Artículo de investigación

Passenger transport service market functioning and development management in urban agglomerations based on integrated approach

Servicio de transporte de pasajeros y de gestión de la aglomeración urbana basada en el enfoque integrado

Funcionamento do mercado de serviços de transporte de passageiros e gestão do desenvolvimento em aglomerações urbanas baseadas em abordagem integrada

Recibido: 20 de abril de 2018. Aceptado: 10 de mayo de 2018

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Abstract

In this article, according to the results of urban agglomeration study of the Krasnodar Territory, they revealed global and local problems of passenger transport service market functioning and development affecting the quality of transport services. A new classification of passenger transport services markets is proposed, which allows to differentiate and optimize a route network in accordance with the requirements of consumer demand. An integrated approach has been formulated that integrates SWOT analysis and PEST analysis tools into a single coherent system that allows to take into account the global and the local aspects of passenger transport service market functioning and development to solve the problems of management in urban agglomerations. The matrix model "CTON" ("Coordination of public transport services") is developed, which includes a substantial part of SWOT and PEST analysis tools, the use of which allows to identify the components that affect an effective functioning and the development of PTS markets systematically and purposefully. SWOT and PEST analysis was carried out, on the basis of which the components of KTON matrix were determined and structured in the issue of various types of markets for PTS functioning and development

Resumen

En este artículo, de acuerdo con los resultados del estudio de aglomeración urbana del territorio de Krasnodar, revelaron los problemas globales y locales del funcionamiento del mercado de servicios de transporte de pasajeros y el desarrollo que afectan la calidad de los servicios de transporte. Se propone una nueva clasificación de los mercados de servicios de transporte de pasajeros, que permite diferenciar y optimizar una red de rutas de acuerdo con los requisitos de la demanda del consumidor. Se ha formulado un enfoque integrado que integra el análisis FODA y las herramientas de análisis PEST en un único sistema coherente que permite tener en cuenta los aspectos globales y locales del funcionamiento y desarrollo del mercado de servicios de transporte de pasajeros para resolver los problemas de gestión en las aglomeraciones urbanas. Se desarrolla el modelo matricial "CTON" ("Coordinación de servicios de transporte público"), que incluye una parte sustancial de las herramientas de análisis FODA y PEST, cuyo uso permite identificar los componentes que afectan un funcionamiento eficaz y el desarrollo de los mercados de PTS sistemática y a propósito. Se llevaron a cabo análisis FODA y PEST, sobre la base de los cuales se determinaron y estructuraron los

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management on the example of urban agglomerations of the Krasnodar Territory. They developed universal script nomograms to optimize a route network, taking into account the seasonal factor of PTS provision to the population and allowing adjust the process of transport services for population in a functional way on the basis of a balance of benefits observation for all interested parties-participants of PTS markets (Customer-Carrier-Consumer). They proposed an estimated economic-mathematical model, on the basis of which an absolute integral economic effect from a route network optimization is determined.

Keywords: the market of passenger transport services, urban agglomeration, the problems of functioning and development management, passenger transport, the quality of transport services for population, integrated approach, SWOT analysis, STEP analysis, scenario effect

componentes de la matriz de KTON en el tema de varios tipos de mercados para el funcionamiento de PTS y la gestión del desarrollo en el ejemplo de las aglomeraciones urbanas del territorio de Krasnodar. Desarrollaron nomogramas de guiones universales para optimizar una red de rutas, teniendo en cuenta el factor estacional de provisión de STP a la población y permitiendo ajustar el proceso de servicios de transporte para la población de manera funcional sobre la base de un balance de observación de beneficios para todas las partes interesadas -participantes de los mercados PTS (Cliente-Transportista-Consumidor).

Propusieron un modelo económico-matemático estimado, sobre la base del cual se determina un efecto económico integral absoluto a partir de una optimización de la red de rutas.

Palabras clave: mercado de servicios de transporte de pasajeros, aglomeración urbana, problemas de funcionamiento y gestión del desarrollo, transporte de pasajeros, calidad de los servicios de transporte para la población, enfoque integrado, análisis FODA, análisis STEP, efecto de escenario

Resumo

Neste artigo, de acordo com os resultados do estudo da aglomeração urbana do território de Krasnodar, eles revelaram os problemas globais e locais da operação do mercado de serviços de transporte de passageiros e desenvolvimento que afetam a qualidade dos serviços de transporte. Propõe-se uma nova classificação dos mercados de serviços de transporte de passageiros, que permite diferenciar e otimizar uma rede de rotas de acordo com as exigências da demanda do consumidor. Uma abordagem integrada foi formulada que integra a análise SWOT e as ferramentas de análise PEST em um único sistema coerente que permite levar em conta os aspectos globais e locais da operação e desenvolvimento do mercado de serviços de transporte de passageiros para resolver os problemas de gerenciamento. em aglomerações urbanas. O modelo matricial "CTON" ("Coordenação dos serviços de transporte público") é desenvolvido, o qual inclui uma parte substancial das ferramentas de análise SWOT e PEST, cujo uso permite identificar os componentes que afetam uma operação eficiente e o desenvolvimento dos mercados. de PTS sistemática e propositalmente. Análises SWOT e PEST foram realizadas, com base nas quais os componentes da matriz KTON foram determinados e estruturados sobre o tema de vários tipos de mercados para a operação de PTS e o gerenciamento do desenvolvimento no exemplo das aglomerações. áreas urbanas do território de Krasnodar. Desenvolveram nomogramas de roteiros universais para otimizar uma rede de rotas, levando em consideração o fator sazonal de provisão de LTS para a população e permitindo ajustar o processo de serviços de transporte para a população de forma funcional com base em um balanço de observação de benefícios para todas as partes interessadas - participantes dos mercados PTS (Customer-Carrier-Consumer). Eles propuseram um modelo econômico-matemático estimado, com base no qual um efeito econômico integral absoluto é determinado a partir de uma otimização da rede de rotas.

Palavras-chave: mercado de serviços de transporte de passageiros, aglomeração urbana, problemas operacionais e gestão do desenvolvimento, transporte de passageiros, qualidade dos serviços de transporte para a população, abordagem integrada, análise SWOT, análise STEP, efeito cenário

Introduction

An insufficient development of passenger transport service (PTS) market, especially in urban agglomerations (including resort areas), leads to a territorial social injustice among the residents of peripheral and dormitory microdistricts, which significantly affects the quality of their life and stay in the urban environment (Kravchenko et al., 2018).

The cities and the agglomerations formed on their basis have recently become the most significant elements of the settlement system in Russia. They provide for the emergence of new growth points, an economic cohesion of the territories, an integrated development of transport and service infrastructure, and serve to implement the main goal - to create comfortable conditions for the life of Russians (Kravchenko & Kravchenko, 2017).

An urban agglomeration is the aggregate of municipalities (settlements and urban districts) within the territory of which a number of settlements, mainly urban ones, is located compactly, united in a complex dynamic developing system with intensive transport, industrial, infrastructural, social and economic ties, with a common use of adjacent territories and development resources (Kravchenko & Kravchenko, 2017; Kravchenko , 2015). The advantage of urban agglomerations lies in the fact that they are the bases for accelerating development and make an impact on the vast territories surrounding them by concentrating huge scientific and technical, industrial and socio-cultural potential. The development of agglomerations is not only a comprehensive development of territories, but also the development of geopolitical influence centers through the unification of city planner, the scientific community and government authority efforts at all levels (Kravchenko, 2015).

