the transport complex in the regions in terms of increasing competitiveness, implementation and rational programs of their activities by sectors and industries.

The main stages of the process of forming a strategy for the development of a transport complex in reggones in terms of increasing competitiveness are to determine, first, the long-term goal, and secondly, the trajectory of its development in the assumption of the absence of restrictions (such a trajectory will be referred to as a trajectory of poorly developed development) third, the trajectory in the presence of real constraints (it will be called the trajectory of limited development of the transport complex in the regions) (Figure 1).

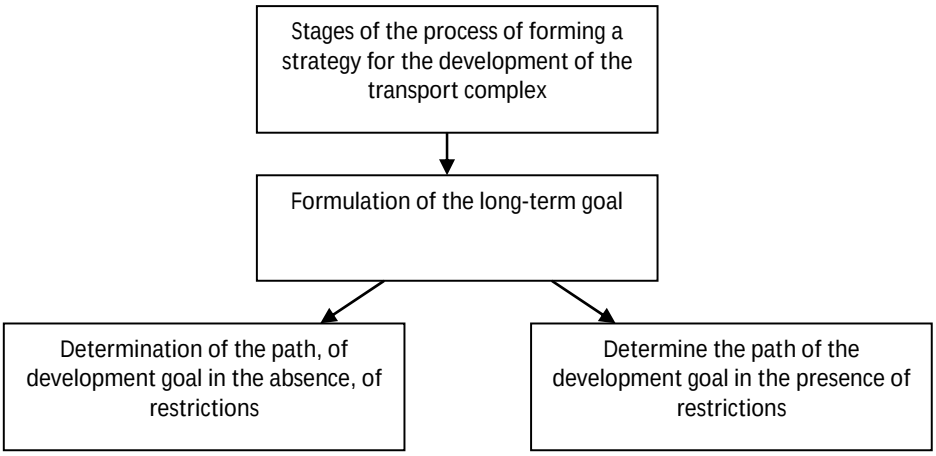
The trajectories of development of the transport complex in the regions imply a set of parameters that reflect the production capacity, the effectiveness of their use, as well as the results of the complex at a given time interval.

Let′ s consider the socio-economic essence and the procedure for building mutually agreed and balanced development trajectories in the aspect of increasing the competitiveness of individual sectors and the transport sector in the regions as a whole.

Trajectories of limited development reflect the achievement of the goal of the transport complex in the regions in different conditions that may arise in the region. In the first case, there are not the restrictions on resources, it is only needed to ensure economically rational duration of the creation (restoration) of technically progressive production capacity in the region. At the same time, it is believed that the efficiency of the use of all resources in the region is at a certain steady level. In the second case, restrictions are imposed on all types of resources, and the effectiveness of their use is determined in such way as to obtain the maximum speed of achieving the goal of the transport system activity in the region.

Figure 1

The main stages of the process of forming a strategy for the development of the transport complex in terms of increasing its competitiveness



The initial task of strategic planning of the development of a transport complex in the regions in the aspect of increasing competitiveness is an analysis of the capabilities of its individual sectors to identify existing and expected "bottlenecks" that may arise in the development of the complex of the region. It is necessary to determine which sectors and when will hinder the accelerated development of the transport complex in the regions in terms of increasing competitiveness. The first step in solving this problem is to identify a trajectory of weakly limited development. On its basis, a trajectory of limited development is constructed, which reflects the real dynamics of key characteristics in terms of increasing the competitiveness of the transport complex in the regions.

The definition of the trajectory of weakly limited development of the transport complex precedes the establishment of the dynamics of its purpose [6,7]. We will assume that the target reflects the level of satisfaction of the needs of the services of the transport complex. In order to reach the goal in theory, the minimum transport term in the regions should be developed along the specified trajectory of the limiting intensity ($P_0P_1P_2P_3P_4$). Such development in the aspect of increasing competitiveness can take place only in exceptional cases, when it is necessary to have the necessary services for the given term and no restrictions on both resources in the region and the effectiveness of their use are not raised.

The trajectory of the weakly limited development of the transport complex ($P_0P_1P_2P_3P_4$), according to the conditions of its construction, can be combined with the trajectory of extremely intensive development ($P_0P_1P_2P_3P_4$) only after a period of time determined by the economically rational duration of introduction (restoration) of production capacities in the region.

In real conditions for the development of the transport complex in the aspect of increasing competitiveness are always allocated limited resources. The timing of the arrival of

resources and the implementation of measures for the development of capacities in the region, for various reasons, deviates from the optimal. Therefore, the trajectory of limited of the transport complex development ($P_0P'_1P'_2P'_3P'_4$) is essentially "lagging" behind the trajectory (P0P1P2P3R4) and, moreover, from ($P_0P_1P_2P_3P_4$).

To move to the accelerated development of the transport complex in aspect of increasing competitiveness, consideration should be given to minimizing the distance between trajectories of weakly limited ($P_0P_1P_2P_3P_4$) and limited development ($P_0P'_1P'_2P'_3P'_4$). To do this, the intermediate trajectories of Mij which are, obtained during the construction of the trajectory ($P_0P_1P_2P_3P_4$) and characterize the development of the transport complex in the next period and after the removal of the restriction j. Their analysis allows to determine the amount of additional resources of specific species, as well as the optimal moment of their introduction in the region for the timely removal of this "bottleneck."

Trajectories of the limited development of the transport complex in terms of increasing competitiveness are combined: the initial state of the transport complex, the ultimate goal of its functioning, the structure of potential "bottlenecks" and the sequence of their occurrence in the purposeful and balanced development of the complex.

Differences between trajectories are manifested because in the first case "bottlenecks" are eliminated by additional input of resources, and with in situation limited development in terms of increasing competitiveness, the time moment and ways to eliminate "bottlenecks" are determined by real resource opportunities in the region.

