URBAN SYSTEM AND URBAN INTERACTION PROSPECTS IN LATVIA

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Abstract

The aim of the study is to characterise the urban system in Latvia and to find out the patterns of urban interaction.
Most of the populated areas in Latvia are particularly small towns or villages. They are not significant industrial or knowledge hubs or regional development centres. According to administrative territorial division, there are 76 cities and towns in Latvia. The urban system is divided on 3 levels. National level development centres, regional and local centres. In all observed cases, the centres demonstrate a strict hierarchy, which means very large differences between cities. We fixed six patterns of inter-urban daily flow, but two of them turned out to be very similar and cater to the surrounding territory of Capital-city Riga. These similar patterns were also in the minority. Other patterns demonstrated decreased rates of interurban communication intensity and increased rates of transport costs. In general it catered to communication between cities and towns outside the surrounding territory of Riga. This situation results in low mobility of inhabitants. A result of low mobility is that the territory beyond the borders of the Riga area becomes the isolated periphery.

Introduction

The urban system in Western Europe and the United States has been widely studied, and these studies have shown many causes of how the urban system is created, exists and develops (AGUILERA, 2004; KRUGMAN, 1994; MEIJERS, 2008; OORT, 2009; PESSOA, 2009). These urban systems were created in free market economy conditions. At the same time, the urban system in Latvia and several other EU countries is fundamentally different because for a long time this system was in planned economic conditions without social choice and free market mechanisms. The creation of this system started already after World War II. As a result, the close network of little towns is a 60 years old reflection, which has preserved the patterns of population distribution and the speed of movement during this time. In accordance with the optimal urban concentration approach (HENDERSON, 2000) extremely high and extremely low urban concentration demonstrates non-optimal urban distribution and, as a result, population incomes per capita tend to decrease. This statement partly relates to the local public goods theory which establishes that if consumers are fully mobile, the appropriate local governments, whose revenue-expenditure patterns are

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set, are adopted by the consumer. Local governments represents a sector where the allocation of public goods is a reflection of the preferences of the population. (TIEBOUT, 1966) Urban functionality can be considered through its economic base or what inhabitants do in this populated place. Part of the employed population of an urban unit is engaged either in the production of goods or the performance of services for areas and people outside the urban itself. They are workers engaged in "export" activities, whose efforts result in money flowing into the community. Collectively they constitute the basic sector of the total urban economic structure. Other workers support themselves by producing goods and services of the urban unit itself. Their efforts, necessary to the well-being and the successful operation of the settlement, do not generate new money for it but comprise a service or non-basic sector of its economy. There are people responsible for the internal functioning of the urban unit. They are crucial to the continued operation of its stores, professional offices, urban government local transit and school systems. (FELLMANN, GETIS, 1997) On the other hand, humans - urban consumers and their interurban migration is a field from other large-scale research, but we have only underlined the statement by W. Alonso, that this interurban movement creates and provides urban spatial structure. (HINCKS, 2012)

Thus, the **hypothesis** is that the urban system in Latvia is highly hierarchical, and this is the reason why resources are mainly concentrated in a single centre, thereby delaying the development of other areas.
The **aim** of the study is to characterise the urban system in Latvia and to find out the patterns of urban interaction.
The following tasks are set to achieve the aim:

1. To explore the diversification of economic activities in cities and towns to determine their hierarchical distribution.
2. To describe the lines of daily passenger flows and to note their intensity depending on destination points.
3. To explore passenger flow intensity depending on destination points.
4. To compare the monthly income of humans by household and transport costs for daily trips.

Methodology

The survey includes data on the number of companies and represents the number of business sectors in each centre according to NACE (statistical classification of economic activities in the EU). The results are represented on scatter plots and maps. In daily passenger flow analyses we employed cluster analyses (k-means method) and mapping. We analysed 8 variables: category of the duration of time spent at the destination; transport costs; possibility to arrive by 8:30; passenger traffic intensity; starting point (urban category); destination point (urban category); maximum of the duration of time spent at the destination; number of trips per day. In order to understand direction of passenger flow, we used Pearson's chi-square test. Transport costs, as important impact factors, were also analysed in this case, we used descriptive statistics and data comparison of monthly incomes by household/transport costs by cluster. All statistical analyses with a p-value under 0.05 are assumed to be statistically significant.

Results and discussion

Most of the populated areas in Latvia are particularly small towns or villages. They are not significant industrial or knowledge hubs or regional development centres.

According to administrative territorial division, there are 76 cities and towns in Latvia. The urban system in Latvia is divided on 3 levels. National level development centres, regional and local centres. Development centres are considered urban areas which are concentration points of human resources, social and economic activities and which can affect surrounding areas. (SAEIMA OF THE REPUBLIC OF LATVIA, 2010) Despite the fact that the capital city was included in the 3 level division as a national level development centre, it showed incomparable population rates and other indicators which suggests that Riga needs to be observed as separate, specific case. For instance, the population number of Riga is six times greater than that of Daugavpils which is the second largest city in Latvia. Table 1 contains information about national level development centres.