With all the diversity of interaction structure and the conditions for the coexistence of cities and their satellites, there is a concise system for a settlement type determination. An urban agglomeration is a process of a settlement territory expansion due to its development and the absorption of adjacent settlements.

There are two main types of agglomerations: monocentric and polycentric ones. The largest number of existing and emerging mergers are classified as the first type. Polycentric agglomerations are rather an exception, they unite several cities, each of which is an independent nucleus and absorbs nearby settlements. Monocentric agglomerations are developed by the principle of one main city domination. There is a nucleus that includes other settlements in its territory during its growth and forms the direction of their further development in symbiosis with its potential capabilities. The largest urban agglomerations (the vast majority) are created precisely by a monotype principle. An example is the Moscow agglomeration (Kravchenko, 2015; Kravchenko, 2011).

The mono-centric type also includes the agglomeration of the municipality of Krasnodar. The city of Krasnodar is characterized by the presence of all conditions for the agglomeration of the territories in the zone of its influence. It is located on the most important highways connecting the center of Russia with the ports of the Black and Azov Seas, as well as the resorts of the Black Sea coast of the North Caucasus. The city has all types of transport: air, automobile, railway (four directions, three railway stations), water (cargo transportation by "river-sea" vessels). The economic situation of Krasnodar is determined by the concentration of human, investment, financial, intellectual and other resources. Krasnodar is the center of science and higher education: the city has more than 80% of scientific workers in the region and about 90% of all students (Kravchenko, 2010).

There are 28 rural settlements within the city. The city closes rural and urban connections and is the center of gravity for "one-day" migrants, the number of which makes 300-400 thousand people a year with the segmental nature of targeted transport movements.

Thus, the effect of the considered factors led to the fact that Krasnodar stood out as a nucleus (a leader), due to which a dynamic system of interrelationships was developed between the city and neighboring settlements, entering its zone of influence, forming a monocentric type of agglomeration.

According to the assessment of the Territorial Body of the Federal State Statistics Service for the Krasnodar Territory (Krasnodarstat), the population of the city of Krasnodar makes 943,827 people as of January 1, 2017. According to the administration of the city of Krasnodar municipality, in recent years the population of Krasnodar has grown dramatically and amounted to more than 1,250,000 people in 2017.

Apart from the city of Krasnodar, the Krasnodar city agglomeration includes the part of the Dinskoy, Krasnoarmeisky and Seversky districts. The area of the agglomeration territory makes 2,200 km2. The agglomeration territory has 60 settlements where more than 1.1 million people live (according to the latest population census), and taking into account the estimated data of the Krasnodar administration - more than 1.4 million people.

An effective development of the monocentric type of the Krasnodar agglomeration is impossible without the creation of favorable conditions for the qualitative functioning and the development of the markets for passenger transport services (PTS) on the basis of a balance of benefits for all interested parties (Customer - Carrier - Consumer). The balance of PTS market participant benefits is the following one: for a customer - the reduction of social tension, the increase of agglomeration image due to a higher quality of transport services for population and the territorial development of a route network, and a tax base expansion; for the carrier - the increase of profits from the provision of PTS; for transport service consumers - the increase of service quality and culture (Kravchenko & Kravchenko, 2008a; Kravchenko & Kravchenko, 2011; Kravchenko & Kravchenko, 2008b; Kravchenko & Kravchenko, 2008c; Sampaio et al., 2008).

Theoretical Part: Problems And Integrated Approach To Their Solution

PTS markets are characterized by different transportation potential and an uneven development of service and transport infrastructure and, along with information and financial markets, they ensure the viability and the sustainability of the whole system of transport services for the population of the urban agglomeration (Kravchenko et al., 2017a; Kravchenko et al., 2017b; Kravchenko & Dernovoi, 2017).

Passenger transportation is carried out on a regular, custom and flexible basis by bus transport, ground electric transport and passenger taxis.

PTS markets in the urban agglomeration of Krasnodar are characterized by a pronounced territorial-segment consumer demand, which has a significant impact on the dynamics and the effectiveness of a municipality social and economic development as a whole (Kravchenko et al., 2016; Kravchenko & Shchepakin, 2016; Kravchenko & Kravchenko, 2015; Hensher & Golob, 2008; Cipriani et al, 2012; Alvarez et al., 2010; Odeck, 2008; Sheth et al., 2007; Boudali et al., 2008). According to the suggestion of the authors, monocentric agglomeration integrates the following types of markets for PTS (Kravchenko & Kravchenko, 2015a; Kravchenko, 2014a; Kravchenko, 2014b; Kravchenko, 2013; Kravchenko & Ushmaev, 2012):

1. The saturated PTS market with a developed service and transport infrastructure in which the probability of a planned profit (X) obtaining from passenger transportation makes 0.90-0.99, which is conditioned by a stable passenger traffic, a greater transport mobility of population, the accessibility of transport services, a regular traffic, the density of a route network in the districts of the city, tariff development, the possibility of choice for the land type of passenger transport to move to the objects of a goal, the travel without a transfer, a higher level of transport service development and population density, the developed system of situational control centers for transportation processes, a high motivational interest of business entities to the development of transport business due to the short payback periods.

2. A developing PTS market, in which the probability of a planned profit (X) obtaining from the transportation of passengers makes 0.61 ... 0.89, which is conditioned by less stable passenger flows, a lower density of a route network of settlements, an insufficient level of transport service development, the

need to make transfers to the periphery of the city, less (in relation to the urban one) frequency of traffic, a lower population density, a high transport fatigue due to a longer route and the time of correspondence to a goal object, the greater importance of customized passenger transportation in relation to a saturated market.

3. PTS market with limited growth potential, in which the probability of a planned profit (X) obtaining from passenger transportation makes 0.31 ... 0.60, which is conditioned by the seasonal factor of population transport activity, a limited development potential of the residential area, and, thus, a route network, less (in comparison with the developing market) frequency of traffic movement, a low population density, a higher (in comparison with the developing market) transport fatigue due to the greater length of a route and the time of correspondence to a target site, a low level of transport service development, the lack of a developed transport infrastructure, and the lesser interest of business entities to the development of the transport business due to high production costs and long payback periods. The characteristics of PTS markets in the Krasnodar agglomeration are presented in Table 1.

