

Введение

Феномен арктической урбанизации парадоксален по своей сути. Уже на первый взгляд видно, что развитие арктических городов противоречит самым базовым принципам урбанистической теории: арктические города лишены многих преимуществ городского развития – агломерационного эффекта, синергии, плотных сетевых взаимодействий, перетоков знания и т.д. (figure 1).

Introduction

The phenomenon of Arctic urbanization¹ is inherently paradoxical. Already at glance it is clear that the development of Arctic cities is contrary to the very basic principles of urban theory: the Arctic city suffers from the lack many of the benefits of urban development such as e agglomeration effect, synergy, dense network of interactions, knowledge spillovers, etc. (figure 1).

However, despite the obviously harsh climatic conditions, despite the rare isolated placement in space and following from this an obvious gap from the point of view of classical competitive advantages of the urban development of the agglomeration effect, capabilities, knowledge flows, etc. the Arctic is increasingly faced with the phenomenon of urbanization. In the key work on social development in the Arctic the authors tells that «Of Arctic countries, all but the Faroe Islands have three-quarters or more of their populations residing in urban areas. ... Iceland, with much of the population residing in the capital of Reykjavik and a few other urban centers, has the highest percent urban of Arctic countries at 94%, followed by Greenland and Sweden at 86%»².

The very notion of "development" in relation to Arctic cities can be redefined as "overcoming" of difficulties – as is done, for example, in generalizing the work of L. Huskey and T. Morehouse on the development in remote regions³. It is obvious that Arctic cities have some resistance mechanisms against permanent, permanent disaster Arctic conditions.

¹ Arctic urbanization is a relatively new but quickly becoming popular object of study. See: Pilyasov, A.N. Towns of the Russian Arctic: Comparison of the economic indicators *Vestnik Moskovskogo Universiteta, Seriya 5: Geografiya*. 2011, №4. Pp. 64–69; Heleniak T. Changing Settlement Patterns across the Russian North at the Turn of the Millennium // *Russia's Northern Regions on the Edge: Communities, Industries and Populations from Murmansk to Magadan* / Ed. by M. Tykkylainen and V. Rautio. Kikimora Publications University of Helsinki: Helsinki, Finland, 2008. P. 25-52; Heleniak T. Growth Poles and Ghost Towns in the Russian Far North // *Russia and the North* / Ed. by E.Wilson Rowe. University of Ottawa Press: Ottawa, 2009. P. 129-163; City-region planning for everyday life. Experiences from four Nordic city-regions. NORDREGIO Policy brief. 2015. № 7. URL: <http://www.nordregio.se/en/Publications/Publications-2015/City-region-planning-for-everyday-life/>; Proceedings from the First International Conference on Urbanisation in the Arctic Conference 28-30 August 2012, Ilulissat, Nuuk, Greenland / Ed.by Klaus Georg Hansen, Rasmus Ole Rasmussen and Ryan Weber. Nordregio Working Paper 2013. No. 6; Sustaining Russia's Arctic Cities: Resource Politics, Migration, and Climate Change / Ed. by R. Orttung. Berghahn Books, 2016; New Mobilities and Social Changes in Russia's Arctic Regions / Ed. by M. Laruelle. Routledge Research in Polar Regions. Routledge: London and New York, 2017; Zamyatina N. Iu. *Arkticheskaya urbanizatsiya kak frontir* // *Nauchnyi vestnik IANAO* № 3 (92). Obdoriia: istoriia, kul'tura, sovremennost'. — Vol. 92. — Gosudarstvennoe kazennoe uchrezhdenie Iamalo-Nenetskogo avtonomnogo okruga "Nauchnyi tsentr izucheniiia Arktiki" Tiumen', 2017. — Pp. 114–120.)

² Arctic Human Development Report: Regional Processes and Global Linkages. Ed. by Larsen, Joan Nyman and Fondahl, Gail. Copenhagen: Nordisk Ministerråd, 2015. P. 6.

³ Huskey, Lee, and Morehouse, Thomas A. 1992. Development in remote regions: What do we know? // *Arctic*, 45(2): Pp. 128-137

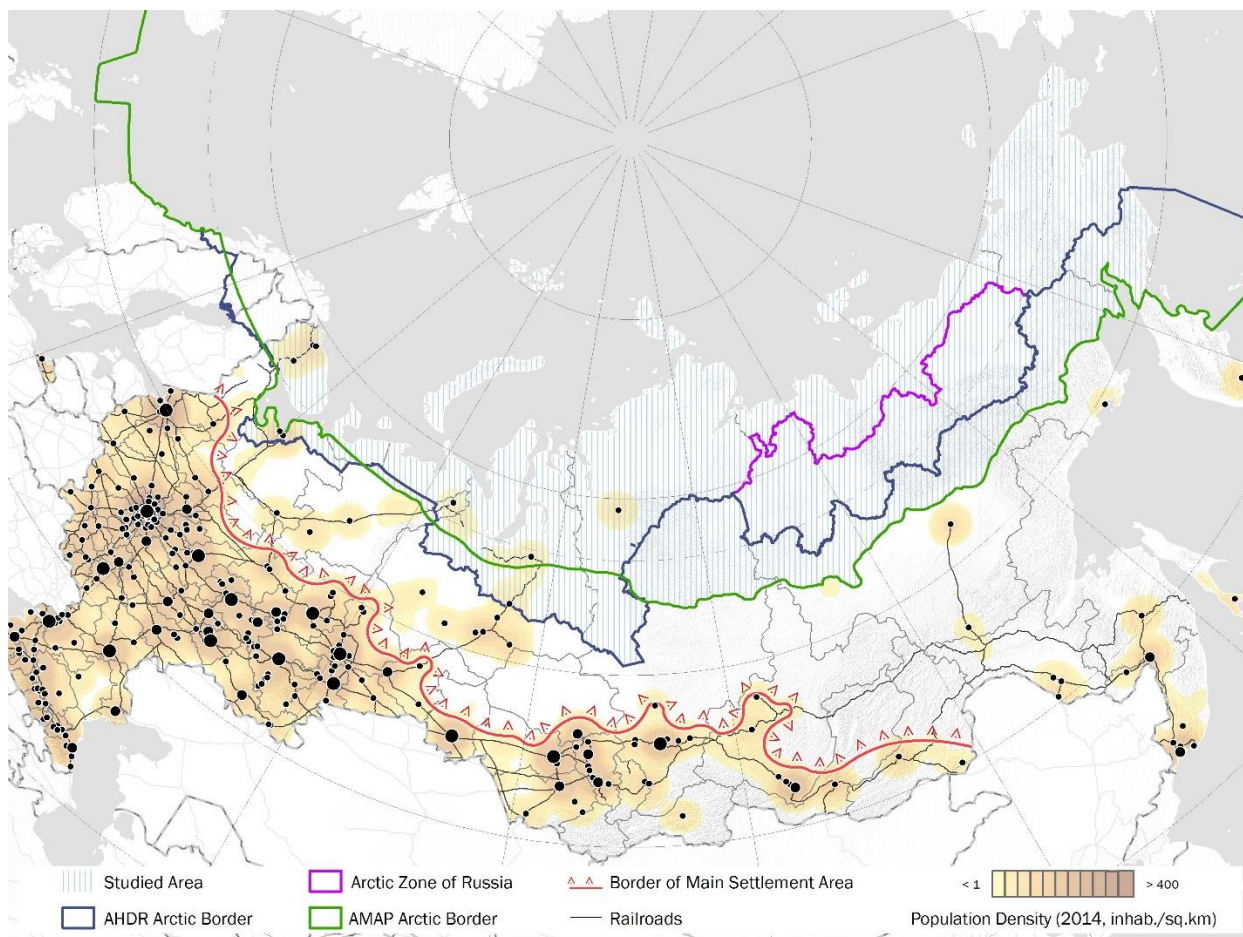


Figure 1. Arctic cities in Russia are located outside densely populated areas and agglomeration effects