Table 1.

The Latvian National Level development centres

National level development centres	Area/sq km	Population 2011	Population density 2011	Functional urban areas according with ESPON
Daugavpils	72	102 496	1423.6	Medium city
Jekabpils	26	26 284	1030.7	-
Jelgava	61	64 516	1057.6	Small city
Jurmala*	**100**	**56 060**	**561**	**-**
Liepaja	61	83 415	1367.5	Medium city
Rezekne	18	34 596	1922	Small city
Riga**	**303**	**703 581**	**2322**	**Metropolis**
Valmiera	18	27 040	1485.7	-
Ventspils	58	42 509	732.9	Small city
Total in National level development centres	**717**	**1 140 497**	**1591.3**	**-**
Total in Latvia	**64 559**	**2 229 641**	**34.5**	**-**

*Jurmala is functionally closely related to Riga and has a common border

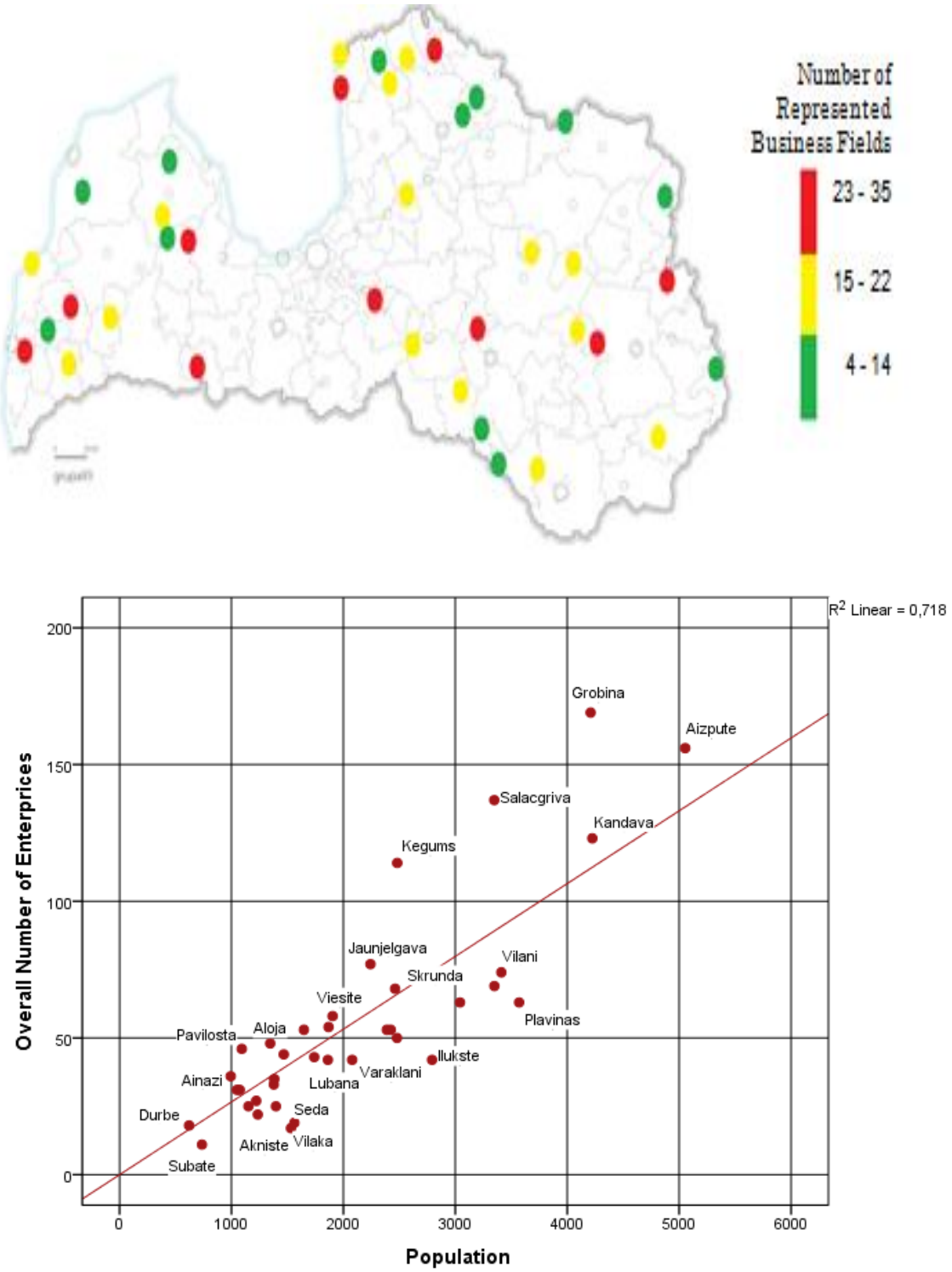
**Riga – Capital City

Source: Authors constructed according to Data of the (State Regional Development Agency, 2010) and (ESPON, 2007)

