COASTAL CITIES AS CENTERS OF INNOVATION ACTIVITY IN THE BALTIC REGION

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Abstract

The Baltic region's innovation space is representing the intersection of the interests of countries with different levels of innovation development: both advanced and following an active catch-up policy. All these countries are united by the Baltic Sea, which stimulates cross-border cooperation and regionalization. It fuels the generation and diffusion of innovations in the macro-region, setting the centre-periphery model for the distribution of innovation activity. Cities come to the fore as innovation centres, which, due to the combination of intellectual resources, technological and economic infrastructure, investments, and institutional capital, ensure the sustainability of innovation processes with the subsequent dissemination of the best practices in innovation. This study is devoted to assessing the stratification of innovation activity in the macro-region with a focus on cities and their role in the technological development of the economy. The geography of the study covered the cities of 10 coastal countries: Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Norway, Poland, Russia, and Sweden. The sources of information were international rankings on innovative development of cities and national statistical bureaus. The innovation-active cities of the Baltic region identified are, foremost, capitals, large centres of industrial production, as well as cities with a concentration of research organizations.

Key words: innovation, core-periphery, innovative activity, cross-border regionalization

JEL Code: O18, O36, R12

Introduction

Cities around the globe represent the centre part of national and regional innovation systems by accumulating human resources, intellectual capital, business clusters, advanced infrastructure, and other components critical for the generation, diffusion, and adoption of innovations. The institutional thickness of cities, determined by the variety of co-located organisations involved in complex interrelations and networks, ensures the cross-fertilization between the industry, government, academia, and other elements of the quintuple innovation helix framework (Arant

et al., 2019; Carayannis et al., 2018; Zukauskaite et al., 2017). With that, it is natural that innovation space is as divergent and asymmetrical as the social or economic wellbeing (Mikhaylov et al., 2020; Mikhaylov and Mikhaylova, 2017).

Over the years scholars have proposed numerous performance indicators and criteria for evaluating and assessing the innovative activity of cities and their urban innovation systems. It shall be said that city-level statistics reported by national statistical bureaus is rather poor and does not provide as much information as available at the regional or country level. Therefore, indirect quantitative data is often used for comparative studies – share of Internet users, coverage of high-speed mobile Internet, number of start-ups, cultural diversity, highly skilled migrants, public expenditure on education, graduate share of population, university rankings, etc. (e.g. Lyu et al., 2019; Penco et al., 2020). In-depth researches tend to rely on qualitative data and case studies, describing best practices achieved in certain industries or business clusters (Esmaeilpoorarabi et al., 2018). These practices are hard to replicate (Malecki, 2021), while some of the cases are controversial and ambiguous as after the state subsidies or project funding ends, the well-described best practices are found to be criticized for being a 'bubble' with no resilience. For example, the success of Swedish-Danish Medicon valley case has been questioned by Cappellano et al. (2022), for it being "neither a 'success story' nor a 'failed case', but a nuanced experience that shows how the presence of a border can have both advantages and drawbacks".

When considering the geography of innovation, the Baltic region is one of the global innovation hotspots. However, the innovation space of the macro-region has its core and periphery. In terms of the geography of innovation, the Baltic region is one of the world's centres of innovation. Researchers describe it as the region of coopetition (Fedorov et al., 2020), where innovative cooperation coexists with increased competition between cities (primarily capitals) of innovatively developed countries (Denmark, Germany, Sweden, Finland, Norway) and countries striving to catch up with them (Lithuania, Latvia, Estonia). This creates conditions for the deformation of the innovation space of the macro-region with the formation of the core and periphery. In this regard, the purpose of this article is to assess the stratification of modern innovation activity in the Baltic region with a focus on cities.

1 Ranking-based assessment system on the spatial stratification of innovative activity

The assessment of the territorial heterogeneity of innovation activity in the urbanized space of the Baltic region was based on the identification of cities that make a significant recognized contribution to the creation of new knowledge and innovation. International rankings of cities were chosen as a tool for such a comparative assessment of cities in different countries with different levels of innovative development, innovation statistics, institutional approaches to regulating innovation. This made it possible, firstly, to level the problem of differences in national data and the paucity of innovation statistics at the city level. Secondly, by using not only general innovation rankings, but also specific ones (for example, those focusing on start-ups or investments), we obtain a more voluminous picture of the participation of cities in the countries of the macro-region in international innovation processes. The sources of information were nine international innovation rankings of 2020 – 2021. Further, the representation of cities of the Baltic region countries in each of the rankings will be considered in detail (Table 1).