We can assume that the problem of resilience of the Arctic cities is solved in quite specific way, and we need to talk about some very specific base of the resilience of Arctic cities, differing from the base of the resilience of "normal" cities. Therefore, our hypothesis is formulated for comparison of two sets of the theoretical literature. First and foremost, it is obviously Arctic science, which are characterized by the basic conditions of development of Arctic cities – work on peculiarities of development of the Arctic cities and territories from the point of view of regional Economics, urban planning, demography, migration studies and other related disciplines. The second set of information is the work on urban development, starting from Jacobs and ending with modern authors such as Glaser, Storper etc. The third set of literature is work on resilience⁴, which, in the first place, interesting findings in the study of resilience against permanent odds.

To study the problems of the resilience of Arctic cities we need to solve the following problem:

1. Assessment of the extent of Arctic urbanization, fixing the object of study
2. A theoretical "collision" of Arctic science and urban studies with the aim of identifying

⁴ Pendall, R., Foster, K. A., Cowell, M. (2010) Resilience and regions: building understanding of the metaphor. Berkeley, institute of urban and regional development. Cambridge Journal of Regions, Economy and Society, 3: 71–84; Collier F., Hambling J et al. Tomorrow's cities: a framework to assess urban resilience // Proceedings of the Institution of Civil Engineers: Urban Design and Planning. 2014. T. 167. № 2. C. 79-91; Andy Pikea, Stuart Dawleya and John Tomaney. Resilience, adaptation and adaptability. Cambridge Journal of Regions, Economy and Society 2010, 1–12; Weichselgartner J. and Ilan Kelman. Geographies of resilience: Challenges and opportunities of a descriptive concept. Progress in Human Geography, 2014. Pp. 1–19; Meerow S., J. Newell, Melissa Stults. Defining urban resilience: A review. Landscape and Urban Planning 147 (2016) 38–49. , etc.

the main driving forces behind the development of Northern cities and the formation of a conceptual framework adequate for the study of the Arctic

3. Preliminary assessment of specific Arctic factors of resilience: a pilot study on the comparison of pairs of southern and Northern cities

4. Choosing of the criteria of development of the Arctic cities in the context of resilience

5. Development and testing of the model resilience of the Arctic cities.

This article represents the first part of a larger study, so this paper presents the results of the initial (1-4) research stages, ending with the identification of adequate indicators to measure the factors of destabilization and the development of the Arctic cities of Russia. The testing of indicators of instability and resilience of Arctic cities and constructing of a special models of the resilience of Arctic cities would be the next stage of the study.

1. Assessment of the Arctic urbanization

Assessment of the level of urbanization of different Arctic regions of the world has a number of challenges.

The first problem is actually the border of the Arctic. In literature and legislation in different countries there are various options for determining the boundaries of the Arctic. The most common are the borders defined by the working Commission of the Arctic Council (AMAP), based primarily on natural criteria, and the boundaries of the Arctic used in the editors of the Arctic Human development report (AHDR). In Russia (the Arctic zone which make up about half of the Arctic territories of the world) the border of the Arctic zone (Arctic Zone of Russian Federation – AZRF) is officially adopted by the decree of the President. All three boundaries are not the same, and repeatedly intersect each other. Comparison and selection criteria of the Arctic border, obviously is the separate issue of interdisciplinary research. So for the purposes of the present work the border criteria were simplified. Arctic is defined here as an area lying to the North of the most southern (in each point) of these boundaries (AMAP, AHDR, AZRF) – figure. 2.

The second problem is an absence of comparable assessment of the level of urbanization of the Arctic territories. Different countries have different criteria of the city. For example, in Canada the threshold for the classification of settlements in the category of 2000, Scandinavia – 2000. In Russia in Soviet times it was adopted the criterion of 12 thousand persons (with additional criteria regarding the specialization of cities), but it was more of a purely scientific nature; a de facto cities are many settlements with a smaller population (for example, Verkhoyansk) because of tradition. While in Russia there are no officially adopted criteria of the city as an urban area.

In the end, for further study there were selected settlements with population more than 5 thousand people (similar to the methodology of the AHDR), but without regard to their functional specialization. In Russia, thus, in this initial sample were some settlements having the status of a villages with a population of more than 5 thousand people (Ust ' -Nera, Khandyga, Purpe, Pangody, etc.)



Figure 2. The different variants of the boundaries of the Arctic, Arctic cities and the dynamics of their population, 2010-2015.

The third major problem is that most of the statistics in all countries aren't attached to cities, but to the bits of the statistical observation or municipal authorities, whose boundaries usually do not coincide with the boundaries of cities. Further, conventionally, we call such units "municipalities". In Russia, such municipalities are defined by the law on local self-government⁵. Thus there are three levels of administrative-territorial division: regional level, the level of municipal districts and urban "okrugs" and the level of urban and rural settlements. The most adequate base for study are urban okrugs (2nd level) which in some cases, however, includes rural settlements; statistics provided by Rosstat (as well as local statistical bodies) at the level of urban settlements (level 3), as a rule, is very poor.

In the end, to form a comparable basis of the study we decided to use the statistics on the municipalities which includes Arctic cities in cases when the population of the city is more than 5000 and at least is half the population of the municipality in which this city is situated (cases where a city consists of several municipalities is not met in Arctic). This article further analyzes the statistics only for cities in the Russian Arctic and in many cases we use data on urban okrugs.

⁵ http://www.consultant.ru/document/cons_doc_LAW_44571/6d3b1321c4f9966d07ca33533fc7ca347581c3a8/.

