METHODOLOGICAL APPROACHES TO DEFINING "DEMOGRAPHIC "FRAMEWORK" OF THE TERRITORIES INDUSTRIAL AND LOGISTIC DEVELOPMENT (CASE-STUDY FOR REGIONS IN THE VOLGA FEDERAL DISTRICT)

Marat R. Safiullin
Kazan Federal University, Russia
cp@tatar.ru

Leonid A. Elshin
Kazan Federal University, Russia
Leonid.Elshin@tatar.ru

Maria I. Prygunova
Kazan Federal University, Russia
Mariya.Prigunova@tatar.ru

ABSTRACT
The industrial development and the spatial concentration of its corresponding economic activities are based and are in many respects caused by a demographic profile of regions, city population displacement type, positive and negative demographic trends taking place, an energy potential, as well as raw opportunities of the considered regions rent development. In article methodological approaches to discovering reasons for integrated indicator of demographic capacity development in the region are provided, its definition is given, the indicators included in its structure are theoretically proved and also the high level of influence of the demographic environment development on rates of social and economic growth in regions is theoretically proven and has found complex reflection in the model representing correlation dependence between the considered indicator.

Keywords: *demographic framework, agglomerations competitiveness of regions, number of urban population, demographic priorities of productive forces development, industrial hubs of regions.*

INTRODUCTION

In regions the centers of industrial and industrial development are agglomerations. And here the hierarchy of industrial priorities and industrial development is created, not completely matching the regional.

It is reasonable to carry out methods of priorities determination in the methodological plan in the terms "number of urban population - city rank". It is known that the locus in the specified system of "phase" coordinates within a natural way of the created and developing city displacement system is described by Zipf's curve: $P_N = \frac{P_{MAX}}{N}$, where P_N- the number of urban population with a rank N, and P_{MAX}- the number of urban population in the largest ("capital") city of the considered regional system.

If "natural order" of city system forming of the region was broken for one reason or another, then the generalized analog of the Zipf's curve is recommended: $P_N = \frac{P_{MAX}}{N^{\alpha}}$, where α – the shifts parameter of actually developed structure of city displacement from the "natural" look to which α=1 corresponds.

Submit Date: 13.09.2016, Acceptance Date: 21.10.2016, DOI NO: 10.7456/1060NVSE/162

Having drawn up the logarithm for both parts in the equation of the generalized sedate Zipf's curve, we will receive $logP_N = log\frac{P_{MAX}}{N^{\alpha}}$, or, expression equivalent to it $logP_N = logP_{MAX} - \alpha logN$. Here N represents "rank" of the city settlement from 1 to 1537, $logP_N$ – function in which arguments are P_{MAX}, α and N. The main here are α and N, and P_{MAX}acts as mathematicians say, "an arbitrary parameter" as the fixed parameter depending on territorial borders for which Zipf's curve is being built.

Further we suggest to range the cities in the researched and estimated city agglomeration from the point of view of their "demographic priority" identification in the forthcoming industrial and industrial development by means of an indicator $logP_N$, which acts as mathematicians say, "an arbitrary parameter" as the fixed parameter depending on territorial borders for which Zipf's curve is being built.

Further we suggest locate the cities in the researched and expected city accumulation from the point of view of their "demographic priority" identification in the forthcoming industrial development by means of the indicator $logP_N$, which is the bigger, the bigger N is. Further observance of these priorities will allow to bring closer structure of city displacement to its "natural" look if α=1.

Ranging of agglomerations, both in one region, and between regions, can be carried out at the same time as follows: $R_K = \sum_{i=1}^{m_k} \alpha_{ik} logP_{ik}$, where α_{ik}- specific weight of *i* city settlement in the total number of the agglomerations population *k* ($\sum_{i=1}^{m_k} \alpha_{ik} = 1$), m_k- the number of the city settlements allocated in *k* agglomeration P_{ik}- number of resident urban population of the city, settlement of city type. That is, $R_K = \sum_{i=1}^{m_k} \frac{P_{ik} logP_{ik}}{\sum_{i=1}^{m_{ik}} P_{ik}}$.

METHODS

Approbation and verification of developed approach have been performed on the basis of determining the rank values of the agglomerations which are a part of the Volga Federal District of the Russian Federation regions [Safiullin et al., 2015].