Detected in the process of constructing a trajectory of weekly limited development in the aspect of increasing competitiveness the sequence of bottlenecks is maintained and with limited development, if the goal of functioning of the transport complex and the efficiency of the use of resources in the region remains unchanged. It should be noted that the change in the efficiency of the use of resources within the limits of the elimination of another "bottleneck" does not affect the subsequent sequencing of the elimination of potential "bottlenecks". Compliance with the above conditions does not cause any particular difficulties and enables to create the necessary information base for constructing a trajectory of limited development in the aspect of increasing competitiveness.

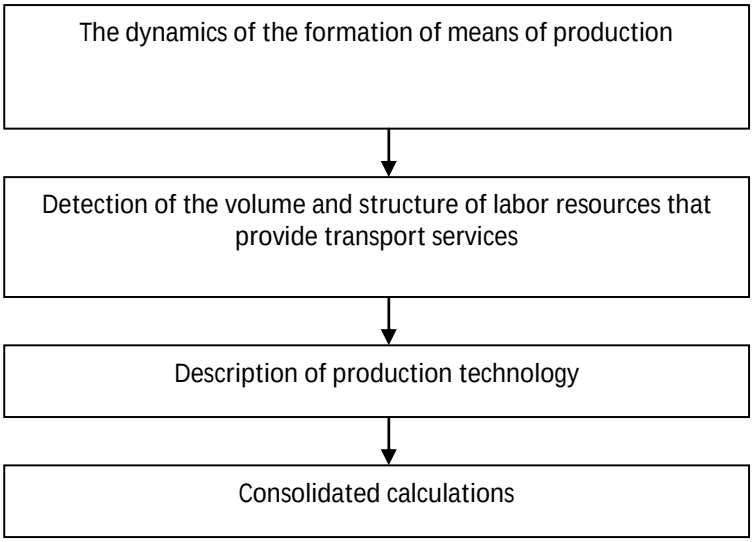
A complex of simulation models can be used to identify the trajectories of the transport complex development [8]. It consists of a block determining the purpose of the transport complex, local simulation models for the development of production capacity of individual sectors and a block of consolidated calculations. The interconnections between local models are determined by the technological sequence of participation of sectors and production units in the process of providing final services in the transport complex. Therefore, the number and structure of the interconnections of local models depends on the peculiarities and scale of the functioning of the transport complex. But in principle, the composition and scheme of the functioning of the whole complex of models and each local model are common to the transport complex of different types and correspond to the basic theoretical position of constructing trajectories of the weakly limited development of the transport complex in terms of increasing competitiveness. Therefore, these provisions can be considered as the only theoretical basis of simulation of transport complex development in the aspect of increasing competitiveness.

The content of the calculations carried out in the block definition of the goal of development and operation of the transport complex, depends to a large extent on the specifics of the services of the transport complex, which are provided to them by the territorial communities of the region. Therefore, universal mathematical apparatus is not suitable here, but at the same time, in accordance with the construction of the transport complex development path in the aspect of increasing competitiveness, it is necessary to take into account the dynamics of changes in the demand for services of the transport complex. In view of this, methods that can reasonably set goals for the long term should be used.

The local simulation model of the infrastructure and resource components of the transport complex consists of the following four blocks: means of production, labor resources, production technology or activities in the area of providing services to the territorial communities of the region and consolidated calculations (Figure 2).

Figure 2

General algorithm of calculations in the local simulation model of the infrastructure and resource components of the transport complex



The first two blocks simulate the dynamics of production potential, which is expressed by the fund of working time, as well as the work of the main occupations. The third block serves to assess the effectiveness (norms) of the use of productive resources in the areas of production activities of sectors and units, the fourth identifies the potential bottlenecks and the sequence of their occurrence in the purposeful development of production capacity of the sector or subdivision, additional need for resources to eliminate bottlenecks "As well as a rational production program for this sector or a transport complex unit in terms of increasing competitiveness.

The algorithm of a local simulation model is constructed in such a way that, with the help of iterative calculation cycles, the dynamics of the key parameters of the simulated unit is detected. It should be noted that in the process of implementing iterative cycles the values of the investigated parameters are determined at the beginning of the forecasting period, then on the basis of the corresponding computational schemes - their value at the end of the year, and thus the necessary information base creates for the implementation of the next cycle of calculations.

Let's consider the most important tasks that are solved by separate blocks of the local simulation model of sector development or production unit of the transport complex in terms of increasing competitiveness.

The Block of "means of production" serves to determine the dynamics of capacity of the main types of vehicles serving the region. In the model, these capacities are expressed by the annual fund of working time, which requires the identification of the dynamics of a number of characteristics of key aspects of the process of reproduction of fixed assets. These include the indicators of the main types of vehicles (taking into account the normative duration of their service and the actual degree of wear), as well as the state of new ones introduced into the work (taking into account the normative duration and the actual stage of introduction) both in the natural and in value form.

The main result of the unit is the annual fund of working time by their individual types.

In the "Labor Resources" section, calculations are conducted to identify the scope and structure of labor resources used in this sector or subdivision of the transport complex. The main performance indicators of the bloc are the annual fund of working time of workers of individual professions and the number of employees at the end of the planned year.

The final result of the transport complex's activity is a set of certain products and services for the regional communities of the region. For the production and production capacities in the sphere of services rendering it is possible to use a different composition of the primary resources, that is, a number of technologies. But it is difficult to fully describe this activity by operating technologies. Therefore, in the block "Production Technologies" they are supplemented by fictitious, through which the production reserves of resources, non-productive losses of working time, materials, products, etc reflect.

The nomenclature of resources used in the description of production technologies includes the main types of machinery and equipment, the professions of workers, the most important types of material resources and energy, as well as financial resources. The results of calculations for this block are expressed by matrices, the elements of which reflect the efficiency of the use of resources.

The "Consolidated Settlements" block serves to identify "bottlenecks" in the production potential of the sectors and units of the transport complex in their purposeful development in terms of increasing competitiveness. In addition, the final results of the transport complex and the additional resource requirements for implementing a rational production program, as well as for further development of the transport complex in terms of increasing competitiveness, are determined here.