Also some “model” cities were constructed here to use the data of a municipal district instead the data on a city (due to the lack for data on city level as mentioned). As a "model" Arctic cities it was decided to use the data in the following municipal districts: Nadymskiy district (instead of Nadym and settlement of Pangody together), Purovsky district (similarly, "instead of" the city of Tarko-sale and Urengoy settlement), Kandalaksha district (the town of Kandalaksha and the settlement of Zelenoborskiy), Kola district (conditional model analog "sum" of the city, including Kola city and towns Milk and Murmashi), the Taimyr Autonomous district (Dudinka), Onezhsky (Onega), Lovozerskiy district (the settlement of Revda), Pechengskiy district (the city of Zapolyarny and the settlement of Nickel), Bilibinsky district (Bilibino) and Oymyakonsky ulus of the Sakha – Yakutia (the settlement of Ust-Nera). However, part of the Arctic settlements of the original sample even in this case had still to endure beyond the review: this is closed administrative-territorial formations or also cities and towns with population less than half of the population of the municipal districts, within which they are located (e.g., city of Viluysk, the settlement of Iskateley, the settlement Khandyga).

In the end, the level of Arctic urbanization was in most cases lower than is usually considered (see table 1). In Russia this is due to the inclusion in the Arctic zone areas outside the official boundaries of the Arctic (first of all, it is about some “ulus” of the Sakha Republic – Yakutia, located South of the official boundaries of the AZRF with a high proportion of the rural population). In the Arctic outside of Russia, decrease in the level of urbanization is resulted from a revaluation of the criteria of the city's. Many settlements with population less than 5 thousand residents which are considered as cities according to local statistical standards, have been excluded from consideration.

Table 1. Arctic urbanization as a result of re-assessment on universal criteria

Country or territory	Arctic population, thousands of inhabitants	Revaluation of Arctic urban population, thousands of inhabitants	Assessment of the level urbanization, %	Alternative assessment, %
Russia	2669,2	2086	78,2	89 (Rosstat)
Iceland	332,5	257	77,3	94 (AHDR)
Sweden	190,6	135	70,8	86 (AHDR)
Finland	170,1	101	59,4	
Alaska (USA)	741,9	371	50,0	57 (AHDR)
Norway	467,6	208	44,5	69 (AHDR)
Canada	113,6	47	41,4	76/46/32 ⁶ (AHDR)
Greenland	56,5	22	38,9	86 (AHDR)
Faroe Islands	49,2	13	26,4	42 (AHDR)

⁶ For Provinces: correspondently Yukon, North-West Territories and Nunavut.

Total	4271,2	3240	67,6	85 (AHDR)
-------	--------	------	------	-----------

Thus comparable assessment of the level of urbanization in the Arctic territories of different countries shows that the level of Arctic urbanization is not out of the ordinary phenomenon. The most high it was in Russia, in Iceland and Sweden, the lowest in the Faroe Islands, in Greenland and in Canada.

Decrease the level of Arctic urbanization does not eliminate the problem of "paradoxical" Arctic urbanization. It regards especially to Russia, which is the absolute leader by the share of urban population in the Arctic.

2. A theoretical "collision" Arctic science and urbanism in the context of resilience

Modern mainstream of Western regional science almost all is centred on the effects of high concentration of economic actors, ideas, and infrastructure. Here is a classical agglomeration effects and cluster theory, and many works on the geography of innovation the last twenty years. The essence of concentration as a factor of modern economic development is the understanding of the fact that the close spatial proximity of firms, entrepreneurs, inventors, etc. allows you to develop communication in "face to face" regime (F2F) which accelerates the local circulation of knowledge – primarily tacit knowledge, which is very important for the development of innovation process.⁷ On the wave of interest in knowledge-spillover processes the study of different types of proximity (proximity) appears with detailed examination of the potential interaction between different objects from the point of view of the various factors – social, spatial, institutional and other⁸.

But referring to the Arctic, we have to "unscrew" the situation inside out: here we are dealing with regions that are far from the main cores of economic development. The key to their economic and geographic characteristics is their remoteness. Indeed, the concept of "remote" areas became widely used in the 1930-ies in the practice of planning spatial development of the Soviet Union. The concept of remoteness was also used to characterize the key features of the development of the North by S. V. Slavin⁹ and other soviet scientists. Greater fame was acquired by the book of the canadian geographer L.-E. Hamelin¹⁰. Even now American economists still consider remoteness as a key, defining characteristic of the Arctic: "the Arctic as a region is determined by physical-geographical conditions (North of the Arctic circle, the average July isotherme 10°... to the forest border). The Arctic Council uses a more complex approach, but it is based on natural features. But if you define it from the point of view of social (socio-economic) geography, the Arctic is better to determine as remote region"¹¹.

So let us focus on the remoteness as a key socio-economic features of the Arctic cities, without attention to their resilience in relation to natural influences (permafrost, etc.).

In different disciplines there was, in general, three main "branches" of the study of remoteness (table 2). The first is based on the works of American economists who study mainly

⁷ Storper Michael, Venables Anthony J. Buzz: face-to-face contact and the urban economy // *Journal of Economic Geography*, Vol. 4, No. 4 (4). Pp. 351-370.

⁸ Zamyatina N., Pelyasov A. The conception of proximity: foreign experience and prospects for research in Russia// *Izvestiya Akademii Nauk, Seriya Geograficheskaya*. 2017. № 3. Pp. 8-21.

⁹ Slavin S.V. *Promyshlennoe i transportnoe osvoenie Severa SSSR*. Moscow: Ekonomizdat. 1961. 302 p. [Slavin, S. V. *Industrial and transport development of the North of USSR*. Moscow: Ekonomizdat. 1961. 302 p.]

¹⁰ Hamelin L.-E. *Canadian Nordicity: It's Your North, Too*. Montreal: Harvest House. 1979. 392 p.

¹¹ Berman Matthew. Remoteness and Mobility: Transportation Routes, Technologies, and Sustainability in Arctic Communities. Working paper. 2013. https://www2.gwu.edu/~ieresgwu/assets/docs/Berman_Remoteness_mobility.pdf

the direct negative impact of remoteness on economic development through higher transport costs, inability to obtain economies of scale, etc. the Second is the European study of peripherality based on the network approach and actor-network theory. In this context, the remoteness can be reinterpreted as a lack of networking. At the same time is the key to understanding of the Arctic cities resilience, insofar as geographical, spatial distance can be overcome through the active development of the network, deducing a remote region of the state of the "network peripherality". Finally, the anthropological approach to the remoteness gives the the positive properties of the remoteness: it is about the fact that remote areas are forced to have a higher level of creativity. In addition, their availability is "anisotropic": from the remote areas the distance to the economic and cultural centers is generally perceived as easy to overcome.

Table 2 – Different approaches for the study of remoteness

Approach	Authors	Special notes	The aim of study
Economic	Huskey, Berman et all ¹²	Three main types of remoteness: - spatial, - economic (pricing), due to high transportation costs, - institutional	Inhibiting effect on economic development
Networks-based	Herrschell ¹³ Copus ¹⁴	Two types of peripherality: spatial remoteness from centres of economic development ("on the edge", edgeness) - failure to include the social network ("in-betweenness")	Inhibiting effect on economic development
Anthropological	Ardener ¹⁵ , Humphrey ¹⁶	The world of special values and "exotic" behaviours	- "Anisotropism": open for the world inside, but difficult for the foreign traveler; - High level of innovation

A comparison of different concepts of remoteness allows the hypothesis regarding base resilience of Arctic cities, focusing upon the differences in relation to non-Arctic cities. According to our hypothesis, the main difference is remoteness.

