Regional Differences in the Conditions of Technological Progress in Europe

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Abstract

The spatial structure of the world is unequal, centres and peripheries alternate. There are significant social and development differences between countries in the world, but there is also an unequal development within the countries. The main purpose of the regional policy is to reduce spatial inequalities by catching up the underdeveloped areas. Nowadays, in the era of the Fourth Industrial Revolution, technological progress creates possibilities for developing regions to catch up, because new technologies require new skills that are less dependent on factor endowments of countries. Most economies are unable to create new technologies because they do not have the appropriate resources or their institutional environment does not favour innovation. However, technological progress can also be observed in these countries by adopting and applying new technologies effectively. This research aims to illustrate the regional differences in the conditions of technological progress in Europe, using multivariate statistical methods. Based on the European Regional Competitiveness Index, the research question to be analysed is whether new technologies may be able to decrease spatial differences. We compare the European regions in the field of innovation in order to highlight the critical areas that can promote or prevent the reduction of inequalities.

Keywords: regional differences in Europe, technological progress, innovation leaders, innovation followers

Introduction

There are significant differences in income and economic development between countries that can be derived from the spread of technology and the incentive system influencing this process. Diffusion is important for the realization of technological progress because it creates the possibility of imitation in countries where the capabilities do not allow the creation of new technologies. In developed countries, technological progress realizes in an innovation-driven way, where the invention is realized, but in most countries, the adoption of existing technologies, i.e. imitation, creates possibilities for technological and economic development. It

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is also observed that countries are not homogeneous in terms of their level of development, there are significant regional differences not only in income but also in factor endowments which affect the possibilities of technology application.

Based on cross-sectional and panel data, national and regional growth rates are correlated with economic, social and political variables, including a number of factors influenced by government policies (Grossmann-Helpman, 1994, p. 23). Some empirical studies analyse the technological differences between countries, e.g. using the world technological frontier (see Caselli-Coleman, 2006; Growiec, 2006), but analysing regional competitiveness, the role of innovation is appreciated (Camagni-Capello, 2013; Békés, 2015). Our empirical research aims to highlight technological inequalities at a regional level. In the European Union, the NUTS classification (Nomenclature of territorial units for statistics) is used to collect regional statistics. Based on the NUTS system, the Regional Competitiveness Index (RCI) provides data to compare regions' performance in various areas of competitiveness. In this paper, we try to illustrate the regional differences in the conditions of technological progress in the European Union using various statistical methods.

Why Is There a Technology Gap between Countries?

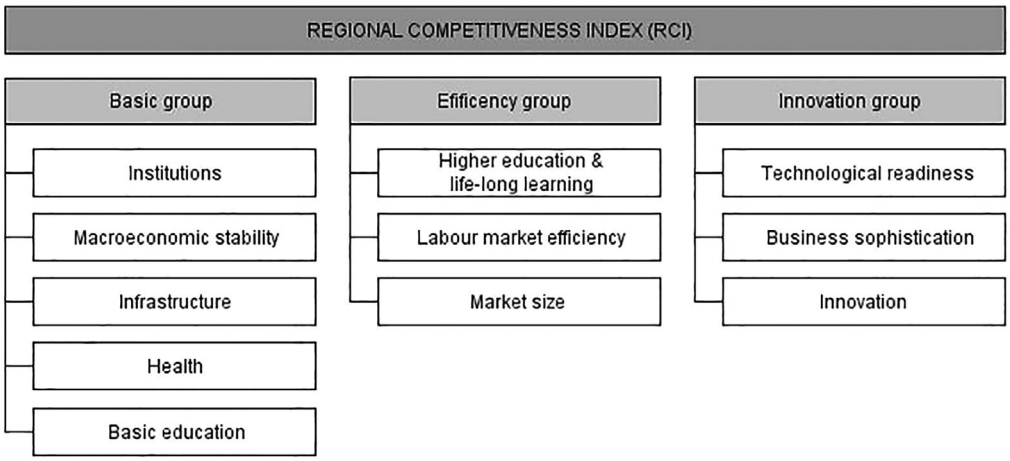
Based on empirical experiences, differences in technology application across countries are closely related to income differences. The technology gap depends on how a country can mobilize its resources for the social, institutional and economic restructuring required by innovation, so close relationships can be assumed between a country's technological and economic development level (Fagerberg, 1987). Developed countries create new technology because their environment is favourable for this, but it is not certain that it will work in developing countries as well. The choice of the appropriate technology depends on factor-endowments, because technology can apply effectively if adequate resources are available. Each country chooses the best technology which fits its own capabilities, but it is not necessarily the best one in the world. Basu and Weil (1998, p. 1025) pointed out that a technology derived from a special combination of physical and human capital can be optimally matched to only one capital-labour ratio. This means that a given technology cannot work as efficiently as possible in every country. According to Krugman (1979), innovation is realized typically in developed countries, because human and physical resources, i.e. skills, knowledge and material resources required to create new ideas are available together, complemented by an appropriate institutional background. Barro and Sala-i-Martin (1997) pointed out that imitation, i.e. adoption of new technology, is cheaper in developing countries, where investment and appropriate human resources are required to apply new technologies. To reduce technological and economic inequalities between regions, the innovation policies may help lagging regions to reach a critical mass, which allows them to benefit from knowledge spillovers within and across the region (Autant-Bernard et al., 2013). Lukovics (2009) pointed out that the opportunities for improving competitiveness are scarce in several regions. Nevertheless, innovation can create possibilities for regions to converge.