Tab. 1: Ranking used to measure the innovative activity of cities, 2020-2021

The spatial stratification of innovative activity	Ranking title	Cities of the Baltic region countries
Innovation landscape	Innovation Cities Index	40
Points of global influence and innovative growth	The Global Cities Index / The Global Cities Outlook	10 / 10
Poles of attraction of innovative economy resources	The Global Power City Index / The Global Liveability Index	5 / 3
Innovation economy infrastructure and innovation generation	The Global Innovation Index / The Cities Global Ranking of Startup Ecosystem / The Intelligent Community Forum Rankings	14 / 37 / 2
Efficiency of the urban innovation systems	The European Cities and Regions of the Future	29

Source: Developed by the authors based on methodology of the rankings

1.1 Innovation landscape of the Baltic region

Innovation Cities Index (https://www.innovation-cities.com) – an annual ranking of the top 500 cities in the world since 2007, which are divided into Nexus, Hub Cities, Node Cities and Upstart in terms of the degree of involvement in the global innovation economy. It is built on 162 indicators divided into 31 categories (for example, “Startups and Entrepreneurs”, “Technology and Communications”, “Education, Science and Universities”, etc.). This made it possible to cover the various functions of the modern economy and annually highlight the most

significant types of innovations for urban development (in 2021, these are innovations in the areas of digital technologies, entrepreneurship, smart cities, and sustainability).

In 2021, this ranking included 40 cities of the Baltic region. Most of them (22 or 55%) are in Germany. In addition to the capital Berlin (31st place, "nexus" type), a number of large industrial, financial and transport and logistics centres are present, such as Munich, Hamburg, Frankfurt, Stuttgart, Dusseldorf and others, as well as significant cultural and research centres with the oldest universities – Leipzig, Bonn, etc. It should be noted that German cities were represented during the entire history of this ranking, and their number gradually increased. Thus, in the first ranking of 2007, only Berlin and Leipzig were taken into account (the latter was marked as "2007 Most Improved Innovator"), in 2008 – already 9 cities, and since 2016 – 22 cities (Wuppertal added last and referred to as "node city", i.e. cities that are competitive in many segments of the innovative economy).

The second place among the countries of the Baltic region in terms of the number of cities included in this ranking in 2021 is Poland. There are 5 cities ranked, and all of them are assigned to the "Node Cities" group: Warsaw (123rd place), the next Wroclaw, lagging behind the capital by 107 points, taking 230th place; also, Krakow (266th place), Gdansk (274th place), Katowice (278th place). Poland first appeared in this ranking since 2008 and was represented first by Gdansk, Krakow, and Warsaw. Since 2014, 4 Polish cities have been considered, and since 2016, with the addition of Wroclaw, five cities have been ranked. Polish cities are characterized by a strong (more than 2 times) gap between the capital and other cities, which has been observed in all years since 2014.

Sweden is represented in the 2021 ranking by three cities – the metropolitan Stockholm (16th place, type "nexus") and two large scientific centres Gothenburg (108th place) and Malmö (128th place) lagging behind it by the integral value of the index, classified as "Node Cities". Stockholm has been ranked since 2008, holding a strong position in the Top 50 innovative cities in the world, while Malmö has been included in the ranking since 2012, and Gothenburg since 2014 and their positions are less stable.

Denmark has two cities in the ranking (namely Copenhagen – "Hub Cities", and Odense – "Node Cities"), as does the North-West of Russia (only the cities of the North-western Federal District are taken into account: Saint Petersburg – "Node Cities", and Kaliningrad – "Upstart", i.e. moving towards global competitiveness). It should be noted that there is a trend towards a decrease in the places of Danish and Russian cities in the ranking. While back in 2014 Copenhagen took 9th place and Odense 156th place, by 2021 they are 54th and 318th,

respectively. Similarly, in 2014 Saint Petersburg ranked 81st and Kaliningrad ranked 314th, while in 2021 there was a decrease to 121 and 404 ranks.

The innovation landscape in Norway, Finland, Lithuania, Latvia, Estonia, according to the Innovation Cities ranking, is represented only by capital cities, among which Oslo (25th place) is classified as a "nexus", Helsinki (41st place) is a "Hub Cities" type, and "Node Cities" are Tallinn (113th place), Riga (225th place), Vilnius (335th place). It should be noted that while the capitals of Norway and Finland have been included in the ranking annually since 2008, the capitals of the Baltic states have been on a permanent basis only since 2014. A pronounced positive trend is typical only for Tallinn, which in 2014 occupied the 257th position and annually improved its result.

Thus, the innovation space of the Baltic region, presented by the "Innovation Cities Index", is strongly deformed towards the German economy, and has several key growth poles, which, generally, are capital cities (Berlin, Stockholm, Copenhagen, Oslo, and Helsinki). The remaining cities of the macro-region demonstrate success only in some areas of the innovative economy, therefore, included in the Node Cities group, while one city (Russian Kaliningrad) is at its "Upstart", whose innovative potential should be developed.