As it seems in Table 1, Contrary to Latvian Geographers, ESPON excluded Valmiera and Jekabpils, which have morphological cores of around 28 thousand inhabitants but functional urban areas of under 40 thousand inhabitants. Inversely, they have kept Rezekne, which is just under the functional urban area limit and is considered a "national city" as well as the other functional urban areas considered, with the exception of any other city. ESPON excludes the city of Jurmala, a seaside residential city, Riga's labour pool but with a population of 56 thousand inhabitants, it can be considered a secondary morphological core inside Riga's functional urban area. In addition, two cores — Ogre and Salaspils, which are located in the surrounding territory of Riga, are particularly considered regional level development centres by Latvian geographers, but, according to ESPON, are also secondary morphological cores inside Riga's functional urban area. (ESPON, 2007) Each of levels has planed specific role in national space context and specific functions according with its resources and potential. See more detailed review in Appendix 1.

Urban rank size distribution by functional complexity

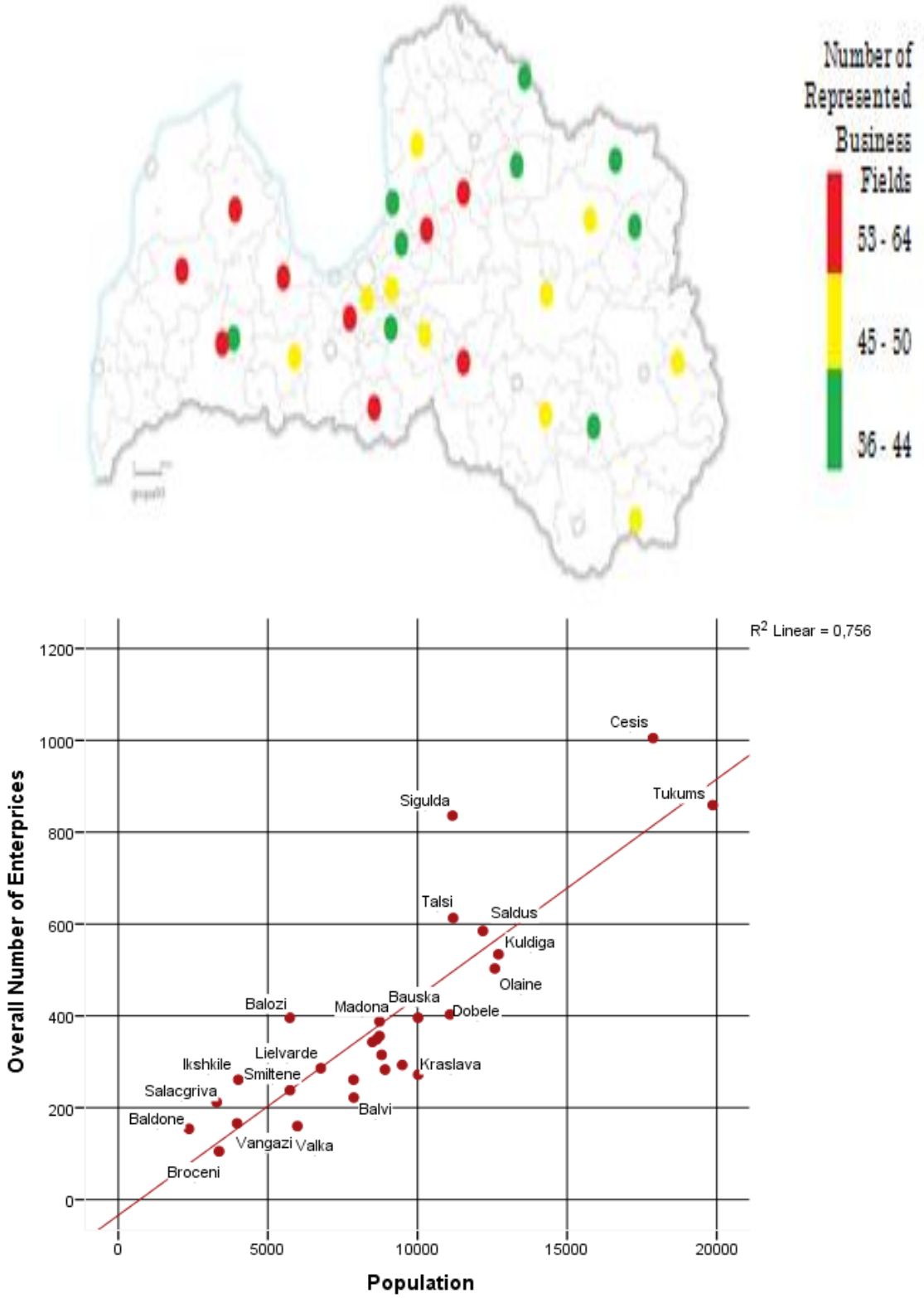
One of the more effective ways to understand the urban system more is to consider the urban hierarchy, a ranking of cities based on their population rates and its functional complexity. In given research by a functional complexity, we titled a number of different business fields in a given area or number of different services and goods in each centre. We studied a rank-size distribution of enterprises in each of the centres and the number of represented business sectors in each centre according to NACE as z-scores from few diversified to very diversify. As the result, the smallest towns, with populations not exceeding 5 000 and the number of different business field not exceeding 35 units. (See figure 1). It has been suggested that most of these enterprises are only oriented toward the local consumer, which characterises this area as a place with a closet type of local economy. (KRUGMAN, 1994)