The central place in the block is an optimization task. The coefficients of the linear target function in it reflect the level of dissatisfied needs in services provided by sectors or units of the transport complex, and the variables are the intensity of technology use.

The target function is inherent in the following properties: the higher its value, the more effective the set of technologies in terms of achieving the goal; the rational production program is dominated by the types of products and services the need for which is maximal.

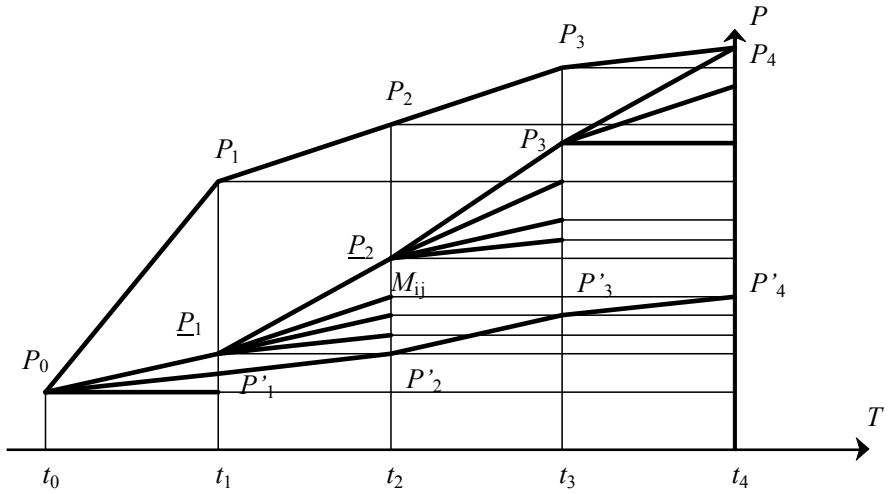
Products and services, for which the level of satisfaction of needs will be closer to the established, will no longer be included in the program. Therefore, compliance with the continuity of production and the provision of services of one kind is not ensured, in connection with which the task additionally introduces upper and lower limits of volume. In addition, it includes restrictions on fixed assets, labor, material and financial resources. In this case, material resources are conventionally divided into two groups: those coming from the environment of the transport complex, and those coming from other sectors or units.

Limits of the first group allow to coordinate the activities of this unit, and thus the transport complex with the "external environment" of the complex. This is supplemented by appropriate managerial decisions.

The peculiarities of using models in the construction of trajectories of the poorly developed transport complex are considered. The trajectory of the weakly limited development consists of balanced (co-ordinated) local trajectories of poorly defined development of individual production components in the aspect of increasing competitiveness (Figure 3).

Figure 3

Dynamics of achievement of the goal in conditions of extreme-intensive (P0P1R2P3R4), weakly limited (P0P1P2P3P4) and limited (P0P'1P'2P'3P'4) development



The obtained local trajectories are balanced only unilaterally, as in the conditions of the weakly limited development in the aspect of increasing competitiveness, the duration of

time until reaching the immediate ultimate goal in different sectors or units of the transport complex will be different. That is why it is necessary to balance the growth rate in terms of increasing competitiveness with regard to the sector or unit for which the duration of the goal is maximized.

To do this, a re-simulation of the weakly developed sectors or units in reverse order from the unit, which is a "bottleneck" relative to the potentially possible pace of development of other units, is carried out. Thus, the full balance of the trajectory of weakly limited development in the aspect of increasing competitiveness is achieved.

Such trajectory can be successfully used to build a trajectory of limited development in terms of increasing competitiveness. The scheme of application of a complex of simulation models fully coincides with the above.

But it should be borne in mind that now the resources are allocated not according to the identified needs, but in limited amounts, that is, "bottlenecks" can not be eliminated completely. To eliminate the deficit, opportunities for increasing the efficiency of the use of resources, changing the structure of products and services, etc., are considered.

Such information is only available to officials of the regional level management system in relation to transport complex, and therefore the construction of a trajectory of limited development in terms of increasing competitiveness without their personal involvement is impossible. It is these workers who must determine the set and timing of measures to eliminate bottlenecks. The simulation model does not. Answers to the ways in which you can try to eliminate "bottlenecks". But it allows you to check the exact consequences of each event. To this end, according to the data on possible measures for the elimination of bottlenecks, an executive body prepares the initial information on the basis of which the development and activity are simulated in the aspect of increasing competitiveness and determines the dynamics of the parameters characterizing the production potential of the SRS and the final results of its use.

The presence of characteristics of the trajectory of the limited development of the complex opens up possibilities for constructing a trajectory of accelerated development in the aspect of increasing competitiveness. In addition, the development of a strategy for accelerated development involves the maximum use of available reserves.

Thus, the analysis of the developed system of simulation models of the control process allows us to propose a method of making optimal managerial decisions on the strategy of its development by solving an optimization problem with different levels of constraints of development trajectories and determining the basic parameters of a rational trajectory of accelerated development of the complex in terms of increasing competitiveness.

Based on the obtained trajectories, the process of achieving the goal of functioning of the production complex of any administrative-territorial unit can be optimized, for example, satisfaction of the needs of transport services by the transport complex in the Zaporozhye region from the requirement "for every inhabitant of cities and villages of the area proper service" (Table 1). The table accepts the notation: N, A – respectively the number of inhabitants in the administrative-territorial units of the oblast and the required number of buses, which, by their maximum weight, are divided into two categories:

- category M2 – buses for the carriage of passengers and having more than 8 seats for passengers and a maximum weight of not more than 5 tons;
- Category M3 – buses for the carriage of passengers and have more than 8 seats for passengers and a maximum mass exceeding 5 tons; buses with a capacity of no more than 22 passengers are divided into two classes:
- Class A: buses intended for the carriage of seated passengers and seats for standing passengers;
- Class B: buses intended for the carriage of seated passengers.