Today three regions form "the core" of the "demographic framework" of future industrial development of the Volga Federal District – the Republic of Tatarstan, Samara and Nizhny Novgorod regions. And in this “core" the rating of the predicted demographic development in the Samara region is slightly higher, than in the Republic of Tatarstan, and in each of these regions is a little more preferable, than in Nizhny Novgorod Region.

The allocated “core" of "the demographic framework" is effectively supplemented by the Republic of Bashkortostan. Having promptly increased a share of the cities population from 3,6% in 1897 to 11,7% in 1989, the Republic of Bashkortostan gradually further raised this share: to 12,1% in 2002 and 12,4% in 2010. Such dynamics represents undoubted "asset" of the region and brings it closer to three regions considered above [Asian Social Science].

All above gives the grounds to provide "the core" of "the demographic framework" of regions industrial development for Volga Federal District taking into account "internal hierarchy" as follows:

Submit Date: 13.09.2016, Acceptance Date: 21.10.2016, DOI NO: 10.7456/1060NVSE/162

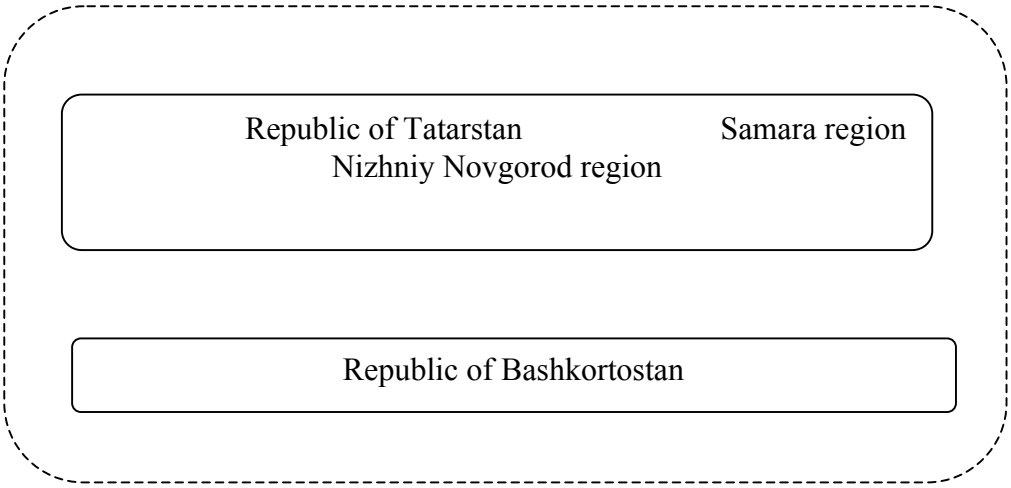

Figure 1 - "Internal hierarchy" of "the core" of "the demographic framework" for regions of Volga Federal District

Having determined "the core" of "the demographic framework" of Volga Federal District regions we will determine and make comparative dynamics analysis of their logarithmic ratings for estimated city agglomerations from the point of view of their "demographic priority" identification in the forthcoming industrial development.

We will determine and compare R_k for the agglomerations allocated by us in"the core" regions of "the demographic framework" of the Volga Federal District. First of all, we will consider the largest of them.

Agglomeration of Samara includes, along with Samara itself, the cities of Novokuybyshevsk, Kinel, as well as city type settlements of Smyshlyaevk, Novosemeykino, Alekseyevka, Ust-Kinelsky, Mirny, Volga. 9 settlements total. The table of calculation of the demographic structure priority covering the specified agglomeration will look as follows.

Table 1.Calculation of priority in the forthcoming industrial development of agglomeration of the cities of Samara and Novokuybyshevsk

		N (1989)	$logP_{ik}$, k=1	P_{ik} (th.peopl.) (k=1, 1989)	α_{ik}	$\alpha_{ik} logP_{ik}$
1	Samara	5	3,099	1257,3	0,8653	2,6816
2	Novokuybyshevsk	123	2,053	112,5	0,0774	0,1590
3	Kinel	443	1,509	32,3	0,0222	0,0335
4	Smyshlyaevk	889	1,134	13,6	0,0094	0,0106

Submit Date: 13.09.2016, Acceptance Date: 21.10.2016, DOI NO: 10.7456/1060NVSE/162

5	Novosemeykino	1176	0,991	9,8	0,0067	0,0067
6	Alekseyevka	1239	0,959	9,1	0,0063	0,0060
7	Ust-Kinelsky	1369	0,869	7,4	0,0051	0,0051
8	Mirny	1387	0,857	7,2	0,0050	0,0042
9	Volga	1510	0,681	4,7	0,0032	0,0022
	Total	**x**	**x**	**1453**	**1,00**	**2,9089**

Data on which the subsequent similar tables are based are taken for 1989. We believe that upon transition to 2002, and then to 2010 received with the help of$logP_{ik}$, α and N agglomerations ranging and the residential locations entering them will change little.