Database and Methodology

Based on the NUTS classification, the Regional Competitiveness Index (RCI) measures the different dimensions of competitiveness at the regional level in the European Union. The RCI is published every three years, the latest database, the RCI 2019, contains data for the period 2015-2017. RCI defines the regional competitiveness as the ability of a region to offer an attractive and sustainable environment for firms and residents to live and work (Annoni - Dijkstra, 2019). For this purpose, the RCI is divided into 11 pillars including 74 indicators to measure the different aspects of regional competitiveness and classify them into three groups: Basic, Efficiency and Innovation. The Basic group represents the main drivers of competitiveness in all types of countries. The Efficiency group contains variables from the fields of labour market. The Innovation group consists of three pillars related to the relevant fields of innovation. The triple division is the basis for the weighting scheme whose starting point is that the higher the regional GDP per capita, the higher the weight assigned to innovative aspects. Because of this, RCI considers the region's stage of development, the RCI does not measure all regions with the same yardstick but focuses on the most relevant aspects given their level of development (Annoni - Dijkstra, 2019). The pillars of the groups can be seen in Figure 1.

Our research focuses on the Innovation group, with highlighted regional differences mainly in the innovation pillar because this pillar includes the most relevant variables related to technological progress. The regional technological readiness contains three variables at the regional level (households' access to broadband; individuals buying over internet; households' access to the internet). The business sophistication pillar measures the degree to which small and medium enterprises are involved in innovation cooperation, but there are very small differences in the most relevant variables. There are four variables in this pillar, employment and GVA (K-N sectors), innovative SMEs and

Figure 1. The composition of the Regional Competitiveness Index (RCI)



Source: Own construction based on Annoni and Dijkstra (2019)

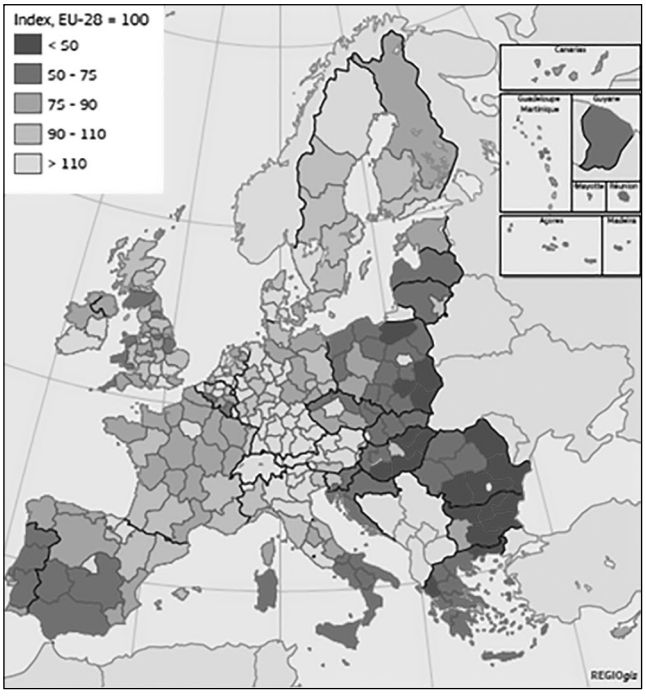
marketing organisational innovators. The innovation pillar consists of eight variables by region, which characterize well the main fields of innovation as human resources, innovation output and corporate activities. The variables of innovation pillar are core creative class employment; knowledge workers; scientific publications; total intramural R&D expenditure; human resources in Science and Technology; employment in technology and knowledge-intensive sectors; exports in medium-high/high tech manufacturing; sales of new-to-market and new-to-firm innovation. Compared to the previous RCI index, patenting activities are not measured at the regional level, but sales of new-to-market and new-to-firm innovation can be measured in regions.