1.2 Points of global influence and innovative growth in the Baltic region

The Global Cities Index and *Global Cities Outlook* (https://www.kearney.com/global-cities/2021), presented by the international consulting firm Kearney, cover a smaller list of cities. However, they provide an insight into the key and most influential cities in the world that serve as centres of social, political, and economic dynamics and set the trend for the global innovation space. The Global Cities Index (GCI) is based on a quantitative assessment of the degree of global integration of 156 cities and their competitiveness in five groups of indicators: business activity, human capital, information exchange, cultural experience, and political participation.

The Global Cities Outlook (GCO) complements the GCI ranking by predicting the future trajectories of urban spaces by measuring personal well-being, economics, innovation, and governance. It should be noted that since 2014 (the first year of the GCI), none of the cities of the Baltic region countries has ever entered the top 10. In total, the ranking includes 10 cities of the macro-region. Closest to the top ten leading world centres is Berlin. In 2014-2021 the capital of Germany is successfully advancing in the second ten, having risen from 19th place to 13th. Two more German cities Frankfurt and Munich are represented in the top 30 in 2021.

Moreover, the gap between them is shrinking every year: in 2014 it was 14 places, by 2021 it is only 2. The remaining 7 cities of the macro-region occupy places from 41 to 78 in 2021 (in descending order): Stockholm, Copenhagen, Oslo, Helsinki, Warsaw, Dusseldorf, and Saint Petersburg.

It should be noted that the Norwegian capital Oslo and the Finnish Helsinki entered the ranking only in 2020, and the capitals of such countries as Lithuania, Latvia, Estonia are not presented either as global cities or as having the potential to become such in the future. According to GCO 2021, the largest growth potential among the cities of the macro-region has Munich and Stockholm, which are among the top ten out of 156 cities in the world that demonstrate sustainable positive dynamics. Stockholm was also singled out as a city with a lead in public administration, along with Warsaw, which has a lead in attracting foreign direct investment. Thus, based on these rankings, we can expect that the development trajectory of the Baltic macro-region will be primarily shaped by Germany, whose cities have the strongest global influence. Sweden and Poland are gaining, thus, will also play an important role in the innovation space of the Baltic region.

1.3 Poles of attraction of innovative economy resources in the Baltic region

The Global Power City Index (https://mori-m-foundation.or.jp/english/ius2/gpci2/index.shtml) focuses on identifying the largest cities on a global scale – poles of attraction for resources for innovative development: human, capital, companies and others. The ranking has been conducted since 2012 and includes 48 cities, of which five are in the countries of the Baltic region: 2 in Germany (Berlin, Frankfurt), 1 in Sweden (Stockholm), Denmark (Copenhagen) and Finland (Helsinki, included since 2019). In 2021, Berlin is in the top 10 at number 7, Copenhagen is in the top 20 at number 15, and the other three cities are in the top 30. It should be noted that the cities of the macro-region have the strongest positions in terms of the categories “Livability” (the top 20 includes Berlin – 4, Copenhagen – 14, and Stockholm – 19) and “Environment” (the top 20 includes Stockholm – 1, Copenhagen – 2, Helsinki – 6, Berlin – 7, Frankfurt – 12), which makes them attractive centres for migration. In terms of other categories of functional specificity: Berlin has a strong position in cultural interaction (10th place) and the development of the R&D sector (17th place). In the spheres of Economy and Transportation, only two cities of the Baltic region were in the top 20: in the first case, Stockholm and Copenhagen, in the second, Frankfurt and Copenhagen. Summing up, we note that of the five cities of the countries of the Baltic region represented in the Global Power City

Index, only Berlin and Copenhagen have the strongest positions in attracting resources for an innovative economy, entering the top 20 in 4 out of 6 categories.

The Global Liveability Index (https://www.eiu.com/n/campaigns/global-liveability-index-2021), compiled by the Economist Intelligence Unit (EIU), complements the idea of the attractiveness of cities for living, and, therefore, allows identify additional points of attraction for people seeking to improve living conditions. The ranking includes 140 cities of the world and evaluates them in five categories: stability, healthcare, culture and environment, education and infrastructure. In 2021, it included three cities in Germany – Frankfurt (39th place), Hamburg (47th place), Dusseldorf (50th place). Earlier in 2018-2019 Danish Copenhagen was among the top ten cities in the world with a high quality of life. Thus, both rankings showed a similar result, highlighting the cities of Germany and Denmark as attractive for attracting human resources.

1.4 Innovation economy infrastructure and innovation generation in the Baltic region

Three more international rankings give an idea about the specifics of the territorial distribution of innovation activity in the Baltic region – these are the *Global Innovation Index* (https://www.globalinnovationindex.org); *Cities Global Ranking of Startup Ecosystem* (https://www.startupblink.com) and *The Intelligent Community Forum Rankings* (https://www.intelligentcommunity.org/icf_rankings_by_sustainability).