Table 1 - Characteristics of PTS markets in Krasnodar agglomeration

Market name	Market composition	Area, km^2	Population number, men	Population density, men/km^2
Saturated market	Karasunsky District	152	268445	1766,09
	Kuban area District	474	357449	754,11
	Western District	22	182157	8279,86
	Central District	28,5	182152	6391,3
Developing market	Beloezerny s.	4,46	4342	973,54
	Znamensky s.	7,246	6242	861,44
	Industrialny s.	10,463	4785	457,33
	Kolosisty s.	0,743	2080	2799,46
	Krasnodarsky s.	0,448	681	1520,09
	Lazurny s.	4,147	2754	664,09
The market with a limited growth potential	Dinskoy district	1549,11	143448	92,6
	Seversky district	2122	120586	56,83
	Krasnoarmeysky district	1899	104868	55,3
	Ust-Labinsky region	1511	108210	71,61

The information on PTS markets presented in Table 1 makes it possible to ensure an optimal planning of a route network, focusing on the volumes and the dynamics of consumer demand, taking into account the features of a territorial settlement when population transport services are organized and managed. The characteristics of PTS markets in the Krasnodar agglomeration, presented in Table 1, have (according to the results of the study) similar features with the resort agglomerations of the Krasnodar Territory (Table 2).

Table 2 - The characteristics of the markets for passenger transport services, based on the example of Anapa resort agglomeration of the Krasnodar Territory

Market type	Agglomeration composition	Population, men / holiday makers	
Saturated market	Anapa	75865	175210 / 5600000
	Vityazevo s.	7936	
Developing market	Anapskaya st.	16107	
	Blagoveschenskaya st.	2780	
	Voskresensky h.	1509	
	Gostagayevskaya st.	9772	
	Jiginka s.	4361	
	Sukko s.	3156	
	Supseh s.	6669	
	Cibanobalka s.	5452	

A market with a limited growth potential	Bolshoy Raznokol h.	630
	Great Utrish s.	198
	Buzhor s.	487
	Varvarovka s.	1980
	Verhnee Dzhemete s.	135
	Verhniy Hanchakrak h.	301
	Verhniy Checone h.	124
	Veselaya gora h.	162
	Vestnik h.	618
	Vinogradny s.	3354
	Guy-Codzor s.	2968
	Zarya h.	1179
	Ivanov h.	549
	Kapustin h.	41
	Kovalenko h.	6
	Krasnaya gorka h.	93
	Krasnaya skala h.	121
	Krasny h.	939
	Krasny kurgan h.	676
	Kumatyr h.	145
	Kurbatsky h.	187
	Kutok h.	11
	Maly Raznokol h.	147
	Maly Utrish h.	51
	Maly Checone h.	41
	Nizhny Hanchakrak h.	75
	Nizhnaya Gostagayka h.	715
	Peschany h.	317
	Prikubansky h.	6
	Prostorny s.	875
	Pyatikhatki s.	1178
	Rassvet h.	1516
	Rose Luxembourg h.	141
	Suvorov-Cherkessky s.	878
	Tarusin h.	392
	Usatova Balka h.	866
	Utash s.	1919
	Utash h.	531
	Checone h.	1570
	Cherny h.	301
	Chemburka h.	574
	Yurovka s.	3537

The information presented in Table 2 on PTS markets in resort agglomerations makes it possible to provide an optimal planning of a route network, focusing not only on the volumes of consumer demand among local population, but also on a visitor for recreation and tourism, taking into account the peculiarities of a territorial settlement.

The access to the markets of vocational schools is regulated by the state through federal and regional executive authorities, according to the current legislation. PTS market is represented by a number of private entrepreneurs and municipal carrier operators.

An effective functioning and the development of PTS markets is currently limited to a complex of global and local problems in the operational activities of carriers servicing passengers on different routes by different types of passenger transport (Kravchenko, 2012; Kravchenko, 2010a; Kravchenko & Kravchenko, 2010; Kravchenko, 2010b; Kravchenko, 2011).

The global nature of the problems was noted at the meeting of RF State Council Presidium in Ulyanovsk, chaired by the President of Russia V.V. Putin, where a special attention was paid to bus transport. At the meeting, the acting ministers and governors from various regions of Russia in the area of the functional activity of passenger transport, noted the following:

1. Over the past year, 18.7 billion passenger kilometers of passenger turnover have been completed. The buses of especially small and small capacity, who mastered this volume, were mostly unprofitable. Their value was more than 63%. The losses on bus passenger transport amounted to 13.5 billion rubles, of which 60% accounted for the losses from regular intra-municipal bus transportations, and this despite the annual growth of rates from 2 to 5% in this form of communication.
2. It was shown that, despite the growth of traffic in recent years, there were stowaways on the minibuses, which means that 20 - 30% of the revenue received by carriers was lost. This problem is caused by an ineffective line control.
3. In many regions, a poor quality of transport services is observed due to the lack of rolling stock (RS) and its aging. Currently the minibuses older than 10 years are operated, they are not updated and they are very expensive. Its update depends on the financial situation in the region. Often, there is no cash to purchase a new RS because of loan debts to banks.
4. There is a low and an incomplete system of provided services for route passenger transport in municipalities, there are no quality standards for transport services and standardized indicators that regulate transportation activity.
5. Passenger service tariffs are not regulated, there is no monitoring and control over the tariff development system, and the electronic ticket sales system for all types of passenger transport is also underdeveloped.
6. At the level of carriers due to the lack of a unified approach to the classification of routes (there is no concept of multimodal transport, etc.), it is difficult to plan and organize passenger traffic by message type (there is no Law on Integrated Planning of this activity).
7. The lack of a digital system development for servicing the consumers of transport services was mentioned, including technological ones, affecting the quality, reliability and safety, incl. environmental, travel, and environmental safety. It was noted that the street-road network does not provide the necessary capacity of transport, since its growth is 4-6% annually, and the pace of a street-road network development lags behind the pace of motorization.
8. It was noted that although the passenger land transport accounts for 5% of the total number of transport in Russia, it gives a large number of road accidents with serious consequences, which requires the improvement of transportation activities in the regions, especially in long-distance traffic, where an illegal transportation of passengers grows. The current fines for transportation activities are not effective.
9. It was also noted that with the acquisition of a new rolling stock (RS) - electric buses, drivers need to be retrained because they do not have the right to operate them. They should provide a light transition to the driving of electric buses under legal conditions. Also one should consider the issue of carrier exemption from the transport tax and clarify the methodology of transport work cost calculation on routes by traffic types.

The local nature of problems is expressed in the following shortcomings: a) the absence of a flexible tariff policy; b) the imperfection of methods optimizing the structure of rolling stock fleet depending on year seasons and week days; c) the violation of passenger time standards for a trip, taking into account the condition of transfer absence; d) the lack of coherence in the schedule of certain types of passenger transport movement in the network transport-transfer nodes, and, thus, there is the decrease of their interaction effectiveness and, as a consequence, the decrease in the volume of passenger transportation, the level of income for carriers and the growth of social tension; e) the violation of the norms for the rolling stock filling during peak hours; e) the lack of fleet structure adaptation to different segments of consumer demand (disabled population, the passengers with children, etc.); g) a low level of information support quality for passengers; h) the decrease of transportation process safety due to the lack of control system for the selection of qualified personnel; i) non-optimal design of a route does not ensure a proper coverage

 ISSN 2322- 6307

of recreational and other areas of a settlement, k) the absence of variability in the modes of rolling stock on a route; l) the lack of incentive premiums for the improvement of transport service quality and a number of other problems.