Source: Author's calculations according with (Lursoft, 2011) and Central Statistical Bureau, table ISG15

Fig. 1. Urban rank size distribution by functional complexity for local level development centres

Similar situation is observed also in regional level development centres. (See figure 2).

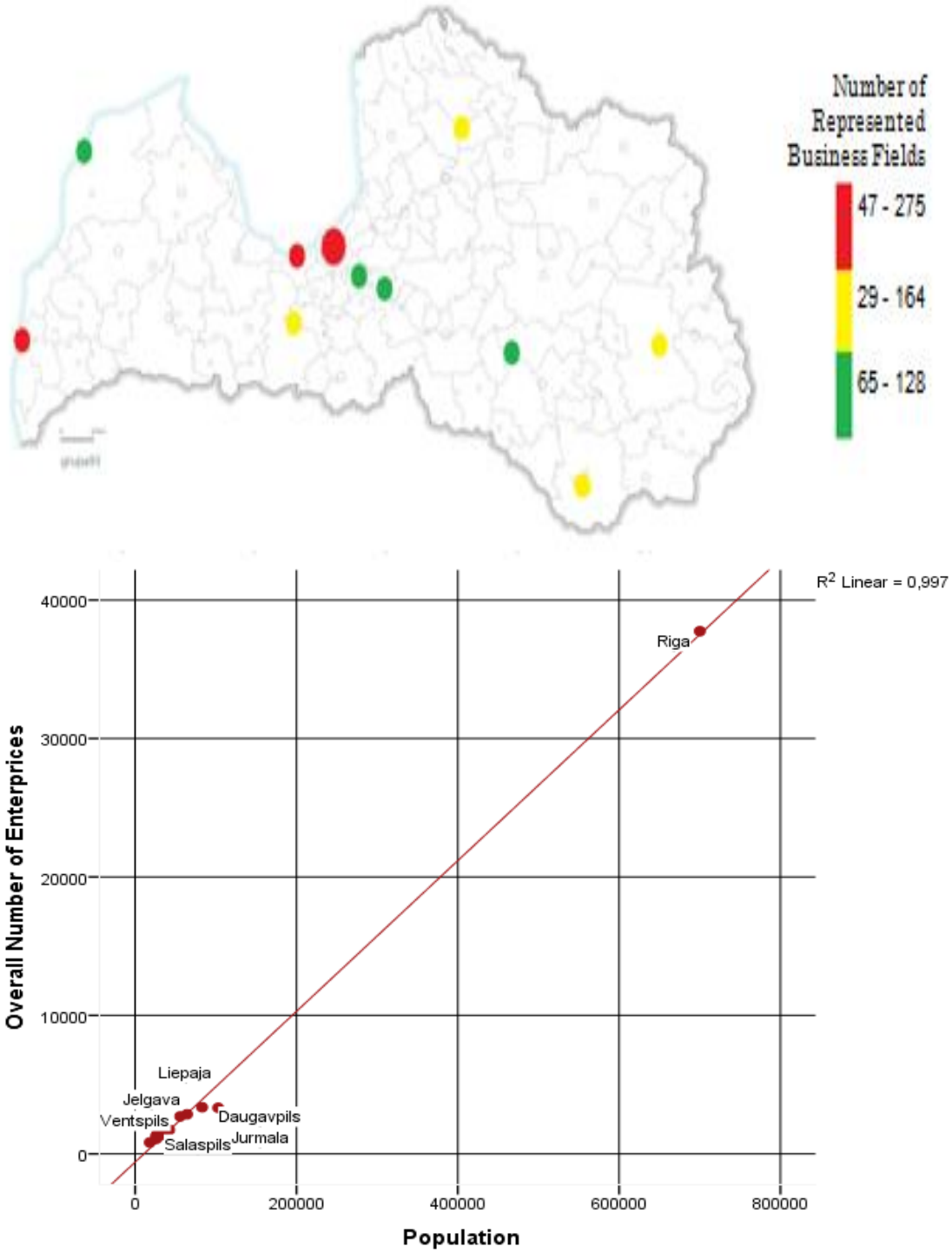


Source: Author's calculations according with (Lursoft, 2011) and Central Statistical Bureau, table ISG15

Fig. 2. Urban rank size distribution by functional complexity for regional level development centres

In all the cases observed, the slope of the linear line demonstrates a strict hierarchy. The gaps between urban areas in Latvia are large, on all levels, but the greater

differences were observed in the national level development centres; and the gap with the capital city is extremely large. (See figure 3).