To compare the European regions' performance, we used SPSS to analyse the differences using quantitative analytical techniques. Firstly, regions are grouped based on their economic performance, then we compare the means of innovation variables between performance groups. In the next step, we used cluster analysis to classify regions based on their innovation performance, and finally, the correlation analysis to analyse the relationship between economic and innovation indicators in order to highlight which innovation variables have the strongest effect on economic performance.

Empirical Results

There is a basic assumption in economics that the economic and technological performance are strongly correlated. Firstly, we categorized regions into five performance groups based on the GDP per capita, which reflects the stages of development. Figure 2 shows this classification, which follows the categorization of RCI. In the first stage of development, the regional GDP is below 50% of the EU-28 average. There are 16 regions, out of 268, in this group that can be defined as falling behind. In the second stage of development, including 67 regions, the regional GDP is at least 50 %, but less than 75% of the EU-28 average. These are the laggards where GDP per capita is less than three quarters of the EU-28 average. In the third stage of development,

Figure 2. The classification of 268 European regions based on their GDP per capita (average 2015-2017) related to EU28 (EU28 = 100%)



Source: Annoni and Dijkstra (2019, p.18)

the regional GDP is at least 75 %, but less than 90% of the EU-28 average. These 55 regions can be called moderately developed. In the fourth stage of development, including 58 regions, the regional GDP is at least 90 %, but less than 110% of the EU-28 average. They can be called developed regions. In the fifth stage of development, the regional GDP is at least 110 % of the EU-28 average. There are 72 regions, out of 268, in this group that are the most developed regions.

Based on the regional GDP per capita, there is one European region, i.e. Luxembourg, whose economic performance is prominently high, because in this country there is only one region. The best performing regions include the capitals of the countries, while the least performing regions are mostly in Hungary, Romania and Bulgaria.

Using the previous classification, we compare the innovation variables of regions' economic performance group. Table 1 contains the mean of innovation variables[1] by regions' economic performance groups.

[1] The description and the source of these variables are in Appendix (Table A1).

Using Kruskal-Wallis test to compare the means of economic performance groups, it can be stated that there is a significant difference between them. These results are found in the Appendix (Table A2). It is not surprising because, in general, the higher innovative activity is associated with the higher economic performance. Therefore, it is worth comparing the groups in pairs as well to highlight which factors can differentiate innovation performance between regions. Using Mann-Whitney U test to compare the means by pairs, it can be stated that there is no significant difference in employment in technology and knowledge-intensive sectors, marketing organizational innovators, innovative SMEs and exports in medium-high/high tech manufacturing between the falling behind and laggards. There is a significant difference in all variables between the laggards and moderately developed regions. There is no significant difference in households' internet access, GVA (K-N sectors), innovative SMEs and sales of new-to-market and new-to-firm innovation between moderately developed and developed regions. The slightest differences are between the developed and most developed regions, because there is a significant difference only in households' internet access, marketing organizational innovators, innovative SMEs and exports in medium-high/

Table 1. Means of innovation variables by regions' economic performance groups

Variables	Falling behind	Laggards	Moderately developed	Developed	The most developed
Households' access to broadband (% of total households)	73.800	79.090	84.527	88.919	89.981
Individuals buying over internet (% of those who ordered goods or services over the internet for private use)	27.133	43.731	62.418	69.170	69.729
Households' internet access (% of total households)	75.000	81.045	87.564	91.463	92.335
Employment (K-N sectors*) (% of total employment)	6.861	9.849	14.440	16.201	17.874
GVA (K-N sectors) (% of total GVA)	16.682	19.120	23.417	24.990	26.305
Innovative SMEs (% of total number of SMEs)	0.123	0.288	0.443	0.505	0.428
Marketing organizational innovators (% of total number of SMEs)	0.139	0.279	0.402	0.444	0.479
Core creative class employment (% of population aged 15-64)	6.038	7.268	8.871	11.290	12.397
Knowledge workers (% out of total employment)	25.826	31.646	38.000	42.617	44.842
Scientific publications (per million inhabitants)	543.487	891.222	1346.186	2023.343	2480.317
Total intramural R&D expenditure (% of GDP)	0.662	0.772	1.255	1.861	2.429
Human Resources in Science and Technology (% of labour force)	28.254	34.020	42.742	46.084	48.796
Employment in technology and knowledge-intensive sectors (% of total employment)	1.962	2.347	3.024	3.789	4.882
Exports in medium-high/high tech manufacturing (% of total product exports)	0.490	0.470	0.574	0.591	0.660
Sales of new-to-market and new-to-firm innovation (% of turnover)	0.242	0.362	0.463	0.461	0.413

Source: own calculations based on RCI (2019)

* K-N sectors mean Financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities.

high tech manufacturing. Based on these results, we can conclude that there is a break between the moderately developed and laggards, so the falling behind and laggards can be called innovation followers, while the other three economic performance groups, i.e. moderately developed, developed and most developed, can be called innovation leaders.