The following works are devoted to the degrees of global and local problem study concerning the management of various PTS markets functioning and development:

- in the issue of economic relations transformation in the service sector (including passenger transport services): T.D. Burmenko, L.G. Ermakova, S.A. Kurgansky, R.G. Leontiev, L.B. Mirotin, V.M. Rutgayzer.
- in the issue of PTS organization and management efficiency: A.M. Bolshakov, A.Yu. Belinsky, G.V. Bolonenkov, G.A. Varelopulo, V.A. Vorotilov, A.G. Dynkin, D. Drew, I.S. Efremov, M.V. Singbush, V.B. Ignatiev, V.S. Kadnikov, E.A. Kravchenko, V.A. Krylov, V.M. Kurganov, N.F. Lopatina, A.N. Lokhov, E.M. Lobanov, L.B. Mirotin, V.A. Persianov, I.S. Spirin, A. Feigenbaum, E.E. Tashbaev, V.V. Shestoktas, S.L. Chernikov.
- in the matter of consumer demand for PTS volume planning: V.N. Burgomenko, V.A. Vorotilov, E.P. Volodin, N.I. Gromov, I.S. Efremov, S.N. Kolesnikov, A.S. Kudryavtsev, S.V. Kolganov, F.G. Kravets, E.M. Lobanov, E.G. Myasoedov, A.K. Mason, B.M. Parasonsky, V.A. Sabolin, A.G. Wilson, V.A. Hyudotayev, A.F. Chempernown, B.A. Shabalin and others.

The analysis of the scientific works of the abovementioned scientists and experts shows that in the issue of PTS market functioning and development management, a special attention was paid to the relationship between the quality and the agglomeration characteristics of transport services for population. In this regard, the modern stage of various sectors of the country economy modernization requires a new integrated approach to solve global and local problems in which the sphere of passenger transport services occupies a special place.

The peculiarity of the integrated approach is that due to the combination of SWOT analysis and PEST analysis tools into a single coherent system, global and local aspects are taken into account to solve the problems of PTS market functioning and development in urban agglomerations on the conditions of benefit balance compliance for all interested parties - the participants of PTS markets (Customer-Carrier-Consumer) (Kravchenko, et al., 2017; Kravchenko & Kravchenko, 2008d).

The purpose of SWOT analysis is the development of information on the specifics of external and internal factor influence on the functioning and the development of PTS markets by the identification and the analysis of strong (S) and weak (W) sides, as well as the opportunities (O) and the threats (T) with the determination of communication chain between them.

The goal of PEST analysis is to identify political (P), economic (E), social (S) and technological (T) factors and to assess their impact on PTS market functioning and development. PEST analysis includes the ability to form an objective view of PTS market state, to assess the prospects and the directions of their competitive development in the agglomeration environment cyclically, using (on the authors' proposal) the "KTON" matrix model - the coordination of public transport services (Table 3).

Table 3 – "KTON" matrix model

K - Coordination		
K1 – Complexity	**K2 - Competition**	**K3 - Supervision**
K_{11} The complexity of consumer segment transport servicing taking into account the peculiarities of territorial zoning (S)	K_{21} The competitiveness of economic entities in the sphere of passenger transport services according to a formed image (E)	K_{31} The supervision of economic entity production process rhythm (E)
K_{12} Integrated approach to the development of passenger transport services (S)	K_{22} The competitiveness of transport technologies (E)	K_{32} The supervision of transportation processes: scheduling (T)

K_{13} The complexity of rolling stock maintenance and repair (T)	K_{23} The competitiveness of additional services (E)	K_{33} The supervision of service flows in the area of passenger transport service (E)
K_{14} The complexity of information and communication support (situational dispatch centers) (T)	K_{24} The competitiveness of carriers by fare (E)	K_{34} The supervision of production resource expenditure (operation) (E)
K_{15} The complexity of transport service culture (S)	K_{25} The competitiveness by PTS quality on a regular basis (E)	K_{35} The supervision of enterprise business processes in the field of passenger transport services (E)
K_{16} The complexity and flexibility of transportation services by week days (S)	K_{26} The competitiveness on the quality of a private (vip) clientele servicing (T)	K_{36} The supervision of motor transport expert training and retraining taking into account the climatic features of a region (P)
K_{17} The complexity and the flexibility of transportation services by seasons (S)	K_{27} The competitiveness in the prospective areas of PTS development (E)	K_{37} The supervision of financial flows in the area of passenger transport services (E)
K_{18} The complexity in the development of passenger transport service market (T)	K_{28} Personnel competitiveness (E)	K_{38} The supervision of material flows in the sphere of passenger transport services (T)
K_{19} The complexity in the issue of transport infrastructure development taking into account related businesses (S)	K_{29} The competitiveness for the right to advertise in passenger transport and in transport infrastructure (E)	K_{39} The supervision of information flows in the sphere of PTS (S)
	T – Transport	
T1 - Tariffs	**T2 - Technologies**	**T3 - Requirements**
T_{11} Baggage transportation rates (E)	T_{21} The technologies for a rolling stock selection with the loading at nominal capacity (T)	T_{31} The requirements for information service provision to the public (P)
T_{12} Tariffs for rolling stock rental (E)	T_{22} The technologies of population transport servicing on a custom basis ("24/7") (T)	T_{32} The requirements for route functioning quality provision (P)
T_{13} Tariffs for travel through the territorial zones of public transport servicing (E)	T_{23} Rolling stock reservation technologies (T)	T_{33} The requirements to the route network for the territorial coverage of municipality districts (P)
T_{14} Technical inspection rates (E)	T_{24} Dispatch control technologies for transportation processes of all types of passenger transport (T)	T_{34} The requirements for the timely renewal of rolling stock (T)
T_{15} Travel rates during public holidays (E)	T_{25} The technologies of ground transport interaction in network transport-transfer nodes (T)	T_{35} Passenger and baggage security requirements (P)
T_{16} Tariffs for ordered transportations (E)	T_{26} The technologies for making managerial decisions using information systems and technologies (T)	T_{36} The requirements for rolling stock compliance with environmental standards (P)
T_{17} Tariffs for rolling stock maintenance (E)	T_{27} The technologies of interaction with partner enterprises for the formation of a range of services, as well as with consumers based on the use of integrated marketing communications (T)	T_{37} The requirements for the compliance with the regularity of transport services (T)
T_{18} Tariffs for travel by week days (E)	T_{28} The development of multimodal (intermodal) transport technologies (T)	T_{38} The requirements for compliance with the pre-trip (post-trip) medical examination for drivers (P)
T_{19} Tariffs for travel by day time (E)	T_{29} The information technologies in transport service production (T)	T_{39} The requirements for the timely conduct of all types of briefings on occupational safety (P)
	O - Servicing	
O1 - Organization	**O2 - Optimization**	**O3 - Provision**