Its influence on resilience is the following.

Of all factors promoting the stability of "normal" cities against external (primarily economic) shocks their internal diversity (which paid special attention to J. Jacobs) and the ability to learn must be chosen for investigation. These factors enable in case of changing market conditions, "start" alternative specialization (of course, this is a strong generalization). Other factors seem to us to be universal and typical both for the Arctic and non-Arctic cities, and to a lesser extent volatile in connection with remoteness.

¹² Berman M., Lance H. Remoteness, Transportation Infrastructure, and Urban-Rural Population Movements in the Arctic // Proceedings of the International Conference on Urbanisation of the Arctic, Nuuk, Greenland, August 2012, Stockholm: Nordregio, 2012. P. 108—122; Huskey L., Morehouse Th. A Development in remote regions: What do we know? // Arctic. 1992. Vol. 45(2). P. 128-137.

¹³ Herrschell Tassilo. Regionalisation and marginalization: bridging old and new divisions in regional governance // Regional development in Northern Europe. Peripherality, marginality and border issues. Routledge, 2012. Pp. 30—48.

¹⁴ Copus A. From core-periphery to polycentric development: concepts of spatial and aspatial peripherality. European Planning Studies, 9 (4): 539—552.

¹⁵ Ardener E. "Remote areas": some theoretical considerations // The Voice of Prophecy and Other Essays / E. Ardener (ed.). Berghahn Books: L. and N.Y., 2007. P. 211—223.

¹⁶ Humphrey K. Changing importance of remoteness in modern Russia. At: Ethnographic review, No. 3, 2014, C. 8—24. [In Russian]

In "normal" cities the proximity becomes factor of increasing diversity and leaning capacity. In in remote cities we have to find some alternative the factor of increasing diversity. It might be a mobility of the population (including temporary mobility¹⁷). In addition, we can assume that the Northern cities have wider specialization. Being remote from major economic centers, they are forced to develop all the necessary range of basic services. This fact can be considered as a factor in the increased cost of living in the Northern areas (Berman, Husky etc. have wrote on this) – but also it maybe also the basis of resilience. In addition, the study of creativity of Arctic cities could be the area of study. By the way it is just a topic that has already been the subject of special studies¹⁸.

In the end, the following aspects of the development of the Arctic cities of Russia were chosen for further consideration:

- mobility and its various aspects;
- the level of specialization and diversity of the local economy;
- creativity.

Our hypothesis is that the resilience of Arctic cities to the socio-economic challenges is based on their specific characteristics. We assume that Arctic city are different from their non-Arctic counterparts in the areas of mobility, forced diversity and creativity of local communities.

3. Preliminary assessment of specific Arctic factors of resilience: a pilot study on the comparison of pairs of southern and Northern cities

To test this hypothesis for all the Arctic cities of Russia (including contingent models of cities based on the use of data by municipal districts) their analogs were selected within the main area of settlement of Russia (Fig. 3).

¹⁷ Torre A. On the role played by temporary geographical proximity in knowledge transmission. In Regional Studies. 2008. No 42 (6). Pp. 869-889.

¹⁸ Peliasov A., Kolesnikova O. Otsenka tvorcheskogo potentsiala rossiiskikh regional'nykh soobshchestv // Voprosy ekonomiki. 2008. No 9. pp. 50-69. [Pilyasov A., Kolesnikova O. Evaluation of creativity of Russian regional communities, At: Voprosy Ekonomiki. 2008. No 9. p. 50-69.]; Peliasov A.N. I poslednie stanut pervymi. Severnaia periferiia na puti k ekonomike znaniia. – Moscow: URSS, 2009. 544 p. [Pelyasov A. N. And the last shall be first. Northern periphery on the way to knowledge economy. – Moscow: URSS, 2009. 544 p.]; Petrov A. Talent in the Cold? Creative Capital and the Economic Future of the Canadian North. At: Arctic. Vol. 61, No. 2 (JUNE 2008) P. 162 – 176.