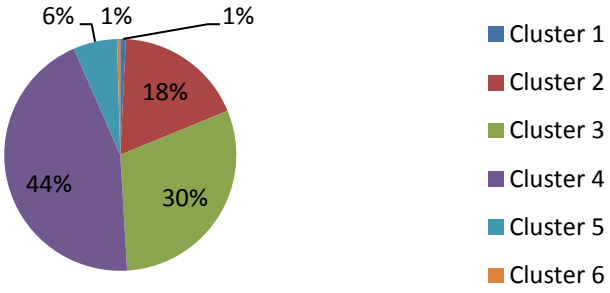
Source: Author's calculations according with (Lursoft, 2011) and Central Statistical Bureau, table ISG15

Fig. 3. Urban rank size distribution by functional complexity for regional level development centres

In most cases, populated areas in Latvia demonstrate low rates of population, and low diversification of businesses fields. 50% of all observed cases show fewer than 160 enterprises in the given area. See also the data representation in table in Appendix 2.

Interurban Daily Flows

The empirical research builds on the survey of all existing passenger transport services in the country (N=899) to find the most popular directions of passenger movement and the intensity of daily passenger flow in different directions. (ZALUKSNE, V., 2012) The study included transport proposals that are being held regularly every working day (Monday to Friday). The study did not include services that occur on weekends, or services which are not arranged each working day. This study is based on the assumption that passenger traffic is arranged according to existing demand. Thus, data on public transport flows could be used to represent the daily inter-urban flow of people. We used the k-means cluster analysis method which allows for producing the exact k-different clusters demanded with the greatest possible distinction. In this case, we have 8 variables: category of the duration of time spent at the destination; transport costs; possibility to arrive by 8:30; passenger traffic intensity; starting point (urban category); destination point (urban category); maximum of the duration of time spent at the destination; number of trips per day. The number of clusters was estimated by the gap method (TIBSHIRANI, WALTHER, HASTIE, 2001) and 6 clusters were found this way. (See Figure 4).



Source: Author's calculation
Fig. 4. Public transport daily flow cluster distribution

It is significant to find whether really all variables differ in the all 6th clusters. This estimation is carried out by Analyses of variance (F-criterion) which results are reflected in the following Table 2. Significance value for all scales of dough very high, all values of F-criterion are significant. Thus, all scales of dough are criteria of classification.

Table 2.

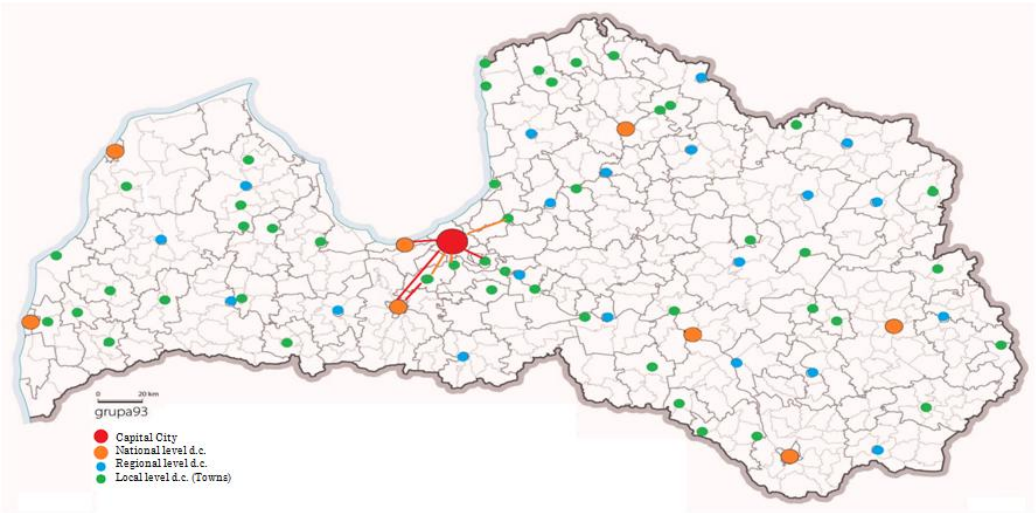
Results of Analyses of variance

ANOVA						
	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Category of the Staying Duration at the Destination	234.482	5	.299	894	783.383	.000
Transport Costs	82.516	5	1.973	894	41.825	.000
Possibility to Arrive Till 8.30	17.626	5	.153	894	115.429	.000