Other large city agglomeration is represented by Nizhny Novgorod, Dzerzhinsk, Bor, Kstovo, Balakhna, Zavolzhye, Gorodets, Bogorodsk, Volodarsk. It is one of the oldest city industrial agglomerations in the Volga Federal District and in Russia in general. We will provide the table of the Nizhny Novgorod agglomeration assessment.

Table 2.Calculation of priority in the forthcoming industrial development of city agglomeration of Nizhny Novgorod, Dzerzhinsk, Bor, Kstovo, Balakhna

		N (1989)	$logP_{ik}$, k=2	P_{ik} (th.peopl.) (k=2, 1989)	α_{ik}		$\alpha_{ik} logP_{ik}$
1	Nizhny Novgorod	3	3,157	1434,7	0,7122		2,2485
2	Dzerzhinsk	61	2,463	285,4	0,1417		0,3490
3	Kstovo	224	1,811	64,5	0,0320		0,0580
4	Bor	226	1,809	64,4	0,032		0,0578
5	Zavolzhye	331	1,643	43,9	0,0218		0,0358
6	Balakhna	380	1,581	38,1	0,0189		0,0299
7	Bogorodsk	380	1,581	38,1	0,0189		0,0299
8	Gorodets	423	1,534	34,2	0,0170		0,0260
9	Volodarsk	1062	1,045	11,1	0,0055		0,0058
	Total	**x**	**x**	**2014,4**	**1,00**		**2,8407**

Submit Date: 13.09.2016, Acceptance Date: 21.10.2016, DOI NO: 10.7456/1060NVSE/162

As we see, agglomeration Samara in spite of the fact that Nizhny Novgorod in 1989 was 14% larger on the urban population number, being from the point of view of a demographic priority in the forthcoming industrial development of greater priority, than agglomeration of Nizhny Novgorod. Moreover, the assessment corrected on values of specific weight in agglomeration $\alpha_{ik} logP_{ik}$, actually, for was higher Samara, than for Nizhny Novgorod [World Applied Sciences Journal].

We will consider and will estimate agglomeration of Kazan now. Other than Kazan it also includes the cities of Zelenodolsk, Volzhsk (Republic of Mari El), city type settlements of Vasilyevo, Lower Vyazovye. We will notice that in Kazan 1085,3 thousand people lived in 1989. Insignificant feature of the Kazan agglomeration is that its borders cover not a really big city of 61,4 thousand people, but this city enters into territorial and administrative part of another region – the Republic of Mari El. And by the size Volzhsk is the second city of this republic. The table of the Kazan city agglomeration assessment looks as follows.

Table 3. Calculation of priority in the forthcoming industrial development of the Kazan city agglomeration

		N (1989)	$logP_{ik}$, k=3	P_{ik} (th.peopl.) (k=3, 1989)	α_{ik}	$\alpha_{ik} logP_{ik}$
1	Kazan	9	3,036	1085,3	0,8575	2,6033
2	Zelenodolsk	149	1,979	94,9	0,0750	0,1484
3	Volzhsk (Republic of Mari El)	239	1,789	61,4	0,0485	0,0868
4	cts Vasilyevo	714	1,255	18,0	0,0142	0,0178
5	cts Lower Vyazovye	1462	0,785	6,1	0,0048	0,0038
	Total	**x**	**x**	**1265,7**	**1,00**	**2,8601**

From the above it is visible that the Kazan city agglomeration has slightly better demographic priority in comparison with Nizhny Novgorod and very slightly yields to the Samara region. By and large all given values of "logarithmic ratings" on the leading agglomerations of "the core" of "the demographic framework" of Volga Federal District are comparable, and all above ranked agglomeration almost equally are high-priority [Scott and Peter, 2012]. In the specified regions "core" we allocated only agglomeration Ufa which also includes Blagoveshchensk and settlement of city type Chishma can compete with these agglomerations. We will provide the table of Ufa agglomeration assessment.