Cluster analysis is an adequate method to classify the regions based on their innovation performance. In the previous section, we compared the means, and the results show that there is no convincing difference in innovation variables between the developed and developing regions. Using a hierarchical cluster analysis, it can be stated that two clusters are optimal in this sample. This is confirmed by the previous empirical result, where there is a break between the moderately developed and laggards. In the K-means cluster analysis, there are 56 regions in cluster 1, where all innovation variables are higher than in cluster 2, consisting of 184 regions. 28 regions cannot be classified because of their missing data. Cluster 1 can be called innovation leaders, while cluster 2 are innovation followers. Table 2 shows the final cluster centres of innovation leader and follower groups. The cluster membership of the regions is found in the Appendix (Table A3).

Table 2. The final cluster centres of innovation leader and follower groups

Variables	Innovation leaders	Innovation followers
Households' access to broadband	90.665	84.053
Individuals buying over internet	72.864	56.893
Households' internet access	92.614	86.632
Employment (K-N sectors)	18.834	13.061
GVA (K-N sectors) (% of total GVA)	26.778	22.085
Innovative SMEs	0.527	0.365
Marketing organizational innovators	0.485	0.359
Core creative class employment	13.230	8.902
Knowledge workers	46.150	36.756
Scientific publications	3350.058	1212.084
Total intramural R&D expenditure	2.560	1.334
Human Resources in Science and Technology	50.076	40.195
Employment in technology and knowledge-intensive sectors	4.813	3.076
Exports in medium-high/high tech manufacturing	0.643	0.574
Sales of new-to-market and new-to-firm innovation	0.428	0.416

Source: Own calculations based on RCI (2019)

Table 3. Correlation coefficients between GDP per capita and innovation variables

Variables	GDP per capita
Human Resources in Science and Technology	0.694**
Employment (K-N sectors)	0.691**
Knowledge workers	0.685**
Core creative class employment	0.661**
Employment in technology and knowledge-intensive sectors	0.619**
Households' internet access	0.608**
GVA (K-N sectors) (as % of total GVA)	0.583**
Households' access to broadband	0.559**
Scientific publications	0.553**
Individuals buying over internet	0.543**
Marketing organizational innovators	0.524**
Total intramural R&D expenditure	0.522**
Exports in medium-high/high tech manufacturing	0.395**
Innovative SMEs	0.276**
Sales of new-to-market and new-to-firm innovation	0.160*

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed).

Source: Own calculations based on RCI (2019)

The highest difference between innovation leaders and followers is in scientific publications, which is followed by total intramural R&D expenditure and employment in technology and knowledge-intensive sectors. The slightest difference is in sales of new-to-market and new-to-firm innovation, which is followed by households' access to the internet and households' access to broadband. Based on these results, we can conclude that internet penetration is good in both groups, which creates possibilities to exploit the advantages of the new internet-based technologies.

There are some interesting cases where a low GDP per capita is associated with good innovation performance, while in contrast, there are cases where a high GDP per capita and low innovation performance can be seen. Because of this contrast, we ran a correlation analysis to reveal the relationship between innovation variables and economic performance of the regions. We found that there is a quite strong correlation between GDP per capita and innovation variables; the results can be seen in Table 3.

Based on the correlation analysis, we can conclude that human resources in Science and Technology, employment (K-N sectors) and knowledge workers, meaning human resources indicators, have the biggest impact on innovation and economic performance of the regions.

Conclusion

There are significant differences in income and economic development not only between countries, but also within the countries. These economic inequalities are strongly correlated with the innovation performance of the regions. In the era of the Fourth Industrial Revolution, technological progress creates possibilities for a catch-up, because new technologies require new skills that are less dependent on factor endowments of countries and regions. This research tried to illustrate the regional differences in the conditions of innovation in Europe using multivariate statistical methods. Based on the European Regional Competitiveness Index, the research question to be analysed is whether new technologies may be able to decrease spatial differences. To answer the question, we first classified the regions into five economic performance group based on RCI, i.e. the most developed, developed, moderately developed, laggards and falling behind, and then we compared 15 innovation variables in these groups. There is a significant difference in all variables between poor performing groups and a less significant difference between well performing ones. Our analysis confirmed a strong relationship between economic and innovation performance, but also highlighted a bigger difference between the regions in innovation than in economic performance. The critical area preventing the reduction of innovation inequalities is creation of new knowledge; if the region can develop its R&D&I activity, it will become an innovation leader. It is promising that the regions converge in the field of human resources, which is the result of the labour market changes. Summarizing our results, we can conclude that regional differences remain in the era of the Fourth Industrial Revolution, but a restructuring of the economic process will occur in all regions regardless of whether the region is an innovation leader or follower, and technological progress will promote economic development.