As part of the *Global Innovation Index*, information is presented on the 100 largest clusters of science and technology based on an analysis of the territorial localization of publication and patent activity. In 2018-2021, 14 such clusters were identified with the participation of the countries of the Baltic region: 8 in Germany, 3 in Sweden, 1 in Finland, Denmark and Poland. The top 50 in 2021 included Cologne, Munich, Stuttgart, Stockholm, Frankfurt-Am-Main, Berlin. In the second half of the list are Mannheim-Heidelberg, Copenhagen, Nuremberg-Erlangen, Helsinki, Hamburg, Lund-Malmö, Gothenburg, and Warsaw.

The Cities Global Ranking of Startup Ecosystem supplements the understanding of the infrastructure of an innovative economy by assessing the geographical distribution of startup. In 2021, 37 cities of the macro-region had startups registered, which is significantly less than in 2019, when there were 79 such cities. Geographically, most of them in 2021 were located in 20 German cities. In second place is Poland with 5 cities. In third place is Sweden with three cities. The top 100 includes 11 cities, incl. Berlin, Munich, Hamburg, Frankfurt in Germany,

Stockholm in Sweden, Helsinki in Finland, Copenhagen in Denmark, Tallinn in Estonia, Warsaw in Poland, Vilnius in Lithuania, Oslo in Norway. It should be noted that after the *Innovation Cities Index*, this is another ranking that took into account the cities of the Baltic states, which are "invisible" in the framework of other rankings, as well as the cities of the north-west of Russia (Saint Petersburg and Kaliningrad). In addition, it considers smaller cities (primarily in Germany and Poland), which were not shortlisted before, for example, within the framework of S&T activity. In total, 23 cities in the Baltic region had start-ups but were not counted as S&T clusters. Another 14 cities were present in two ratings at once (first of all, the cities of Germany, as well as the capitals of Sweden, Denmark, Poland, Finland).

The Intelligent Community Forum Rankings focuses on the formation of digital intelligent communities and the development of smart city infrastructure. As successful cases in different years, the experience of Finnish Espoo (2018) and Estonian Tallinn (2020), which were included in the list of 21 cities with successful practices, was considered.

1.5 Efficiency of the urban innovation systems in the Baltic region

The European Cities and Regions of the Future ranking data (https://www.fdiintelligence.com) provides information on the effectiveness of the innovation system of cities. The 2020/21 ranking included 29 cities, incl. 18 in Germany, 4 in Poland, 2 in Sweden, as well as the capitals of Norway, Denmark, Finland, Lithuania, Estonia. The cities of Latvia and the North-West of Russia were not ranked. Compared to previous periods, the number of cities in the macro-region included in the ranking increased: in 2014/15 there were 3 (Helsinki, Munich, Berlin), and in 2018/19 – 9 (Frankfurt, Warsaw, Stockholm, Copenhagen, Stuttgart, Hamburg were added). Munich showed the most dynamic growth, ranking 4 out of 10, thanks to the co-location of corporations, SMEs, innovative start-ups, universities, and research institutes. Warsaw, Berlin and Helsinki also have high positions, which entered the top 10 European cities of the future at 6, 7 and 10 places. In terms of categories, Warsaw has a strong position in terms of economic efficiency (10th place), business environment (2nd place) and economic potential (8th place). Also high in these categories are Stockholm, Oslo, Copenhagen in terms of business friendliness and Munich, Berlin and Helsinki in terms of economic potential. Five cities of the macro-region showed leadership positions in accumulated human capital and lifestyle (the capitals of Norway, Germany, Sweden, Finland and Denmark), and four of them – in the development of digital technologies (except Stockholm).

Conclusion

Cities are the main nodes of innovative growth in the world. Possessing a gravitational force in relation to the most important resources – intellectual, investment, technological, institutional and others, cities launch innovation processes and set new development trajectories. The review and joint consideration of a series of international city ratings made it possible to obtain a three-dimensional picture of the territorial features of the innovation space of the Baltic region and trace potential trends in its deformation in the future. The materials of 9 rankings demonstrated that the most active innovation processes in the macro-region at the city level are taking place in Germany. The cities of this country act as both scientific and technological, innovative, and industrial centres. They also have a significant impact on global processes due to their deep integration into the global innovation space.

An important role in the intensification of innovation activity (primarily in the field of R&D) is played by the capital cities of the northern countries, which, having favourable living conditions, attract and accumulate human capital. Poland plays an increasingly prominent role in the innovation space of the Baltic region. A number of cities in this country (along with Warsaw) are characterized by favourable economic and investment potential. The cities of the Baltic states are the least visible on the innovation map, but among them there are some successful practices in the development of intellectual communities (for example, in Estonia). The role of the cities of the North-West of Russia seems to be underestimated, one of the reasons for this is their lower integration into the innovation processes of the macro-region.

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