Table 4. Calculation of priority in the forthcoming industrial development of the Ufa city agglomeration

		N (1989)	$logP_{ik}$, k=4	P_{ik} (th.peopl.) (k=4, 1989)	α_{ik}	$\alpha_{ik} logP_{ik}$
1	Ufa	10	3,033	1079,8	0,9585	2,9073

Submit Date: 13.09.2016, Acceptance Date: 21.10.2016, DOI NO: 10.7456/1060NVSE/162

2	Blagoveshchensk	497	1,444	27,7	0,0246	0,0355
3	cts Chishma	648	1,2788	19	0,0169	0,0216
	Total	**x**	**x**	**1126,5**	**1,00**	**2,9644**

RESULTS

Results of the conducted research allow to build the considered largest agglomerations of "the demographic framework core" for regions of Volga Federal District in a kind of hierarchy. The priority of the head structure-forming city of agglomeration in noticeable degree depends on the specific weight of this city urban population number in the total number of all formed agglomerations urban population.

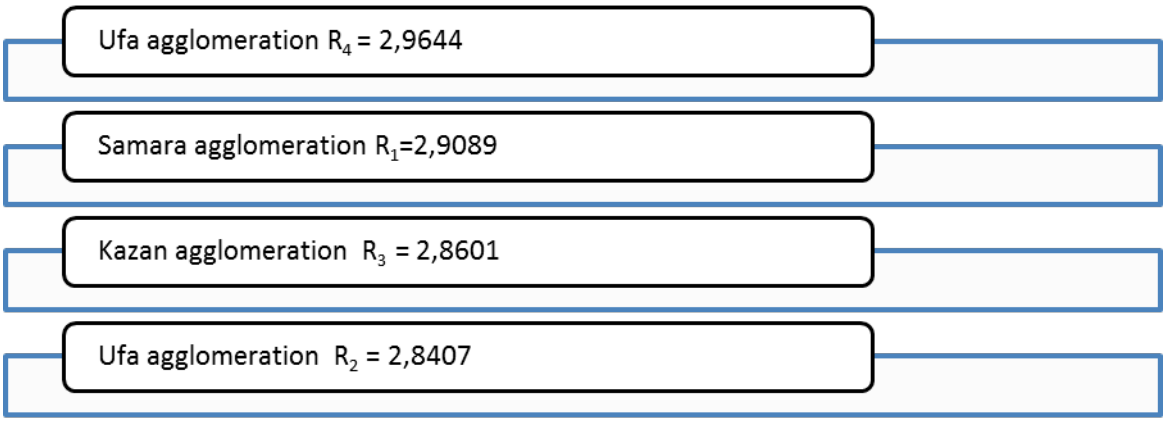

Figure 2. Demographic priorities of the forthcoming industrial development of the largest agglomerations of Volga Federal District in 1989

In 2010 structure of "the core" agglomerations of "the demographic framework" changed insignificantly:

Submit Date: 13.09.2016, Acceptance Date: 21.10.2016, DOI NO: 10.7456/1060NVSE/162