O_{11} Organization of a route taking into account the specifics of population migration processes (T)	O_{21} The optimization of a route network according to RS fleet structure (T)	O_{31} The provision of travel time standards (S)
O_{12} Organization of the transportation process for disabled people (T)	O_{22} The optimization of bus travel modes on a route taking into account the seasonal factor (T)	O_{32} The provision of regulated environmental standards for transport (P)
O_{13} Traffic management: the aspect of traffic flow regulation and redistribution (T)	O_{23} The optimization of potential participant composition at PTS market (P)	O_{33} The provision of RS timely maintenance and repair (T)
O_{14} The organization of dispatch control for transportation processes (T)	O_{24} The Optimization of territorial and seasonal distribution of production capacities (T)	O_{34} The provision of transportation services for disabled people (S)
O_{15} The organization of highway timely repair and maintenance (T)	O_{25} The optimization of the tariff network and the modes of payment for travel (cash / cashless settlement) (T)	O_{35} Tax collection provision (P)
O_{16} The arrangement of stopping points (T)	O_{26} The optimization of various modes of transport interaction in complex transport-transfer nodes (T)	O_{36} The provision of recreational, leisure-entertainment, sports and other areas and suburban urban infrastructure with transport services (S)
O_{17} The organization of interaction with the suppliers of materials, parts, assemblies, the units for timely maintenance and repair of rolling stock fleet (T)	O_{27} The optimization of production and economic activities among carriers (E)	O_{37} The provision of a favorable investment climate in the industry and promotional activities (E)
O_{18} The organization of emergency assistance in transport infrastructure facilities (P)	O_{28} The optimization of the transport service development strategy (E)	O_{38} The provision of corporate culture, personnel policy and social responsibility development (S)
O_{19} The organization of additional services in the objects of transport infrastructure (S)	O_{29} The optimization of economic entity management organizational structure (T)	O_{39} The provision of a change management system, risk management, rapid response methods and tools, etc.(T)
	H - Population	
H1 - Standartization	**H2 - Continuity**	**H3 - Violations**
H_{11} Standartization of labor regime and recreation of drivers (P)	H_{21} The continuity in the development of management systems within PTS area (E)	H_{31} Traffic safety violations (S)
H_{12} Standartization of RS fleet structure (T)	H_{22} The continuity of transport technology development in the field of passenger transport services (T)	H_{32} The violations of transport safety requirements, incl. the ones related to the activities of illegal carriers (S)
H_{13} Regulation of working capital using logistics tools (E)	H_{23} The continuity in the development of competition within the area of passenger transport services (E)	H_{33} The violations of rolling stock operation rules on ecological components (S)
H_{14} Regulation of transportation cost (P)	H_{24} The continuity of innovation use in the field of passenger transport services (T)	H_{34} Production rhythm disturbances (E)
H_{15} Regulation of rolling stock speeds on routes by day hours and week days (T)	H_{25} The continuity of the investment process in the area of passenger transport services (E)	H_{35} The violations of the rolling stock exit mode on a route (T)
H_{16} Administrative regulation of passenger transportation operator admission to PTS markets (P)	H_{26} The continuity of scientific approach development to service quality management (S)	H_{36} The violations of quality requirements for the provision of services (S)
H_{17} The regulation of transport service quality (quantitative aspect) (T)	H_{27} The continuity of service life-cycle management system improvement (E)	H_{37} The violations of carrier contractual obligations: a legal aspect (P)

H_{18} The normalization of the need for production personnel (drivers, conductors, repair workers, etc.) (E)	H_{28} The continuity of a route network improvement on the basis of passenger traffic regular survey (T)	H_{38} The violation of an organization strategic goal and objective implementation (E)
H_{19} The normalization of time for rolling stock maintenance and repair (E)	H_{29} The continuity of servicing for different population segments (S)	H_{39} The violations (the failures) of logistics processes (the supply of materials, parts, aggregates, etc.) (E)

Integrating SWOT and PEST analysis tools, the components of KTON matrix were determined and structured in the issue of various types of PTS market functioning and development management based on the example of Krasnodar Territory urban agglomerations (Table 4).

The analysis of different types of PTS markets functioning and development within the Krasnodar agglomeration, presented in Table 3, should be subject to systematic review in connection with the influence of political, economic, social and technological factors, taking into account the influence of a seasonal factor on the cycles of PTS provision.

The cycle of PTS provision in urban agglomerations can be conditionally divided into autumn-winter and spring-summer periods, which have the following peculiarities in the development of passenger transport volumes and, as a consequence, incomes (Kravchenko et al., 2013; Kravchenko & Kravchenko, 2014).

- during an autumn-winter period the passenger traffic on urban and suburban routes of an agglomeration is stable, connected with official, labor, cultural, household and other purposes of consumers, based on the principle of external and internal pendulum population migration within one working day (without an overnight stay), and also the influence of negative natural and climatic and road factors increases in the matter of personal transport use refusal to move along an agglomeration in favor of public passenger transport;
- during a spring-summer period the passenger traffic on urban agglomeration routes is an unstable (impulsive one), due to the increase of vacations, the decrease of labor movements among schoolchildren, and the predominance of cultural, entertainment, resort, tourist and other leisure activity trips in the direction of agglomeration peripheral areas and in suburban communication, and also the influence of favorable natural-climatic and road factors increases concerning the use of personal transport instead of public passenger transport.

Table 4 – The evaluation of different types of PTS markets functioning and development in Krasnodar agglomeration