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References

Annoni, P., & Dijkstra, L. (2019). *The EU Regional Competitiveness Index 2019*. Retrieved from https://ec.europa.eu/regional_policy/sources/docgener/work/2019_03_rci2019.pdf

Camagni, R., & Capello, R. (2013): Regional Competitiveness and Territorial Capital: A Conceptual Approach and Empirical Evidence from the European Union. *Regional Studies*, *47*(9), 1383-1402. https://doi.org/10.1080/00343404.2012.681640

Corinne Autant-Bernard, C., Fadairo, M., & Massard, N. (2013). Knowledge diffusion and innovation policies within the European regions: Challenges based on recent empirical evidence. *Research Policy, 42*(1), 196-210. https://doi.org/10.1016/j.respol.2012.07.009

Barro, R. J., & Sala–i–Martin, X. (1997). Technological Diffusion, Convergence, and Growth. *Journal of Economic Growth, 2*(1), 1–26. https://doi.org/10.1023/A:1009746629269

Basu, S., & Weil, D. N. (1998). Appropriate Technology and Growth. *The Quarterly Journal of Economics*, *113*(4), 1025 – 1054. https://doi.org/10.1162/003355398555829

Békés, G. (2015). *Measuring regional competitiveness: A survey of approaches, measurement and data*. Discussion Papers Institute of Economics, Centre for Economic and Regional Studies, Hungarian Academy of Sciences, Budapest.

Caselli, F., & Coleman, W. J. (2006). The World Technology Frontier. *The American Economic Review*, *96*(3), 499 – 522. https://doi.org/10.1257/aer.96.3.499

European Commission (2019). *Regional Competitiveness Index*. Retrieved from https://ec.europa.eu/regional_policy/en/information/maps/regional_competitiveness/

Fagerberg, J. (1987). A Technology Gap Approach to Why Growth Rates Differ. *Research Policy*, *16*, 87–99. https://doi.org/10.1016/0048-7333(87)90025-4

Grossmann, G. M., & Helpman, E. (1994). Endogenous Innovation in the Theory of Growth. *The Journal of Economic Perspectives, 8*(1), 23–44. https://doi.org/10.1257/jep.8.1.23

Growiec, J. (2006). The World Technology Frontier: What Can We Learn from the US States? *Oxford Bulletin of Economic and Statistics*, *74*(6), 777 – 807. https://doi.org/10.1111/j.1468-0084.2011.00686.x

Krugman, P. (1979). A Model of Innovation, Technology Transfer, and the World Distribution of Income. *The Journal of Political Economy*, *87*(2), 253–266. https://doi.org/10.1086/260755

Lukovics, M. (2009). Measuring Regional Disparities on Competitiveness Basis. In Bajmócy, Z. – Lengyel, I. (eds): *Regional Competitiveness, Innovation and Environment*. JATEPress, Szeged, pp. 39 – 53.

Sleuwaegen. L., & Ramboer, S. (2019). Regional competitiveness and high growth firms in the EU: the creativity premium. *Applied Economics*, https://doi.org/10.1080/00036846.2019.1686454

Appendix

Table A1. The description and the source of innovation variables

Variables	Description	Source
Households' access to broadband	% of total households with access to broadband	Eurostat ICT Survey
Individuals buying over internet	% of individuals who ordered goods or services over the internet for private use	Eurostat ICT Survey
Households' internet access	% of total households with internet access	Eurostat ICT Survey
Employment (K-N sectors)	Employment in the "Financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities" sectors (K-N) as % of total employment	Eurostat
GVA (K-N sectors)	GVA in the "Financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities" sectors (K-N) as % of total GVA	Eurostat
Innovative SMEs	SMEs with innovation co-operation activities as % of total number of SMEs	Regional Innovation Scoreboard (RIS)
Marketing organisational innovators	SMEs introducing marketing or organisational innovation as % of total number of SMEs	Regional Innovation Scoreboard (RIS)
Core creative class employment	% of population aged 15-64	Eurostat, LFS
Knowledge workers	knowledge workers as % of total employment	Eurostat, LFS
Scientific publications	Scientific Publications per million inhabitants	Centre for Science and Technology Studies (CWTS) - Leiden University - based on in-house version of Web of Science
Total intramural R&D expenditure	total R&D expenditure as % of GDP	Eurostat, Regional Science and Technology Statistics (RSTS)
Human Resources in Science and Technology	persons with higher education and/or employed in Science and Technology as % of labour force	Eurostat, RSTS
Employment in technology and knowledge-intensive sectors	as % of total employment	Eurostat, RSTS
Exports in medium-high/high-tech manufacturing	Exports in medium/high technology products as % of total product exports: measures the technological competitiveness of the EU, the ability to commercialise the results of research and development (R&D)	Regional Innovation Scoreboard 2017, EC-DG GROW
Sales of new-to-market and new-to-firm innovation	Sales of new-to-market and new-to-firm innovations as % of turnover: it captures both the creation of state-of-the-art technologies (new to market products) and the diffusion of these technologies (new to firm products)	Regional Innovation Scoreboard 2017, EC-DG GROW