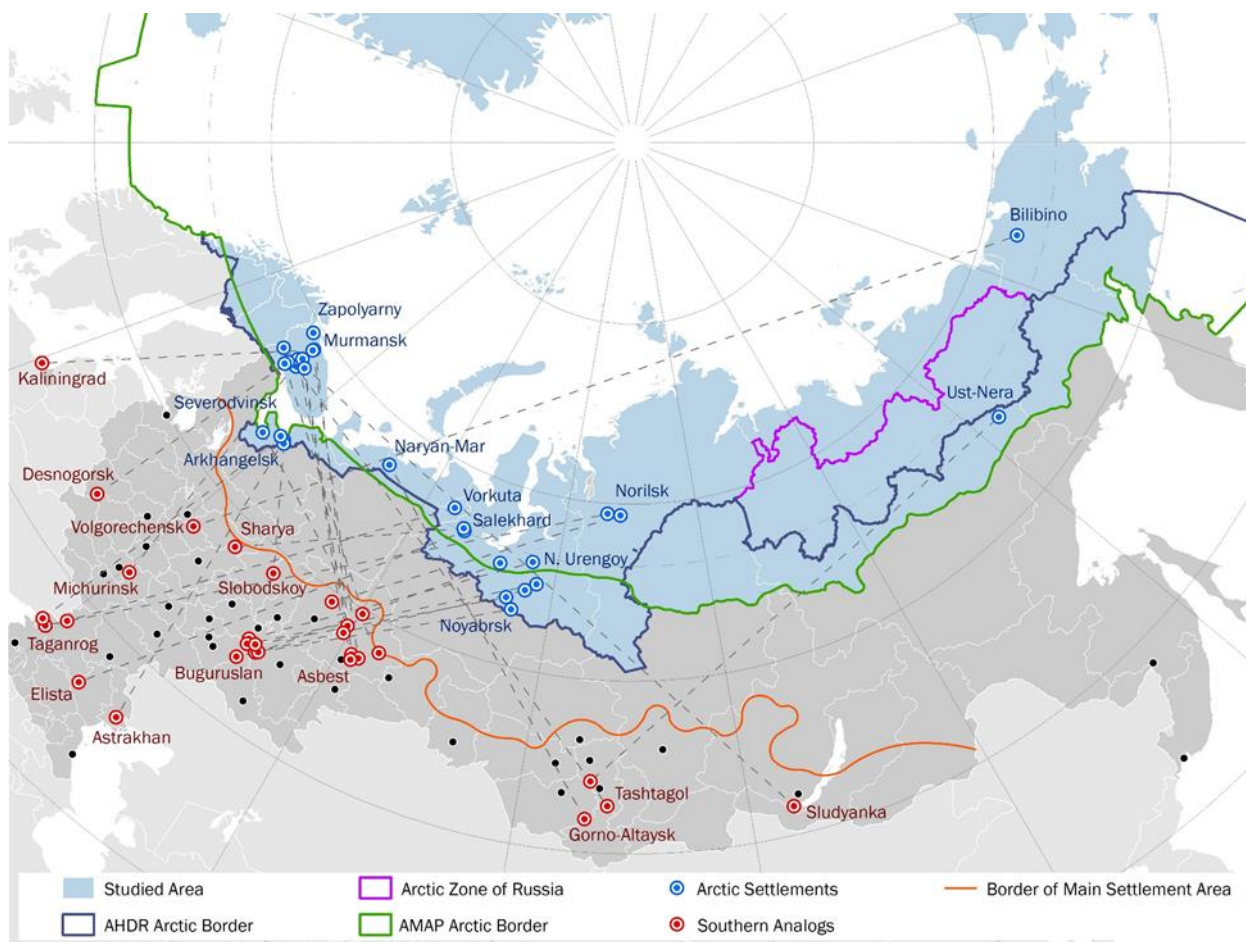


Figure 3. City counterparts: the Arctic cities and those analogs in the main area of settlement of Russia

To test the main hypothesis of the research we used the method of comparative analysis of the Arctic and southern cities. To improve the objectivity of the results of the comparison for each Arctic city it was picked up its city-counterpart located within the main area of settlement of Russia and which is the most similar to certain Arctic city with a set of criteria: population, the structure of employment by economic sector and geographical location (in particular proximity to the sea). The basis of the developed technique is a tool for analysis of similarity, performing a z-transformation for all incoming attributes and rank the objects from the joined sample according to the degree of similarity with each object of the target sample. As the target sample were used Arctic city (29), as joined were the cities from the main zone of settlement (more than 400), which were found similar in data. We used GIS as a platform for the analysis with the spatial factors (distance between cities) was not considered. After completion of the automated analysis an expert analysis of each received pair was conducted in the correctness of similarities.

The result of this phase of the study were 29 pairs of similar cities, which formed the basis of further research (figure 3).

The selected cities were compared on a number of parameters.

Population mobility and migration. Migration mobility is obviously one of the most important aspects of life Arctic cities. It was studied by us from different points of view.

In the study of population mobility draws attention to amplitude changes in the population of Arctic cities. In just 5 years (2010-2015), the population of many of them changed in one or other direction in 5-10 percent (figure 2).

This observation is confirmed by special studies. We tried to assess the *overall mobility of the urban population P*, using the following formula:

$$P = (\text{Migr_IN} + \text{Migr_OUT}) / \text{Popul},$$

where Popul is the city population at the end of the reporting year, Migr_IN – in-migration flow for the same year, and Migr_OUT is out- migration flow.

The analysis of statistical data showed that the average value of the mobility of the population for Northern cities was 9.8% in 2015 (in other words, migration processes involved almost every tenth resident of the “typical” Arctic city). For South counterparts the value of this indicator was 5.8%.

The average mobility rate over a five year period (2011-2015) showed similar results of 9.9% for the Arctic cities and 5.4% for the southern analogs. Thus, the analysis of a wider range of data demonstrates an even greater “separation” of Northern cities from their southern analogs.

It should be noted that we have analyzed the statistical significance of all identified patterns using standard statistical methods, in particular the Kolmogorov-Smirnov test, F-test and T-tests. In the analysis of samples for inbound flow p-value was 1.2e-06, mobile - 5.4e-07. Thus, all statistical differences are representative.

Another characteristic of the mobility of the population of Arctic cities is the predominance of the long-distant migration flows above the others (Tabl 3).

Table 3. Percentage of Long distant migrations

Cities	In-migration from the region, %	Out-migration to the external region, %
Northern cities	67,9	71,3
Southern cities	44,4	45,2

Finally, an attempt was made to assess the stability of migration flows, which was mapped net migration in all cities, two dates, separated by 5 years (2011 and 2015 figure 4).

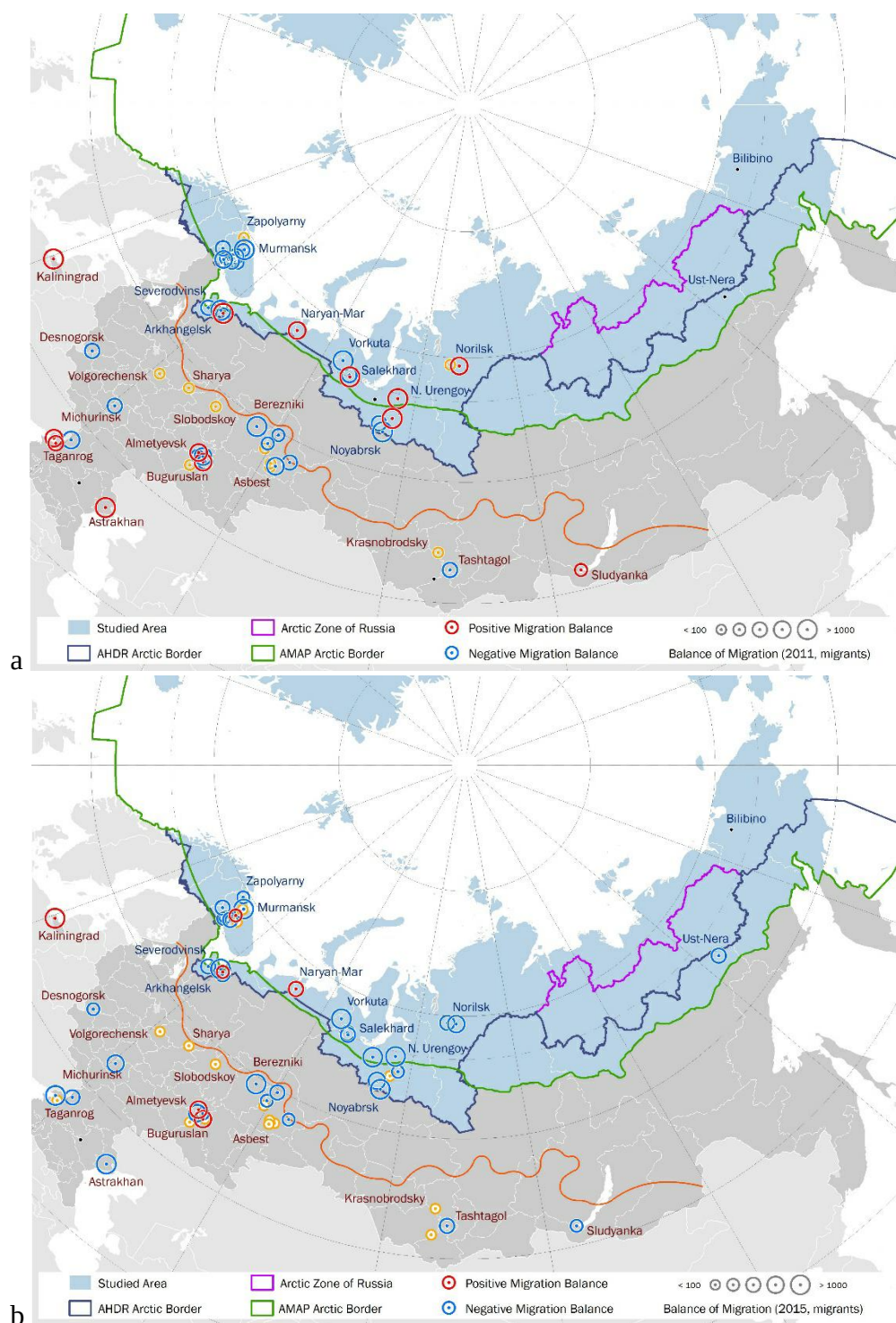


Figure 4. Migration balance of the urban population in 2011 (a) 2015 and (b)