Market name	Market belonging	SWOT-analysis by "KTON" matrix				PEST- analysis by "KTON" matrix
		S advantages	**W** disadvantages	**O** possibilities	**T** risks	
Saturated market	Karasunsky district, Prikubansky district, Western district, Central district	$T_{33}, H_{11}, H_{16}, O_{18}, T_{31}$	$H_{14}, O_{32}, O_{23}, O_{35}, H_{39}, H_{37}, K_{36}$	T_{32}	$T_{35}, T_{36}, T_{38}, T_{39}$	**P** – political factors
		$K_{29}, K_{37}, T_{11}, T_{12}, T_{14}, T_{17}, T_{19}, H_{18}$	$K_{28}, K_{25}, K_{24}, K_{23}, K_{31}, T_{13}, H_{38}, H_{21}, H_{27}, H_{19}$	$K_{27}, K_{21}, K_{22} K_{33}, K_{35}, T_{15}, T_{18}, O_{27}, O_{28}, O_{37}, H_{13}, H_{23}, H_{25}, T_{16}$	K_{34}, H_{34}	**E** – economic factors
		$K_{11}, O_{36}, O_{34}, O_{19}, H_{29}$	K_{19}, O_{31}, H_{36}	$K_{12}, K_{16}, K_{17}, K_{39}, O_{38}, H_{26}$	$K_{15}, H_{31}, H_{32}, H_{33}$	**S** – social factors
		$T_{24}, T_{25}, K_{14}, O_{12}, O_{16}$	$O_{25}, K_{32}, K_{38}, T_{26}, T_{27}, T_{28}, T_{34}, T_{37}, O_{11}, O_{13}, O_{14}, O_{22}, O_{24}, O_{26}, H_{15}, H_{17}, H_{28}, H_{35}, K_{18}$	$T_{22}, H_{12}, O_{21}, K_{26}, T_{21}, T_{23}, T_{29}, O_{17}, O_{29}, O_{39}, H_{22}, H_{24}$	O_{15}, O_{33}	**T** – technical and technological factors
Developing market	Belozyorny s., Znamensky s., Industrialny s., Kolosisty s., Krasnodarsky s., Lazurny s.	O_{18}, H_{16}	$O_{32}, O_{35}, K_{36}, H_{11}, H_{14}, H_{37}$	T_{31}, T_{32}, O_{23}	$T_{35}, T_{36}, T_{38}, T_{39}$	**P** – political factors
		$T_{11}, T_{12}, T_{13}, T_{14}, T_{16}, T_{17}, T_{19}$	$K_{22}, K_{24}, K_{25}, K_{33}, K_{37}, H_{18}, H_{19}, H_{21}, H_{23}, H_{25}, H_{27}$	$K_{21}, K_{27}, K_{29}, K_{34}, K_{35}, T_{15}, T_{18}, O_{27}, O_{28}, O_{37}, H_{13}$	H_{34}, H_{38}, H_{39}	**E** – economic factors
		H_{29}, O_{34}	$K_{12}, K_{15}, K_{19}, O_{31}, H_{32}, H_{36}$	$K_{11}, K_{39}, O_{38}, H_{26}$	H_{31}, H_{33}	**S** – social factors
		O_{11}, O_{12}, O_{25}	$K_{18}, T_{21}, K_{32}, T_{24}, T_{25}, T_{26}, T_{29}, T_{37}, O_{13}, O_{14}, O_{15}, O_{16}, O_{17}, O_{19}, O_{21}, O_{24}, O_{33}, H_{12}, H_{15}, H_{22}$	$K_{26}, K_{31}, K_{38}, T_{22}, T_{23}, T_{27}, T_{28}, O_{22}, O_{26}, O_{29}, O_{39}, H_{17}, H_{24}, H_{28}$	T_{34}, H_{35}	**T** – technical and technological factors
The market with limited growth potential	Dinskoy region, Seversky region, Krasnoarmeysky region, Ust-Labinsky region	O_{18}	$H_{16}, O_{32}, O_{35}, T_{31}, H_{11}$	$O_{23}, T_{32}, H_{14}, K_{36}$	$T_{35}, T_{36}, T_{38}, T_{39}, H_{37}$	**P** – political factors
		$K_{24}, T_{11}, T_{12}, T_{13}, T_{14}, T_{17}$	$K_{21}, K_{22}, K_{25}, H_{13}, H_{18}, H_{19}$	$K_{29}, K_{33}, K_{34}, K_{35}, T_{15}, T_{16}, T_{18}, O_{27}, O_{28}, H_{21}, H_{23}, H_{25}, H_{27}$	$H_{34}, H_{38}, H_{39}, K_{37}$	**E** – economic factors
		H_{29}, O_{34}	$K_{11}, K_{39}, O_{31}, H_{26}$	K_{12}, K_{19}, O_{38}	$H_{31}, H_{33}, H_{32}, H_{36}$	**S** – social factors
		O_{11}	$K_{26}, T_{21}, T_{37}, K_{32}, O_{12}, O_{13}, O_{14}, O_{15}, O_{16}, H_{12}, H_{15}, H_{17}$	$K_{31}, K_{38}, T_{22}, T_{23}, T_{24}, T_{25}, T_{26}, T_{27}, T_{28}, T_{29}, O_{17}, O_{21}, O_{22}, O_{24}, O_{25}, O_{26}, O_{29}, O_{33}, O_{39}, H_{22}, H_{24}, H_{28}$	T_{34}, H_{35}	**T** – technical and technological factors

These features are taken into account in the issue of the urban agglomeration route network optimization and largely influence the formation and the dynamics of consumer demand for passenger transport services (Kravchenko & Kravchenko, 2014; Kravchenko, 2014c). The relationship between the level of consumer demand, which determines the volume of transportation, with the system of PTS organization and provision is presented on the nomograms of Figure 1 and 2. For clarity, an example of the regular bus route optimization No. 96 "City Psychiatric Hospital - Central Collective Farm Market" in Krasnodar is considered for an autumn-winter period. Similarly, it is possible to carry out the optimization for an autumn-summer period. A radial pendulum route number 96 has the following characteristics: rolling stock (RS) - medium capacity (72 passenger seats); number of RS - 12 buses; the turnaround time makes 120 minutes; the RS interval makes 10 minutes; the maximum passenger traffic on the busiest section of the route makes 60 people (720 people for all RS units); the average passenger travel distance makes 6 km.

The optimization of Route 96 can be carried out in two scenarios:
- with the change in the structure of the park and a route preservation
- with the change of the fleet structure and a route change

The optimization with the change in the fleet structure and with the preservation of a route provides the use of a medium-capacity RS (72 passenger seats) and the decrease of its number on a route to 10 units with the traffic interval increase of up to 12 minutes. At the same time, the economic effect will be achieved due to passenger traffic increase by 5% in relation with the elimination of shortcomings in the route functioning and a 12.4% decrease in the cost of transportation as compared to the current mode of operation due to a smaller number of rolling stock involved in the route and the elimination of route operation shortcomings.

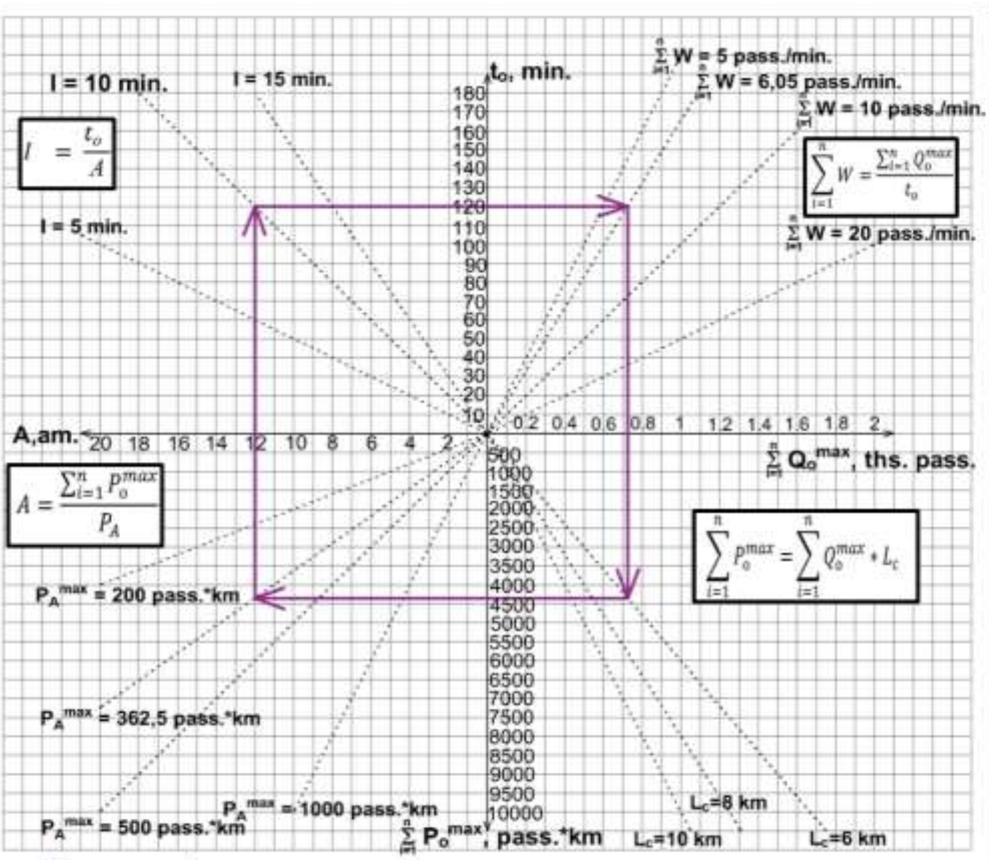

Figure 1 – Nomogram of the route operation current mode:

t_o– turnaround time; W – the productivity of all units of rolling stock (RS) on the busiest run of the route for a turnaround; Q_o^{max} – the maximum value of passenger traffic on the busiest run of the route for a turnaround; L_c – an average range of a trip; P_o^{max} – the maximum value of the transport work performed by all RS units for a turnaround; P_A^{max} – the maximum value of the transport work performed by one RS unit for a turnaround; A – the number of RS units on a route; I – RS motion interval.