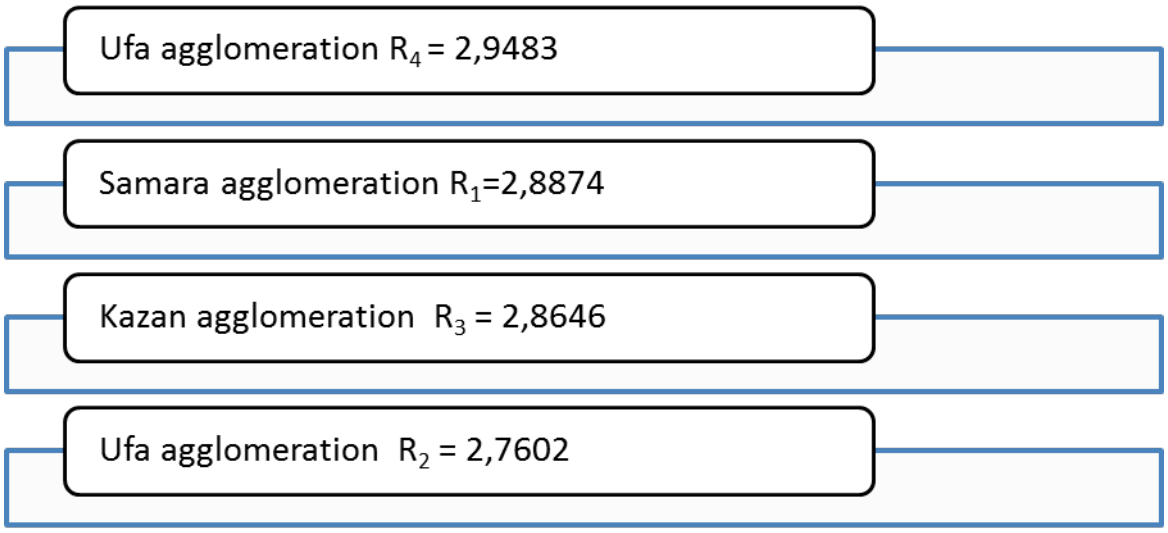

Figure 3. Demographic priorities of the forthcoming industrial development of the largest agglomerations of Volga Federal District in 2010

If to take other indicator, - the amount of the cities and city type settlements population logarithms of the researched agglomeration which values reflect the capability of city agglomeration (or other city system) to reproduce the number of urban population, then the picture will look as follows: agglomeration Samara 12,152 in 1989 and 12,1831 in 2010; agglomeration Kazan – 8,844 in 1989 and 8,9274 in 2010, agglomeration Ufa – 5,7558 in 1989 and 5,8865 in 2010, agglomeration of Nizhny Novgorod – 16,624 in 1989 and 16,5461 in 2010. That is, despite some insignificant decrease in "average demographic rating" in city agglomerations of Ufa, Samara, Nizhny Novgorod, from 1989 to 2010 demographic priorities in absolute expression of these agglomerations have increased.

On the basis of the received assessment using logarithms, it is possible to determine average "demographic rating" of each of the considered regions of Volga Federal District. Methods of calculation and results are reflected in Table 5.

From the table it is well visible that the Nizhny Novgorod Region from 1989 to 2010 at the same time has slightly lowered both average weighed and absolute values, the "demographic ratings" received proceeding from structure of the developed agglomerations. Very noticeable reducing from 89,7% to 88,61% of the urban population share for Nizhny Novgorod agglomeration became one of the basic reasons of it. At the same time, should we count "demographic capacity" of this agglomeration as the amount $logP_{ik}$, the cities entering agglomeration, we will see that agglomeration of Nizhny Novgorod was and remains to the largest in the Volga Federal District. Received amount of logarithms on population of the cities equals to 16,624 in 1989 and 16,5461 in 2010. In general on both agglomerations of the Nizhny Novgorod Region absolute "demographic capacity" of all Nizhny Novgorod Region made 23,768 in 1989 and 23,6656 in 2010. And values of this last indicator much more exceeded the average weighed amount of averages on each agglomeration of the region.

Submit Date: 13.09.2016, Acceptance Date: 21.10.2016, DOI NO: 10.7456/1060NVSE/162

Table 5. The structural and demographic characteristic of the Volga Federal District regions on the basis of the received averages of the weighed "demographic ratings" on the agglomerations and industrial hubs forming them

	Region, agglomerations	Calculation of an average of the weighed "demographic rating" for regions of Volga Federal District				Absolute "demographic rating" of agglomerations	
		1989		2010		1989	2010
		$\alpha_{ik} = \Delta_k \sum_{i=1}^{n_k}$	$\sum_{k=1}^{n_k} \Delta_k R_k$	$\alpha_{ik} = \Delta_k \sum_{i=1}^{n_k}$	$\sum_{k=1}^{n_k} \Delta_k \acute{R}_k$	$\sum_{k=1}^{n_k} \acute{R}_k$	
I	**Republic of Tatarstan**	**1,00**	**2,6318**	**1,00**	**2,6459**	**7,3428**	**7,3863**
	Kazan city agglomeration	0,5444	1,5571	0,5349	1,5443	2,8601	2,8874
	Agglomeration Naberezhnye Chelny	0,3312	0,8281	0,3399	0,8521	2,5004	2,5071
	Microagglomerative industrial hub Almetyevsk	0,1244	0,2466	0,1253	0,2495	1,9823	1,9918
II	**Republic of Bashkortostan**	**1,00**	**2,6205**	**1,00**	**2,6085**	**8,9104**	**8,9777**
	Agglomeration Ufa	0,6009	1,7812	0,5839	1,7216	2,9644	2,9483
	Agglomeration Sterlitamak	0,250	0,5613	0,2591	0,5901	2,2452	2,278
	Microagglomerative industrial hub of Tuymazy, Octobersk	0,0869	0,1678	0,0921	0,1804	1,9311	1,9581

