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INNOVATIVENESS – DOES THE TERRITORIAL TYPOLOGY MATTERS?

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Abstract

National and regional strategies and policies on innovation have been prioritized and innovation is now core to most EU funds and strategies. However, regions are not (should not be) alike in terms of innovation and innovation policy. The development strategies based on innovativeness ideas must include specific local conditions. Effective actions and efforts, to create good environment for innovativeness must bring tangible results.

The aim of the paper is comparison of innovativeness on different regions types according to territorial typology: rural, intermediate and urban.

The research questions are: Does innovativeness depends on regional typology: urban-rural? Do remote, less developed rural areas have also low achievements (poor performance) in this regard?

Innovation output is measured using its hard result, which is number of patent application per capita. To examine group differences according to the innovativeness, the Kruskal-Wallis test was conducted. The test statistic showed, that there is no statistically significant difference between patent applications on different regions types. It has been found that the highest variable value in the whole sample has been calculated in rural group, for rural regions in Switzerland.

Keywords: innovations, patents, rural areas, Kruskal-Wallis test

INTRODUCTION

Over the last decades, innovation and creativity have become critical skills for achieving success in developed economies.

It is widely recognized and accepted that the path to competitiveness of economies, regions, companies, goes through innovation (Doina and Sandu 2014, Ciocanel and Pavelescu 2015, Balkyte and Tvaronavičiene 2010).

National and regional strategies and policies on innovation have been prioritized and innovation is now core to most EU economic and regional development funding programmes (Kolehmainen at al. 2016).

In the knowledge-based economy, which is an achievement of economic well-developed countries, an extremely important role played by innovation, becomes a key factor in their sustainable development.

Importance of the human resources with their knowledge, competence, need for achievement, creativity, ability to create and seize opportunities still increases. It is significant not only in large academic centers (university cities), where knowledge transfer is much easier.

Many of the regional strategies and policies aimed at developing innovation emanate from policymakers in centrally located urban conurbations and are assumed universally applicable for the development of rural areas, both in terms of diversification and increased competitiveness, innovation is a central factor.

The underdevelopment of rural areas raises the need to explore and introduce new necessary solutions, among the other things, to the smooth functioning of agricultural activity and face global competition.

It is widely regarded that innovation is for agriculture a solid foundation for sustainable growth and opportunity to improve primarily the living conditions in rural areas, in both economic and social (Cannarella and Piccioni 2011, Ziemiańczyk et al. 2013, Di Iacovo et al. 2014, Provenzano et al. 2016).

The EU's support to speed up innovation in rural regions is The European Innovation Partnership for Agricultural productivity and Sustainability (EIP-AGRI). It has been launched to contribute to the European Union's strategy "Europe 2020" for smart, sustainable and inclusive growth. This strategy sets the strengthening of research and innovation as one of its five main objectives and supports a new interactive approach to innovation: European Innovation Partnerships (ec.europa.eu).

There are several studies on knowledge-based development, innovation systems and innovation policies in rural and peripheral regions (Doloreux and Dionne 2008, Pelkonen and Nieminen 2015, Feher and Handaric 2016). All of these studies examine certain aspects of the specific nature of innovation and innovation policy in the context of rural, peripheral and less-favoured regions (Kolehmainen et al. 2016).

The need and search for new solutions is also affected by numerous agricultural conditions, which include (Kolarska-Bobińska et al. 2001, Wójcik 2011):

- climatic conditions,
- economic conditions,
- demand from consumer preferences,
- search for alternative sources of income.

It is important also that all regions are not alike in terms of innovation and innovation policy (Kolehmainen et al. 2016). The development strategies based on innovativeness ideas must include specific local conditions.

All of these efforts, to create good environment for innovativeness must bring tangible results. Among many objective metrics of innovation performance are included:

- deliverables to goals,
- completing activities that enhance the brand image (e.g., publications, conference presentations, interviews, etc.),
- production of intellectual property (e.g., patents, trade secrets, etc.).

This paper aims to verify innovativeness performance using its hard result that is number of patent applications.