Source: RCI (2019)

Table A2. The results of Kruskal-Wallis test

Variables	Chi-Square	Asymp. Sig.
Human Resources in Science and Technology	132.534	0.000
Employment (K-N sectors)	123.183	0.000
Knowledge workers	127.245	0.000
Core creative class employment	128.630	0.000
Employment in technology and knowledge-intensive sectors	83.976	0.000
Households' internet access	121.357	0.000
GVA (K-N sectors) (as % of total GVA)	81.576	0.000
Households' access to broadband	100.339	0.000
Scientific publications	97.194	0.000
Individuals buying over internet	102.652	0.000
Marketing organizational innovators	71.967	0.000
Total intramural R&D expenditure	113.802	0.000
Exports in medium-high/high tech manufacturing	27.595	0.000
Innovative SMEs	55.971	0.000
Sales of new-to-market and new-to-firm innovation	41.721	0.000

Source: Own calculations based on RCI (2019).

Table A2. The results of Mann-Whitney U tests

Variables	Mann-Whitney U and Sig.							
	Falling behind – laggards		Laggards – moderate developed		Moderate developed – developed		Developed – the most developed	
Human Resources in Science and Technology	275.500	0.006	1132.0	*0.000*	1051.0	*0.002*	1860.5	*0.346*
Employment (K-N sectors)	188.000	0.000	749.5	*0.000*	1197.0	*0.022*	2002.0	*0.787*
Knowledge workers	243.000	0.002	895.5	*0.000*	996.5	*0.001*	1802.5	*0.223*
Core creative class employment	205.000	0.000	541.0	*0.000*	1174.0	*0.016*	1741.0	*0.104*
Employment in technology and knowledge-intensive sectors	387.000	0.085	930.0	*0.000*	1240.0	*0.041*	1896.0	*0.369*
Households' internet access	221.000	0.002	929.0	*0.000*	1230.0	*0.126*	1543.0	*0.038*
GVA (K-N sectors) (as % of total GVA)	277.000	0.022	909.0	*0.000*	1166.0	*0.055*	1676.0	*0.154*
Households' access to broadband	279.000	0.009	981.0	*0.000*	797.0	*0.000*	1760.0	*0.124*
Scientific publications	232.000	0.001	834.0	*0.000*	896.0	*0.000*	1816.0	*0.203*
Individuals buying over internet	289.000	0.017	953.0	*0.000*	897.0	*0.000*	1722.5	*0.087*
Marketing organizational innovators	394.000	0.282	906.0	*0.000*	975.0	*0.001*	1542.0	*0.011*
Total intramural R&D expenditure	267.500	0.002	599.0	*0.000*	1056.0	*0.002*	1724.5	*0.089*
Exports in medium-high/high tech manufacturing	300.000	0.113	1034.0	*0.002*	944.0	*0.001*	1473.0	*0.011*
Innovative SMEs	433.000	0.822	1086.0	*0.006*	1397.0	*0.717*	1437.0	*0.019*
Sales of new-to-market and new-to-firm innovation	266.000	0.015	1068.0	*0.004*	1457.0	*0.879*	1613.0	*0.083*

Source: Own calculations based on RCI (2019).

Table A3. The members of the innovation follower cluster

Region	Distance
Kärnten	657.190
Steiermark	657.207
Oberösterreich	197.391
Salzburg	197.530
Tirol	197.460
Vorarlberg	197.527
Rég. de Bruxelles-Cap./Brussels Hfst. Gew. & Vlaams-Brabant & Brabant Wallon	960.966
Hainaut	77.906
Liège	78.259
Luxembourg	77.683
Namur	78.801
Severozapaden	1138.700
Severen tsentralen	1138.714
Severoiztochen	1138.253
Yugoiztochen	1138.678
Yugozapaden	584.004
Yuzhen tsentralen	584.763
Jihozápad	114.289
Severozápad	1056.089
Severovýchod	528.990
Jihovýchod	609.922
Střední Morava	83.648
Moravskoslezsko	600.530
Stuttgart	295.997
Freiburg	983.999
Niederbayern	934.843
Oberpfalz	363.938
Oberfranken	56.335
Mittelfranken	1024.025
Unterfranken	773.620
Schwaben	803.886
Darmstadt	567.637
Kassel	628.712
Mecklenburg-Vorpommern	660.800
Hannover	740.291
Lüneburg	968.643
Weser-Ems	577.299
Düsseldorf	29.414
Münster	26.494
Detmold	380.936
Auvergne	760.655
Rhône-Alpes	684.313
Chemnitz	450.343