Passenger Traffic Intensity	206.032	5	.150	894	1373.666	.000
Starting Point (Urban Category)	6.008	5	.904	894	6.647	.000
Destination Point (Urban Category)	4.876	5	.879	894	5.547	.000
Maximum of Staying Duration at the Destination	4578.134	5	5.471	894	836.724	.000
Number of Trips Per Day	19169.582	5	6.986	894	2743.980	.000

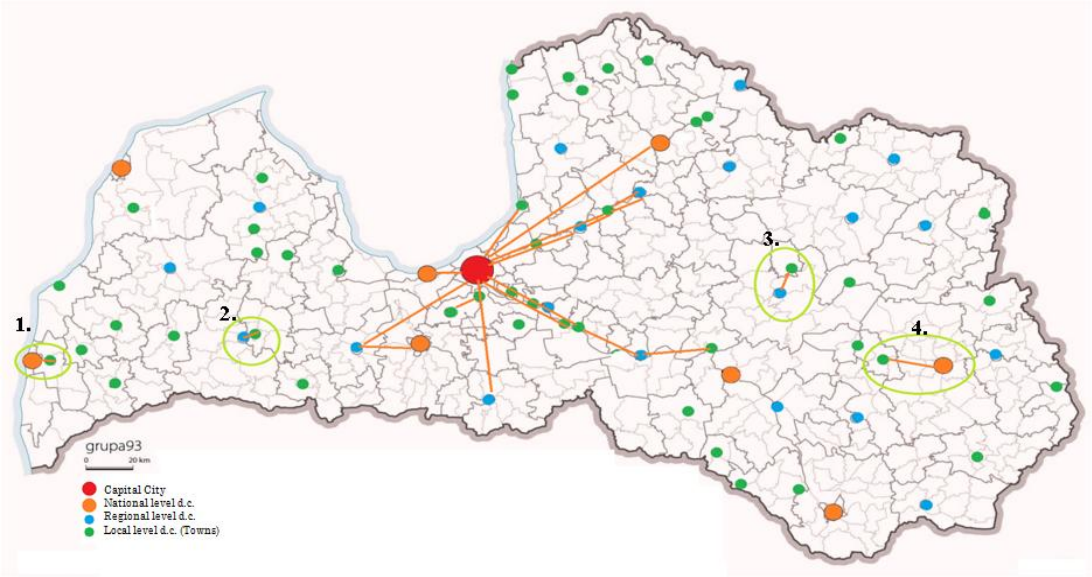
Source: author's calculations

Interurban daily flows included in the first cluster demonstrate that people may stay at a point of destination during the day and, thanks to high traffic intensity, people may leave this destination at any time. They could also arrive in the early morning. Average transport costs are not high which suggests that the area represented in this cluster is convenient for living and working in one of the surrounding populated areas. A similar situation is also characteristic to the 6th cluster, which only differs in the demonstrated number of trips per day, which is 35 in cluster 1 and 66 in cluster 6. Cluster 1 and 6 represent two per cent of all observed cases. All cases in these clusters characterise the situation for the surrounding territory of the capital city of Riga. This is illustrated in Figure 5.



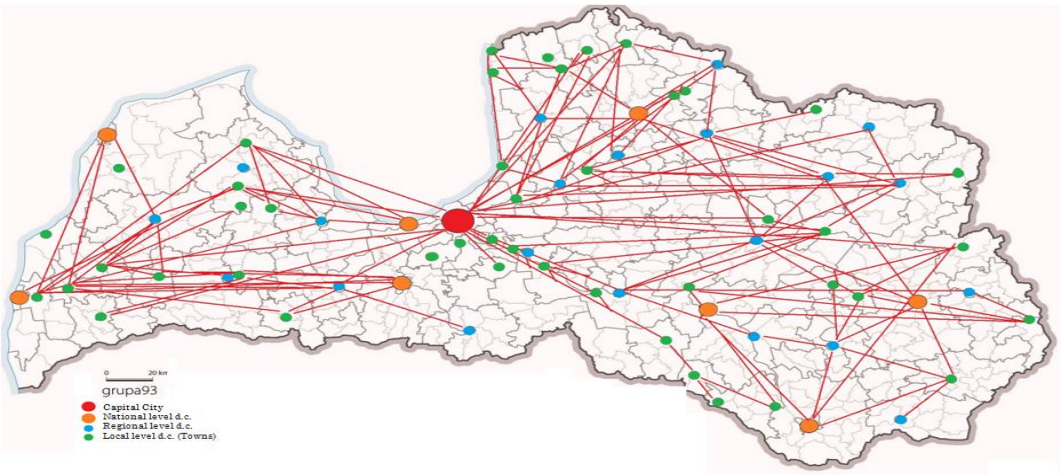
Source: author's construction according to cluster analysis
Fig. 5. Interurban daily passenger flow in clusters 1 and 6

Cluster 5 demonstrates six per cent of interurban communication in the country, and also characterises good transport service activity. People can stay at the destination for 16 – 20 hours. However, a number of trips per day is slightly less; 20 trips per day on average. Different from the other clusters, cluster 5 relates to distances further from Riga and includes a centre – periphery constructions in regions out of the surrounding territory of Riga. Cluster 5 also demonstrates 4 particular core/periphery constructions out of surrounding territory of Riga. (See Figure 6).