Comparison of the maps on the figure 4-a and 4-b shows that in just 5 years migration balance changed to the opposite in such large Arctic cities like New Urengoy and Salekhard. In Novy Urengoy the value of the annual balance is of more than 5 thousand people (of a total mobility of the population in 2015 to 26 thousand), in Salekhard it ranges from 500 to 1 thousand (of a total mobility in 2015 of 6.6 thousands) in the population, respectively, Novy Urengoy to 115 thousand people, Salekhard – 48 thousand persons. Thus, for example, the general mobility of the population of Almeteyevsk which was chosen as a city-equivalent of Novy Urengoy is about 10 thousand people for a population of about 200 thousand, whereas the balance does not exceed 1 thousand. A similar situation is observed for other pairs of cities.

Thus, it can be proven the high mobility of the population of Arctic cities. In this case the

migration over long distances dominates, and the value and balance of migration flows is unstable. The population of Arctic cities can thus be characterized as "pulsating" - and this is perhaps the most important characteristic in their difference from the southern counterparts.

Other parameters of the Arctic cities (the level of development of social and cultural infrastructure, the level of diversification of the labour market, etc.) do not have significant differences compared to the southern counterparts.

Beyond the consideration of the left temporal mobility is obviously an extremely important aspect of life of the communities of Northern cities, is associated, among other things, the formation of information flows¹⁹. However, due to lack of information, this aspect of mobility can be studied only through field research.

The diversity of the local economy. It is obvious that the remoteness should affect the development of the service sector, cultural and leisure sphere. Therefore, the following parameters were considered:

- Number of sits to a haircut per 1000 inhabitants
- Retail trade turnover per capita, RUB/person.
- Number of seats in bars and restaurants pro 1000 inhabitants
- Number of music schools teachers per 1000 inhabitants,
- Number of specialists in museums per 1000 inhabitants,
- Percentage of the employment in the main sector.

In this case, we assumed that the development of the service sector could be a sign of diversification of the economy of Northern cities.

In addition, the work was done to analyze the specific factors of diversity, namely the sectoral diversity of the local labour market. For this purpose we have analyzed two special indicators of diversity of the economy of the Arctic cities in comparison with their southern counterparts. The structure of employment by economic sectors, which were also used for the search of analogs, was at the basis of the analysis. For this reason, the comparison of two samples - Arctic cities and their counterparts previously used in our work did not make sense here. Therefore, the Arctic city were compared with the whole array of cities in the zone of primary resettlement, previously "cleaned" from not relevant data (total of about 280 cities).

In this analysis, we used 2 parameters as measures of diversity. These two are the index of Shannon and the index of Herfindahl-Hirschman, which are often used in economic-geographical research. In particular, in recent years the first one has been actively used by economists and geographers to measure the diversity of any phenomena. The second (together with their derivatives) have long used to assess the degree of specialization of industries (or their monopolization if we are talking about companies and the corporate structure of the industry). Thus, both metrics can be used to assess diversification and economies of cities.

The Shannon diversity index takes positive values (the higher the value -- the higher the diversity) and it is relevant when comparing multiple samples. Specialization index Herfindahl-Hirschman index takes values from 0 to 1, the larger the value, the lower diversification and so the higher is the specialization in one or more industries.

The analysis showed that at the level of individual statistical indicators significant

¹⁹ Zamiatina N. Iu. Rol' otpuska v podderzhanii ustoichivogo razvitiia gorodov Severa i kontseptsii vremennoi geograficheskoi blizosti // Mozaika gorodskikh prostranstv: ekonomicheskie, sotsial'nye, kul'turnye i ekologicheskie protsessy. Sbornik materialov Vserossiiskoi nauchnoi konferentsii (Moscow, MSU, 27–29 november 2015). — MSU. Moscow, 2016. — Pp. 120–126. N. Zamyatina and A. Yashunsky. Organized proximity and migration flows: How do universities push young talents to Russian Arctic. In 8th international conference on population geography (30 June – 3 July 2015, The University of Queensland, Brisbane, Australia): Conference handbook, page 91. The University of Queensland Brisbane, Australia, 2015; N. Zamyatina and A. Yashunsky. The stabilizing role of social proximity in the Arctic migration: The case of Russian cities Norilsk, Dudinka and Igarka in comparison with international Arctic zone. In 8th international conference on population geography (30 June – 3 July 2015, The University of Queensland, Brisbane, Australia): Conference handbook, page 102. The University of Queensland Brisbane, Australia, 2015.

differences between the Northern sample of cities and southern analogues appears only in terms of "Number of seats in bars and restaurants pro 1000 inhabitants" -- figure 5.