Table 1

The optimal structure of the bus fleet of the Zaporizhzhya region

№ п/ п	Name of cities (districts)	N, people	A, unit.	Park structure (units)*						
				Categories						
				M2		M3		M3		
				Classes						
				A	B	A	B	I	II	III
	Total for Zaporozhye region	1834929	4960	621	1156			596	1862	725
1	Incl in the cities of Zaporozhye	784695	2110	125	320	-	-	530	820	315
2	M. Berdyansk	121278	335	39	79	-	-	17	138	62
3	M. Melitopol	158263	443	49	118	-	-	22	175	79
4	M. Tokmak	34552	ПО	19	38	-	-	13	27	13
5	M. Energodar	54454	145	20	48	-	-	14	49	14
	Rural areas									
1	Berdyansk	28053	70	13	22	-	-	-	30	5
2	Vasilevsky	68851	190	28	60	-	-	-	83	19
3	V.-Belozersky	8644	25	5	8	-	-	-	12	0
4	Veselovsky	22990	62	14	18	-	-	-	21	9
5	Vilnyansky	49066	135	29	39	-	-	-	46	21
6	Gulyaypilsky	30041	78	18	25	-	-	-	25	10
7	Zaporozhye	56503	155	31	46	-	-	-	55	23
8	K.-Dniprovsky	43073	110	23	32	-	-	-	40	15
9	Kuybyshevsky	25063	62	14	18	-	-	-	21	9
10	Melitopol	52587	140	28	42	-	-	-	50	20
11	Michael's	30740	85	20	28	-	-	-	26	11
12	New Nikolayev	17784	45	8	12	-	-	-	17	8
13	Oryhivsky	49702	140	28	42	-	-	-	50	20
14	Pologovsky	43980	110	23	32	-	-	-	40	15
15	Priazovsky	29997	85	20	28	-	-	-	26	11
16	Seaside	32701	85	20	28	-	-	-	26	11
17	Rose	10428	23	5	7	-	-	-	8	3
18	Tokmatsky	25882	62	14	18	-	-	-	21	9
19	Chernihiv	19608	60	10	20	-	-	-	21	9
20	Yakimivsky	35994	95	18	28	-	-	-	35	14

Buses with a capacity of more than 22 passengers are divided into three classes:

- class I: buses intended for the carriage of seated and standing passengers, the design of which allows passengers to move freely in the cabin;
- Class II: buses intended for the carriage of mostly sedentary passengers, as well as standing passengers in the aisle between rows and (or) on the platform for standing passengers, the size of which does not exceed 1.5 m2;
- Class III: buses intended for the carriage of seated passengers only.

The number of inhabitants of the city and rural areas can be estimated by the results of demographic forecasts. The optimal structure of the bus fleet of the region allows for the provide of the required number of buses to improve the level of passenger service and to facilitate their safe travel in the required directions.

According to the calculation of the optimal structure of the bus fleet, taking into account the existing number of rolling stock and taking into account the need for decommissioning buses older than 10 years, the calculation of the number of buses to be purchased (Table 2) is mate.

Table 2

Distribution by categories and classes of the required number of buses to be purchased for servicing the population in Zaporozhye region

№	Structure		Existing number buses (unit)	With the term exploitation more than 10 years	Required quantity buses, (unit)	Number buses that are necessary buy (unit)
	Category	Class				
1	2	3	4	5	6	7
2	M2	A	587	-	621	34
		B	1834	745	1156	67
3	M3	A	382	382	-	-
		B	-	-	-	-
4	M3	I	637	543	596	502
		II	1638	790	1862	1014
		III	712	324	725	337
5	Σ		5790	2784	4960	1954

Thus, for the organization of a stable bus service in the area of transport in the Zaporozhye region, the normalization of passenger traffic in cities and districts the purchase of buses requires, mainly categories M3 cl. II (middle class: LAZ, Etalon, Bogdan), and full refurbishment of buses of category M3 cl. 1 (great and especially great class: Lyase, Ikarus and others.

For a comprehensive solution to the issue of transport services, it is necessary to develop a regional rolling stock update program.

One of the possible mechanisms for updating an automobile park is defined:

- obtaining long-term loans at the National Bank of Ukraine as a guarantor of state support at low interest rates (5-9% per annum), at the same time, lifting taxes on the sale of new buses, as well as reducing the insurance premium;
- lending funds to local budgets for the purchase of buses for communal enterprises;
- improvement of the mechanism of renewal of vehicles by leasing.

3. Implementation of the Algorithm Solving the Problem

The course on transformation of Ukraine into a social state in conditions of deepening of market transformations in the economy requires intensification of the state policy in the field of social protection of the population and increase its efficiency. In connection with this, one of the key tasks of local self-government bodies is the approval of programs of socio-economic development of the respective regions, settlements, other targeted programs in order to improve the quality of life of the members of the respective territorial communities. An important part of this process is the preliminary assessment of the level of socio-economic development of the region or settlement in terms of strengthening the resource potential, identifying weaknesses and developing targeted management influences in order to mitigate their negative development of the region or locality. A model for assessing the socio-economic development of a region or locality, on the basis of which it is possible to improve the quality of the relevant management decisions that are used to increase the competitiveness of the region and develop its resource potential, is developed.

It seems legitimate for the regions of Ukraine to proceed from the necessity and expediency of equalizing levels of socio-economic development in different regions or settlements.

For the planned management of socio-economic development of the region or settlement, the positive significance would be the expansion of the circle and improvement of the quality of information on the basis of which appropriate management decisions are made. In our view, it would be useful, along with traditional partial indicators of socio-economic development, to use some consolidated general indicators that characterize the aspects of strengthening resource potential in the analysis and forecasting.

Before proceeding to the consideration of the integral indicator below, we note that the development of different types of integral characteristics for applications is an extremely difficult task [9]. Naturally, when moving from a number of partial to one generalizing indicator, as with any aggregation, certain information is lost. At the same time, quantitative criteria for assessing the loss of information are absent or non-indicative. Thus, small differences in the distribution of the most essential components of social infrastructure may be more weighty than the strong variation of less important components. In world science, attempts have been made repeatedly to construct generalized living standards of the population by applying statistical procedures that reduce the size of the space of features. Methods of factor and component analysis are the most commonly used [10]. Indeed, with the help of procedures of this type it is possible to obtain a small number of generalized characteristics that accumulate the variance of the source factors. You can also calculate the value of these characteristics for the units under study.