Source: author's construction according to cluster analysis
Fig. 6. Interurban daily passenger flow in cluster 5

Other clusters (2, 3, 4) demonstrate a decrease in the rates of traffic intensity and increase in the rates of transport costs. In general, this relates to communication between urban areas out of the surrounding territory of Riga. For example, the number of interurban trips per day in clusters 2, 3, 4 respectively is 3, 2 and 9 on average. People can stay at the destination for 10 – 15 hours (Clusters 2 and 4) or 1 - 4 hours (Cluster 3). These three clusters demonstrate 92 per cent of all interurban communication. These situations are partly demonstrated in Figure 7.



Source: author's construction according to cluster analysis
Fig. 7. Interurban daily passenger flow in cluster 4

Passenger flow direction

Clusters showed traffic direction, flow rate and other issues, but they do not allow for fixing the intensity of the traffic of people depending on the direction of destination. But it is very significant to find out the transport flow intensity depending on the point of destination. We used the chi–square test and the estimations demonstrate that there exists a dependence between the location of the starting point and the destination

point in urban regions. In other words, we fixed the passenger flow directed at more significant centres. (See Table 3).

Table 3.

Traffic Intensity Depending on the Point of Destination

Whether the category of the destination point had an impact on the number of trips to this point, if the:	Pearson Chi-Square	Result
Destination is Riga	0.000	Has impact
Destination is outside any urban regions	0.449	Has no impact
Destination is any national level development centre	0.003	Has impact

Source: author's calculations

Transport costs

The cluster division, according to the transport costs, demonstrates that most of the forwarded trips are very expensive. Therefore, it is necessary to compare transport costs in each of the clusters with monthly household incomes.

Table 4.

Transport costs divided in clusters in comparison with the monthly incomes for one household member

	Clusters					
Transport costs (LVL)	1	2	3	4	5	6
Minimum	0.85	0.48	0.50	0.60	0.48	0.50
Maximum	1.60	6.00	7.95	8.00	3.30	1.70
Range	0.75	5.52	7.45	7.40	2.82	1.20
Approximate roundtrips expenditures every working day per month (n=21)	31.5	231.84	312.9	310.8	118.4	50.4
Monthly incomes of one of household member	200.75					
Transport expenditures is 12% of monthly income = 24.09 (LVL)	24.09					

Source: author's calculations based on cluster analysis and data from Central Statistical Bureau of Latvia tabeles IIG11 and MBG01

These comparisons clearly show that transport expenditures exceed individual incomes in most cases. An exception is trips included in the 1st and 6th clusters, which represent the surrounding territory of the capital city. This situation causes the low mobility of people. As a result of low mobility, the territory behind the border of Riga agglomeration becomes an isolated periphery.

Conclusions

1. Urban rank size distribution by functional complexity

In most cases, populated areas in Latvia demonstrate a low rate of population and low diversity in businesses fields. In all observed cases, the centres demonstrate a strict hierarchy, which means very large differences between cities. In addition, a greater difference was observed in the national level development centres.

2. Daily Flows

In general we fixed six patterns of inter-urban daily flow, but two of them turned out to be very similar and cater to the surrounding territory of Riga. These similar patterns were also in the minority. Other patterns demonstrated decreased rates of traffic intensity and increased rates of transport costs. In general it catered to communication between cities and towns outside the surrounding territory of Riga.

3. Passenger Direction

Chi-square estimations demonstrate that there is a correlation between the location of the starting point and the destination point in urban regions and demonstrate passenger flow directed to more significant centres.

4. Transport costs

The cluster division according to the transport costs demonstrates that most forwarded trips are very expensive. Transport costs in comparison with household monthly incomes clearly show that transport expenditures exceed these incomes in most of cases. The exceptions are trips included in the 1st and 6th clusters, which represent the surrounding territory of the capital city. This situation results in low mobility of inhabitants. A result of low mobility is that the territory beyond the borders of the Riga area becomes the isolated periphery.