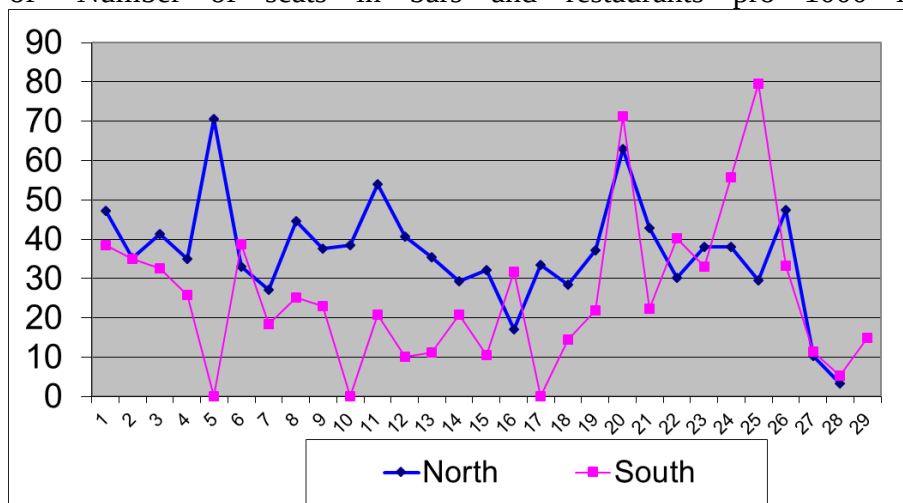


Figure 5. Number of seats in bars and restaurants pro 1000 inhabitants, 2015

Cities 1—29: 1. Arkhangel'sk - Astrakhan', 2. Murmansk - Kaliningrad, 3. Severodvinsk - Taganrog, 4. Noril'sk - Berezniki, 5. Novyi Urengoi - Al'met'evsk, 6. Noiabr'sk - Oktiabr'skii, 7. Vorkuta (gorodskoi okrug) - Leninsk-Kuznetskii, 8. Nadym'skii raion - Tuimazinskii raion, 9. Apatity - Michurinsk, 10. Purovskii raion - Leninogorsk, 11. Monchegorsk - Kachkanar, 12. Kandalakshskii raion - Krasnotur'insk, 13. Kol'skii raion - Artemovskii gorodskoi okrug, 14. Novodvinsk - Slobodskoi, 15. Pechengskii raion - Rezhevskoi gorodskoi okrug, 16. Taimyrskii raion - Azov, 17. Muravlenko - Aznakaevskii raion, 18. Onezhskii raion - Turinskii raion, 19. Olenegorsk - Kushva, 20. Kirovsk - Tashtagol, 21. Gubkinskii - Buguruslan, 22. Labytnangi - Shar'ia, 23. Nar'ian- Mar - Gorno-Altai'sk, 24. Salekhard - Elista, 25. Kovdor - Sliudianka, 26. Poliarnye Zori - Desnogorsk, 27. Lovozerskii raion - Malyshevskii gorodskoi okrug, 28. Oimiakonskii ulus - Krasnobrodskii, 29. Bilibinskii raion - Volgorechensk.

With regard to specific indicators, the differences North and South of the whole sample of cities in terms of diversity of the sectoral structure of employment, which is expressed using the Shannon index, was not significant. In particular, the p-value amounted to more than 0.9, which indicates non-representative differences between the two samples.

While the Herfindahl-Hirschman index shows us that the Arctic cities have a little less "specialized" structures of the economies than the Southern ones (the values of the index mean 0,147 vs 0,171). These differences are at the edge of statistically significant area (p-value was 0,42), which generally allows us to conclude that our initial hypothesis of greater diversification of the economies of Arctic cities is confirmed only partly. However, this aspect requires further study and verification.

Creativity. The idea that the Northern cities have high level of creativity because of their special conditions for development is not new. In particular it was developed by A. Pelyasov, A. Petrov, etc²⁰.

Without having a goal to reassess the creativity of the Arctic cities, we tried to introduce into consideration the new indicator – the number of scientific publications per 1000 inhabitants of the city. Publications were considered from the system of Russian Index of scientific citation (<https://elibrary.ru/defaultx.asp>). We used the number of publications in the system where the names of the studied cities were mentioned in the authors' affiliation (figure 6).

²⁰ Pilyasov, A.N. Russia's Arctic frontier: Paradoxes of development. Regional Research of Russia. 2016 Vol. 6, # 3. Pp227-239; Pilyasov A.N. And the last will be the first. Northern Periphery towards the knowledge economy. M.: URSS. 2009. 542 p.; Pilyasov A. N., Kuritsyna-Korsovskaya E. N. Geographic dimension of innovation activity // Izvestiya Akademii Nauk, Seriya Geograficheskaya. — 2009. — no. 2. — P. 8–16. N. Zamyatina, A. Pilyasov. Russia, which we have found: exploring space on a micro level. - New Chronograph Moscow, 2013. – 548 p.; Pilyasov A. Northern Futurology: the Next 20 years // Northern Sustainability. Keynote Presentations and Other Highlights from the 8th International Congress of Arctic Social Sciences (ICASS 8). Prince George, Canada. May 22-26, 2014. Topics in Arctic Social Sciences, Vol. 8, 2015. IASSA. 2015. 170p. C.54-81; see also: Petrov A. Talent in the Cold? Creative Capital and the Economic Future of the Canadian North. At: Arctic. Vol. 61, No. 2 (JUNE 2008) P. 162 – 176.

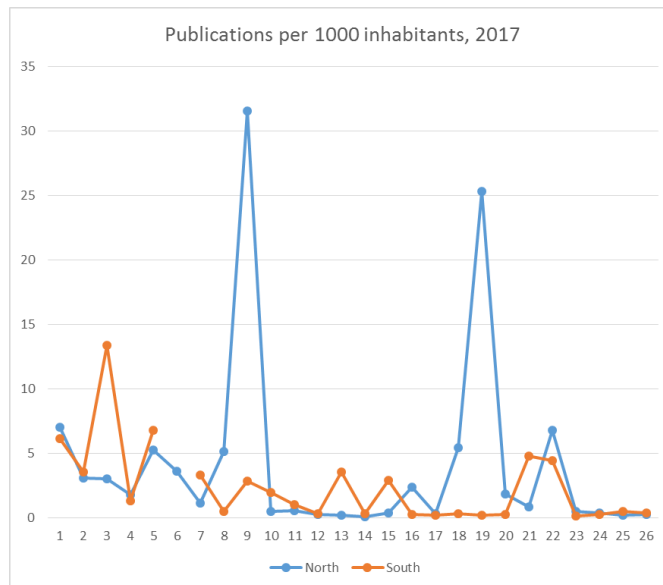


Figure 6. The number of scientific publications (RISC) per 1000 inhabitants of a city, Arctic-non-Arctic in comparison

1—29 pars of cities: 1. Arkhangel'sk - Astrakhan', 2. Murmansk - Kaliningrad, 3. Severodvinsk - Taganrog, 4. Noril'sk - Berezniki, 5. Novyi Urengoi - Al'met'evsk, 6. Noiabr'sk - Oktiabr'skii, 7. Vorkuta (gorodskoi okrug) - Leninsk-Kuznetskii, 8. Nadym'skii raion - Tuimazinskii raion, 9. Apatity - Michurinsk, 10. Purov'skii raion - Leninogorsk, 11. Monchegorsk - Kachkanar, 12. Kandalakshskii raion - Krasnotur'insk, 13. Novodvinsk - Slobodskoi, 14. Pechengskii raion - Rezhevskoi gorodskoi okrug, 15. Taimyr'skii raion - Azov, 16. Muravlenko - Aznakaevskii raion, 17. Olenegorsk - Kushva, 18. Kirovsk - Tashtagol, 19. Gubkinskii - Buguruslan, 20. Labytnangi - Shar'ia, 21. Nar'ian- Mar - Gorno-Altai'sk, 22. Salekhard - Elista, 23. Kovdor - Sliudianka, 24. Poliarnye Zori - Desnogorsk, 25. Oimiakonskii ulus - Krasnobrodskii, 26. Bilibinskii raion - Volgorechensk.

The results do not support the hypothesis that Northern cities are more creative in comparison to their southern counterparts (with the exception of a sharp excess of the city of Apatity, where the famous scientific institutes are situated. Northern cities as a whole do not demonstrate higher level of publication activity. The case of Gubkinskiy, something that stands out, apparently, inflated because of the overlap of the city's name with the name of another city and a University which all were called in honor of the geologist Gubkin. The data on this town needs to be checked in manual; although a preliminary analysis shows that the error in this case should not exceed 20%.