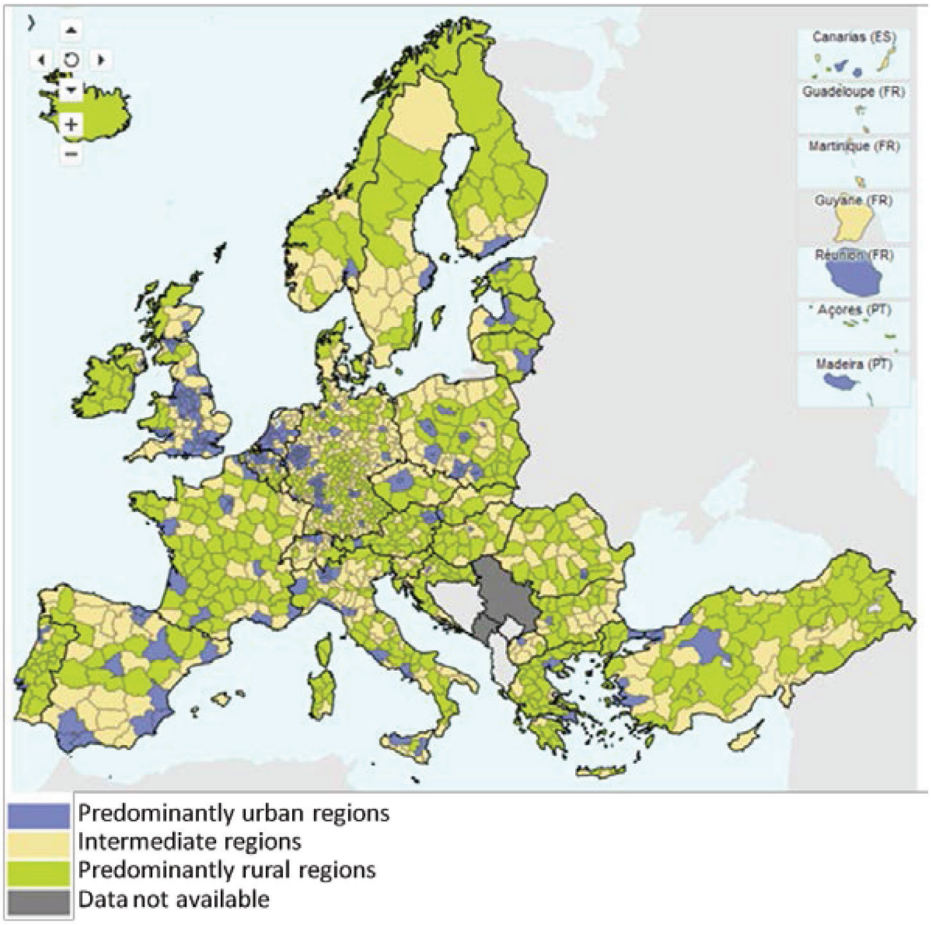
MATERIAL AND METHOD

The aim of the paper is comparison of innovativeness on different regions types according to European Union typology of "predominantly rural", "intermediate" and "predominantly urban" regions, shown on the Fig.1. They are classified as:

- *Predominantly urban regions*: rural population less than 20% of total population,
- *Intermediate regions*: rural population between 20% and 50% of total population,
- *Predominantly rural regions*: rural population is 20% or more of total population.

All the 28 EU countries were analyzed, but included were only those with valid data. Eurostat database is used. As innovativeness tangible results (output), the patent applications to the European Patent Office (EPO) per 10 thousand inhabitants were adopted and evaluated.

The analysis answers the question: Does innovativeness depends on regional typology: urban-rural? Do remote, less developed rural areas have also low achievements (poor performance) in this regard?



Source: ec.europa.eu

Figure 1. Urban-rural typology of EU regions (NUTS-3)

To examine group differences according to the innovativeness, the Kruskal-Wallis test was conducted. It is a non-parametric test that is used for comparing samples from two or more groups. This test does not make assumptions about normality.

The Kruskal-Wallis test becomes useful, in particular, when:

- group sample strongly deviates from normal,
- group variances are quite different (especially when there are significant outliers).