– current mode of route functioning

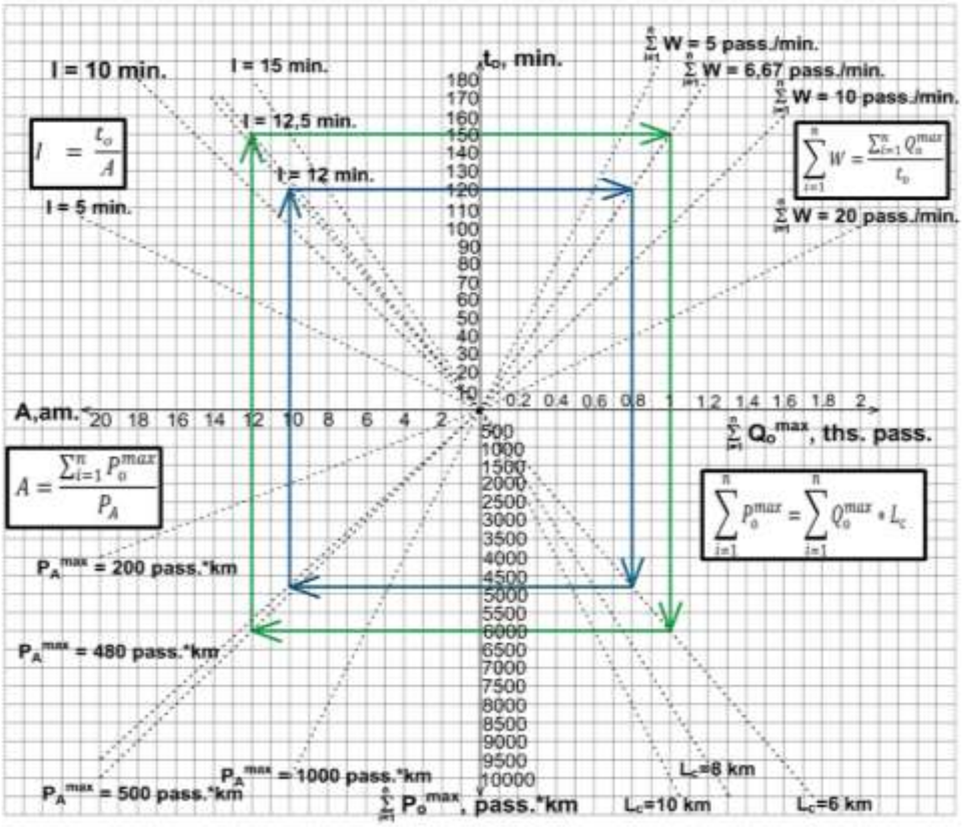

Figure 2 – Route optimization nomogram:

t_o– turnaround time; W – the productivity of all units of rolling stock (RS) on the busiest run of the route for a turnaround; Q_o^{max} – the maximum value of passenger traffic on the busiest run of the route for a turnaroud; L_c – an average range of a trip; P_o^{max} – the maximum value of the transport work performed by all RS units for a turnaround; P_A^{max} – the maximum value of the transport work performed by one RS unit for a turnaround; A – the number of RS units on a route; I – RS motion interval

– optimization with fleet structure change and the preservation of a route

– optimization with fleet structure preservation and a route change

The optimization with the change of the fleet structure and a route change provides the use of RS with a large capacity (110 passenger seats), the maintaining of the current number of PS on a route (12 units) and travel time increase to 12.5 minutes, which is offered to provide through a combination of different driving modes on a route (speedy, express, normal) and the normalization of speeds. At the same time, the economic effect will be achieved due to passenger traffic increase by 32% and the coverage of new recreational and leisure-entertainment zones of the city, as well as due to the elimination of shortcomings in a route operation.

Descriptive characteristic of nomograms

The presented nomograms have universal parametric characteristics, which allow to optimize a route network in different scenarios. The presented nomograms have the Krasnodar route No. 96 as an example, for which two optimization scenarios are possible: with a RS fleet structure change, preserving a route and preserving the fleet structure with a route change.
The nomogram consists of four quadrants:

The first quadrant of nomograms (Figure 1 and Figure 2) reflects the functional relationship between a turnaround time (tоб) and the maximum value of passenger traffic on the busiest runway of a turnaround ($Q_о^{мах}$). The value of these parameters is determined by the results of a route survey. The turnaround time includes the flight time in the forward direction and the voyage time in the reverse direction (t_f), the idle time at the intermediate stopping points (t_i) and the idle time at the final stopping points (t_{if}):

$$t_о = t_f + t_i + t_{if} \quad . \tag{1}$$

The value of passenger traffic on the busiest run of a route for a turnaround ($Q_о^{мах}$) is determined by the following formula:

$$Q_о^{мах} = Q_{p/h}^{мах} * t_о \quad , \tag{2}$$

where $Q_{p/h}^{мах}$ - an hourly passenger traffic on the busiest route, pass.

The functional relationship between these parameters determines RS output value ($W_о^{мах}$) with the maximum value of the passenger traffic on the busiest run of a route for a turnaround:

$$W_о^{мах} = \frac{Q_о^{мах}}{t_о} \quad . \tag{3}$$

The second quadrant of nomograms (Figure 1 and Figure 2) reflects the functional relationship between the maximum value of passenger traffic on the busiest runway for a turnaround ($Q_о^{мах}$) and the maximum value of the transportation work performed by all rolling stock units for a turnaround ($P_о^{мах}$):

$$\sum_{i=1}^{n} P_о^{мах}{}_i = Q_о^{мах} * L_с \ , \tag{4}$$

where $L_с$ – the average range of passenger travel, km, is determined by the following formula:

$$l_{ср} = 1{,}3 + 0{,}3 * K_H \sqrt{S} \ , \tag{5}$$

where S is the residential area of a municipality of an agglomeration type, in which services are provided for the transportation of passengers by public motor vehicles on regular intraurban routes; K_H – the coefficient of non-rectilinearity of a street-road network in a municipality (K_H = 1,1...1,5).
The third quadrant of nomograms (Figure 1 and Figure 2) reflects the functional relationship between the maximum value of the transport work performed by all RS units for a turnaround ($P_о^{мах}$), and the number of rolling stock (A) necessary for this route servicing for a turnaround:

$$\sum_{i=1}^{n} P_о^{мах}{}_i = A * P_{А/о}^{мах} \ , \tag{6}$$

where $P_{А/о}^{мах}$ – the maximum transport work performed by one RS unit for a turnaround; it is calculated by the following formula:

$$P_{А/об}^{мах} = \frac{1}{k} \sum_{j=1}^{k} q_j * L_c \ . \tag{7}$$

where q_j is the nominal capacity of each j-type of rolling stock involved on a route, k is the number of RS types on a route.
The fourth quadrant of nomograms (Figure 1 and Figure 2) reflects the functional relationship between the number of rolling stock (A) required to service this route in terms of a turnaround and a turnaround time (t_o):

$$t_о = A * I, \tag{8}$$

where I - the interval of rolling stock movement, min.