However, experience has shown that the generalized characteristics obtained by methods of compression of information are usually difficult to interpret. From the practical point of view, the main disadvantage of this kind of indicators is the impossibility of their use in the actual technology of making managerial decisions. The numerical values of such generalized characteristics and the conclusions emanating from them are directly dependent on the number of variations of the originally chosen factors. At the same time, "factor loadings" or other indicators linking output factors with generalized ones do not depend on the actual significance of a particular factor, but on some statistical characteristics of its distribution (primarily from dispersion).

In practice, for the purpose of generating aggregate indicators, the method of weight coefficients is most often used. In this case, the factors that form the integral characteristic are added with some weighting factors, which simultaneously lead factors to a single unit of measurement. The most vulnerable feature of this method is the choice of weight coefficients, which is compulsory based on subjective criteria, for example, on expert estimates.

However, it is unlikely to deny the usefulness of development and practical use in analyzing and forecasting various general characteristics, including the integral indicator of socio-economic development in terms of strengthening resource potential. In case of the correct selection of the output can be an indicator that is numerically equal to the sum of deviations of the current values of partial indicators from their target values. As a target, you can use the average or maximum values of partial indicators, or their normative values, if there are sufficient grounds for constructing the relevant norms.

In our view, in the construction of an integral indicator of socio-economic development in the aspect of strengthening the resource potential, it is more convenient and expedient to use the maximum values of partial indicators, as the normalized index will vary from zero to one (with the same - equal units - weighted coefficients), and the members of this territorial community form an opinion on the level of its socio-economic development by the way it is better or worse than others (especially in neighboring regions or cities).

The goals of forecasting socio-economic development are closely linked with the achievement of social homogeneity of the population of the region. Therefore, it is necessary to predict it based on the need for sustainable creation of general conditions for the life of all Ukrainian citizens - regardless of the region where they live and work. The Law of Ukraine "On State Social Standards and State Social Guarantees" [11,12] establishes certain norms of social development that can be used as the basis for calculating the level of socio-economic development of a region or city in terms of strengthening resource potential.

In order to ensure Ukraine's systematic integration into the European community, in accordance with the "European Social Charter" ratified by the Verkhovna Rada of Ukraine [93], it is also necessary to continue work on improving and bringing national social standards in line with international norms and standards, in particular, those related to issues wages, increase of pension provision, compulsory state social insurance, provision of social assistance to families with children and low income families.

Taking into account the foregoing we will take as an integral indicator in the following form.

$$J_i = \sum_{k=1}^{n} \frac{a_{ik}}{\max a_{ik}}, \qquad i = 1, \ldots, m, \tag{1}$$

where aik - a partial indicator (population provision of housing, communal services and other services) of socio-economic development k in the aspect of strengthening resource potential in the region i.

Generally speaking, an integral indicator of the development of social infrastructure in the aspect of strengthening the resource potential in this territory can be any of the norms of the vector, components of which are partial indicators of security.

$$J_i = \sqrt[p]{\sum_{k=1}^{n} \left(\frac{a_{ik}}{\max\limits_{i} a_{ik}} \right)^p}. \tag{2}$$

However, the form (1) for the integral indicator of the development of social infrastructure in terms of strengthening the resource potential (at p = 1) seems the most natural.

To compile the model of social development in the aspect of strengthening the resource potential, we introduce the following notation: b (s), s = l, ..., p - the limiting value of the resource s used to improve the indicators of social development; kij (s) - specific costs of the resource s in the region i in support and improvement of the indicator of social development; Δij - the magnitude of the increase in security by the indicator of social development; f (aij + Δij) - the function of priorities of social development in the region i for the indicator j.

Suppose also that the process of mechanical migration of the population of the region i can be described as follows.

$$\delta_i = c_i I_i + c_{0i}, \qquad i = 1, \ldots m, \tag{3}$$

where δi - the balance of mechanical migration of the population of the region i; Ii - an integral indicator of social development of the region in terms of strengthening resource potential.

$$I_i = \sum_{k=1}^{n} \frac{a_{ik}}{\max\limits_{i} a_{ik}}, \qquad i = 1, \ldots m, \tag{4}$$

c0i - the size of the balance of migration of the population of the region i, which does not depend on the degree of social development in one region or another (in particular, it is a natural increase or a decrease in the population); ci – a value indicating a change in the

balance of migration of the population of the region i with an increase in the value of the integral index per unit.

Using the introduced notation, the model of social development in terms of strengthening the resource potential can be written in the form.

$$L(\Delta)=\sum_{i=1}^{m}c_i\sum_{k=1}^{n}\frac{(a_{ik}+\Delta_{ik})f(a_{ik}+\Delta_{ik})}{\max\limits_{i}[(a_{ik}+\Delta_{ik})f(a_{ik}+\Delta_{ik})]}\to\max \tag{5}$$

for restrictions on the use of material, financial, labor and other resources for social development

$$\sum_{i=1}^{m}\sum_{k=1}^{n}y_{ik}^{(s)}(a_{ik}+\Delta_{ik})\le b^{(s)},\qquad s=1,\dots,p, \tag{6}$$

$$\Delta_{ik}\ge 0,\qquad i=1,\dots m,\qquad k=1,\dots n. \tag{7}$$

For the convenience of describing the solution process, replace the variables.

$$x_{ik}=a_{ik}+\Delta_{ik},\qquad i=1,\dots m,\qquad k=1,\dots n. \tag{8}$$

Then the considered model in the aspect of strengthening the resource potential will take the form.

$$L(\Delta)=\sum_{i=1}^{m}c_i\sum_{k=1}^{n}\frac{x_{ik}f(x_{ik})}{\max\limits_{i}[x_{ik}f(x_{ik})]} \tag{9}$$

under conditions

$$\sum_{i=1}^{m}\sum_{k=1}^{n}y_{ik}^{(s)}x_{ik}\le b^{(s)},\qquad s=1,\dots,p, \tag{10}$$

$$x_{ik}\ge a_{ik},\qquad i=1,\dots m,\qquad k=1,\dots n. \tag{11}$$

In order to ensure the uniformity of social development, the {xik} is supplemented by additional restrictions

$$x_{ik}\le m_k,\qquad i=1,\dots m,\qquad k=1,\dots n, \tag{12}$$

that is, regardless of the possibility of increasing the value of the target function due to the further development of social infrastructure in terms of strengthening the resource potential in already developed regions, funds should be directed to regions with a relatively underdeveloped infrastructure.