Region	Distance
Provence-Alpes-Côte d'Azur	476.881
Corse	413.365
Jadranska Hrvatska	475.030
Kontinentalna Hrvatska	138.323
Közép-Magyarország	466.260
Közép-Dunántúl	893.377
Nyugat-Dunántúl	962.231
Dél-Dunántúl	527.862
Észak-Magyarország	1058.599
Észak-Alföld	449.588
Dél-Alföld	307.640
Northern and Western	222.451
Southern	988.086
Eastern and Midland	729.436
Piemonte	182.733
Liguria	905.452
Lombardia	476.141
Abruzzo	432.287
Molise	575.496
Campania	61.229
Puglia	196.686
Basilicata	54.608
Calabria	277.668
Sicilia	171.569
Sardegna	81.205
Prov. Autonoma di Bolzano/Bozen	250.693
Veneto	311.138
Emilia-Romagna	967.655
Umbria	972.166
Marche	46.345
Friesland	789.293
Drenthe	603.403
Overijssel	691.864
Zeeland	774.430
Noord-Brabant	280.041
Małopolskie	441.202
Śląskie	569.732
Wielkopolskie	309.420
Zachodniopomorskie	667.886
Arnsberg	41.706
Koblenz	977.566
Saarland	544.879
Kujawsko-pomorskie	650.085

Table A3. The members of the innovation follower cluster (continue)

Region	Distance
Sachsen-Anhalt	251.977
Schleswig-Holstein	248.971
Thüringen	503.436
Sjælland	571.209
Attiki	344.722
Kriti	847.632
Anatoliki Makedonia, Thraki	529.543
Kentriki Makedonia	116.366
Thessalia	392.732
Dytiki Ellada	480.590
Sterea Ellada	1073.428
Peloponnisos	1058.698
Galicia	179.461
Principado de Asturias	476.347
Cantabria	644.102
País Vasco	687.921
La Rioja	100.516
Aragón	760.932
Castilla y León	15.556
Castilla-La Mancha	482.977
Extremadura	405.620
Cataluña	1057.064
Comunidad Valenciana	328.561
Illes Balears	256.044
Andalucía	16.700
Región de Murcia	202.477
Canarias	277.380
Länsi-Suomi	980.785
Centre - Val de Loire	504.079
Bourgogne	494.609
Franche-Comté	142.805
Basse-Normandie	497.923
Haute-Normandie	504.429
Nord-Pas de Calais	209.396
Picardie	501.252
Alsace	127.256
Champagne-Ardenne	494.595
Lorraine	158.712
Pays de la Loire	164.606
Bretagne	150.464
Lubuskie	963.683
Dolnośląskie	100.542
Opolskie	867.555
West Wales and The Valleys	539.182

Region	Distance
Warmińsko-mazurskie	645.317
Pomorskie	338.752
Łódzkie	301.078
Lubelskie	280.820
Podkarpackie	914.990
Podlaskie	522.166
Warszawski stołeczny	310.703
Mazowiecki regionalny	369.935
Norte	349.270
Centro	615.429
Alentejo	598.729
Nord-Vest	498.507
Sud - Muntenia	1147.642
Bucureşti - Ilfov	444.442
Sud-Vest Oltenia	1030.273
Vest	680.140
Småland med öarna	332.533
Norra Mellansverige	436.671
Mellersta Norrland	477.829
Vzhodna Slovenija	513.351
Západné Slovensko	967.062
Stredné Slovensko	842.214
Východné Slovensko	508.412
Tees Valley and Durham	974.680
Northumberland and Tyne and Wear	974.713
Cumbria	702.086
Greater Manchester	702.349
Lancashire	702.134
Cheshire	702.619
Merseyside	702.219
East Yorkshire and Northern Lincolnshire	832.831
North Yorkshire	833.037
South Yorkshire	832.869
West Yorkshire	832.990
Derbyshire and Nottinghamshire	512.501
Lincolnshire	512.320
Leicestershire, Rutland and Northamptonshire	512.532
Aquitaine	269.026
Gloucestershire, Wiltshire and Bristol/Bath area	728.084
Poitou-Charentes	136.013
Languedoc-Roussillon	425.155
Midi-Pyrénées	271.783
Devon	727.731
West Midlands	371.869

Table A3. The members of the innovation follower cluster (continue)