Test will assess for significant differences on a dependent variable (patent applications) by a grouping independent variable (urban, intermediate, rural location). The accepted significant level is $\alpha = 0{,}05$.
Two hypotheses were tested:

- null hypothesis assumes that the mean ranks of the groups are the same

$$H_0: R_1 = R_2 = R_3$$

- alternative hypothesis H_A – there is at least one difference between the mean ranks

$$H_A: R_1 \neq R_2;\ R_1 \neq R_3;\ R_2 \neq R_3$$

The test statistic is given by:

$$\boldsymbol{T = \frac{12}{n(n+1)} \sum_{j=1}^{k} \frac{R_j^2}{n_j} - 3(n+1)}$$

where:
k – the number of groups,
nj – the number of observations in group j,
$n = \sum_{j=1}^{k} n_j$ – the total number of observations,
Rj – the rank sum of the observations from the sample Aj within the whole sample of $n = \sum_{j=1}^{k} n_j$ observations.

Under the null hypothesis, the test statistic follows a chi-square distribution with $k - 1$ degrees of freedom.

RESULTS AND DISCUSSION

It is noticeable and expected that in terms of the patent applications number, rural areas are the weakest group. In urban regions this number is more than 3 times higher. Nevertheless, the number of international patents in general is impressive. Taking into account patent applications calculated per 10 thousand inhabitants, the differences between analyzed groups are not so marked. It is interesting that the highest variable value in the whole sample has been calculated in rural group. Rural regions in Switzerland have the highest number of patent applications from all the others (4.659). Also the Swiss intermediate regions are the best in group. Within urban regions excels Finland (3.96) and Germany is on the second position (2.602).

The highest average value is obtained for intermediate regions (1.116). The data shows also big differentiation between EU countries and regions within

groups. The most internally diversed set is the intermediate group. The main parameters of groups are given in the Tab.1.

Table.1. Descriptive statistics of patent applications in groups

		Patent applications		*Patent applications per 10 000 inhabitants*	
Groups	*Number of valid observations*	*Sum*	*Average*	*Average*	*Standard deviation*
Urban regions	23	21233.95	923.22	1.065	1.054
Intermediate regions	20	15230.51	761.53	1.116	1.182
Rural regions	16	4261.52	266.35	0.846	1.166

The Kruskal–Wallis test starts by substituting the rank in the overall data set for each measurement value. The highest value gets a rank of 1 and the smallest value gets a rank of 59, because there are 59 observations in set. The average ranks in groups are respectively: 27.8 for urban, 29.4 for intermediate and 33.9 for rural regions. The lower is the rank value, the higher is the position. Therefore, urban regions are better ranked then the others.

Answering the research question it has been found, that there is no reason to reject the null hypothesis. The obtained test results are presented in the Tab.2. Calculated *p value* = 0.544 is higher than $\alpha = 0.05$. Test statistic $T = 1.218$ is outside the critical area $(5.99 ; \infty)$. It means that innovation outputs on rural, intermediate and urban regions have the same mean ranks.

Table 2. Kruskal-Wallis test results

	Groups		
	Urban	*Intermediate*	*Rural*
Rank sum *Rj*	639.00	589.00	542.00
Group size *nj*	23	20	16
T statistic	1.218		
Df	2		
p-value	0.544		
χ^2	5.992		
α	0.050		

CONCLUSIONS

1. The highest value of innovation output (patent applications per capita) in the whole sample has been calculated in rural group, for Swiss regions,
2. The best in the intermediate regions is also Switzerland,
3. Within urban regions excels Finland (3.96),
4. Kruskal-Wallis test indicated, that there is no statistic significant difference between patent applications on different regions types,
5. There is a big differentiation between EU countries and regions within groups.

The obtained results allow an optimistic assess of the rural development prospects. The fact that innovative activity did not exclude rural areas, means a chance for dynamic development of these areas. It also means that, despite many rural problems mainly infrastructural, institutional and economic, the environment for innovation in rural regions is good. Of course, the scale and dynamism of innovative activities are also diversified in agriculture and rural areas. There are numerous examples of regions and individual farms, which effects are at the highest world level.

Innovation in and from developing economies, which can include rural areas, has become a significant component of global innovative output and further embellishes the increasing competitiveness in the global market place. Nowadays successful businesses no longer need a manufacturing plant, but can be launched from a single computer. The result is a healthy entrepreneurship level that acts in parts as a driver of innovation, even if at times only considered as "microinnovations" (Ramstad and Chao 2011, Kumar et al. 2013).

It is difficult to measure innovativeness processes. There is no best metric, since single measurement processes can sometimes negatively impact the innovation processes they are attempting to measure. Preferably, in the future research a suite of metrics should be used to measure the innovation process.

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