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Appendix 1

Development centres and its role in national space context

Urban Title	Role in national space context	Planed specific functions, specialisation field	Resources, potential
National level development centres There are more industrialised areas and contain transport, public services and social infrastructure. National level development centres are Daugavpils, Jelgava, Jekabpils, Liepaja, Rezekne, Valmiera, Ventspils and Jurmala.			
Liepaja	Transnational level development centre	Logistic services related with Nordic and Western European markets.	Port, railway, airport, borderwith Lithuania
Daugavpils	Transnational level development centre	Transit hub of international significance, need to develop western – eastern relationship	Multicultural, multiethnic and multifunctional urban-space
Ventspils	Transnational level development centre	Innovation and high added value, industrial and engineering(especially in electronic, information and communication technology) and also logistic and transit centre	Logistic and intermodal transport services endowment. Education and research potential
Jurmala	Culture heritage and recreation centre, the development of which are closely related with capital-city development	Health resort and business tourism active tourism and culture centre which attract tourists	Sea, culture heritage and traditions of resort locations
Regional level development centres There are important for the region's cultural and/or production centres, with a developed social infrastructure and the wide range of services.			
Kuldiga, Talsi, Tukums, Saldus, Dobele, Bauska, Ogre, Aizkraukle,Sigulda, Cesis, Limbazi, Smiltene, Aluksne, Gulbene, Balvi, Preili, Livani, Ludza, Kraslava, Madona	The effects to growth prospects is not noted	Development centres must continue to specialise in the development of complementary cooperation, thus reaching the level of the national development centres	The urban potential far exceeds the rest of the small-town potential
Valka	Transport hub	Valka and Valga seem to be twins It should develop as a significant transport hub, logistic and inter boundary cooperation centre, as a Nord gateway of Latvia	Single boundary city in Latvia and one of 6 border cities in Europe which is located directly at a country boundary.
Local level development centres Small towns and, in some cases, the largest rural population centres, must develop *the local development centres. They have* ***a significant role in providing the services and jobs for the population of the surrounding area. They must concentrate services, which provide an attractive environment for life and conditions for economic development.***			

Source: authors constructed according with Saeima of the Republic of Latvia (2010)

Appendix 2

Urban Rank Size Distribution by Functional Complexity

Urban Title	*Number of enterprices*	*Diversified/Undiversified z-score*	*Ranking*	
Durbe	18	-,59845	1	***Few diversified***
Subate	11	-,58797	2	
Vilaka	17	-,56699	3	
Strenci	25	-,54602	4	
Seda	19	-,52504	5	
Piltene	31	-,51456	6	
Staicele	25	-,51456	7	
Valdemarpils	33	-,51456	8	
Akniste	22	-,49358	9	
Ape	31	-,49358	10	
Sabile	35	-,49358	11	
Zilupe	43	-,49358	12	
Lubana	42	-,48310	13	
Dagda	50	-,47261	14	
Mazsalaca	44	-,47261	15	
Ligatne	27	-,46212	16	
Viesite	58	-,46212	17	
Ainazi	36	-,45163	18	
Ilukste	42	-,45163	19	
Aloja	48	-,43066	20	
Jaunjelgava	77	-,43066	21	
Cesvaine	53	-,42017	22	
Pavilosta	46	-,42017	23	
Priekule	53	-,40969	24	
Skrunda	68	-,40969	25	
Stende	54	-,40969	26	
Varaklani	42	-,40969	27	
Karsava	53	-,39920	28	
Auce	63	-,38871	29	
Plavinas	63	-,38871	30	
Rujiena	69	-,38871	31	
Vilani	74	-,38871	32	
Kandava	123	-,33628	33	
Salacgriva	137	-,33628	34	
Grobina	169	-,31530	35	
Kegums	114	-,30482	36	
Aizpute	156	-,29433	37	
Valka	**160**	**-,29433**	**38**	***Mediana***
Broceni	105	-,25238	39	
Balvi	222	-,23141	40	

Vangazi	166	-,23141	41	
Preili	261	-,22092	42	
Saulkrasti	212	-,21043	43	
Smiltene	238	-,21043	44	
Baldone	154	-,19994	45	
Aluksne	283	-,17897	46	
Livani	315	-,16848	47	
Kraslava	272	-,15800	48	
Lielvarde	286	-,15800	49	
Madona	388	-,15800	50	
Gulbene	356	-,14751	51	
Dobele	403	-,13702	52	
Limbazi	343	-,12653	53	
Ludza	293	-,12653	54	
Balozi	396	-,11605	55	
Ikshkile	261	-,11605	56	
Aizkraukle	349	-,08459	57	
Bauska	396	-,08459	58	
Saldus	585	-,08459	59	
Kuldiga	534	-,07410	60	
Talsi	613	-,03215	61	
Tukums	859	-,03215	62	
Olaine	503	-,02166	63	
Cesis	1005	-,01118	64	
Sigulda	836	-,00069	65	
Salaspils	827	,04126	66	
Ogre	1284	,06223	67	
Ventspils	1729	,57610	68	
Jekabpils	1086	,68097	69	
Rezekne	1398	,80682	70	
Valmiera	1415	1,14240	71	
Jelgava	2860	2,45329	72	
Daugavpils	3326	2,92521	73	
Jurmala	2707	2,95667	74	
Liepaja	3366	3,16641	75	
Riga	37750	5,53649	76	***Very diversify***

Source: Source: Author's calculations according with (Lursoft, 2011) and Central Statistical Bureau, table ISG13