Region	Distance	Region	Distance
East Wales	539.449	Limousin	355.290
Northern Ireland	266.230	Dorset and Somerset	727.801
Shropshire and Staffordshire	371.756	Cornwall and Isles of Scilly	727.688
Herefordshire, Worcestershire and Warwickshire	372.152	Gloucestershire, Wiltshire and Bristol/Bath area	728.084

Table A3. The members of the innovation leader cluster

Region	Distance	Region	Distance
Wien & Niederösterreich	556.399	Lazio	869.280
Burgenland	771.326	Flevoland & Noord-Holland	478.322
Antwerpen	930.443	Groningen	4853.869
Limburg (BE)	930.431	Gelderland	557.876
Oost-Vlaanderen	930.432	Utrecht	3053.473
West-Vlaanderen	930.526	Zuid-Holland	231.477
Praha & Střední Čechy	260.420	Limburg (NL)	213.032
Berlin & Branderburg	446.700	Área Metr. de Lisboa	1002.969
Karlsruhe	696.410	Stockholm	1736.441
Tübingen	180.505	Östra Mellansverige	1600.483
Oberbayern	179.705	Sydsverige	312.084
Bremen	191.190	Västsverige	531.674
Hamburg	107.031	Övre Norrland	2104.937
Gießen	38.656	Zahodna Slovenija	330.830
Braunschweig	395.195	Bratislavský kraj	184.773
Köln	422.771	Inner London West & Inner London East & Outer London East-North-East & Outer London South & Outer London West North West & Bedfordshire/ Hertfordshire & Essex	432.815
Rheinhessen-Pfalz	955.970	East Anglia	705.233
Dresden	246.550	Berkshire, Buckinghamshire and Oxfordshire	517.716
Leipzig	325.820	Surrey, East and West Sussex	517.649
Hovedstaden	3368.177	Hampshire and Isle of Wight	517.394
Syddanmark	1020.458	Kent	517.389
Midtjylland	378.766	North Eastern Scotland	449.858
Nordjylland	235.465	Highlands and Islands	371.050
Comunidad Foral de Navarra	971.849	Eastern Scotland	447.686
Comunidad de Madrid	679.761	West Central Scotland	409.492
Pohjois- ja Itä-Suomi	931.650		
Île de France	603.479		
Provincia Autonoma di Trento	238.680		
Friuli-Venezia Giulia	262.070		
Toscana	859.977		
Southern Scotland	304.874		

Note: There is no cluster membership because of the missing data for: Kýpros; Trier; Eesti; Voreio Aigaio; Notio Aigaio; Dytiki Makedonia; Ipeiros; Ionia Nisia; Ciudad Autónoma de Ceuta; Ciudad Autónoma de Melilla; Helsinki-Uusimaa; Etelä-Suomi; Åland; Guadeloupe; Martinique; Guyane; La Réunion; Mayotte; Valle d'Aosta/Vallée d'Aoste; Sostinės regionas; Vidurio ir vakarų Lietuvos regionas; Luxembourg; Latvija; Malta; Świętokrzyskie; Algarve; Região Autónoma dos Açores; Região Autónoma da Madeira.

Regionalne razlike v pogojih tehnološkega napredka v Evropi

Izvleček

Prostorska struktura sveta je neenakomerna, središča in obrobja se izmenjavajo. Obstajajo znatne družbene in razvojne razlike med državami v svetu ter tudi neenakomeren razvoj znotraj držav. Ključni namen regionalne politike je zmanjšati prostorske neenakosti med razvitimi in nerazvitimi območji. Danes, v obdobju četrte industrijske revolucije, tehnološki napredek ustvarja možnosti, da regije v razvoju nadoknadijo zaostanek, ker nove tehnologije zahtevajo nove veščine, ki so manj odvisne od posedovanja faktorjev držav. Večina gospodarstev je nezmožnih ustvarjati nove tehnologije, ker nimajo primernih virov ali njihovo institucionalno okolje ni naklonjeno novostim. Kljub temu pa je v teh državah s sprejemanjem in učinkovito uporabo novih tehnologij mogoče spremljati tehnološki razvoj. Cilj te raziskave je ponazoriti regionalne razlike v pogojih tehnološkega napredka v Evropi z uporabo multivariatnih statističnih metod. Temelječa na Indeksu evropske regionalne konkurenčnosti, poskuša odgovoriti na raziskovalno vprašanje, ali so nove tehnologije zmožne zmanjšati prostorske razlike. Primerjamo evropske regije na področju inoviranja, da bi izpostavili kritična področja, ki lahko spodbudijo ali preprečijo zmanjšanje neenakosti.

Ključne besede: regionalne razlike v Evropi, tehnološki napredek, inovacijski vodje, inovacijski sledilci