Since the model (1) – (12) described above is nonlinear, the iteration process is used to solve it, at which point the linear programming problem is solved. Let's describe this process in more detail.

As a starting point, we assume that the considered indicators of social development in the aspect of strengthening the resource potential are equally high priority, that is, $f^{(0)}(x_{ik})=1$ the possible value of each indicator does not exceed its maximum actual value in other regions.

$$\max\left[x_{ik} f^{(0)}(x_{ik})\right] = \max x_{ik} = \max a_{ik} = m_k^{(0)}. \tag{13}$$

In addition, we will introduce the designation

$$c_{ik}^{(0)} = \frac{c_i}{m_k^{(0)}}, \qquad i=1,\ldots m, \qquad k=1,\ldots n. \tag{14}$$

Then the problem (12) - (15) is reduced to the problem of linear programming)

$$L(\Delta) = \sum_{i=1}^{m}\sum_{k=1}^{n} c_{ik}^{(0)} x_{ik} \to \max \tag{15}$$

under conditions

$$\sum_{i=1}^{m}\sum_{k=1}^{n} y_{ik}^{(s)} x_{ik} \le b^{(s)}, \qquad s=1,\ldots,p, \tag{16}$$

$$x_{ik} \ge a_{ik}, \qquad i=1,\ldots m, \qquad k=1,\ldots n. \tag{17}$$

$$x_{ik} \le m_k^{(0)}, \qquad i=1,\ldots m, \qquad k=1,\ldots n. \tag{18}$$

Let z_s, z_{ik} (1), z_{ik} be two-dimensional estimates of constraints (19) - (21) respectively. They are correlated

$$\sum_{s=1}^{p} k_{ik}^{(s)} z_s + z_{ik}^{(1)} + z_{ik} \ge c_{ik}^{(0)}, \qquad i=1,\ldots m, \qquad k=1,\ldots n. \tag{19}$$

It is legitimate to assert that the conditions (20) are not restrictive. This is substantiated by the natural assumption of the adequacy of the allocated resources in $b^{(s)}$ to maintain the already existing level of social development in the aspect of strengthening the resource potential, the condition $m_j^{(0)} \ge a_{ij}$, which follows from the definition of the value $m_j^{(0)}$, and the direct proportional dependence of the value functional of x_{ij}. Consequently, z_{ij} (1) = 0.

If the resources $b^{(s)}$ are large enough for social development in the aspect of strengthening the resource potential and restricting only the conditions (21), then $z_s = 0$ and the above ratio for binary variables takes the form.

$$z_{ik} \geq \frac{c_i}{m_k^{(0)}}, \qquad i = 1, \ldots m, \qquad k = 1, \ldots n. \tag{20}$$

To remove the limited growth of social development indicators in the aspect of strengthening the resource potential (ie, the uniform relaxation of the constraints of type (21) is proposed to proceed in this case in this way (we refuse to index this step of the iterative process as the first, since the given ratios are valid for any step).

$$m_k^{(q+1)} = m_k^q + \gamma_k^{(q+1)} \frac{\max\limits_i \frac{c_i}{m_k^{(q)}}}{\sqrt{\sum\limits_{i=1}^{m} \sum\limits_{k=1}^{n} \left(\frac{c_i}{m_k^{(q)}} \right)^2}}, \qquad k = 1, \ldots, n, \tag{21}$$

where $\gamma_k^{(q+1)}$ - is a step multiplier whose initial value is chosen empirically.

If the resources $b^{(s)}$ are not sufficient for social development in terms of strengthening the resource potential for each indicator in the size $m_j^{(0)}$, then some binary estimates $z^{(s)}$ of constraints (19) will be different from zero, and the formula for refinements m_k will look like.

$$m_k^{(q+1)} = m_k^q + \gamma_k^{(q+1)} \frac{\max\limits_i z_{ik}^q}{\sqrt{\sum\limits_{i=1}^{m} \sum\limits_{k=1}^{n} \left(z_{ik}^q \right)^2}}, \qquad k = 1, \ldots, n, \tag{22}$$

Thus, if for some t

$$x_{it} < m_t^{(q)}, \qquad i = 1, \ldots m, \tag{23}$$

$$z_{it} = 0, \qquad i = 1, \ldots m, \qquad m_t^{(q+1)} = m_t^{(q)}. \tag{24}$$

Then the step multiplier can be selected in the following way

$$\gamma^{(q+1)} = \begin{cases} \gamma^{(q)}, L^{(q+1)}(x) > L^{(q)}(x), \\ \dfrac{\gamma^{(q)}}{q}, L^{(q+1)}(x) \le L^{(q)}(x). \end{cases} \tag{25}$$

As a result, indicators of social development in the aspect of strengthening resource potential within the allocated resources b $^{(s)}$ are evenly increasing.

At each step of integration, you also need to define the values of the priority function.

If the optimal plan is a task, consideration of any restrictions (з $x_{ik} \le m_k^{(q-1)}$) are executed as severe inequalities, then the corresponding variables of the dual problem are zero, that is, dual evaluations $z_{ik}^{(q-1)}$; $x_{ik} \le m_k^{(q-1)}$, $i = 1, \ldots, m$, $k = 1, \ldots, m$, get zero values if $x_{ik} < m_k^{(q-1)}$, and more than zero if $x_{ik} = m_k^{(q-1)}$.