An absolute integral economic effect from the scenario optimization of a route network is proposed to be determined by the following developed formula (Kravchenko et al., 2017; Kravchenko et al., 2017):

$$AIE = \Delta_{a-w}\sum_{i=1}^{n}\sum_{j=1}^{m}\sum_{k=1}^{z}\frac{X_{ijk}\cdot\left[\left(\frac{t_o}{I}\cdot\frac{P}{L_c}\cdot T - C_b\cdot f(C_f + C_v)\right)\cdot(1-F\cdot f(s)) - C_a\cdot f(r_1, r_2, r_3)\right]}{1+(1-K_{ijk})} +$$

$$+\Delta_{s-s}\sum_{i=1}^{n}\sum_{j=1}^{m}\sum_{k=1}^{z}\frac{X_{ijk}\cdot\left[\left(\frac{t_o}{I}\cdot\frac{P}{L_c}\cdot T - C_b\cdot f(C_f + C_v)\right)\cdot(1-F\cdot f(s)) - C_a\cdot f(r_1, r_2, r_3)\right]}{1+(1-K_{ijk})},$$

where Δ_{a-w} is the autumn-winter period (6 months); Δ_{s-s} – the spring-summer period (6 months); *i* – the number of routes; *j* – the number of rolling stock types on a route (of especially small, small, medium, large and extra large capacity); *k* – the number of route operation days in each period; the required number of units of rolling stock on a route A=t_o/I: t_o – the time of a turnaround, min.; I – the interval of rolling stock movement, min.; the amount of passengers on a route can be determined by the results of a passenger traffic survey or by the following formula Q=P/L_c: P – transport work, pass *km; L_c – an average distance of passenger travel, km; X_{ijk} – the probability of a planned profit obtaining from passenger transportation, in unit fractions; T – an average rate per travel, rub./pass.; C_b – the cost of passenger transportation as a function of permanent (C_f) and variable (C_v) costs, including depreciation, rub.; C_a – additional cost (costs) due to the violation of passenger and baggage transportation safety requirements (r_1), the non-regularity of traffic (r_2) and the violation of RS operation environmental safety on a route (r_3), rub.; *F*f(s)* – the tax rate as the function of taxation system type (*s*) (an imputed tax, a simplified system, an ordinary taxation system), in fractions of a unit; K_{ijk} – a discount indicator that characterizes the level of transport service quality is determined by the ratio of the actually realized components of "CTON" matrix to their total number, in unit fractions.

Based on calculation results, the following values of an absolute integral economic effect were obtained for the bus route No. 96 in Krasnodar:

- for the current route operation mode - 27 311 924 rubles per year;
- for the optimization scenario with RS fleet structure change and the preservation of the route - 40,061,605 rubles/year (the growth of 12,749,781 rubles/year);
- for the optimization scenario with the change of the fleet structure and a route change - 51,572,952 rubles/year (the increase of 24,261,028 rubles/year).

The most preferable scenario is the optimization with the change of the fleet structure and a route change, as the greatest value of an absolute integral economic effect was obtained for it in the course of calculation.

Summary

The level of public transport servicing quality should meet the modern requirements of consumer demand, take into account the spatial planning features of urban development, taking into account the resource capabilities of transport operators. In order to optimize an urban agglomeration route network, a comprehensive analysis of local and global problems concerning PTS market functioning is needed, taking into account the influence of the seasonal factor on population transport activity. Based on the results of this analysis, we propose the application of a new integrated approach to the route network optimization on the basis of a balance of benefits for all interested parties - the participants of PTS markets (Customer -Carrier - Consumer).

Conclusions

1. It was determined that an insufficient development of PTS markets, especially in urban agglomerations (including resorts), leads to territorial social injustice among the residents of peripheral and dormitory microdistricts, which significantly affects the quality of their life and stay in urban environment, which is

conditioned predominantly by the lack of understanding of different types of PTS market feature functioning.

2. A new classification of PTS market types in urban agglomerations is proposed: a saturated market, an emerging market, a market with limited growth potential. This classification of PTS markets takes into account the territorial-segment nature and the dynamics of consumer demand in urban agglomeration, which make a significant impact on the efficiency of a municipality social and economic development as a whole and determine the need to optimize a route network taking into account the seasonal factor.

3. An integrated approach was formulated to optimize a route network, combining the SWOT analysis and PEST analysis tools into a single coherent system that allows to take into account the global and the local aspects to solve the problems of PTS market functioning and development management in urban agglomerations.

4. They developed the conceptual model "KTON" ("The coordination of public transport services"), which is represented by a set of structural-system components (in the amount of 108) in the form of a matrix, which allows to assess the quality of a route network operation in urban agglomerations by the ratio of actually realized component number (which can vary depending on a season) to their total number in the matrix.

5. Based on "KTON" model, an integrated SWOT analysis and PEST analysis of the PTS markets was carried out in the Krasnodar agglomeration due to the coordinated system of their operation various aspects evaluation. Thus, they revealed the relationship between the quality and the agglomeration characteristics of public transport services with the reference to PTS market type. This relationship greatly influences the process of a route network optimization.

6. Universal nomograms have been developed that make it possible to optimize a route network for different scenarios on the basis of a balanced benefit for all interested parties - the participants of PTS markets (Customer - Carrier - Consumer). The balance of benefits among the participants of PTS market is the following one: for the customer - the reduction of social tension, the increase of the agglomeration image due to a higher quality of transport services for population and a route network territorial development, as well as the tax base expansion; for a carrier - the increase of profit from PTS provision; for the consumers of transport services - to increase the level of quality and service culture.

7. They developed the formula to determine an absolute integral economic effect from the scenario optimization of a route network on the basis of a benefit-balanced approach for all interested parties - the participants of PTS markets (Customer-Carrier - Consumer), the results of calculation of which provide the following values , using the example of the bus route No. 96 of Krasnodar: for the current mode of the route operation - 27 311 924 rubles per year; for the optimization scenario with RS fleet structure change and wtih the route preservation - 40,061,605 rubles/year (the growth made 12,749,781 rubles/year); for the optimization scenario with the maintenance of the fleet structure and with the route change - 51,572,952 rubles/year (the increase of 24,261,028 rubles/year). The most preferable scenario is the optimization with the preservation of the fleet structure and with a route change, since the highest value of an absolute integral economic effect was obtained for it in the course of calculation (51,572,952 rubles/year).

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