Thus, migration and related changes in population really are the area where the differences between the Arctic and non-Arctic cities are manifested most clear. On the contrary, the hypothesis of greater diversification in Northern cities under the influence of the conditions of the remoteness (in relation to their southern counterparts), and more creativity was not confirmed. However, it is possible, that the diversification and complexity of the Arctic lifestyle is manifested on a more subtle level – for example, the prevalence of combination of professions (these data are present in the literature).

Let us now move to the question of what role could be played by high level of mobility in Arctic cities in the provision of their resilience?

4. Discussion. Development of the Arctic cities in the framework of resilience

So the two key differences in Arctic cities from their southern counterparts are the migration characteristics and the level of provision of restaurants. The second is obviously the result of overcoming severe natural conditions: increased demand in bars and restaurants, apparently, compensate for the inability for most of the year to use open spaces as "public spaces", communication sites, and thereby demonstrates the resilience of Arctic cities to their

climate conditions²¹. "Inflated" value of the square of bars and restaurants makes you wonder about the organization of particular forms of leisure "under the roof", the creation of multifunctional centers of leisure and communication, similar to the South public space (in some cases, as those just act a disproportionately large foyer in shopping centres and restaurants – figure 7).

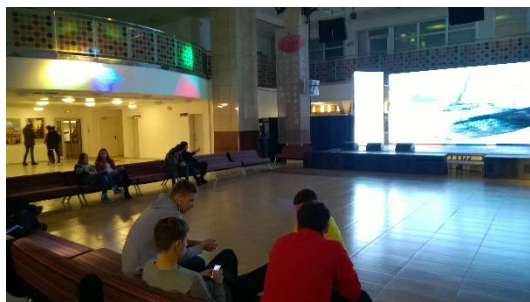


Figure 7. Interior of a shopping center in Salekhard: it is obvious that the shopping center plays the role of a communication space or "public space under the roof."

However, in the context of set objectives, we need to focus on mobility.

Traditionally a high turnover of the population was considered as a problem of the Far North, the source of its social instability.

However, the paradoxical nature of Arctic urbanization as a phenomenon admits the paradoxical explanations of its resilience. The experience of previous years of a detailed study of Arctic migration²² leads us to the following reasoning.

Arctic migration have a number of characteristics. First, migration is closely associated with regular temporal trips to the more southern regions (temporal proximity). In Russia regular contacts between Arctic and non-Arctic areas are stimulated, among other reasons, by legislated practice of providing the residents of Northern areas of a paid leave – usually used for maintaining of social ties in not-Arctic areas. Second, a substantial amount of the time spent by the inhabitants of the Arctic in more southern areas allows them to accumulate tangible and intangible assets in Southern areas: real estate, new social capital, etc. It allows northerners to migrate from the North relatively easier than the process of migration of the inhabitants of other (non-Arctic) areas of the country from one region to another. Therefore, in the case of strengthening of negative trends Arctic town rapidly (and relatively easy!) loses its population. When conditions change, the population of Arctic towns is also quickly restored, and social ties and previous experience also play a significant role here.

On the mental level the mobility of the population of the Arctic and cities is reinforced by their "double" territorial identity that allows them to feel themselves "at home" in some southern parts of the country.

²¹ There is, however, a variant that this is the result of a high proportion of "temporary" population that has no ability or desire to cook at home; another option is that is a characteristics of the local preference leisure activity. It requires a special study.

²² Nadezhda Zamyatina, Alexey Yashunsky. Migration cycles, social capital, and networks: A new way to look at arctic mobility // *New Mobilities and Social Changes in Russia's Arctic Regions*. Edited by Marlene Laruelle. — Routledge Research in Polar Regions. — Routledge London and New York, 2016. — P. 59–84; Zamyatina N. Intercity networks as a factor promoting arctic city sustainability // *Russian analytical digest*. — 2013. — no. 29. — P. 4–6; Zamyatina Nadezhda. Multiple territorial identity: Arctic and post-modernity. In *Book of abstracts of International Geographical Union Regional Conference Geography, Culture and Society for Our Future Earth, 17-21 August 2015, Moscow, Russia, volume 3701 of C12.09 Environment Evolution*, pages 1352–1352, Russian Federation, 2015. Russian Federation; Zamyatina N. Iu. Rol' otpuska v podderzhanii ustoychivogo razvitiia gorodov Severa i kontseptsii vremennoi geograficheskoi blizosti // *Mozaika gorodskikh prostranstv: ekonomicheskie, sotsial'nye, kul'turnye i ekologicheskie protsessy. Sbornik materialov Vserossiiskoi nauchnoi konferentsii* (Moscow, MSU, 27–29 november 2015). — MSU. Moscow, 2016. — Pp. 120–126 (in Russian).

Reverse processes occur when conditions in the southern regions of the country become worse and people who were related to the Arctic in the past easily return to the North (for example, during the armed conflict in the Donbass region of Ukraine, many residents of this area moved to the Arctic).

Mentioned arguments allow us to propose an assumption about the need of revision of the fluctuations in migration flows in the Arctic cities. Instead of the complaints of the inconstancy of the Arctic population, high migration mobility of northerners can be regarded, however, as a kind of safety valve for Arctic cities responsive to adapt to changes in economic conditions. Due their ability to be mobile it is relatively easy for Arctic cities to gain and lose population. Otherwise, the Arctic city would permanently faced with total unemployment, and, apparently, a much stronger social deviance in local communities.

Mobile Northern communities as a rule do not lose the "roots" in the more southern areas. The worst variant of depressed areas are observed there where economic disasters catch the population deeply embedded in place "having nowhere to go." Of course, people without social capital in other areas are also could be seen in the North; the high proportion of them could be expected in the most depressed cities. However, overall, it seems that mobility is not an obstacle, but, on the contrary, specifically Northern "guarantor" for resilience.

In addition, high mobility contributes to enhancing the learning ability of Arctic communities and their creativity.

Conclusions

The sustainability of Arctic cities is exciting subject which is full of puzzles. The main differences of the Russian Arctic cities from their southern counterparts are 1) their remoteness which prevents innovative development, and 2) the very complicated dynamics of population, high mobility of residents. We assume that a high level of mobility of the inhabitants of the Arctic (backed by strong social bonds and tangible assets of northerners which they have outside of the Arctic zone) serves as a kind of "safety valve" that provides resilient Arctic cities – for example, saving them from total unemployment during the economic crises.

Perhaps this finding is more relevant in relation to the Arctic cities of Russia than other countries, especially the countries in North America, where the population as a whole is highly mobile. We expected to make international comparisons to check it.

As for future research we also plan to build up a model of the resilience of Arctic cities. It will be based on identifying those features of the Arctic cities in the past (status, economic features, migration characteristics), which provide their relative resilient with the collapse of the Soviet system in the 1990th.