This means that only the resources that are fully utilized in the optimal version of the socio-economic development program can have a positive two-way assessment; estimates of non-fully utilized resources are always zero. But in this case, it is not about resources, but about achievements in social development in terms of strengthening the resource potential of a certain level for each indicator.

In other words, if by any indicator one region or another is significantly behind the region with the best indicator, the two-digit score is zero. But it is the regions with significant lag behind the indicators of social development in terms of strengthening the resource potential should be given a higher priority. Therefore, the value of the priority function is proposed to be defined as.

$$f^{(q+1)}\left(x_{ik}^{q}\right) = \frac{G}{z_{ik}^{q} + c}, \tag{29}$$

where G and c - are constant nonzero.

As a result of (q + 1) -th step the target function is written

$$\sum_{i=1}^{m} c_i \sum_{k=1}^{n} \frac{x_{ik} \dfrac{G}{z_{it} + c}}{\max\left(x_{it} \dfrac{G}{z_{it} + c} \right)} = \sum_{i=1}^{m} \sum_{k=1}^{n} c_{it} x_{ik}. \tag{30}$$

Iterations end when the condition is fulfilled $\gamma^{(q+1)} = \dfrac{\gamma^{(q)}}{q} \le \varepsilon$

The growth of the indicator $m_k^{(q)}$ is based on the considerations of further increase in the balance of mechanical migration, for all components of the integral index is proportional to

the double estimates $z_{ik}^{(q)}$. In the presence of substantiated social standards and standards of security, individual elements of social development in the aspect of strengthening the resource potential built on their basis, the integral indicator will be.

$$I_i^{(H)} = \sum_{k=1}^{n} \frac{a_{ik}}{m_{ik}^{(H)}}, \qquad i = 1, \ldots m, \tag{31}$$

where $m_{ik}^{(H)}$ is the normative level of the provision of the region and the element of k social development in the aspect of strengthening the resource potential.

Then the model (8) - (10) will look like

$$L(\Delta) = \sum_{i=1}^{m} c_i \sum_{k=1}^{n} \frac{(a_{ik} + \Delta_{ik}) f(a_{ik} + \Delta_{ik})}{m_{ik}^{(H)}} \tag{32}$$

with the same conditions (9), (10).

Some "intermediate" option statement of the task is to maximize

$$L(\Delta) = \sum_{i=1}^{m} c_i \sum_{k=1}^{n} \frac{(a_{ik} + \Delta_{ik}) f(a_{ik} + \Delta_{ik})}{\min(m_k^{(H)} \max_i (a_{ik} + \Delta_{ik}))} \tag{33}$$

under the constraints of the model (9), (10) and condition $\max_i (a_{ik} + \Delta_{ik}) \le m_i^{(H)}$

4. Estimating Expected Results

In this case, the situation when the standard takes the level of security for the considered indicator of the region, which may be better than the standard adopted, is excluded.

In the aspect of practical application of the proposed integral indicator and conducting analytical calculations in order to substantiate the prospects of social development in the aspect of strengthening the resource potential in a particular region. It is expedient to carry out calculations according to the indicators of state social standards and state social guarantees.

Using the proposed integral indicator, analytical calculations were performed to substantiate the prospects for the development of social infrastructure in the Zaporizhzhya region of Ukraine. To ensure the necessary comparison, calculations were carried out separately for 5 cities, 20 rural areas (with settlements of city type and district centers) of the region (as of the beginning of 2017) for 17 indicators: population provision in places in preschool institutions, schools, cinemas, in houses of culture, in catering enterprises, in homes of everyday life, in bathhouses; books and magazines in libraries, hospital beds,

shopping areas in stores, laundry facilities, dry-cleaners, outpatient clinics; residential telephone, residential area, water supply and sewerage.

Calculations have shown that for rural areas, the integral indicator has a rather large range of changes. According to this indicator, the most secured were the villages of the Melitopol district, and the smallest - the Roziv district. As to the standard, these areas are provided: Melitopol area - by 63%, Rosevsky - only 6.9%. By the integral indicator "the best area" (Melitopol) is provided in 2.3 times better than "the worst".

The classification of rural areas of Zaporizhzhya Oblast by the integral indicator is as follows: Melitopol area - 15.7; Zaporozhye - 14,5; Vasiliev area - 13,2. Then there are 15 districts with the value of the integral index from 10.0 to 12.1. The following 18 districts: 8.0 - 9.9. The last three districts: Novomykolaiv district- 7.7; Veliko-Belozersk area- 7.6 and Roziv area- 6.9. It is concluded that the negative balance of migration of the population is explained not so much by the "attraction" of large cities, but by "repulsion" of the underdeveloped social infrastructure in the countryside.

Unevenly developed social infrastructure and in the context of regional centers of the region. The integral indicator is best provided with the center of the Berdyansk region, and worse - Veliko-Belozersk region (3.2 times).

Classification of district centers of the Zaporizhzhya region by the integral indicator is as follows: Berdyansk - 17,7; Melitopol - 13,0; Tokmatsk - 11,5, followed by 18 district centers with the value of the integral index 8,3 - 11,2; 15 with a value of 6.0 - 7.9, Chernihiv - 5.9; Rosiv - 5.5; Veliko-Belozersk - 5.5.

The provision of social infrastructure of rayon centers in the region varies from 23% (Veliko-Belozersk) to 71% (Berdyansk).

Some interest also represents the classification of cities in the Zaporizhzhya region by the value of the integral indicator. In this sense, the best was Berdyansk (18.2), followed by Melitopol (17.5), and only - the third was the regional center - Zaporozhye (15.3). This, apparently, is largely due to the fact that the growth rate of the population: the population in Zaporozhye were in recent years significantly higher than in Berdyansk and Melitopol.