Submit Date: 13.09.2016, Acceptance Date: 21.10.2016, DOI NO: 10.7456/1060NVSE/162

	Microagglomerative industrial hub of of Kumertau, Meleuz	0,0622	0,1102	0,0649	0,1164	1,7697	1,7933
III	**Samara region**	**1,00**	**2,7874**	**1,00**	**2,7723**	**7,7841**	**7,7861**
	Agglomeration of Samara, Novokuybyshevsk	0,6219	1,809	0,5807	1,6635	2,9089	2,8646
	Agglomeration of Tolyatti	0,2886	0,7856	0,3313	0,9201	2,7226	2,7773
	Microagglomerative industrial hub Syzran	0,0896	0,1928	0,088	0,1887	2,1526	2,1442
IV	**Nizhny Novgorod Region**	**1,00**	**2,7395**	**1,00**	**2,658**	**4,6985**	**4,6213**
	Agglomeration of Nizhny Novgorod	0,897	2,5481	0,8861	2,4458	2,8407	2,7602
	Microagglomerative industrial hub of Arzamas, Sarov	0,103	0,1914	0,114	0,2122	1,8578	1,8611

CONCLUSION

The amount of logarithms of the numerical population of all cities and city type settlements forming agglomerations of the Republic of Tatarstan region alone had absolute "demographic capacity", close to the Nizhny Novgorod Region, from four leading areas of Volga Federal District: 23,63 in 1989 and 24,1151 in 2010. For the Samara region values of absolute "demographic capacity" were estimated in 20,302 in 1989 and 20,4718 in 2010, for the Republic of Bashkortostan, respectively, - 19,5038 and 19,7889. At the same time the Republic of Tatarstan, Bashkortostan and the Samara region had much higher values of absolute "demographic rating". And, in the first two regions these values increased slightly quicker, than in the Samara region.

With their growth the average weighed "demographic rating" of the Republic of Tatarstan, as appears from Table 1.7, has grown from 2,6318 in 1989 to 2,6459 in 2010, the Samara region – has slightly decreased from 2,7874 to 2,7723, the Republic of Bashkortostan – from 2,6205 to 2,6085.

Thus, results of the conducted research allow to assume that on the current and perspective time-points the most priority regions of Volga Federal District, from the point of view of industrial industrial potential development, are the Republic of Tatarstan, the Samara and Nizhny Novgorod regions [Safiullin et al., 2013]. They, in fact, form "framework" of the Volga Federal District demographic profile generating the potential of productive forces development. At the same time it is necessary to notice that the prompt growth of demographic capacity "quality" of the Republic of Bashkortostan (growth of the population share in the cities to 12,4% in 2010) also predetermines entry of this region into so-called "framework" of demographic capacity of Volga Federal District.

Submit Date: 13.09.2016, Acceptance Date: 21.10.2016, DOI NO: 10.7456/1060NVSE/162

ACKNOWLEDGMENTS

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

REFERENCES

Marat Rashitovich Safiullin, Leonid Alekseevich Elshin and Alina Ildarovna Shakirova. Analysis of the Impact of Environmental Stress on Social-and-Economic Well-Being of Population: Development of the Methodology and its Testing // Middle-East Journal of Scientific Research 13 (Socio-Economic Sciences and Humanities): 108-114, 2013

Safiullin M.R., Elshin L.A., Prygunova M. I. Development of a technique, forecasts and scenarios of the region economy development on the basis of modeling business activity. 2015.

Safiullin M.R., Elshin L.A., Prygunova M.I., Galyavov A.A. Complex analysis of prospects of the Volga Federal District regions development: methodology and practice. World Applied Sciences Journal. 2013. T. 27. № 4. C. 508-511.

Safiullin M.R., Safiullin A.R., Elshin L.A., Prygunova M.I. Matrix approach to assessing competitiveness of regions: from methodology to practice. Asian Social Science. 2014. T. 10. № 20. C. 47-56.

Scott, N.W. and M.F. Peter, The relationship between overall quality of life and its subdimensions was influenced by culture: analysis of an international database. Journal of Clinical Epidemiology, 61(8): 788-795

Submit Date: 13.09.2016, Acceptance Date: 21.10.2016, DOI NO: 10.7456/1060NVSE/162