According to our calculations, the total provision of social infrastructure per citizen of Zaporozhye region is 40 thousand UAH, rural - 50 thousand UAH. However, if in Zaporozhye, Berdyansk, and Melitopol, in fact, the security varies slightly: from 38 thousand rubles. in Energodar to 41 thousand UAH. in Tokmak, then in rural areas the amplitude of fluctuations is significant: the most secure is the Melitopol district - 66 thousand UAH, the least - Veliko-Belozersk district - 43 thousand UAH.

Significant differentiation in the level of actual provision of social infrastructure within the districts is due to a large proportion of the value of housing stock in the Berdyansk district, where per capita accounts for 23 square meters. m area, while in Rosevsky - only 12.3 sq.m. The same is my explanation of the gap in the levels of cities and districts. In the districts of the Zaporizhzhya region, an average of 16.6 square meters is needed per inhabitant. m of housing, in cities - 10 sq.m. In addition, when constructing larger social infrastructure objects typical of large cities, the cost per unit costs less.

Thus, social infrastructure of rural areas costs more than cities, more than 25% (per person).

In order to ensure the provision of social infrastructure with social standards for each indicator in the development of cities of the Zaporizhzhia region, investment is about 59 billion UAH, and districts - 700 billion UAH.

Experience has shown that the use of concrete results of such calculations contributes to enhancing the validity of relevant decisions on the aspect of strengthening the resource potential of programs of socio-economic and cultural development of regions on the territory of Ukraine.

5. Conclusions

Summarizing the theoretical aspects of increasing the competitiveness of regions and developing their potential on the basis of a structural approach to the organization of the activity of executive authorities and local governments in this area, modeling and research of the developed models allowed to draw the following conclusions.

During creating the organizational mechanism of public administration to improve the competitiveness of regions and the development of their potential, it should be borne in mind that the relationship between the growth of financing and the efficiency of the development of production and services is mainly of an exponential nature, which explains the periodicity of radical change in methods and sources of production. The principles of cost-effectiveness for increasing the competitiveness and development of resource potential of the region from state-management positions are determined and it is shown that when forming the organizational mechanisms of state policy it should be taken into account that the problem of increasing the competitiveness and development of resource potential is one of the number of multicriteria, weakly structured tasks, there is a need for purely economic approach; distribution of limited resources taking into account dynamic features of the resource support system. The scheme of implementation of organizational mechanisms with a multicriteria assessment of the features of the system of increasing competitiveness and development of the resource potential of the region is substantiated, and in the first place, its inertia, the output to its desired structure is associated with a certain period and a combination of short and long-term measures with different times of obtaining the effect.

The directions of the regulatory influence on the competitiveness of the industrial complexes of the region are determined, the main stages of the process of their implementation are determining, firstly, the long-term goal, and secondly, the trajectories of its development in the assumption of the absence of restrictions (such a trajectory will be referred to as a trajectory of the weakly limited development of the transport complex) and, thirdly, the trajectory in the presence of real constraints (it will be called the trajectory of limited development). The economic content and the procedure of constructing mutually coordinated and balanced trajectories of regulatory influence are considered, which means a set of parameters reflecting production capacities, the efficiency of their use, as well as the results of the complex at a given time interval.

To identify the trajectories of the development of the transport complex in the process of drafting regulatory acts, a set of simulation models has been used, which consists of a unit for determining the purpose of the activity, local simulation models for the development of production capacities of individual sectors and a block of consolidated calculations. The interconnections between local models are determined by the technological sequence of participation of sectors and production units in the process of manufacturing the final product. Therefore, the number and structure of the interconnections of local models depends on the peculiarities and scales of its production activity.

The prospects of development of social infrastructure of the region in the aspect of increasing its competitiveness and strengthening of resource potential by the integral indicator of socio-economic development are revealed. The proposed integral indicator is used in the model of social development for the aspect of solving the tasks of increasing competitiveness and strengthening the resource potential of the region and is defined as the sum of the ratios of the current and maximum values of the partial indicators of population security by type of services in the region.

It is believed that the use of specific results of calculations using the model will contribute to increasing the validity of relevant management decisions and Ukraine's compliance with European standards.

Referense

1. Simonenko, V. K. (1997). Regions of Ukraine: Problems of Development. – Testament, 256 p.
2. Troyanovsky, V. M. (1999). Mathematical modeling in management: study. Manual. – Russian Business Letter, 521 p.
3. Ruban, Yu. G. (ed.) (2007). Ukraine in 2007: Internal and external situation and prospects of development: expert report. NISS, p. 31.
4. Forrester, D. (2003). World Dynamics. M.: AST, 384 p.
5. Ponomarenko, O. I., Perestyuk, M. O., Burim, V. M. (2003). Fundamentals of Mathematical Economics. – Informtekhnika, 456 p.
6. Melnychenko, V. (1996). Local authorities: the balance of rights and responsibilities. – Veche, N 4, p. 118-125.
7. Lukinov, I. (1997). Investment activity in economic renewal and growth. – Economy of Ukraine. N 8, p. 4-8.
8. Plisak, S. P. (1983). System Analysis and Problems of the Development of Regions. M.: Science, 227 p.
9. Kabushkin, N. I. (2006). Fundamentals of Management. Minsk: BGZU, 284 p.
10. Maksimenko, O. (2000). Regional Policy in Europe: Lessons for Ukraine. Kiev, Center for East-West, 171 p.
11. The Law of Ukraine on State Social Standards and State Social Guarantees // Officer. Visn Of Ukraine. - 2000. - No. 16. - Art. 657.
12. The Constitution of Ukraine: Adopted at the fifth session of the Verkhovna Rada of Ukraine on June 28. 1996 (as amended in accordance with the Law No. 2222-1V dated December 8, 2004) // Amit. The Verkhovna Rada of Ukraine. - 2005. - No. 2. - Art. 44.; H.: Folio, 2006. – 61 p.
13. Mayorova, T. V. 2003 (). Investment activity: teaching. Manual. K.: ZUL, 376 p.